

EMBODIED DESIGN: BRINGING FORTH MATHEMATICAL PERCEPTIONS

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Embodied design is a theory-based pedagogical framework for building content-oriented learning environments where students ground STEM concepts through first solving non-symbolical control-and-anticipation problems and then adopting normative disciplinary forms as means of enhancing their enactive, cognitive, and discursive interactions. In particular, the action-based genre of embodied design specifies how to create conditions for students to develop new sensorimotor perceptions of situations (i.e., affordances) as the prospective meanings of mathematical concepts. In this talk I will motivate embodied design within the E-turn in the cognitive sciences and situate the framework among the current range of design rationales for interactive STEM educational products. Demonstrating empirical findings from multimodal evaluation studies of embodied designs for mathematics (proportions, geometry, trigonometry, parabolas, etc.), in which we analyzed audio–video, clinical, and eye-tracking data, I will argue that the framework implements key principles of enactivism, namely that: “(1) perception consists in perceptually guided action and (2) cognitive structures emerge from the recurrent sensorimotor patterns that enable action to be perceptually guided” (Varela et al., 1991, p. 173). Specifically, the embodied meanings of mathematical concepts—that is, the new situated and goal-oriented sensorimotor perceptual structures students discern and generate in response to challenging interaction tasks—emerge spontaneously as their tacit, adaptive, pragmatic means of facilitating and regulating the coordination of motor actions that enact control movements. I will end by reissuing a call for the learning sciences to adopt perspectives and methodologies of the movement sciences, in particular coordination dynamics, as tools for investigating, characterizing, and engineering embodied design for mathematics.

References

Austin, J. L., & Howson, A. G. (1979). Language and mathematical education. *Educational Studies in Mathematics*, 10, 161-197.