



The Impact of Contextualized Mathematics Storybooks on Grade 7 Numeracy: A Literature Review

JEAN C. AGUILAR, NAIDEL MAE A. MIGUEL,
ALVEN G. TAYON

Maygatasan National High School, Maygatasan, Bayugan City,
Agusan del Sur, Bayugan City Division, Caraga Region, Philippines

Email: jeanaguilar062@gmail.com, tayonalven@gmail.com

ABSTRACT

Article history:

Received: 17 Jan 2026
Revised: 16 Aug 2026
Accepted: 11 Sept 2026
Published: 31 Oct 2026

Keywords — contextualized mathematics, storybooks, numeracy, Grade 7, RMA, Phil-IRI, narrative instruction, Philippines

Declining performance in literacy and numeracy among school-aged learners has become a focal concern of educators and policymakers worldwide, and the Philippines is no exception. International assessments such as PISA, together with national diagnostics like the Department of Education's Rapid Mathematics Assessment (RMA) and the Philippine Informal Reading Inventory (Phil-IRI), consistently reveal foundational gaps that appear most acute during transition points such as entry to junior high. This literature review examines the theoretical and empirical foundations for integrating contextualized mathematics storybooks into Grade 7 instruction as a targeted response to these gaps. Drawing on social constructivist, situated cognition, and motivational theories, the review synthesizes international and local studies on diagnostic-driven remediation, narrative- and context-based instruction, peer-mediated learning, and the literacy-numeracy interface. Evidence indicates that well-designed contextualized narratives, when explicitly



© Aguilar, J. C., Miguel, N. M. A., & Tayon, A. G. (2026). Open Access. This article published by JPAIR Institutional Research is licensed under a Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC 4.0). You are free to share (copy and redistribute the material in any medium or format) and adapt (remix, transform, and build upon the material). Under the following terms, you must give appropriate credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use. You may not use the material for commercial purposes. To view a copy of this license, visit: <https://creativecommons.org/licenses/by-nc/4.0/>

linked to formal representations and supported by dialogic classroom practices and formative assessment, can strengthen number sense, improve problem representation, and increase learner engagement. The review identifies practical challenges (teacher capacity, fidelity, equity) and proposes recommendations for educators, material developers, and policymakers. It concludes that a carefully implemented, diagnostic-aligned storybook approach is a promising, low-cost strategy for improving Grade 7 numeracy in Philippine classrooms, while also calling for rigorous mixed-methods evaluations to confirm and refine the approach.

INTRODUCTION

Concerns about declining literacy and numeracy among school-aged learners have been reinforced by waves of international and national assessment data. The Programme for International Student Assessment (PISA) repeatedly highlights persistent weaknesses in adolescents' mathematical competencies and problem-solving capacities (PISA, 2019). Far from being isolated statistics, these findings signal deeper instructional and curricular challenges, problems that are particularly visible in countries where systemic constraints limit consistent, high-quality pedagogy. In the Philippines, national diagnostic instruments such as the Department of Education's Rapid Mathematics Assessment (RMA) and the Philippine Informal Reading Inventory (Phil-IRI) reveal school-level patterns of weak foundational skills, especially at crucial transition points such as the move from elementary to junior high (DepEd, 2018; DepEd, 2024). These diagnostics show that many learners enter Grade 7 with fragile number sense, limited facility with decimals and place value, and an underdeveloped capacity to read and reason through text-based problems, conditions that undermine their chances of succeeding under the Matatag curriculum and beyond.

Within this policy and diagnostic landscape, educators are increasingly interested in instructional approaches that combine conceptual depth with cultural relevance. One such approach, the focus of this review, is the use of contextualized mathematics storybooks: short narrative texts, locally grounded, that embed mathematical tasks within familiar situations and characters so that learners can encounter number ideas as meaningful, purpose-driven tools rather than as abstract, decontextualized procedures. The basic rationale is straightforward: when students can relate a mathematical problem to an experience they recognize, and when that problem is mediated through socially supported discourse and scaffolding, the chances of conceptual uptake rise. This review brings together the theoretical foundations, international and local

evidence, and practical considerations that bear on the potential of contextualized storybooks to strengthen Grade 7 numeracy.

