Exploring the Impact of Cognitive and Sensorimotor Activity on Arousal in an Embodied Learning Environment

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Abstract

Embodied cognition theory posits cognition as fundamentally situated within and enacted through the affective and physical body and environment. Grounding in this theoretical perspective, we investigate learners' fluctuations in arousal state in the context of a math pedagogical tool, Balance Board Math, that invites children to explore concepts through bodily movement on rockable boards. Balance Board Math's design invites bodily movement as both a means to explore mathematical concepts and as a means to provide affectively-regulating sensory input to the vestibular (balance) sense. In this pilot analysis, we explore data collected with electrodermal activity wristbands (N = 9017 from 6 participants) to examine how their arousal states varied in relation to their cognitive-affective-physical activity as they explored and learned concepts through Balance Board Math movement-based activities. Using a mixed-effects regression model, we analyze how bodily rocking movements with different situated meaning within learners' problem-solving, as well as the impact of reaching fluency within each activity, impacted their arousal. We found that rocking movements undertaken to generate graphs had the opposite impact on arousal from non-instrumental rocking movements, and that reaching fluency with enacting and explaining solutions to movement-based math problems was associated with reduced arousal. These findings highlight the interplay of cognitive and physical drivers of arousal regulation in embodied learning environments.

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