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Actions speak louder with words: the roles of action and pedagogical language for grounding mathematical proof.

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Summary: Theories of grounded and embodied cognition posit that situated actions are central constituents in cognitive processes. We investigate whether grounding actions influence reasoning, and how pedagogical language influences the action-cognition relationship. Undergraduate students ($N = 120$) generated proofs for two mathematical tasks after performing either grounding or non-grounding actions. Grounding actions facilitated key mathematical insights for both tasks, but did not lead to superior proofs. Pedagogical language in the form of prompts (prospective statements) and hints (retrospective statements) accompanying grounding actions enhanced proof performance on one task but not the other. Results from transfer tasks suggested that participants learned to apply their mathematical insights to new contexts. The findings suggest that relations between action and cognition are reciprocal: actions facilitate insight, while pedagogical language strengthens the influence of task-relevant actions for proof production. Pedagogically supported grounding actions offer alternative ways of fostering mathematical reasoning.

Classification: C55 E55 C35

Keywords: grounded cognition; embodied cognition; justification; proof; pedagogical language

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