METHODOLOGY

This review adopts a systematic narrative approach designed to integrate empirical findings and theoretical perspectives relevant to contextualized mathematics instruction for early secondary learners. The literature search prioritized peer-reviewed empirical studies, meta-analyses, policy documents, and comparative reviews published primarily between 2000 and 2025 but included seminal earlier sources where theory warranted (e.g., Vygotsky, Freudenthal). Databases searched included ERIC, Scopus, JSTOR, Google Scholar, and local Philippine education repositories; search terms combined mathematics education and narrative/context keywords (e.g., “mathematics storybook,” “contextualized mathematics,” “numeracy intervention,” “RMA,” “Phil-IRI,” “story problems,” “narrative instruction”). Selection criteria emphasized relevance to Grade 6–9 transitional contexts, methodological rigor (experimental/quasi-experimental designs or strong mixed-methods studies), and applicability to resource-constrained classrooms. Studies were then thematically synthesized across theoretical frameworks, evidence of effectiveness, mechanisms of action (discourse, representation, motivation), and implementation considerations. Where Philippine studies were available, these received particular attention to ensure local relevance.

THEORETICAL FRAMEWORK

Three interlocking theoretical perspectives underpin the argument for contextualized mathematics storybooks: social constructivism, Realistic Mathematics Education (RME)/situated cognition, and motivation theory (particularly Self-Determination Theory).

Vygotsky’s social constructivism foregrounds the social mediation of learning. Knowledge is not a solitary product but emerges through interaction: dialogic exchanges, scaffolding, and co-constructed meaning within the Zone of Proximal Development (ZPD) enable learners to perform tasks they could not complete independently (Vygotsky & Cole, 1978). Storybook lessons lend themselves naturally to such interactions: narratives stimulate questions, invite multiple perspectives, and create contexts for peer explanation and teacher prompts that scaffold formalization.

Realistic Mathematics Education, advanced by Freudenthal and colleagues,

argues that mathematics is best learned when tied to reality; learners “reinvent” formal concepts by working through contextual problems and gradually moving toward abstraction (Freudenthal, 2012; Gravemeijer, 1994). Storybooks act as designed contextual milieus that make quantity relationships and operations meaningful: a market story situates ratios and decimals, a construction vignette situates measurement and proportional reasoning. When the teacher explicitly links the narrative situation to graphical, symbolic, and verbal representations, learners can translate informal reasoning into formalized mathematics.

Motivational frameworks, particularly Self-Determination Theory (Deci & Ryan, 2000), explain why context and narrative matter beyond pure cognition. SDT posits that autonomy, competence, and relatedness are key drivers of sustained engagement. Contextualized storybooks can enhance relatedness (by reflecting learners’ cultural worlds), promote autonomy (through open tasks and choices in problem solving), and support competence (through scaffolded success), collectively increasing willingness to engage with challenging tasks. The combination of social scaffolding, contextual anchoring, and motivation thus provides a convincing theoretical basis for the intervention.

International Evidence: Narrative and Context in Mathematics Learning

A robust international literature supports the pedagogical value of context and narrative in mathematics. Freudenthal (2012) and later RME scholars emphasize that realistic contexts help learners to internalize mathematical structures rather than merely memorize procedures. Empirical studies and meta-analyses indicate that well-designed contextual tasks and story problems improve conceptual understanding, enhance problem representation, and support the transfer of informal quantitative reasoning to formal school mathematics (Nunes et al., 1993; Hiebert & Grouws, 2007). Bruner’s work on narrative cognition further shows that stories support memory and comprehension by organizing information temporally and causally (Bruner, 1991), a feature particularly useful for complex multi-step mathematical tasks.

