



Fostering Students' Mathematical Understanding through Problem-Posing-Based Learning (P-PBL)

Jinfa Cai

Texas A&M University

jfcai@tamu.edu

There are at least two major debates surrounding mathematical understanding. The first is the product-process debate. The word “understanding” has dual meanings, being both the present participle of the verb “to understand” (process) and a gerund acting as a noun (product). The second major debate is the procedural-conceptual debate. Cai et al. (2026) proposed a theoretical framework outlining five aspects of mathematical understanding—factual, procedural, conceptual, metacognitive, and affective—and five lenses employed by mathematics educators—mathematical, cognitive, social, diagnostic, and instructional—when considering how to foster students' mathematical understanding.

Problem posing is a key activity for improving mathematical understanding. Problem posing refers to several related types of activity that entail teachers and students formulating (or reformulating) and expressing a problem or task based on a particular context (the *problem situation*; Cai, 2022; Silver, 1994). Fostering students' mathematical understanding through problem-posing-based learning (P-PBL) involves viewing problem posing as an instructional approach to teach mathematics. Both theoretically and empirically, problem posing supports students' understanding of mathematics. Ran et al. (2025) found a very positive effect of engaging students in problem-posing interventions, indicating a statistically significant positive relationship between problem-posing interventions and learners' cognitive (Hedges' $\bar{g} = 0.53$) and affective (Hedges' $\bar{g} = 0.67$) mathematical learning outcomes. The P-PBL instructional model outlines four steps involved in teaching through problem posing: (a) the teacher introduces a problem-posing situation; (b) the teacher provides a problem-posing prompt with the situation; (c) students pose problems individually or in groups; and (d) teachers guide students to solve the posed problems in alignment with learning objectives (Cai, 2022).

In this paper, I present the framework on mathematical understanding and fostering mathematical understanding and discuss the potential ability of P-PBL to foster students' mathematical understanding. Finally, I discuss two areas of possible future research.

References

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For more information, please refer to the following paper presented at the 48th Annual Conference of MERGA in July 2026.

Cai, J. (2026). Fostering students' mathematical understanding through problem-posing-based learning (P-PBL). In N. Berger, M. Thompson, J. Ley & C. Wilsmore (Eds.), *Beyond boundaries: Strengthening futures in mathematics education*. Proceedings of the 48th annual conference of the Mathematics Education Research Group of Australasia, Sydney (pp. 16–24). MERGA.



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