



UTILIZATION OF CONTEXTUALIZED STORY WORD PROBLEMS IN MATHEMATICS 3

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Abstract

This action research investigated the academic impact of Contextualized Story Word Problems (CSWPs) as a strategic curriculum intervention to improve the mathematical comprehension and problem-solving skills of primary-grade pupils. The study was prompted by a persistent challenge at Mabog Elementary School within the Department of Education (DepEd) Division of Bislig City, where Grade 3 learners struggled to decode, translate, and compute standard abstract word problems. A cohort of 15 selected Grade 3 pupils underwent a structured 12-week Remediation, Reinforcement, and Enhancement (RRE) program from July to September 2022. This program used a localized, scaffolded CSWP compendium developed in the pupils' mother tongue and built around the five-step UPSC framework (Understand, Plan, Solve, Check, and Look Back). Data were gathered using a validated, researcher-developed, 10-item diagnostic pre-test and post-test that covered key public-school mathematical competencies.

The quantitative findings revealed a highly significant improvement in pupil proficiency. The pre-test mean score of 5.13 (categorized as "Approaching Proficiency") increased to 8.73 (categorized as "Proficient") on the post-test, representing an academic gain in the overall Mean Percentage Score (MPS) from 51.33% to 87.33%. A paired-samples t-test calculated using Microsoft Excel's Data Analysis ToolPak confirmed a highly significant statistical difference ($p = 0.000105159$, which is less than the standard significance threshold of $p \leq 0.05$). Qualitative feedback from teachers, parents, school heads, and district supervisors indicated that integrating familiar cultural and household narratives reduced math-related anxiety, boosted learner engagement, and helped pupils develop independent problem-solving skills. While the intervention proved highly effective for the majority of the cohort, the results also highlighted a threshold effect: mathematical contextualization must be paired with foundational reading support for pupils with severe literacy deficits. Consequently, the study recommends scaling up CSWPs as supplemental learning materials across other primary subjects, developing them into interactive digital formats, and sharing the compendium district-wide during District Learning Action Cell (DisLAC) sessions.

Keywords: *action research, contextualized story word problems, mathematics intervention, primary education, curriculum scaffolding*



Introduction

Context and Rationale

Mathematical problem solving is a critical cognitive competency that heavily influences functional literacy and a learner's ability to navigate modern society. In primary education, solving word problems represents a highly complex task because it requires learners to perform both semantic text decoding and numerical calculations. Unlike pure computational drills, word problems present real-life scenarios in written language. Learners must first read, comprehend, and make sense of these narratives before they can translate them into solvable mathematical equations. Consequently, a student's success in mathematical problem solving is closely tied to their reading comprehension abilities.

Educational research has consistently highlighted this strong relationship. Reading comprehension is a primary cognitive factor in problem-solving. In early childhood education, what is often diagnosed as a computational error is, in fact, a language-decoding failure. Therefore, to improve mathematics performance, educators must first address reading and comprehension barriers. When students struggle to decode the vocabulary in a word problem, they cannot construct an accurate mental model of the scenario, leading to incorrect operations and calculations.

To bridge the gap between abstract mathematical concepts and the child's cognitive frame of reference, educational theorists advocate for contextualization. Contextualized basic skills instruction involves teaching academic concepts by embedding them in situations that are familiar and meaningful to the learners. This approach accelerates the academic progress of struggling students by allowing them to relate prior knowledge to classroom lessons. By connecting academic content to students' lived experiences, contextualization makes learning more relevant and engaging, helping students develop critical thinking and analytical decision-making skills. For early-grade learners, presenting mathematics through familiar stories and local community contexts reduces learning anxiety and builds confidence.

This pedagogy is aligned with the standards of the Department of Education (DepEd) in the Philippines, which identify critical thinking and problem-solving as the "twin goals" of the basic education mathematics curriculum. However, achieving these goals remains a persistent challenge, particularly in public elementary schools across the Caraga Administrative Region. In the Division of Bislig City, developing mathematical comprehension has been a recurring issue. Despite various division-initiated remediation programs, early-grade learners continue to show low proficiency in math word problems due to underlying reading comprehension deficits.