Research across age ranges suggests that story-based instruction fosters multiple representations, verbal, pictorial, tabular, symbolic, and strengthens learners’ ability to move between these representations, a skill central to mathematical proficiency. While many studies target primary grades, evidence from secondary contexts indicates that adolescents benefit from contextualized tasks when these are designed to scaffold transitions into more abstract domains such as algebraic thinking or proportional reasoning (Blum et al., 2009; Jankvist & Misfeldt, 2019). Crucially, international work highlights design features associated with success: explicit teacher-mediated links between the story and

formal math, iterative opportunities to translate representations, and formative assessment to guide scaffolding. These features inform how contextualized storybooks should be written and enacted in classrooms.

Diagnostic Assessment and Data-Driven Remediation: RMA and Phil-IRI

Assessment is most effective when it serves instruction (Black & Wiliam, 1998). Rapid, curriculum-aligned diagnostics that reveal specific least-learned competencies can direct targeted remediation efforts far more efficiently than one-size-fits-all catch-up programs (Wiliam, 2011; Hattie, 2008). In the Philippine context, DepEd's Rapid Mathematics Assessment (RMA) is explicitly designed to provide such diagnostic intelligence at the beginning of the school year; paired with the Phil-IRI for literacy diagnosis, these instruments offer schools actionable data on where learners struggle and why (DepEd, 2018; DepEd, 2024).

The import of diagnostics to this review is pragmatic: contextualized storybooks are not proposed as a general remedy but as a diagnostic-driven strategy. Where RMA identifies gaps in decimals, number-line reasoning, or exponent understanding, storybooks can be written to foreground those exact competencies within compelling narratives. International syntheses suggest that diagnostic-aligned interventions produce larger effect sizes because they narrow the target and allow repeated, scaffolded practice on specific misconceptions (Findell et al., 2001). The Phil-IRI contributes by clarifying reading comprehension needs so that story presentation and embedded reading supports (e.g., pre-teaching key vocabulary) do not inadvertently create barriers to math reasoning.

Narrative/Contextualized Instruction in Secondary Mathematics

The notion that storybooks are solely for younger children underestimates the power of narrative to support adolescents' conceptual development. Secondary learners, especially those entering junior high with gaps, face conceptual transitions that are often best scaffolded with meaningful contexts. Boaler (2019) and other scholars show that when tasks are open, context-rich, and invite multiple solution pathways, students develop more flexible understanding and more positive mathematical identities. For adolescents, contextualization can incorporate more complex socio-economic and scientific scenarios (market economics, community projects, data from local contexts) that require modeling, interpretation, and justification, practices central to higher-order numeracy.

Crucially, authenticity and cultural resonance matter. Stories that reflect students' communities (for example, local market practices, household budgeting, or agricultural tasks) increase relevancy and reduce the psychological distance between school mathematics and real life, thereby fostering motivation and

persistence (Ainley, 2012). In practical terms, this means storybook development should be teacher-led or co-created with local stakeholders to ensure realism and inclusivity.

Peer-Assisted Learning and Classroom Discourse to Mechanisms

Contextualized stories by themselves are not a silver bullet, their potency depends on classroom enactment. Social mechanisms such as peer discussion, reciprocal explanation, and teacher questioning transform narrative contexts into learning opportunities. Peer-assisted learning approaches (structured reciprocal tutoring, small cooperative groups) have been shown to yield meaningful gains in mathematics when they include tutor training and clear role structures (Rohrbeck et al., 2003; Topping, 2005). In a storybook lesson, small-group discussion encourages learners to externalize their reasoning, confront alternatives, and negotiate representations. Teacher facilitation is then critical to synthesize group outputs, highlight formal links, and correct misconceptions before they solidify.

Research on classroom discourse emphasizes the cognitive value of explanation and justification: tasks that require learners to articulate why an answer is correct deepen understanding far more than tasks focused on answer-getting alone (Mercer & Littleton, 2007; Hiebert & Grouws, 2007). Thus, storybook activities should be explicitly designed with discussion prompts, representational tasks (draw the scenario, make a table, write an equation), and short formative checks that inform immediate scaffolding.

