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

Improving Students' Ability in Solving Oblique Triangles Through Concept-Base Journaling

John Luis M. Aoanan[1*] and Ana Perla B. De Guzman[2,2]
[1] *Palguyod National High School, Department of Education, Philippines*
[2]*Bantugan Elementary School, Pozorrubio, Pangasinan, Philippines*
[*]*jlaoanan54@gmail.com* , [2]*anaperla1004@gmail.com*

Date Submitted:
April 19, 2026

Date Accepted:
July 21, 2026

Date Published:
September 15, 2026

DOI:
10.5281/zenodo.22769024

ABSTRACT

This study examined whether concept-based journaling improved Grade 10 students' ability to solve problems involving oblique triangles. A pretest–posttest quasi-experimental design involved 44 students from two intact classes at Palguyod National High School during School Year 2026–2027. The experimental group (n = 23) completed structured journals after mathematics lessons for one week, identifying relevant concepts, explaining why the Law of Sines or Law of Cosines applied, documenting solution steps, analyzing errors, and reflecting on answers. The control group (n = 21) received regular instruction. A researcher-developed 30-item test, reviewed by three experts and demonstrating acceptable internal consistency (Cronbach's α = .705), was administered before and after the intervention. The groups did not differ significantly at pretest, t(42) = 0.349, p = .729. At posttest, the experimental group (M = 17.91, SD = 3.18) outperformed the control group (M = 12.05, SD = 3.41), t(42) = −5.906, p < .001. The experimental group gained 6.04 points, t(22) = −6.251, p < .001, whereas the control group showed no significant change, mean difference = −0.24, t(20) = 0.188, p = .853. The findings indicate that structured mathematical journaling can support conceptual reasoning and problem-solving in oblique-triangle lessons, although the short intervention, intact classes, and single-school sample limit generalization.

Keywords: *concept-based journaling, mathematical problem solving, oblique triangles, reflective writing, trigonometry*

INTRODUCTION

Mathematical problem solving requires learners to interpret information, select suitable relationships, carry out procedures accurately, and evaluate whether a result is reasonable. These demands are especially visible in oblique-triangle problems because students must decide whether a configuration calls for the Law of Sines or the Law of Cosines before computation begins. Internationally, problem solving is treated as central to mathematical learning because it connects conceptual understanding, reasoning, and communication rather than reducing achievement to formula recall (Santos-Trigo, 2024). In the Philippines, the urgency of improving mathematical reasoning is reinforced by PISA 2022: Filipino 15-year-olds obtained a mean mathematics score of 355, compared with the OECD average of 472 (Organisation for Economic Co-operation and Development [OECD], 2023).

Research has documented persistent conceptual and procedural errors in trigonometry and the need for instruction that makes learners' reasoning visible. Students may perform routine calculations yet struggle to interpret unfamiliar conditions, connect representations, or select an appropriate trigonometric law. In a Philippine lesson

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

study, Anapi et al. (2021) emphasized the role of conceptual construction and carefully balanced teacher support in learning the area of oblique triangles. Such evidence suggests that successful instruction should address not only computational accuracy but also the reasoning that precedes and follows computation.

Mathematics journaling offers one way to externalize that reasoning. Journal writing can prompt learners to describe what a concept means, justify a strategy, identify an error, and connect procedures with underlying principles (Borasi & Rose, 1989). A systematic review found that reflective journal writing can foster self-inquiry, organization, and cognitive and metacognitive development across learning contexts (Sudirman et al., 2021). In mathematics, reflective journals have also been associated with stronger task value and more positive achievement emotions (Ko & Park, 2021). Recent Philippine evidence further indicates that journal writing can support conceptual growth and reflective thinking in geometry (Arban et al., 2025).

Despite this promise, evidence remains limited on structured journaling for the specific decision-making demands of solving oblique triangles. The present action research therefore investigated whether concept-based journaling could improve Grade 10 students' performance. It addressed two questions: (1) What were the pretest and posttest performance levels of the control and experimental groups? and (2) Were there significant between-group and within-group differences in test performance? The study tested the null hypotheses that the groups would not differ at pretest or posttest and that neither group would demonstrate a significant pretest-to-posttest change, using $\alpha = .01$.

