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Development of a sustainable school-based Mathematics remedial framework

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Abstract
This study aimed to develop a sustainable school-based Mathematics remedial framework for instructional materials management. Guided by the ADDIE model, the study employed a developmental design to examine the availability and use, management, and sustainability of instructional materials in Mathematics remediation in selected public elementary schools in Passi II-A (East) District. Survey questionnaires and interviews were used to gather quantitative and qualitative data from teachers and school heads. Findings revealed that instructional materials were generally insufficient, inconsistently utilized, and weakly sustained, resulting in a low overall level of availability and use, management, and sustainability. Interview data further showed that existing practices were fragmented and reactive, marked by inadequate planning, weak monitoring and inventory systems, limited accessibility, and insufficient institutional support. Despite these challenges, teachers showed strong adaptability and commitment in sustaining remedial instruction. In response, the study developed the Math Bridge: A Sustainable School-Based Mathematics Remedial Program Framework, which integrates systematic planning, instructional materials monitoring, accessibility mechanisms, and sustainability strategies. The framework was rated highly acceptable, indicating its practical relevance and feasibility. The study underscores the need for a structured and sustainable instructional materials management system to strengthen Mathematics remediation and improve learners' foundational numeracy outcomes.

Keywords: Development, sustainable, school-based, mathematics remedial framework

Introduction

The sustainability and effective management of instructional resources have become significant concerns in contemporary education, particularly in public elementary schools where limited resources, increasing learner diversity, and curriculum reforms continue to challenge the delivery of quality instruction. Instructional materials serve as essential components of the teaching-learning process because they enhance learner engagement, support concept development, and improve academic achievement. According to Ghanney (2008) [13], instructional materials help simplify abstract concepts and make learning more meaningful and interactive for learners. Similarly, Carbonneau, Marley, and Selig (2013) [4] emphasized through a meta-analysis that the use of concrete manipulatives significantly improves learners' mathematical understanding and achievement. In mathematics education, especially at the primary level, the use of tangible and visual learning tools supports conceptual mastery and learner retention (Clements & Sarama, 2011) [5].

Educational institutions are increasingly recognizing that the sustainability of instructional resources is not only an operational concern but also a strategic educational issue. Sustainable instructional resource management refers to the effective allocation, maintenance, utilization, and reproduction of teaching materials to ensure long-term educational benefits despite resource limitations. UNESCO (2017) [28] highlighted that sustainable educational resource management strengthens institutional resilience and promotes equitable access to quality education. Likewise, the Global Reporting Initiative (GRI, 2006) [14] stressed that sustainability practices in organizations, including schools, require responsible utilization of resources to ensure continuity and efficiency.

In the Philippine educational setting, the issue of sustaining instructional materials remains highly relevant, particularly in public schools that experience budget constraints and shortages of teaching tools. Pilar (2021) [22] identified major challenges in sustaining learning materials in resource-limited public schools, including inadequate funding, poor maintenance systems, and lack of technical support. Similarly, Del Rosario (2022) [7] found that school administrators' instructional resource management practices significantly influence classroom effectiveness and learner outcomes. Bautista and Ramirez (2020) [2] further revealed that sustainable management of classroom resources positively affects elementary learners' academic performance and classroom participation.

The Department of Education (DepEd, 2019) [8] continues to advocate inclusive and learner-centered education through policies that encourage schools to provide accessible, adaptive, and sustainable learning materials for all learners, including those with disabilities. This initiative aligns with the broader educational reforms emphasizing quality, inclusivity, and sustainability in basic education. The recent reports of the Second Congressional Commission on Education (EDCOM II, 2025; 2026) [23, 24] underscored the urgent need to strengthen foundational learning systems in the Philippines due to declining learner performance, inadequate instructional support, and systemic educational gaps. The reports emphasized that improving instructional resources and their sustainability is critical in addressing learning poverty and enhancing educational outcomes nationwide.

Globally, educational reforms increasingly integrate sustainability principles into school leadership and instructional planning. Thapa, Nieß, and Bätzing (2020) [27] explained that sustainable school leadership promotes long-term educational effectiveness through strategic resource planning and institutional innovation. Similarly, Sucuoğlu and Erdem (2021) [26] argued that sustainable strategic planning enhances the effectiveness of Total Quality

Management practices in schools. Fullan (2007; 2016) [11, 12] further emphasized that educational change becomes successful when schools develop sustainable systems that support continuous improvement and adaptive learning environments.