Motivation, Engagement, and the Literacy to Numeracy Interface

The affective dimension, motivation, confidence, and interest, plays a decisive role in whether learners persist with challenging tasks. Self-Determination Theory (Deci & Ryan, 2000) offers a useful lens: interventions that support autonomy, build competence through scaffolded success, and create social relatedness increase intrinsic motivation. Contextualized storybooks have the potential to do precisely this: they situate problems in familiar settings (relatedness), allow learners to approach tasks in personally meaningful ways (autonomy, when choices are offered), and provide scaffolded success experiences (competence). Empirical work shows that narrative framing can reduce math anxiety and encourage participation, particularly among learners who have previously experienced repeated failure (Hidi & Renninger, 2006; Ramirez et al., 2016).

Because storybooks are text-based, literacy skills intersect strongly with numeracy outcomes. A learner who struggles with vocabulary or comprehension may misinterpret a story problem and fail to extract the underlying quantitative relations. The Phil-IRI thus has a practical function: by diagnosing reading

needs, teachers can adapt story presentation (simplify or pre-teach vocabulary, provide oral reading) so that comprehension barriers do not confound numeracy instruction (Graham & Harris, 2019). Integrating reading strategies within storybook math lessons, for example, guided reading, vocabulary maps, and comprehension checks, is therefore not optional but essential to the approach's success in contexts where reading proficiency varies.

Philippine Context, Policy Alignment, and Local Evidence

National policy in the Philippines emphasizes learning recovery and data-driven remediation. The Department of Education's ARAL initiatives and related orders encourage schools to implement targeted, localized strategies that address diagnostic findings (DepEd, 2023). Local policy briefs and project evaluations (SEAMEO-INNOTECH, UPOU) recommend teacher-developed materials and capacity building as sustainable, cost-effective responses in geographically and resource-diverse regions (SEAMEO-INNOTECH, 2020). Case reports from Philippine classrooms provide promising but preliminary evidence that localized contextual tasks and teacher-facilitated discourse can yield improvements in engagement and conceptual understanding (Bello et al., 2023). However, rigorous, generalizable mixed-methods studies remain rare; this scarcity underlines the need for the kind of diagnostic-aligned, storybook-based research proposed in the present study.

Challenges and Critical Considerations

Several practical and theoretical challenges must be acknowledged. First, teacher capacity is central: developing high-quality contextualized storybooks and enacting dialogic lessons requires time, pedagogical skill, and familiarity with formative assessment practices. Without targeted professional development, attempts at contextualization can become superficial, stories that are culturally recognizable but fail to make explicit mathematical links will not produce desired learning outcomes. Second, fidelity and scalability pose dilemmas. Small pilot successes may not scale without institutional support, materials funding, and monitoring. Third, inequity risks arise if story contexts privilege certain community experiences; developers must ensure inclusivity so that marginalized learners are not alienated. Fourth, assessment alignment is critical: storybook tasks must map intentionally to curriculum competencies and diagnostic measures to produce evidence of impact. Lastly, time constraints in packed curricula may limit the space teachers can allocate for narrative-based lessons unless school timetables or remedial blocks are adjusted.

Effectiveness: What the Evidence Suggests

Synthesizing quantitative and qualitative evidence yields guarded optimism. Experimental and quasi-experimental studies that isolate contextualized instruction (with good fidelity and scaffolding) report improvements in conceptual understanding, representational flexibility, and problem-solving accuracy. Meta-analyses of peer-assisted and tutoring interventions show moderate to large effect sizes when interventions are structured, frequent, and aligned with curricular objectives (Rohrbeck et al., 2003; Slavin, 1996). In practical classrooms, mixed-methods pilots indicate additional benefits: increased participation, improved mathematical discourse, and greater student confidence. Nevertheless, effect magnitudes vary depending on dosage, fidelity, and the match between story content and diagnosed needs. The strongest evidence points to gains when storybooks are diagnostic-aligned (targeting RMA-identified competencies), teacher-mediated (explicit links to formal representations), and coupled with literacy supports (to ensure comprehension).

