How We Model Educational Embodiment: Practical Considerations and a Theoretical Proposal

Mark J. Keitges
University of Illinois at Urbana-Champaign

In his essay, "Neuroscience, Education, and a Radical Embodiment Model of Mind and Cognition," Clarence Joldersma aims to "develop a model that more adequately situates the conversation about neuroscience's possible contribution to educational practice, including the idea of interventions." The radical embodiment model Joldersma develops here is a speculative yet well-balanced account, substantially informed by the broader theoretical project of embodiment in recent cognitive science. Radical embodied cognition's avowedly non-representational stance — that perception is fundamentally goal-directed action and learning occurs *outside* of the head, in the space between brains, bodies, and lifeworld — unfolds educational possibilities in a way that previous computationalist theories never did. As a result, constructive dialogue between neuroscientists and educators seems much more plausible.

While Joldersma's aim is to paint in broad strokes what a generalized model of radical embodied cognition must include, he says very little about the implications of his model for educational practices aside from intervention into cognitive deficits. I will leave aside, for now, my great doubts about the efficacy of interventions; I am more interested in radical embodied cognition as a "guide to discovery" for the design of digital learning technologies, which I discuss later. I believe a more robust "practical orientation" is needed. First, I provide a conceptual analysis of different uses of the term "model." Then, I discuss radical embodiment in digital learning technologies as a case study. And finally, I show how these technologies require a deeper philosophical understanding of the concepts of "presentation" and "affordance" than is currently offered in Joldersma's radical embodiment model of mind and cognition.

Changing models changes how one views education and the world. Thus, it is useful to clarify what exactly a model is and what it may accomplish. According to Anthony Chemero, the purpose of a model is to "put theory in mediated contact with data."[1] In a scientific context, a model is an abstract, fabricated, and inherently disposable form — often expressed as a mathematical algorithm — that structures empirical phenomena in a very particular way. Three implications are worth noting: first, models rely on specific empirical phenomena that they gesture toward (you cannot have a model without "data"); second, models are transcendental; they simplify phenomenal reality in order to "explain" and "predict" it; and third, model-making is a highly creative, design-oriented act.[2] That phenomena are, in a manner of speaking, "constructed" rather than "discovered," through a model, may be disconcerting. This only serves to underscore the importance of our models and the necessity of replacing them when they become unfaithful or inscrutable.

I find philosopher Vilem Flusser's distinction between "objective" and "phenomenological" models helpful here.[3] Objective models are by far the most prevalent type; they connote efficiency, elegance, and mastery over nature. Objective models are often pictured as "networks" of relations, where phenomena are interchangeable for each other. Nearly every scientific and philosophical model stands outside of the phenomena it speaks about; they are objective in this sense. Models of embodied cognition — though committed to a non-representationalist stance — have often been construed in this fashion. Flusser argues that phenomenological models are more effective for understanding embodiment because they show "the way though which people are in the world and change it." Such models, according to Flusser, "provide a knowledge of the human body that may be trusted better, because it takes the interference of subject within object as its point of departure."[4]

Digital learning technologies have been designed with both objective and phenomenological models of embodied cognition. Chemero argues that less radical versions of embodiment "off-load" intelligence in the form of "action-oriented representations" to our body, social environment, and to well-designed tools.[5] This notion, that cognition is "distributed" and "ubiquitous," where intelligence is no longer solely in the head but spread throughout a network of people and programs, has exercised great influence on designing any manner of computerized handheld devices. But this is a superficial picture of embodiment. Whether I am computing in my "head," or computing "out there," it is still a highly individualized rather than dynamical act of cognition.

