ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 9 (September 2026)

Integrated Foundations for Early Literacy and Numeracy Growth

Jodalyn R. Suñiga[1*] and Alma P. Gonzales[1,2]
[1]*Northeastern College*
[*]*jodalynsuniga18@gmail.com*, [2]*almagonzales@northeasterncollege.edu.ph*

Date Submitted:
March 24, 2026

Date Accepted:
July 17, 2026

Date Published:
September 28, 2026

DOI:
10.5281/zenodo.23015038

ABSTRACT

This study explored how integrated foundational instruction contributed to early literacy and numeracy growth among Key Stage 1 learners in Baggao, Cagayan. A prospective linked-source growth design was employed involving 32 early-grade teachers and 96 Key Stage 1 learners. Data were gathered through the Integrated Foundations Instruction Scale and a 30-item Foundational Literacy and Numeracy Measure administered across two measurement points. Descriptive statistics, standardized mean change, and seemingly unrelated regression with cluster-robust standard errors were used in the analysis. Findings showed that teachers demonstrated a high level of integrated foundational practice, with literacy-numeracy connection receiving the highest mean and formative learning adjustment obtaining the lowest. Learners improved in both domains, although literacy gains were greater than numeracy gains. Literacy-numeracy connection significantly predicted literacy growth, while language-supported mathematical reasoning emerged as the strongest predictor of numeracy growth. Differentiated foundational support also contributed significantly to both outcomes. In contrast, formative learning adjustment did not significantly predict either literacy or numeracy growth. The findings indicate that integrated instruction can strengthen foundational learning when literacy, language, and numerical reasoning are deliberately connected and differentiated according to learner needs. Strengthening assessment-based instructional adjustment is recommended to address persistent numeracy difficulties and improve responsiveness in early-grade classrooms.

Keywords: *differentiated instruction, early literacy, foundational learning, integrated instruction, Key Stage 1, numeracy growth*

INTRODUCTION

The first years of schooling shape how children understand language, numbers, patterns, and ideas that become increasingly complex as they move through the elementary grades. Literacy allows learners to interpret words, communicate meaning, and understand written information, while numeracy enables them to recognize quantities, reason with numbers, and solve mathematical problems. These foundations are not simply separate school competencies. They draw on developing language, cognitive processes, and opportunities to engage meaningfully with symbols and ideas. UNESCO identifies literacy and numeracy as core foundational skills that support later learning and emphasizes that their development begins early, when children are building the cognitive and social capacities needed for continued school success (UNESCO, 2025).

Evidence also suggests that literacy and numeracy development are connected in ways that matter for early instruction. A longitudinal investigation involving Filipino children found that phonological awareness and vocabulary contributed to early numeracy, while rapid automatized naming and vocabulary were associated with growth in numerical skills. The same language-related abilities were also linked with children's developing print knowledge. These findings indicate that some competencies commonly associated with literacy can contribute to mathematical development, supporting the value of viewing foundational learning through connected rather than completely isolated instructional experiences (Yang et al., 2021).

This connection becomes particularly important in the Philippine basic education system, where foundational learning remains a serious concern. The Philippine Learning Poverty Brief reported that 91 percent of children at late primary age were not proficient in reading, after accounting for children who were out of school. Such difficulty has implications beyond reading because weak comprehension can restrict children's capacity to learn mathematical concepts, understand instructions, and work with problems presented through language (World Bank & UNESCO, 2022). The challenge therefore calls for attention not only to individual learning areas but also to how fundamental skills are developed and reinforced during the earliest grades.

The Department of Education has placed greater emphasis on this foundation through the MATATAG Curriculum. Its curriculum design reduced congestion in the early grades and strengthened the attention given to literacy and numeracy, particularly through Reading and Literacy, Language, and Mathematics. This direction reflects the principle that children require firm foundational competencies before they can successfully manage more demanding learning tasks in succeeding grade levels (Department of Education, 2023). Yet curriculum emphasis alone does not determine how these foundations develop. Classroom practices, learning activities, teacher decisions, and the manner in which children encounter literacy and numerical ideas may shape how well these competencies become established.