Future Directions and Recommendations

The following recommendations address educators, developers, and policymakers, with an emphasis on practicality and scalability.

For Educators

1. Use diagnostics to prioritize targets. Begin by mapping RMA and Phil-IRI findings to a short list of competencies (e.g., decimals, number lines, exponent notation) and design storybook lessons that foreground those competencies.
2. Adopt a blended enactment model. Combine whole-class story reading with small-group problem solving and reciprocal peer explanation to balance teacher guidance and student agency.
3. Integrate literacy supports. Pre-teach critical vocabulary, use guided reading strategies, and include comprehension checks so that reading difficulty does not mask numerical reasoning.
4. Document and reflect. Keep weekly formative trackers and brief tutor logs; use this data to adjust the focus and form of subsequent lessons.

For Instructional Material Developers

1. Co-create with teachers and communities. Ensure narratives are authentic and inclusive by involving local teachers, parents, and students in story development.
2. Align content tightly to diagnostics and curriculum. Each storybook should have clear learning objectives mapped to RMA TOS and include teacher

notes, representational prompts, and formative checks.

3. Design scalable packages. Provide low-cost printable versions, read-aloud scripts, and short teacher professional development modules that accompany materials.

For Policymakers and School Leaders

1. Institutionalize diagnostic cycles. Fund and mandate regular administration of RMA/Phil-IRI and ensure data are used for targeted remedial programming.

2. Invest in teacher professional learning. Allocate time and resources for short, practice-focused workshops on contextualized lesson design and formative assessment.

3. Support piloting and scale-up. Provide modest grants for school clusters to pilot contextualized storybook interventions and evaluate outcomes using mixed-methods designs; successful pilots can then be integrated into division recovery plans.

4. Ensure equity safeguards. Monitor materials for cultural inclusivity and provide additional supports where learners face other structural disadvantages (e.g., limited learning time, language barriers).

CONCLUSION

The literature reviewed in this paper supports a reasoned and practicable case for using contextualized mathematics storybooks as part of a diagnostic-driven, mixed-methods approach to improving Grade 7 numeracy. The theoretical bases, social constructivism, RME, and motivation theory, provide coherent mechanisms through which narrative contexts, scaffolded discourse, and formative assessment can produce both cognitive and affective gains. Empirical evidence, while heterogeneous, suggests that carefully designed storybook lessons, tightly aligned to diagnostic priorities and enacted with peer interaction and literacy supports, can improve number sense, representational skill, and learner engagement. Challenges remain, teacher capacity, fidelity, equity, and scalability, but these are addressable with targeted professional development, participatory material design, and policy support. Crucially, the approach is low-cost and teacher-centric, making it well suited to many Philippine classrooms. The present study, by combining RMA-informed targets with locally developed storybooks and a robust mixed-methods evaluation, seeks to provide rigorous evidence on both whether and how narrative-based instruction can contribute to closing foundational numeracy gaps in early secondary education.

LITERATURE CITED

- Ainley, M. (2012). Student engagement in mathematics: *Supportive practices and motivational strategies*. Cambridge University Press.
- Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education: principles, policy & practice*, 5(1), 7-74. <https://doi.org/10.1080/0969595980050102>
- Blum, W., & Borromeo Ferri, R. (2009). Mathematical modelling: Can it be taught and learnt. *Journal of mathematical modelling and application*, 1(1), 45-58. https://eclass.uoa.gr/modules/document/file.php/MATH601/3rd%20&%204rth%20unit/3rd%20unit_Modelling%20cycle.pdf
- Boaler, J. (2019). Developing Mathematical Mindsets: The Need to Interact with Numbers Flexibly and Conceptually. *American educator*, 42(4), 28.
- Bruner, J. (1991). Narrative and paradigmatic modes of thought. In A. Collins & R. Halverson (Eds.), *The construction of knowledge* (pp. 62–84). Ablex. <https://www.scribd.com/document/961973757/Jerome-S-Bruner-Paradigmatic-vs-Narrative-Thought-Vincent-W-Hevern-S-J>
- Deci, E. L., & Ryan, R. M. (2000). The” what” and” why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological inquiry*, 11(4), 227-268. https://doi.org/10.1207/S15327965PLI1104_01
- DepEd. (2018). *Philippine Informal Reading Inventory: Manual*. Department of Education, Philippines.
- DepEd. (2023). *Adoption of the National Learning Recovery Program* (DepEd Order No. 013, s. 2023). Department of Education, Philippines.
- DepEd. (2024). *Rapid Mathematics Assessment Teacher’s Guide*. Department of Education, Philippines.
- Freudenthal, H. (2012). *Mathematics as an educational task*. Springer Science & Business Media.

