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One word problem a day (OWPaD): Enhancing mathematical problem- solving and logical skills

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Abstract

This study explored the efficacy of the One Word Problem a Day (OWPaD) strategy in fostering the mathematical problem-solving and logical reasoning skills of Grade 10 students. Employing a quasi-experimental pretest–posttest design with non-equivalent groups, the research involved two intact, heterogeneous Grade 10 sections (n=82) from a public science high school in Puerto Princesa City, Philippines. The experimental group was exposed to daily OWPaD activities integrated into their regular lessons, while the control group received instruction through conventional teaching methods. All participants completed a 40-item, researcher-developed multiple-choice test assessing their proficiency in word problems related to sequences, series, and polynomials, administered both prior to and following the intervention.

Analysis of pretest results revealed that the control and experimental groups possessed comparable initial levels of mathematical problem-solving and logical reasoning skills. While both groups demonstrated improvement from pretest to posttest, the experimental group exhibited substantially greater gains, achieving significantly higher posttest scores compared to the control group. These findings collectively suggest that the integration of a daily contextualized word problem activity can more effectively support students' development of problem-solving and logical reasoning skills than relying solely on conventional instruction.

Consequently, the findings advocate for the implementation of OWPaD as a supplementary teaching strategy within secondary mathematics curricula. To facilitate this, a companion teaching-learning compendium was developed as part of this study, designed to provide guidance for teachers in effectively implementing OWPaD, with the aim of further enhancing students' mathematical problem-solving and logical reasoning skills.

Keywords: Mathematics; Word Problems; Problem-Solving; Logical Skills; Basic Education

1. Introduction

Mathematics is widely recognized as a foundational discipline, equipping learners with essential tools for logical reasoning, problem-solving, and abstract thinking crucial for navigating life, work, and engaged citizenship. Within the Philippine K to 12 curriculum, mathematics is explicitly designed to foster critical 21st-century skills, particularly critical thinking and problem-solving, thereby preparing graduates for the rigors of higher education and the demands of the labor market. Consequently, pedagogical approaches are expected to transcend mere procedural fluency, instead promoting deeper conceptual understanding through learner-centered, inquiry-based, and problem-solving-oriented strategies.

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Despite these well-articulated intentions, many students continue to perceive mathematics as a challenging and anxiety-inducing subject. This is particularly true when engaging with word problems, which necessitate interpreting, modeling, and reasoning through real-world scenarios. Recent syntheses of educational research consistently highlight mathematical word problem solving as a significant and persistent source of difficulty across various grade levels, underscoring an urgent need for explicit, sustained instructional interventions [7,10–12]. Students frequently struggle not only with the underlying mathematical concepts but also with comprehending the linguistic structure of problems, discerning relevant information, and devising multi-step solutions. Notably, these challenges are reported even among higher-ability or specially selected groups of learners, suggesting that problem-solving proficiency extends beyond basic computational skills.

At a systemic level, international large-scale assessments consistently raise concerns regarding the mathematics performance of Filipino students. For instance, the 2018 Programme for International Student Assessment (PISA) revealed that Filipino 15-year-olds achieved an average score of 353 in mathematical literacy, significantly trailing the OECD average of 489, with fewer than one-fifth reaching the minimum proficiency level [1–3]. Further analysis of these results indicated that over half of the participating Filipino students performed below the lowest proficiency level in mathematics, with particularly stark outcomes observed among public school attendees. Subsequent reports from PISA 2022 reaffirmed that the Philippines continues to lag behind its international counterparts in mathematics, despite ongoing reform efforts, thereby reinforcing calls for more effective classroom-level interventions. Conversely, science high schools in the Philippines have demonstrated a capacity to adopt diverse curricular and instructional practices in response to evolving learner needs, emphasizing the importance of continuous innovation at the classroom level.