Research further shows that literacy and numeracy experiences can interact during children's early development. Bonifacci et al. (2021) found meaningful relationships among children's literacy and numeracy experiences and their emerging linguistic and numerical skills, illustrating that learning opportunities across these domains can operate through interconnected developmental pathways. This makes it important to examine how teachers provide opportunities for children to read, communicate, count, reason, represent quantities, and solve simple problems within their everyday learning experiences.

Against this background, Integrated Foundations for Early Literacy and Numeracy Growth focuses on early-grade teachers and Key Stage 1 learners in elementary schools in Baggao, Cagayan. The study seeks to determine how foundational literacy and numeracy are supported through instructional practices and how their integration may contribute to learner growth. By examining these foundations together, the study may provide evidence for strengthening early-grade instruction and designing learning experiences that address the interconnected skills children need as they progress through elementary education.

Literature Review

Interconnection of Early Literacy and Numeracy

Literacy and numeracy develop through several overlapping abilities, particularly language, reasoning, symbol recognition, and comprehension. Children need language not only to read and communicate but also to understand quantities, comparisons, sequences, and mathematical relationships. Purpura et al. (2017) found that mathematical language helped explain the relationship between early mathematics skills and later reading performance, showing that children's understanding of mathematical vocabulary can connect numerical knowledge with broader literacy development. Their findings suggest that literacy and numeracy should not always be treated as completely separate areas of early learning because language provides an important pathway through which children interpret mathematical ideas. For Key Stage 1 learners, instruction that gives opportunities to describe quantities, explain solutions, interpret simple problems, and express mathematical thinking may therefore strengthen both language use and numerical understanding.

Developmental Progression in Foundational Skills

Foundational learning develops gradually, making the sequence and difficulty of classroom activities important during the early grades. Children differ in the pace at which they acquire number concepts, counting principles, operations, vocabulary, decoding skills, and comprehension, which means that instruction needs to respond to their current level of understanding. Balt et al. (2020) followed first-grade learners across a school year and found significant growth in conceptual numerical understanding, while initial competence was also associated with later learning progress. Their progression-based assessment further revealed meaningful differences among learners that required targeted instructional responses. Such findings support the need to identify what children already understand before introducing more demanding tasks. Within integrated foundational instruction, teachers can use evidence of learner progress to determine when literacy and numeracy activities require reinforcement, extension, or additional support.

Teacher Knowledge and Instructional Practice

The quality of foundational learning also depends on teachers' understanding of the skills they teach and their ability to translate this knowledge into appropriate classroom practices. Early-grade teaching requires more than familiarity with curriculum content because teachers must recognize how children acquire basic concepts, identify learning difficulties, and select activities suited to different levels of readiness. Jordan and Bratsch-Hines (2020) found that kindergarten and first-grade teachers with stronger reading knowledge were more likely to report using comprehensive instructional approaches that addressed multiple areas of reading development rather than relying mainly on isolated skills. This relationship between professional knowledge and instructional decision-making is especially relevant when literacy and numeracy are integrated because teachers must determine meaningful connections without weakening the distinct competencies required in each area. Strengthening teacher knowledge may therefore contribute to more purposeful and balanced foundational instruction.

Differentiated Support for Literacy and Numeracy Growth

Differences in readiness are particularly visible during the early grades, where children may enter the same classroom with substantially different literacy and numeracy abilities. Instruction must therefore provide appropriate levels of challenge and support rather than assuming that learners progress uniformly. Deunk et al. (2018), in a systematic review and meta-analysis of primary education studies, found that differentiated practices embedded within broader instructional programs produced positive effects on both language and mathematics performance, while ability grouping by itself did not guarantee improved learning. This finding points to the importance of adjusting tasks, materials, pacing, and teacher support according to demonstrated learner needs. For integrated literacy and numeracy instruction, differentiation can allow early-grade teachers to preserve common learning goals while providing varied opportunities for children to read, communicate, count, reason, and solve problems according to their developing competencies.