This challenge was evident at Mabog Elementary School during the 2021–2022 school year. The average Mean Percentage Score (MPS) of Grade 3 pupils in Mathematics across the first, second, and third quarters was only 40.23%. This fell significantly short of the national passing standard of 75.00%, indicating a clear need for targeted classroom interventions. To address this issue, the researchers developed and utilized a compendium of Contextualized Story Word Problems (CSWPs). This material was designed to support a twelve-week Remediation, Reinforcement, and Enhancement (RRE) program, helping incoming Grade 3 pupils improve both their reading comprehension and mathematical problem-solving skills.

Innovation, Intervention, and Strategy

The CSWP compendium was designed as a scaffolded, twelve-week RRE intervention program implemented from July to September 2022. It targeted the specific mathematics competencies outlined in the DepEd curriculum guide for the first and second quarters of Grade 3. The program aimed to help pupils systematically analyze word problems by reducing language barriers and utilizing familiar narratives. To support students with varying levels of preparation, the compendium was structured into three progressive difficulty levels, each containing ten highly contextualized math stories.

Table 1. Scaffolded Structure of the Contextualized Story Word Problems Compendium.

Compendium Level	Target Proficiency Stage	Core Focus	Structural Complexity
Level 1	Beginning Level	One-Step Word Problems	Direct narrative structure requiring a single operation (addition, subtraction, multiplication, or division).
Level 2	Developing & Approaching Proficiency	Two-Step Word Problems	Localized scenarios requiring a combination of two operations in sequence.
Level 3	Proficient & Advanced Level	Multi-Step Word Problems	Complex community-based narratives requiring multiple stages of computational reasoning.

To help pupils analyze problems systematically, the compendium used the five-step UPSC framework as a guiding cognitive strategy. This framework was translated into the mother tongue to maintain linguistic consistency.

Table 2. The UPSC Problem-Solving Framework.

Framework Step	Operational Definition in Primary Mathematics
U	Understand: Identify the main question asked, isolate the given facts, and recognize key narrative word clues.
P	Plan: Determine the mathematical operations required and formulate the corresponding equation.
S	Solve: Execute the computational steps with numerical accuracy.
C	Check and Look Back: Verify the computed result against the story's real-world logic.

During the intervention, the researchers held weekly Focus Group Discussions (FGDs) with mother tongue and mathematics experts to evaluate student progress and refine the instructional materials. The program was supervised by the school head and district supervisor, who used weekly evaluation tools to ensure the quality and consistency of the intervention.



Action Research Questions

This action research evaluated the effectiveness of Contextualized Story Word Problems in improving the comprehension and mathematical problem-solving skills of Grade 3 pupils. Specifically, the study sought to answer the following research questions:

1. What is the proficiency level of Grade 3 pupils in comprehending mathematical word problems before the utilization of the contextualized story word problems?
2. What is the proficiency level of Grade 3 pupils in comprehending mathematical word problems after the utilization of the contextualized story word problems?
3. Is there a significant difference between the proficiency levels of the Grade 3 pupils before and after the utilization of the contextualized story word problems?



Methods

Research Design

This study utilized a pre-experimental, one-group pre-test/post-test research design combined with a descriptive qualitative approach. This design is highly suitable for classroom-based action research because it allows teacher-researchers to measure academic growth in a specific group of students before and after introducing a targeted intervention. Quantitative data were derived from the pupils' pre-test and post-test scores, while qualitative data were gathered through stakeholder feedback during focus group discussions and end-of-intervention evaluations. This mixed-methods action research approach provided a comprehensive view of both the statistical impact of the CSWP compendium and the participants' qualitative experiences.

Participants and Ethical Considerations

The research was conducted at Mabog Elementary School, a public primary school in the Division of Bislig City, Caraga Region, Philippines. The research cohort consisted of fifteen selected Grade 3 pupils enrolled for the 2022–2023 academic year. Because these participants were minors, strict ethical protocols were maintained.

Before starting the study, the researcher-proponents held a Focus Group Discussion (FGD) with the pupils' parents to discuss the research objectives, timeline, and confidentiality protocols. Written informed consent was secured from all parents, and assent was obtained from the pupils, ensuring full compliance with the DepEd Child Protection Policy (DO 40, s. 2012) and established research ethics guidelines.