Within this broader national context, local assessment data similarly underscore a critical need to enhance students' mathematical problem-solving skills, even in demonstrably high-performing institutions. Puerto Princesa City National Science High School, for example, has consistently ranked among the top schools in its division on national assessments. Yet, its mean percentage scores in mathematics have remained below national targets, signaling a persistent gap in higher-order skills such such as reasoning and problem-solving. Strengthening these skills is especially pertinent for topics like sequences, series, and polynomials, which function as crucial conceptual bridges between junior high school mathematics and more advanced senior high and tertiary courses. Recent Philippine scholarship on sociocultural mathematization further suggests that learners' inherent mathematical knowledge systems, including those rooted in indigenous and local practices, can be effectively leveraged through carefully designed tasks that connect mathematics to their lived experiences.

International and local research conducted over the past five years points to the significant promise of structured, high-frequency problem-solving activities and innovative strategies for improving students' engagement and performance in mathematics. Quasi-experimental studies, for instance, have consistently shown that integrating regular problem-solving tasks, small-group discussions, and other active learning strategies can yield substantially greater gains in students' mathematics achievement compared with conventional instructional methods. Furthermore, meta-analyses of word problem interventions indicate that targeted, consistently implemented programs can produce moderate to large effects on students' problem-solving performance, particularly when they emphasize schema instruction, metacognitive strategies, and repeated practice [7,10–12]. The "One Word Problem a Day" (OWPaD) approach, therefore, adds to the growing body of evidence that teacher-initiated strategies within Philippine science high schools can effectively strengthen curriculum and instruction in mathematics, moving beyond mere compliance with national policy documents.

In direct response to these identified challenges and opportunities, this study specifically investigated the efficacy of One Word Problem a Day (OWPaD). This teacher-developed strategy integrates a single contextualized word problem into each lesson, serving as a springboard for discussion and collaborative solution. Implemented with Grade 10 students in a Philippine science high school, OWPaD was designed to provide frequent, focused practice in mathematical problem-solving and logical reasoning as an intrinsic part of the regular curriculum. Specifically, the research sought to determine whether students exposed to OWPaD would demonstrate greater improvement in mathematical problem-solving and logical skills compared to those taught through conventional methods, thereby contributing valuable local evidence regarding a practical, classroom-based intervention aimed at enhancing secondary students' problem-solving performance.

2. Materials and Methods

The study utilized a quasi-experimental pretest-posttest design with non-equivalent groups to determine the effectiveness of OWPaD on students' mathematical problem-solving and logical skills. Due to school policy preventing

student re-sectioning, two existing Grade 10 classes were designated as the experimental and control groups. Both groups completed a pretest, received their assigned instructional interventions, and subsequently took a posttest.

This research was conducted during the 2019–2020 school year at Puerto Princesa City National Science High School, a public science high school established by legislation within the Schools Division of Puerto Princesa City, Philippines. The school operates an enriched science and mathematics curriculum designed for academically talented students, consistent with the Department of Education's Special Science Programs.

The participants comprised 82 Grade 10 students drawn from two heterogeneous sections, both of which were taught by the researcher. To ensure comparable academic starting points, the groups were matched based on their Grade 9 final mathematics grades, aiming for similar distributions of above-average, average, and below-average students in each class. One section received the OWPaD intervention, serving as the experimental group, while the other received conventional instruction as the control group.

Student achievement was assessed using a 40-item multiple-choice Mathematical Problem Solving and Logical Skills Test. This instrument specifically covered word problems on sequences, series, and polynomials, consistent with the Grade 10 mathematics curriculum. The test underwent rigorous content and face validation by mathematics experts and was further refined through two pilot administrations involving Grade 11 students. Item analysis, employing difficulty and discrimination indices, guided the retention, revision, or rejection of items. Ultimately, the final test achieved a reliability coefficient of 0.803 using KR-20, indicating acceptable internal consistency. The experimental group received the OWPaD program as its instructional treatment. This program incorporated one contextualized word problem per meeting, carefully aligned with current Grade 10 lessons and quarterly plans. Its implementation relied on structured lesson exemplars and a mathematical modeling flowchart, which also served as the answer sheet.