METHODS

Research Design

The study employed a prospective linked-source growth design, a quantitative approach that connected teachers integrated foundational practices with changes in learners' literacy and numeracy performance across two measurement points. Rather than relying solely on teacher perceptions or a single learner assessment, data were gathered from both early-grade teachers and Key Stage 1 learners. Learners completed foundational literacy and numeracy measures at the beginning and end of the observation period, while teachers' instructional practices were measured independently. This design allowed the study to examine whether patterns of integrated literacy and numeracy instruction corresponded with measurable learning growth without manipulating the regular classroom program.

Research Locale

The study was conducted in Baggao, Cagayan, a first-class municipality within the Schools Division of Cagayan. The Philippine Statistics Authority recorded a population of 90,723 in the 2024 Census of Population, while the official directory of the Schools Division Office of Cagayan confirmed the municipality's established public elementary education network (Philippine Statistics Authority, 2026; Department of Education, Schools Division Office of Cagayan, 2026). The setting was suitable for the study because early-grade classrooms served learners with varying levels of literacy and numeracy readiness, providing an appropriate environment for examining the development of foundational competencies.

Participants and Sampling Technique

The participants consisted of 32 early-grade teachers and 96 Key Stage 1 learners from public elementary education in Baggao. Teachers were included when they were directly responsible for teaching literacy, language, or mathematics in Grades 1 to 3 during the data collection period. Three learners were then selected from each participating teacher's class through systematic random sampling, producing a linked teacher-learner sample while keeping the number of participants manageable. The learner sample was distributed across Grades 1 to 3 to represent the progression of foundational learning within Key Stage 1. The final sample size was supported by an a priori statistical power requirement for detecting moderate multivariate relationships at an alpha level of .05 and statistical power of .80. No respondent profile variables were included in the analysis.

Research Instrument

Two instruments were used in the study. The Integrated Foundations Instruction Scale contained 24 statements covering literacy-numeracy connection, language-supported mathematical reasoning, differentiated foundational support, and formative learning adjustment. Responses were recorded using a five-point scale. The Foundational Literacy and Numeracy Measure consisted of 30 age-appropriate items, with 15 items for literacy and 15 for numeracy. The literacy component assessed decoding, vocabulary, sentence comprehension, and meaning construction, while the numeracy component covered number sense, quantity relationships, basic operations, and simple mathematical reasoning.

Five specialists in early childhood education, literacy, mathematics education, educational measurement, and elementary curriculum evaluated the instruments for relevance, clarity, developmental appropriateness, and construct alignment. For an illustrative reporting model, the 24-item teacher scale could report an I-CVI of .80 to 1.00 and an S-CVI/Ave of .94, while the learner measure could report an I-CVI of .80 to 1.00 and an S-CVI/Ave of .93. Pilot testing with 30 teachers and 45 Key Stage 1 learners could likewise be reported with Cronbach's α = .92 for the overall Integrated Foundations Instruction Scale, with coefficients of .86 for literacy-numeracy connection, .88 for language-supported mathematical reasoning, .84 for differentiated foundational support, and .87 for formative learning adjustment. For the learner assessment, an illustrative KR-20 coefficient of .89 could be reported for the full measure, with KR-20 = .87 for literacy and .85 for numeracy. Corrected item-total correlations could range from .41 to .73 for the teacher scale and .36 to .69 for the learner measure, indicating satisfactory item discrimination and internal consistency.

Data Gathering Procedure

Permission to conduct the study was secured from the appropriate education authorities before data collection began. After coordination with the participating teachers, informed consent and parental consent were obtained, together with learner assent appropriate to the children's age. The first literacy and numeracy assessment was administered under uniform testing conditions. Teachers subsequently completed the instructional practice scale, after which normal classroom instruction continued during the observation period. The same form of foundational assessment was administered at the second measurement point using standardized instructions and scoring procedures. Teacher and learner records were linked through coded identifiers rather than names to preserve confidentiality.

Data Analysis

Data analysis proceeded through a multivariate growth modeling strategy. Means and standard deviations summarized teachers integrated foundational practices and learner performance at both measurement points. Literacy and numeracy change scores were computed from the difference between the second and first assessments. Standardized mean change was also calculated to determine the magnitude of growth within each learning domain.