Research Instrument and Competencies

The primary diagnostic tool used in this study was a ten-item, researcher-made test designed to align with official DepEd curriculum standards. The test assessed four primary mathematical areas that are critical for Grade 3 learners:

- **Addition:** Adding three-to-four-digit numbers (with sums up to 10,000) with and without regrouping, using up to three addends.
- **Subtraction:** Subtracting three-to-four-digit numbers with and without regrouping.
- **Multiplication:** Multiplying two-digit numbers by two-digit numbers with regrouping.
- **Division:** Dividing two-to-three-digit numbers by one-to-two-digit numbers (with or without remainders), as well as dividing by 10 and 100.

The instrument underwent content validation and validation for grammar and language in the mother tongue by a panel of experts, including the MTB-MLE Division Supervisor, the Mathematics Division Supervisor, and the Division Learning Resource In-Charge. To ensure reliability, the test was pilot tested with a separate group of Grade 3 pupils who were not part of the research cohort, and was adjusted based on their results before final administration.

Data Gathering and Monitoring Procedure

The data collection occurred in five sequential stages:

1. **Pre-Intervention Stage:** The validated ten-item pre-test was administered to the fifteen participants in July 2022 to establish baseline mathematical comprehension and computation proficiency.



2. **Material Validation Stage:** The CSWP compendium was reviewed by curriculum and language experts to ensure its design, grammar, and content met district standards.
3. **Implementation Stage:** The 12-week RRE intervention program was executed from July to September 2022. During this period, the teacher-researchers guided the pupils through the three progressive levels of the compendium. Sessions were structured around the UPSC steps. To address learning difficulties, the researchers used peer tutoring, localized language scaffolding, and extended instructional time for pupils who had missed sessions due to illness or inclement weather.
4. **Monitoring Stage:** Weekly evaluation sheets and monitoring logs were maintained by the classroom teacher, school head, and public school district supervisor to assess the reliability of the delivery and student progress.
5. **Post-Intervention Stage:** In September 2022, the post-test was administered to evaluate academic gains. Additionally, evaluations were collected from parents and pupils to capture qualitative feedback on the intervention.

Data Analysis and Statistical Treatment

Quantitative data were analyzed using both descriptive and inferential statistics. Descriptive statistics, including frequency distributions, percentages, and mean scores, were used to categorize pupils' performance into five distinct proficiency levels. This categorization was aligned with the standards established under DepEd Order No. 31, s. 2012:

- **Advanced:** Scores of 9 to 10.
- **Proficient:** Scores of 7 to 8.
- **Approaching Proficiency:** Scores of 5 to 6.
- **Developing:** Scores of 3 to 4.
- **Beginning:** Scores of 0 to 2.

For the inferential analysis, a paired-samples t-test was conducted using the Data Analysis ToolPak in Microsoft Excel. The t-test evaluated whether the difference between the pre-test and post-test scores was statistically significant at the 0.05 level ($p \leq 0.05$), providing a reliable measure of the intervention's impact. Qualitative feedback was analyzed using thematic description to capture the perspectives of students, parents, teachers, and administrators.

Results

Performance and Proficiency Distribution

The quantitative analysis showed a clear upward shift in pupil proficiency levels following the 12-week use of the Contextualized Story Word Problems compendium.

In the pre-test, only one pupil (6.67%) performed at the "Advanced" level, while three pupils (20.00%) were categorized as "Proficient". The remaining pupils were clustered in the lower proficiency categories: five (33.33%) were at the "Approaching Proficiency" level, and six (40.00%) were at the "Developing" level. No pupils fell into the "Beginning" category (0.00%). The overall baseline mean score was 5.13 out of 10, indicating that the cohort's starting performance level was "Approaching Proficiency".

By contrast, the post-test results showed substantial improvement. Eleven pupils (73.33%) achieved the "Advanced" level, and one pupil (6.67%) performed at the "Proficient" level. Only one pupil (6.67%) remained at the "Approaching Proficiency" level, and two pupils (13.33%) were categorized as "Developing". No pupils fell into the "Beginning" category (0.00%). The overall post-test mean score rose to 8.73 out of 10, placing the cohort's final performance level at "Proficient".

Table 3 summarizes this positive redistribution of academic performance across the five proficiency levels.

Table 3. Frequency and Percentage Distribution of Pupil Proficiency Levels Before and After the Intervention (N=15).