- Graham, S., & Harris, K. R. (2019). Effective teaching of writing and comprehension: Integrating literacy and mathematics. *Educational Psychologist*, 54(2), 131–143.
- Gravemeijer, K. P. E. (1994). Developing realistic mathematics education. <https://research.tue.nl/en/publications/developing-realistic-mathematics-education/>
- Hattie, J. (2008). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. routledge.
- Hiebert, J. & Grouws, D. A (2007). The effects of classroom mathematics teaching. *Second handbook of research on mathematics teaching and learning: A project of the national council of teachers of mathematics*, 1, 371.
- Hidi, S., & Renninger, K. A. (2006). The four-phase model of interest development. *Educational psychologist*, 41(2), 111-127. https://doi.org/10.1207/s15326985ep4102_4
- Jankvist, U. T., & Misfeldt, M. (2019). CAS Assisted Proofs in Upper Secondary School Mathematics Textbooks. *REDIMAT-Journal of Research in Mathematics Education*, 8(3), 232-266. <https://eric.ed.gov/?id=EJ1233141>
- Findell, B., Swafford, J., & Kilpatrick, J. (Eds.). (2001). *Adding it up: Helping children learn mathematics*. National Academies Press.
- Bello, J. B., Concon, L. S., Polache, M. C. C., Ayaton, M. J. C., Manlicayan, R. D., Campomanes, J. P., & Saro, J. M. (2023). Contextualized and localized science teaching and learning materials and its characteristics to improve Students' learning performance. *Psychology and Education: A Multidisciplinary Journal*. <https://tinyurl.com/3v5txyy4>
- Mercer, N., & Littleton, K. (2007). *Dialogue and the development of children's thinking: A sociocultural approach*. Routledge.
- Nunes, T., Schliemann, A. D., & Carraher, D. W. (1993). *Street mathematics and school mathematics*. Cambridge University Press.
- PISA, O. (2019). PISA 2018 result (Volume I): What student know and can do.

- Ramirez, G., Chang, H., Maloney, E. A., Levine, S. C., & Beilock, S. L. (2016). On the relationship between math anxiety and math achievement in early elementary school: The role of problem solving strategies. *Journal of experimental child psychology*, 141, 83-100. <https://doi.org/10.1016/j.jecp.2015.07.014>
- Rohrbeck, C. A., Ginsburg-Block, M. D., Fantuzzo, J. W., & Miller, T. R. (2003). Peer-assisted learning interventions with elementary school students: A meta-analytic review. *Journal of educational Psychology*, 95(2), 240. <https://doi.org/10.1037/0022-0663.95.2.240>
- SEAMEO-INNOTECH. (2020). *Localized pedagogies and resource adaptation for rural schools*. Policy brief.
- Slavin, R. E. (1996). Research on cooperative learning and achievement: What we know, what we need to know. *Contemporary educational psychology*, 21(1), 43-69. <https://tinyurl.com/3nv23azw>
- Topping, K. J. (2005). Trends in peer learning. *Educational psychology*, 25(6), 631-645. <https://doi.org/10.1080/01443410500345172>
- Vygotsky, L. S., & Cole, M. (1978). *Mind in society: Development of higher psychological processes*. Harvard university press.
- Wiliam, D. (2017). *Embedded formative assessment:(Strategies for classroom assessment that drives student engagement and learning)*. Solution tree press.