To examine the joint contribution of integrated instructional practices to literacy and numeracy growth, the study used seemingly unrelated regression analysis with cluster-robust standard errors. This approach was selected because literacy and numeracy gains were treated as related outcomes whose unexplained variations could be correlated. The model simultaneously estimated how the four dimensions of integrated foundational instruction predicted literacy growth and numeracy growth while accounting for the linkage of learners taught by the same teacher. Statistical significance was evaluated at $\alpha = .05$, while standardized coefficients and confidence intervals were considered in interpreting the magnitude and precision of the relationships.

Ethical Considerations

Participation remained voluntary throughout the study. Written consent was obtained from teachers and parents or guardians, while age-appropriate assent was secured from learners. No names were entered into the analytical dataset, and coded records were used solely for research purposes. Participants could withdraw without penalty, learner assessment results were not used for classroom grading, and all electronic records were stored securely with access limited to the researcher.

RESULTS AND DISCUSSION

Table 1. *Integrated Foundational Instruction Practices of Early-Grade Teachers (n = 32)*

Instructional Dimension	M	SD	Interpretation
Literacy-Numeracy Connection	4.18	0.46	High
Language-Supported Mathematical Reasoning	4.05	0.51	High
Differentiated Foundational Support	3.89	0.54	High
Formative Learning Adjustment	3.62	0.58	High
Overall	3.94	0.43	High

Note. Scale: 1.00 to 1.80 = Very Low; 1.81 to 2.60 = Low; 2.61 to 3.40 = Moderate; 3.41 to 4.20 = High; 4.21 to 5.00 = Very High.

Table 1 presents the instructional practices used by early-grade teachers in supporting literacy and numeracy. The overall mean of 3.94 indicated that integrated foundational practices were generally evident in classroom instruction. Literacy-numeracy connection received the highest rating (M = 4.18, SD = 0.46), suggesting that teachers frequently linked reading, language, numbers, and problem-solving within learning activities. Language-supported mathematical reasoning was similarly strong (M = 4.05, SD = 0.51). However, formative learning adjustment obtained the lowest mean (M = 3.62, SD = 0.58). Although still within the high range, this result revealed a relative weakness in using assessment information to modify instruction for individual learners. This gap is important because adaptive cycles of assessment, teaching, and reassessment have been shown to strengthen children's numerical development when instructional decisions respond directly to demonstrated learning needs (Raudenbush et al., 2020).

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 9 (September 2026)

Table 2. *Learner Performance Across the Two Measurement Points (n = 96)*

Learning Outcome	T1 M	T1 SD	T2 M	T2 SD	Mean Gain	Standardized Mean Change
Literacy, 15 items	8.21	2.06	10.46	1.89	2.25	1.14
Numeracy, 15 items	7.64	1.95	9.31	1.88	1.67	0.87
Combined Foundations, 30 items	15.85	3.42	19.77	3.16	3.92	1.19

Note. Positive standardized mean change values indicate improvement from T1 to T2.

Table 2 shows clear growth in both foundational domains. Literacy scores increased from 8.21 to 10.46, producing a mean gain of 2.25 points and a standardized change of 1.14. Numeracy also improved, from 7.64 to 9.31, with a gain of 1.67 points and a standardized change of 0.87. The combined score rose by 3.92 points, indicating substantial development across the observation period. The parallel improvement supports evidence that literacy and mathematics can develop through interconnected processes during the early years of schooling. Cameron et al. (2019) similarly found co-developing associations among literacy, mathematics, and broader cognitive competencies during kindergarten.

Despite the gains, the results also exposed a continuing learning concern. At T2, learners answered approximately 69.7% of literacy items but only 62.1% of numeracy items correctly. Numeracy therefore remained less developed even after measurable improvement. This pattern suggests that progress did not necessarily mean that all foundational difficulties had been resolved. Longitudinal evidence has shown that children may follow markedly different early learning trajectories, with some learners improving while others remain below expected levels and continue to require carefully aligned instructional support (Graham et al., 2020).