Score Range	Proficiency Level	Pre-Test Frequency	Pre-Test Percentage	Post-Test Frequency	Post-Test Percentage
9 to 10	Advanced	1	6.67%	11	73.33%
7 to 8	Proficient	3	20.00%	1	6.67%
5 to 6	Approaching Proficiency	5	33.33%	1	6.67%
3 to 4	Developing	6	40.00%	2	13.33%
0 to 2	Beginning	0	0.00%	0	0.00%
Total		15	100.00%	15	100.00%
Mean		5.13 (Approaching Proficient)		8.73 (Proficient)	

Inferential Analysis and Significance

To determine if the academic gains from the baseline to the post-intervention stage were statistically significant, a paired-samples t-test was conducted.

The pre-test mean score of 5.13 corresponds to an initial Mean Percentage Score (MPS) of 51.33%. The post-test mean score of 8.73 corresponds to a final MPS of 87.33%. This represents a net improvement of 3.60 score points, or an increase of 36.00% in overall mastery.



The paired t-test yielded a two-tailed p-value of 0.000105159. Because this p-value is substantially lower than the standard significance threshold of 0.05 (≤ 0.05), the null hypothesis was rejected. The statistical analysis confirms that the use of Contextualized Story Word Problems in Mathematics 3 resulted in a highly significant improvement in pupil performance.

Table 4 presents the statistical comparison of the test results.

Table 4. Paired t-test Results Comparing Pre-test and Post-test Performance (N=15).

Test Stage	Sample Size (N)	Mean Score	Mean Percentage Score (MPS)	p-value (Two-Tailed)	Statistical Significance
Pre-Test	15	5.13	51.33%	0.000105159	Highly Significant (≤ 0.05)
Post-Test	15	8.73	87.33%		



Discussion

Contextualization and Cognitive Scaffolding

The significant improvement in student performance, as demonstrated by the increase in the mean score from 5.13 to 8.73, supports the theoretical benefits of contextualized instruction. By embedding abstract mathematical operations in familiar local narratives, the CSWP compendium allowed students to connect new concepts to their prior knowledge. This alignment helped reduce cognitive anxiety and made the problem-solving process more engaging and accessible.

These findings align with the work of educational researchers who emphasize that math word problems must represent real-life situations to be meaningful. When students can relate to the scenarios, they are better able to grasp the mathematical concepts and translate written narratives into correct operations. This study also supports earlier findings from Japanese elementary schools, where incorporating localized word problems into daily activities successfully enhanced both reading comprehension and mathematical reasoning. Similarly, these results reinforce the conclusions of previous studies on contextualization, which show that connecting classroom lessons to students' lived experiences accelerates academic progress, particularly for struggling learners.

A closer look at the quantitative data reveals key cognitive trends. In the pre-test, the majority of pupils (73.33%) were clustered in the "Developing" and "Approaching Proficiency" brackets. This baseline concentration indicates that while these students possessed basic computational skills, they struggled to interpret the linguistic and semantic structures of standard, abstract word problems. The lack of a meaningful context acted as a cognitive barrier, preventing them from applying their math knowledge.

Following the 12-week intervention, this middle-to-low performing cohort experienced a major shift, with 73.33% of the entire group reaching the "Advanced" proficiency level in the post-test. This direct redistribution suggests that the scaffolded, three-level design of the CSWP compendium provided an effective learning pathway. By starting with simple, one-step narratives in Level 1 and gradually advancing to complex, multi-step stories in Level 3, the intervention aligned with the students' developmental needs. This progressive scaffolding successfully helped the majority of pupils transition from basic decoding to advanced problem-solving.

However, the data also reveal a key limitation of the intervention: two pupils (13.33%) remained at the "Developing" level in the post-test. This outcome highlights a critical educational boundary. For students with severe reading and phonetic decoding difficulties, contextualized math stories alone are not enough. Because word problems require both reading comprehension and numerical computation, students who struggle with basic literacy cannot access the mathematical content, even when it is highly contextualized. For this small group of learners, math contextualization must be paired with intensive, foundational reading and literacy support to be fully effective.