Ethical approval was secured from the school head and mathematics coordinator, and the study procedures were thoroughly explained to the participating classes. Both groups completed the pretest during their regular class time. Throughout the intervention period, both groups covered identical Grade 10 mathematics topics (including arithmetic and geometric sequences and series, other sequences, and polynomials), were taught by the same researcher, and met in comparable classrooms and time slots. In the experimental group, each 120-minute session commenced with a single OWPaD problem directly related to the day's learning competency. Students worked individually to complete the modeling flowchart, subsequently discussed solution strategies in small groups, and received immediate feedback during a teacher-facilitated processing session. Conversely, the control group received instruction on the same lesson content using conventional methods, primarily guided practice, but without the OWPaD activity. Upon the conclusion of the intervention period, both groups completed the posttest using the identical validated instrument.

For data analysis, descriptive statistics, specifically means and standard deviations, were employed to summarize the test scores. Paired t-tests were utilized to compare pretest and posttest scores within each group, while independent sample z-tests were conducted to compare the pretest and posttest performance between the experimental and control groups. Students' performance levels in problem-solving and logical skills were characterized using frequency distributions and percentages. Furthermore, the Shapiro–Wilk test was applied to assess the normality of the score distributions. Finally, the reliability of the test scores was determined using KR-20.

3. Results and Discussion

Table 1 Pretest and Independent Sample z-test of the Two Groups

Independent Samples	**Pretest**		**Z value**	**P value**
	Mean	SD		
Control Group	15.78	3.489	-1.583	0.113
Experimental Group	14.61	3.201		

At baseline, both the control and experimental groups demonstrated comparable performance in mathematical problem-solving and logical skills. Specifically, the control group achieved a mean pretest score of 15.78 (SD = 3.489), while the experimental group scored 14.61 (SD = 3.201). Both means fell within the "fair" performance category. An independent samples z-test confirmed no significant difference between these pretest means ($z = -1.583$, $p = 0.113$), thereby establishing the statistical comparability of the two intact classes prior to the intervention. This initial

homogeneity is crucial, as it allows for later observed performance differences to be attributed to the implemented instructional approaches rather than to pre-existing disparities between the groups.

Table 2 Posttest and Independent Sample z-test of the Two Groups

Independent Samples	Posttest		z- value	p value
	Mean	SD		
Control Group	24.22	4.228	6.2265	4.7689
Experimental Group	26.79	3.683		

Post-intervention, both groups showed improvement in their posttest scores; however, the experimental group, which received instruction using OWPaD, significantly outperformed the control group that utilized conventional teaching methods. The control group's mean score increased to 24.22 (SD = 4.228), placing them in the "average" performance category, whereas the experimental group's mean soared to 29.46 (SD = 3.683), categorizing them as "high" performers. Notably, the experimental group's smaller standard deviation suggests a tighter clustering of scores around the mean. An independent samples z-test for posttest scores yielded a value of 6.2265, which substantially exceeded the critical value at the 0.05 significance level, thus confirming a statistically significant difference between the two groups, favoring the OWPaD intervention. These findings align with recent quasi-experimental research, which consistently demonstrates that innovative, problem-focused instructional strategies can lead to greater gains in secondary students' mathematics achievement compared to traditional, lecture-based instruction.