Table 3. *Seemingly Unrelated Regression Estimates for Literacy and Numeracy Growth*

Predictor	Literacy Growth β	Robust SE	p	Numeracy Growth β	Robust SE	p
Literacy-Numeracy Connection	0.31	0.10	.002	0.20	0.09	.026
Language-Supported Mathematical Reasoning	0.24	0.10	.016	0.36	0.10	< .001
Differentiated Foundational Support	0.22	0.09	.015	0.19	0.09	.035
Formative Learning Adjustment	0.11	0.09	.222	0.09	0.10	.368

Model Statistic	Literacy Growth	Numeracy Growth
R^2	.43	.40
Wald $\chi^2(4)$	26.84	23.19
p	< .001	< .001

Note. β = standardized regression coefficient. Standard errors were adjusted for clustering of learners within participating teachers.

Table 3 demonstrates that integrated instructional practices accounted for meaningful variation in both literacy and numeracy growth. The literacy model explained 43% of the variation in learner growth, while the numeracy model explained 40%. Both equations were statistically significant. Literacy-numeracy connection emerged as the strongest predictor of literacy growth (β = .31, p = .002), indicating that learners progressed more strongly when teachers deliberately connected language, reading, quantities, and numerical ideas. The finding is consistent with longitudinal evidence showing that reading and mathematics do not develop independently and that stronger reading performance can contribute to subsequent mathematical growth (Erbeli et al., 2021).

Language-supported mathematical reasoning produced the strongest coefficient for numeracy growth (β = .36, p < .001). This suggests that opportunities to explain solutions, interpret mathematical language, discuss quantities, and make sense of word-based mathematical tasks were particularly important for numerical development. Differentiated foundational support also predicted both literacy (β = .22, p = .015) and numeracy growth (β = .19, p = .035). Such results support instructional approaches that combine mathematical problem solving with explicit attention to language comprehension, which have demonstrated positive effects among young learners experiencing academic difficulty (Fuchs et al., 2021).

Formative learning adjustment, however, did not significantly predict literacy growth ($\beta = .11$, $p = .222$) or numeracy growth ($\beta = .09$, $p = .368$). This finding reinforced the descriptive result in Table 1, where the same dimension received the lowest teacher rating. The problem therefore appeared not to be an absence of integrated instruction, but a weaker capacity to use emerging assessment evidence to adjust the pace, difficulty, grouping, or type of support provided to individual learners. The findings suggest that integration was most productive when literacy and numeracy were meaningfully connected and supported through language and differentiation, while assessment-driven instructional adjustment remained an area requiring further strengthening.

Table 4. *Cross-Equation Statistics for Literacy and Numeracy Growth*

Statistic	Value	p
Residual correlation between literacy and numeracy growth	.33	.001
Breusch-Pagan test of equation independence, $\chi^2(1)$	10.45	.001
System Wald $\chi^2(8)$	44.63	< .001

Table 4 provides further support for treating literacy and numeracy growth as related outcomes rather than as completely separate learning processes. The residual correlation of .33 indicated that unexplained changes in literacy tended to move with unexplained changes in numeracy. The significant test of equation independence, $\chi^2(1) = 10.45$, $p = .001$, supported the use of the seemingly unrelated regression framework. Taken together, the findings indicated that learner growth occurred across both foundational domains, but not at the same rate. Literacy showed stronger gains, while numeracy continued to present a greater instructional challenge. The results therefore supported an integrated approach while also showing that integration alone was insufficient when assessment information was not consistently translated into responsive instructional action.

CONCLUSION

Integrated foundational instruction contributed meaningfully to the literacy and numeracy growth of Key Stage 1 learners in Baggao, Cagayan. Learners demonstrated clear improvement in both domains, with literacy showing stronger gains than numeracy, while literacy-numeracy connection, language-supported mathematical reasoning, and differentiated foundational support emerged as significant contributors to learner progress. The results also revealed that formative learning adjustment remained the weakest instructional area and did not significantly predict growth, indicating a need to strengthen how teachers use assessment evidence to modify instruction. It is therefore recommended that early-grade teachers sustain integrated literacy and numeracy practices while giving greater attention to numeracy development, structured mathematical language, differentiated learning tasks, and timely instructional adjustments based on learner performance. School-based professional development may also focus on practical formative assessment, interpretation of learner evidence, and targeted intervention strategies so that instructional decisions become more responsive to individual learning needs. Future studies may further examine how integrated foundational practices operate across longer instructional periods and different elementary settings to determine their sustained contribution to early learning growth.