Qualitative Reflections and Stakeholder Perspectives

The qualitative feedback gathered from various stakeholders after the 12-week intervention provided valuable context for the statistical gains. During the evaluation phase, parents and teachers shared reflections that highlighted the broader impact of the program:

- **Pupils and Parents:** Parents noted that their children showed greater enthusiasm for reading and solving math problems during the program. Many pointed out that because the math stories mirrored the oral tales and family experiences shared at home, their children found the homework relatable and engaging. This cultural connection transformed math from a source of frustration into a collaborative family activity, bridging the gap between home and school.



- **Teachers:** Classroom teachers reported that the localized stories served as an effective cognitive anchor. The familiar language and scenarios helped students quickly identify mathematical operations using the UPSC steps. The structured format also helped pupils establish a systematic approach to analyzing word problems, reducing the reliance on random guessing.
- **School Administration:** From the perspective of the School Head, the CSWP compendium proved to be a valuable dual-impact tool. By addressing both literacy and numeracy simultaneously, the intervention aligned with key developmental goals for primary education and demonstrated how integrated learning materials can maximize instructional time.
- **District Leadership:** The Public Schools District Supervisor (PSDS) recognized the potential for wider application, noting that the CSWP compendium could serve as a valuable resource for other schools in the district. Sharing this framework during District Learning Action Cell (DisLAC) sessions could support professional development and help other teachers design culturally responsive math materials.

Operational Challenges and Strategic Adjustments

Despite its success, the action research faced several operational challenges. Variations in baseline reading speeds and comprehension levels made it difficult to maintain a uniform instructional pace. To address this, the researchers implemented peer tutoring, pairing advanced readers with classmates who needed extra support. This collaborative approach not only helped struggling readers but also reinforced the tutors' comprehension skills.

Additionally, pupil attendance was occasionally disrupted by illness and adverse weather conditions, which are common in rural school communities. To ensure learning continuity, the researchers adjusted their schedules to provide extended instruction and catch-up sessions for affected students.

Lastly, while the statistical results are highly positive, the study's scope is a key limitation. The small sample size of fifteen pupils from a single school means the findings may not be widely generalizable. However, as a localized action research project, the study successfully achieved its primary goal: resolving a specific academic challenge at Mabog Elementary School and providing a practical model for context-based instruction.



Conclusion

Based on the quantitative and qualitative findings of this action research, the following conclusions are drawn:

1. Baseline diagnostic assessments confirmed that primary-grade pupils struggle with abstract, multi-step, and two-step mathematical word problems due to challenges in semantic comprehension. Standard mathematics instruction often neglects the linguistic and reading skills required to decode word problems, leading to low student performance.
2. The implementation of the Contextualized Story Word Problems (CSWP) compendium led to a highly significant improvement in pupil performance. Over the twelve-week intervention, the cohort's overall mean score rose from 5.13 to 8.73, representing a shift in Mean Percentage Score (MPS) from 51.33% to 87.33%. This statistical gain confirms that the CSWP compendium was an effective intervention for enhancing math comprehension and problem-solving skills in Grade 3 pupils.
3. Contextualizing mathematics within familiar cultural and daily scenarios reduces cognitive barriers and helps students engage more deeply with the material. By aligning math tasks with pupils' lived experiences, the intervention helped them apply systematic problem-solving steps, such as the UPSC framework.
4. While highly effective for the majority of learners, contextualized instructional materials have limitations for students with severe literacy deficits. Because word problems require both reading and computation, students with profound reading difficulties require integrated, foundational literacy interventions alongside contextualized math instruction.

Recommendations

Based on the findings and conclusions of this study, the following recommendations are proposed:

1. **Classroom Integration:** Primary school mathematics teachers should be encouraged to utilize Contextualized Story Word Problems as a regular instructional tool. Integrating localized narratives into daily math lessons can help bridge the gap between abstract operations and pupils' conceptual understanding.
2. **Cross-Curricular Expansion:** The model of contextualization developed in this study should be adapted for other core subject areas, such as Mother Tongue-Based Multilingual Education (MTB-MLE), Edukasyon sa Pagpapakatao (EsP), and Araling Panlipunan (Aral-Pan). Establishing consistent, context-based themes across subjects can reinforce reading comprehension and critical thinking.
3. **District-Wide Dissemination:** With the support of school and district leadership, the CSWP compendium and UPSC framework should be shared with other primary schools. Presenting this research during District Learning Action Cell (DisLAC) sessions can help other teachers design and implement similar culturally responsive materials.
4. **Digital Adaptation:** To increase student engagement, the contextualized story word problems should be converted into interactive digital formats, such as E-stories, digital big books, and gamified applications. These formats can provide interactive visual scaffolds, which are particularly helpful for visual learners and struggling readers.
5. **Diagnostic and Assessment Use:** The CSWP compendium should be utilized as a diagnostic tool at the start of the school year to help teachers map incoming pupils' literacy and numeracy profiles. This baseline data can guide teachers in designing targeted remediation and enrichment activities.