The integration of technology and locally developed instructional materials has also emerged as an important strategy for sustainability. Lasekan and Godoy (2020) [16] demonstrated that locally produced instructional videos significantly improved learners' language skills and learner motivation while minimizing dependence on expensive commercial resources. El-Hamamsy *et al*. (2023) [9] likewise discussed the sustainability of digital curricular reforms and professional development programs, emphasizing the importance of continuous teacher support and sustainable technological integration in schools.

In mathematics remediation and intervention programs, sustainable instructional materials have shown significant positive effects on learner performance. Pamulaklakin, Golez, and Closa (2024) [20] found that remedial classes using structured interventions improved the mathematics performance of Grade 7 learners. Similarly, Panganiban (2019) [21] emphasized that multimedia-based instructional materials enhanced learner participation and achievement among Grade 1 pupils during remediation classes. Wang and Tang (2020) [29] also reported that effective instructional resource allocation directly influences the success of remedial mathematics programs.

The theoretical foundation of instructional sustainability is anchored on learner-centered and constructivist approaches. Kitta and Tilya (2010) [15] explained that competence-based and learner-centered curricula require active learner participation supported by appropriate instructional materials. Branch (2009) [3], through the ADDIE instructional design framework, emphasized systematic planning, development, implementation, and evaluation of instructional resources to ensure effectiveness and sustainability. Moreover, Moyer, Bolyard, and Spikell (2000) [19] highlighted the growing importance of virtual manipulatives as innovative instructional tools that support interactive mathematics learning.

This study is also supported by educational psychology principles emphasizing that instructional resources influence motivation, comprehension, and academic achievement. Slavin (2018) [25] explained that effective instructional strategies and materials contribute to meaningful learning experiences and improved learner outcomes. Adeogun and Olatunji (2013) [1] similarly concluded that proper resource management significantly affects students' academic performance in secondary schools, reinforcing the importance of strategic instructional management across educational levels.

Furthermore, research methodology scholars such as Creswell and Creswell (2018), Fraenkel, Wallen, and Hyun (2019), and Lichtman (2013) [6, 10, 17] emphasized the importance of systematic inquiry in understanding educational issues and developing evidence-based interventions. Their works provide methodological support for examining the sustainability of instructional resources and their implications for teaching and learning processes.

Given these educational realities and scholarly findings, there is a strong need to investigate the sustainability of instructional resources in elementary schools, particularly in mathematics education and remediation programs. Despite existing policies and interventions, many schools continue to struggle with maintaining adequate, effective, and sustainable learning materials that support quality instruction. Therefore, this study seeks to explore how instructional resource sustainability practices influence teaching effectiveness and learner performance, with the end goal of contributing evidence-based recommendations for sustainable educational development in public elementary schools.

Conclusions

Based on the findings of the study, the following conclusions were drawn:

The generally low level of availability and use, management, and sustainability of instructional materials indicates that current systems are inadequate and lack the structure necessary to effectively support the development of learners' foundational numeracy skills. This underscores the critical need for systematic improvement in instructional material provision and utilization.

The weak, fragmented, and reactive nature of instructional materials management practices reflects the absence of institutionalized and standardized systems, resulting in inconsistencies that limit the effectiveness and sustainability of Mathematics remediation efforts.

The development of the Math Bridge: A Sustainable School-Based Mathematics Remedial Program Framework affirms the necessity of a structured, integrated, and system-based approach to instructional materials management, providing a strategic solution to address identified gaps and enhance program implementation.

Teachers' demonstrated adaptability, commitment, and resourcefulness highlight that human capacity remains a strong foundation for program implementation; however, these efforts require adequate institutional support, structured systems, and resources to be fully maximized and sustained.

The high level of acceptability of the proposed framework indicates that it is contextually appropriate, practically feasible, and responsive to existing needs, thereby offering strong potential for improving instructional material management and ensuring the long-term sustainability of Mathematics remediation programs.

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