METHODS

Research Design

The study used a quantitative pretest–posttest quasi-experimental design with a comparison group. Two intact, heterogeneous Grade 10 classes were designated as the experimental and control groups. This label is used because the source study documents assignment by existing class section rather than random assignment of individual students. Both groups completed the same pretest and posttest; only the experimental group received concept-based journaling in addition to mathematics instruction.

Research Locale and Participants

The research was conducted in the Junior High School Department of Palguyod National High School, Philippines, during School Year 2026–2027. All 44 students in two Grade 10 sections participated. Grade 10 Sampaguita served as the experimental group ($n = 23$; 12 boys and 11 girls), while Grade 10 Ilang-Ilang served as the control group ($n = 21$; 11 boys and 10 girls). Both classes were described as heterogeneous in prior knowledge, performance, learning styles, and learning needs.

Intervention and Procedure

After the pretest, the experimental group used concept-based journals throughout a one-week instructional period on solving oblique triangles. Following lessons, students documented the mathematical concept involved, identified given and required information, justified the selected trigonometric law, recorded the solution process, examined errors or misconceptions, and reflected on how the solution could be improved. The control group studied the same competency through the regular teaching–learning process without structured journaling. Both groups then completed the posttest under the researcher's supervision.

Instrument

The outcome measure was a researcher-developed, 30-item multiple-choice test aligned with the revised K–10 curriculum and the Mathematics 10 Budget of Work for the Laws of Sines and Cosines. A table of specifications guided item construction. Two junior high school teachers and one master teacher reviewed the

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

instrument for face and content validity and rated it very highly valid. Pilot-test data yielded Cronbach's α = .705, indicating acceptable internal consistency for the study sample.

Data Analysis

SPSS Version 23 was used to compute descriptive statistics and inferential tests. Means, medians, standard deviations, variances, skewness, kurtosis, ranges, and 75th percentiles described score distributions. Independent-samples t tests compared the groups at pretest and posttest, while paired-samples t tests examined change within each group. Statistical decisions followed the source study's α = .01 criterion. Exact p values reported as .000 by SPSS are presented as $p < .001$ in accordance with APA style.

Ethical Considerations

The source action research states that school permission, informed consent from students and parents or guardians, voluntary participation, confidentiality, coded records, secure data handling, and the right to withdraw without penalty were observed. The intervention and assessment procedures were intended to avoid coercion and unequal treatment, and results were reported without identifying individual learners.

RESULTS AND DISCUSSION

Baseline Performance

Table 1. *Pretest performance of the control and experimental groups*

Statistic	Control (n = 21)	Experimental (n = 23)
Mean	12.29	11.87
Median	13	11
Standard deviation	3.95	3.96
Variance	15.614	15.664
Skewness	−0.364	0.226
Kurtosis	−0.703	−0.299
Range	14	15
75th percentile	15.5	14

The two groups began with closely comparable scores. Their means differed by only 0.42 points, and their standard deviations were nearly identical. The independent-samples test confirmed that the difference was not statistically significant, $t(42) = 0.349$, $p = .729$. This result supports baseline comparability, although it does not establish equivalence on every unmeasured characteristic because intact classes were used.

Posttest Performance

Table 2. *Posttest performance of the control and experimental groups*

Statistic	Control (n = 21)	Experimental (n = 23)
Mean	12.05	17.91
Median	12	18
Standard deviation	3.41	3.18
Variance	11.648	10.083
Skewness	−0.112	0.245
Kurtosis	−0.925	−0.021

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

Range	12	13
75th percentile	15	20

After the intervention, the experimental group achieved a mean of 17.91 compared with 12.05 for the control group, a difference of 5.87 points on the 30-item test. The between-group posttest difference was statistically significant, $t(42) = -5.906$, $p < .001$. Scores in both groups showed similar dispersion, with the experimental group displaying a slightly smaller standard deviation. These results indicate that the higher experimental-group mean was not produced by a small cluster of unusually high scores alone.