References

Balt, M., Fritz, A., & Ehlert, A. (2020). Insights into first grade students' development of conceptual numerical understanding as drawn from progression-based assessments. *Frontiers in Education, 5*, Article 80. doi:10.3389/feduc.2020.00080.

Bonifacci, P., Compiani, D., Affranti, A., & Peri, B. (2021). Home literacy and numeracy interact and mediate the relationship between socio-economic status and early linguistic and numeracy skills in preschoolers. *Frontiers in Psychology, 12*, 662265.

Cameron, C. E., Kim, H., Duncan, R. J., Becker, D. R., & McClelland, M. M. (2019). Bidirectional and co-developing associations of cognitive, mathematics, and literacy skills during kindergarten. *Journal of Applied Developmental Psychology, 62*, 135–144. https://doi.org/10.1016/j.appdev.2019.02.004

Department of Education, Schools Division Office of Cagayan. (2026). *Public elementary schools directory*. Schools Division Office of Cagayan.

Department of Education. (2023). *General shaping paper: MATATAG curriculum*. Bureau of Curriculum Development.

Deunk, M. I., Jacobse, A. E., de Boer, H., Doolaard, S., & Bosker, R. J. (2018). Effective differentiation practices: A systematic review and meta-analysis of studies on the cognitive effects of differentiation practices in primary education. *Educational Research Review, 24*, 31–54. doi:10.1016/j.edurev.2018.02.002.

Erbeli, F., Shi, Q., Campbell, A. R., Hart, S. A., & Woltering, S. (2021). Developmental dynamics between reading and math in elementary school. *Developmental Science, 24*(1), e13004. https://doi.org/10.1111/desc.13004

Fuchs, L. S., Seethaler, P. M., Sterba, S. K., Craddock, C., Fuchs, D., Compton, D. L., Geary, D. C., & Changas, P. (2021). Closing the word-problem achievement gap in first grade: Schema-based word-problem intervention with embedded language comprehension instruction. *Journal of Educational Psychology, 113*(1), 86–103. https://doi.org/10.1037/edu0000467

Graham, L. J., White, S. L. J., Tancredi, H. A., Snow, P. C., & Cologon, K. (2020). A longitudinal analysis of the alignment between children's early word-level reading trajectories, teachers' reported concerns and supports provided. *Reading and Writing, 33*(8), 1895–1923. https://doi.org/10.1007/s11145-020-10023-7

Jordan, R. L. P., & Bratsch-Hines, M. (2020). Associations of reading knowledge with kindergarten and first grade teachers' reported instructional strategies. *Literacy Research and Instruction, 59*(4), 277–297. doi:10.1080/19388071.2020.1774689.

Philippine Statistics Authority. (2026). *Philippine Standard Geographic Code: Municipality of Baggao, Cagayan*. Philippine Statistics Authority.

Purpura, D. J., Logan, J. A. R., Hassinger-Das, B., & Napoli, A. R. (2017). Why do early mathematics skills predict later reading? The role of mathematical language. *Developmental Psychology, 53*(9), 1633–1642. doi:10.1037/dev0000375.

Raudenbush, S. W., Hernandez, M., Goldin-Meadow, S., Carrazza, C., Foley, A., Leslie, D., Sorkin, J. E., & Levine, S. C. (2020). Longitudinally adaptive assessment and instruction increase numerical skills of preschool children. *Proceedings of the National Academy of Sciences, 117*(45), 27945–27953. https://doi.org/10.1073/pnas.2002883117

UNESCO. (2025). *Foundational learning: The building blocks for quality learning throughout life*.

World Bank, & UNESCO. (2022). *Philippines: Learning poverty brief 2022*. World Bank.

Yang, X., Dulay, K. M., McBride, C., & Cheung, S. K. (2021). How do phonological awareness, rapid automatized naming, and vocabulary contribute to early numeracy and print knowledge of Filipino children? *Journal of Experimental Child Psychology, 209*, 105179.