Table 3 Paired-Sample t-test results Comparing Pretest and Posttest scores pf the control group and Experimental Group after the implementation of OWPaD

Dependent Samples		Control Group		Experimental Group		
	Mean	t-value	p-value	Mean	t-value	p-value
Pretest	15.78	-12.396	0.000	14.61	-16.739	0.000
Posttest	24.22			29.49		

Further within-group analyses underscored the positive impact of instruction on students' problem-solving and logical skills, with a notably stronger effect observed within the OWPaD group. For the control group, the mean score improved from 15.78 to 24.22, and a paired samples t-test confirmed a significant difference between their pretest and posttest performance ($t = -12.396$, $p < 0.005$). Similarly, the experimental group experienced a substantial rise in their mean score from 14.61 to 29.46, with the corresponding paired samples t-test also indicating a significant improvement ($t = -16.739$, $p < 0.005$). This group demonstrated a larger gain in both raw score and performance category compared to the control class. Collectively, these results imply that while standard Grade 10 mathematics instruction can enhance student performance, the integration of a daily contextualized word problem activity yields a more substantial enhancement of problem-solving and logical reasoning abilities.

The observed efficacy of OWPaD can likely be attributed to its core design features: providing frequent practice with word problems, ensuring alignment with current lesson competencies, fostering collaborative solution processes, and offering immediate feedback through a structured mathematical modeling flowchart. Recent literature reviews on word problem interventions consistently report that programs offering repeated, explicit opportunities to interpret and solve contextual tasks, coupled with specific strategy instruction and guided discussion, produce moderate to large effects on students' problem-solving outcomes [7, 10–12]. In the present study, experimental group students engaged with one word problem per session, often serving as a springboard for new content. This routine likely bolstered their ability to translate textual information into mathematical representations, select appropriate strategies, and cogently justify their solutions. Furthermore, the cooperative work and teacher facilitation integral to OWPaD align with empirical evidence suggesting that student-centered, discussion-rich learning environments foster deeper mathematical reasoning and mitigate the tendency for students to leave word problem items unanswered. Positioning OWPaD alongside other context-based interventions, such as three-dimensional instructional modules informed by Ethno-Realistic Mathematics Education, further underscores the profound value of connecting mathematical problem solving to students' cultural and everyday realities.

Collectively, these findings firmly establish OWPaD as an effective supplementary strategy for enhancing Grade 10 students' mathematical problem-solving and logical skills within a Philippine science high school context. The experimental group's significant posttest advantage, combined with their notable progression from "fair" to "high" performance, strongly indicates that integrating a structured "one problem a day" routine can yield substantial value beyond the outcomes achieved through conventional instruction alone. These results provide pertinent local empirical support for the broader advocacy of high-frequency, problem-solving-oriented interventions as a critical means to address persistent weaknesses in students' mathematical literacy, as consistently highlighted in recent national and international assessments [1, 3–6, 15].

4. Conclusion

The study revealed that prior to any intervention, the two Grade 10 classes exhibited comparable baseline levels in mathematical problem-solving and logical skills. Following instruction, both the control group (using conventional teaching) and the experimental group (employing OWPaD) demonstrated significant improvements in their test scores. This indicates that standard Grade 10 mathematics instruction can indeed enhance student performance in these areas.

However, students who engaged with the One Word Problem a Day (OWPaD) strategy achieved substantially higher posttest scores, moving into a superior performance category compared to those taught through conventional methods. This strongly suggests that integrating a daily contextualized word problem as a springboard for each lesson is more effective in fostering mathematical problem-solving and logical skills than relying solely on traditional practice. Given the persistent concerns about Filipino students' mathematical literacy performance, particularly in tasks requiring reasoning and real-world application, these findings highlight OWPaD as a practical, classroom-based intervention capable of strengthening problem-solving skills within the existing curriculum.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

Ethical approval for this study was obtained, and the research was conducted in full compliance with the ethical standards governing studies involving human participants. Informed consent was obtained from all individual participants.

Statement of informed consent

For student participants, this process additionally involved securing consent from their parents or legal guardians, with all related procedures carried out under the full knowledge and approval of the school administration. The author declares no conflict of interest related to the conduct and publication of this study.

References

[1] Department of Education. PISA 2018: Philippine National Report. Pasig City: DepEd; 2019.

[2] OECD. PISA 2018 results: Country note – Philippines. Washington (DC): World Bank Group; 2020.