Within-Group Change

Table 3. *Paired pretest–posttest comparisons*

Group	Pretest M	Posttest M	Mean difference	t	p	Decision ($\alpha = .01$)
Experimental (n = 23)	11.8696	17.9130	6.0434	−6.251	< .001	Reject H_0
Control (n = 21)	12.2857	12.0476	−0.2381	0.188	.853	Fail to reject H_0

The experimental group improved by 6.04 points, equivalent to approximately 20.1% of the test's total possible score. Its pretest–posttest change was statistically significant, $t(22) = -6.251$, $p < .001$. In contrast, the control group's mean decreased by 0.24 points and did not change significantly, $t(20) = 0.188$, $p = .853$.

The pattern of results is consistent with the proposed role of reflective writing: concept-based journals required learners to state why a trigonometric law was appropriate, articulate steps, and reconsider errors instead of submitting answers without explanation. This interpretation aligns with Borasi and Rose's (1989) account of mathematical writing as a means of examining understanding and with broader evidence that reflective journaling can support metacognitive engagement (Sudirman et al., 2021). It is also compatible with findings that mathematics journal writing can strengthen learners' task value and emotional engagement (Ko & Park, 2021) and that structured journal writing can improve conceptual understanding in geometry (Arban et al., 2025).

Nevertheless, the results should be interpreted as evidence of effectiveness within this classroom context, not as proof that journaling alone caused every observed difference. The intervention lasted only one week, involved two intact classes from one school, and relied on one researcher-developed multiple-choice test. Teacher effects, class-level differences, testing familiarity, or other unmeasured factors may have contributed. Moreover, the study measured immediate achievement rather than long-term retention or the quality of students' written reasoning.

CONCLUSION

Concept-based journaling was associated with substantially better performance in solving oblique triangles. The control and experimental groups had similar pretest performance, but the experimental group achieved a significantly higher posttest mean and a significant 6.04-point gain, whereas the control group did not improve. Structured prompts that asked students to identify concepts, justify their selection of the Law of Sines or Law of Cosines, explain procedures, and reflect on errors appear to have supported the transition from formula recall to deliberate problem solving.

Mathematics teachers may integrate short, structured journal prompts into lessons involving multi-step reasoning, particularly when students must select among competing formulas or strategies. School leaders and mathematics supervisors may support implementation through exemplar prompts, scoring guides, and professional learning focused on assessing mathematical explanations. Future studies should use larger multisite samples, longer interventions, randomized or carefully matched groups where feasible, delayed posttests, and measures of journal quality and conceptual reasoning. Such designs would clarify the durability, mechanisms, and generalizability of the observed gains.

References

Anapi, S. B., Calixto, D. C. A., Peralta, R. R., Velasquez, Q. F., Zamora, A. M., Palanas, V. D., & Elipane, L. E. (2021). Concept construction on the area of oblique triangles: A lesson study. Turkish Journal of Computer and Mathematics Education, 12(3), 3870–3880.

Arban, H. G. C., Arellano, I. M. P., Gestosani, K. A., Sanot, A. J., & Cerado, E. C. (2025). Enhancing conceptual understanding in geometry through journal writing: A case from one Philippine secondary school. American Journal of Interdisciplinary Research and Innovation, 4(3), 74–81. https://doi.org/10.54536/ajiri.v4i3.5915

Borasi, R., & Rose, B. J. (1989). Journal writing and mathematics instruction. Educational Studies in Mathematics, 20(4), 347–365.

Creswell, J. W., & Creswell, J. D. (2023). Research design: Qualitative, quantitative, and mixed methods approaches (7th ed.). SAGE Publications.

Ko, H., & Park, Y. (2021). The effects of reflective journal writing on task value and achievement emotion in sixth graders' mathematics learning. Korean Journal of Educational Methodology Studies, 33(4), 683–713. https://doi.org/10.17927/tkjems.2021.33.4.683

Organisation for Economic Co-operation and Development. (2023). PISA 2022 results (Volume I): The state of learning and equity in education. OECD Publishing. https://doi.org/10.1787/53f23881-en

Santos-Trigo, M. (2024). Problem solving in mathematics education: Tracing its foundations and current research-practice trends. ZDM–Mathematics Education, 56, 211–222.

Sudirman, A., Gemilang, A. V., & Kristanto, T. M. A. (2021). Harnessing the power of reflective journal writing in global contexts: A systematic literature review. International Journal of Learning, Teaching and Educational Research, 20(12), 174–194. https://doi.org/10.26803/ijlter.20.12.11