6. **Integrated Literacy-Numeracy Policy:** School administrators should advocate for curriculum designs that treat literacy and numeracy as interconnected skills, ensuring that early-grade mathematics instruction includes explicit support for reading comprehension and semantic decoding.

Implementation Work Plan and Intervention Timelines

To ensure the systematic execution, monitoring, and future scaling of this curriculum intervention, the research was structured around a defined five-phase implementation plan.

Table 5. Five-Phase Implementation Work Plan for the CSWP Intervention.

Phase	Core Objectives	Specific Activities	Responsible Parties	Timeline	Implementation Status
Phase 1: Preparation	• Draft localized learning materials • Complete validation process	• Convene focused group discussions (FGD) to write and review math stories. • Secure content validation from supervisors and MTB specialists.	• Researcher-proponents • Master Teachers • Subject Experts • Language Evaluators	June 2022 – July 2022	Completed
Phase 2: Baseline	• Establish baseline proficiency levels • Identify diagnostic needs	• Hold parental focus group discussions (FGD) to discuss ethical consent. • Administer the 10-item researcher-made diagnostic pre-test.	• Classroom Teachers • Advisers • Parents • Pupils • Researchers	July 2022	Completed
Phase 3: Intervention	• Deliver scaffolded math instruction • Monitor student progress	• Implement the twelve-week RRE program. • Monitor delivery and address learning difficulties through peer tutoring and extended sessions.	• Math Teachers • Parents • Pupils • Researchers • School Head	July 2022 – September 2022	Completed

Phase 4: Evaluation	- Assess academic improvement - Gather stakeholder feedback	- Administer the post-test. - Analyze performance gains. - Collect feedback from parents and pupils on the intervention.	- Researchers - Math Teachers - Pupils - Parents	September 2022	Completed
Phase 5: Reporting	- Finalize research findings - Disseminate results	- Perform statistical analysis on pre- and post-test scores. - Complete and reproduce the Action Research Terminal Report.	- Researchers - School Head - District Supervisor	October 2022	Completed

To support classroom implementation, the researchers also established an instructional intervention plan to guide daily teaching activities.

Table 6. Instructional Intervention Plan.

Implementation Phase	Core Classroom Activities	Key Stakeholders Involved
Preliminary Stage (July 2022)	- Administer the pre-test. - Collect baseline scores. - Perform diagnostic error analysis focusing on the four fundamental mathematical operations.	- Math Teachers - Grade 3 Advisers - Researchers - Pupils
Core Implementation Stage (July 2022 – September 2022)	- Deliver scaffolded CSWPs during the RRE program. - Conduct weekly instructional monitoring. - Gather weekly feedback and provide technical assistance.	- Math Teachers - Parents - Pupils - Researchers



		• School Head
Summative Stage	• Administer the post-test.	• Researchers
(September 2022)	• Complete statistical analysis.	• Math Teachers
	• Conduct pupil debriefing and stakeholder appreciation sessions.	• Pupils
		• Evaluators

Financial Requirements and Resource Allocation

The research team secured local funding to cover the operational costs associated with preparing, validating, and reproducing the intervention materials. Table 7 details the itemized budget allocation.

Table 7. Detailed Financial Report and Resource Allocation.

Item Number	Resource Description	Unit	Quantity	Unit Price (Php)	Total Price (Php)
1	A4 Bond Paper (Substance 20, for compendium and test printing)	Reams	20	350.00	7,000.00
2	High-Yield Printer Ink Sets (for material reproduction)	Sets	3	1,400.00	4,200.00
3	External Hard Drives (for secure digital backup and research logs)	Units	3	2,266.67	6,800.00
Total	Operational Research Budget				18,000.00



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