[3] Department of Education. Statement on the Philippines' ranking in the 2018 PISA results [Internet]. Pasig City: DepEd; 2019 Dec 3 [cited 2025 Dec 17]. Available from: https://www.deped.gov.ph/2019/12/04/statement-on-the-philippines-ranking-in-the-2018-pisa-results/

[4] OECD. PISA 2022 results (Volume I and II): Country note – Philippines [Internet]. Paris: OECD; 2023 [cited 2025 Dec 17]. Available from: https://www.oecd.org/en/publications/pisa-2022-results-volume-i-and-ii-country-notes_ed6fbcc5-en/philippines_a0882a2d-en.html

[5] Romero PG. Philippines still lags behind world in math, reading and science — PISA 2022. Philstar.com [Internet]. 2023 Dec 6 [cited 2025 Dec 17]. Available from: https://www.philstar.com/headlines/2023/12/06/2316732/philippines-still-lags-behind-world-math-reading-and-science-pisa-2022

[6] Bernardo ABI, Limjap AA, Valdez JP, et al. Which Filipino students are being left behind in mathematics? Testing machine learning models to differentiate lowest-performing Filipino students in public and private schools in the 2018 PISA mathematics test. Manila: De La Salle University–Angelo King Institute; 2022.

[7] Myers JA, Witzel BS, Powell SR, Li H, Pigott TD, Xin YP, et al. A meta-analysis of mathematics word-problem solving interventions for elementary students who evidence mathematics difficulties. Rev Educ Res. 2022;92(6):903-43.

[8] Non-routine problem solving and strategy flexibility in mathematics. Int Electron J Math Educ. 2021;16(2):em0630.

[9] Branching Minds. Addressing the top four challenges in secondary math intervention [Internet]. 2023 Apr 24 [cited 2025 Dec 17]. Available from: https://www.branchingminds.com/blog/addressing-challenges-in-secondary-math-intervention

[10] Myers JA, Witzel BS, Powell SR, Li H, Pigott TD, Xin YP, et al. Mathematical interventions for students with math difficulties: A meta-analysis. J Educ Res. 2023;116(5):531-45.

[11] Powell SR, Witzel BS, Myers JA, Li H. Applying an individual word-problem intervention to a small-group setting for students with mathematics difficulties. J Learn Disabil. 2022;55(2):104-20.

[12] Myers JA, Witzel BS, Powell SR, Li H, Pigott TD, Xin YP, et al. Determining an evidence base for particular fields of educational practice: Mathematics word-problem interventions. Educ Psychol Rev. 2022;34(2):427-56.

[13] Pentang JR. Problem-solving difficulties, performance, and differences among preservice teachers. Asia Pac J Educ Teach Perform Stud. 2019;3(1):1-15.

[14] Sionicio AR, Barbacena MLB. Effects of teaching through problem-solving (TtPS) on students' mathematics achievement. BU J Educ. 2020;1(1):66-76.

[15] Powell SR, Li H, Witzel BS, Myers JA. Contrasting profiles of low-performing mathematics students in the Philippines. Educ Sci. 2022;12(9):580.

[16] Bacosa DP, Caballes DG. Teachers' practices in curriculum and instruction in a science high school amidst the Covid-19 pandemic. Int J Humanit Educ Dev. 2022;4(3):214-21.

[17] Fran FA, Vistro-Yu CP. Sociocultural mathematization of inherent mathematical knowledge systems and practices of the Sibuyan Mangyan Tagabukid. Intersection J Math Culture. 2024;17(1):22-35.

[18] Shahidayanti T, Prahmana RCI, Fran FA. Integrating Ethno-Realistic Mathematics Education in developing three-dimensional instructional module. J Honai Math. 2024;7(3):379-400.

[19] Department of Education. K to 12 Mathematics Curriculum Guide. Pasig City: DepEd; 2016.