New research on learning with technology takes a more phenomenological and radically embodied approach to cognition.[6] The central insight is that learning is not attached to, nor engineered into, a technology; rather, a technology affords kinesthetic-tactile experiences that inform identity development and higher-order thinking in social and cultural contexts. For instance, studies by Arthur Glenberg and colleagues on elementary reading comprehension have shown that acting out stories about farm life with toy farmers, animals, and tools (or with the actual objects themselves!) improves both the understanding and memory of the story; this also creates an imaginary, emotionally rich "farm-world" that aids in understanding similar stories. These effects were also discovered when subjects moved virtual story objects across computer screens.[7] Richer perceptual opportunities have lately included haptic force feedback and gestures to add more layers to the graphic and sound interface of games and simulations. The development of immersive learning technologies that afford radical embodiment restores the connection of physical experience with intellectual development, emotion, and humanistic understanding. Further research on embodied mathematics learning is ongoing, testing the conjecture that "mathematical reasoning … is enacted and evoked as embodied, dynamical, multimodal."[8] Ricki Goldman et al. propose a three-step approach to learning: "have an embodied experience; learn to imagine that embodied experience, and imagine the experience when learning from symbolic materials."[9]

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This brings me to my final point. How might these (and other) experiences of radical educational embodiment help us strengthen our existing and future models? As I mentioned earlier, changing one's model changes how one views the world. The world, from the standpoint of radical embodied cognition, is fundamentally "presented" *to* us, rather than "represented" *for* us. This is no small difference, as Joldersma realizes. The concept of presentation received its most sustained and profound analysis in Immanuel Kant's aesthetic philosophy in the third *Critique*. For Kant, presentation is the "principle able to mediate the necessity of the natural world and the freedom that defines the domain of practical reason."[10] Presentation offers a "sensible guide" to inert concepts. Swaying flowers (Kant called them "free designs"), for instance, present the idea of freedom in two ways: (1) by not being determined by a concept or purpose; and (2) by not satisfying an end of mine.[11] Representations, on the other hand, are human constructions, detached from phenomenal life; alone they are unable to "provide a comprehensive orientation for the self."[12]

How is the world presented to us? Through the slippery construct of an "affordance." In saying that swaying flowers "afford" the idea of freedom, I do not think we are being anachronistic. So far as I can tell, Kantian aesthetic judgment is fully compatible with J.J. Gibson's account of perceiving affordances in nature. Affordances are neither subjective nor objective, in us or in the world; perhaps we could call them "interstitial." Affordances are misconstrued if expressed in an objective model. Joldersma favors referring to the presented world as a "network of affordances": "I am arguing that the brain's central role is to support skillful bodily interactions with the world constituted as a network of affordances." I think we need to be careful about our use, albeit common, of the term "network" in the context of radical embodiment. It tends to force a preexisting, representational framework upon phenomena, thus operationalizing it, which Joldersma himself is at pains to avoid. As Chemero has noted, affordances are abilities and not dispositions. Abilities confer choice upon the actor; dispositions, on the other hand, need only the "right enabling conditions" to become manifest.[13] We have the ability to perceive affordances.

Representations — and representational thinking through objective models — continue to exert an irresistible force in educational theory and practice. One positive outcome of the current research activities surrounding educational neuroscience would be the elaboration of new phenomenological models of radical embodied cognition. In education, such models may best be instantiated through the increasing perceptual acuity — both spatially and temporally — of digital learning technologies. Using these technologies, as vehicles of "presentation," will allow us to rediscover the inner relatedness of kinesthetic-tactile experience and higher-order thinking in the surrounding world.

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1. Anthony Chemero, *Radical Embodied Cognitive Science* (Cambridge, MA: MIT Press, 2009), 100.

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2. Jean-Pierre Dupuy, *On the Origins of Cognitive Science: The Mechanization of the Mind* (Cambridge, MA: MIT Press, 2009), 29–30.

3. Vilem Flusser, "On the Crisis of Our Models: Theoretical Considerations and a Practical Proposal," in *Writings* (Minneapolis: University of Minnesota Press, 2002), 76.

4. Ibid.

5. Chemero, *Radical Embodied*, 27.

6. Ricki Goldman, John Black, John W. Maxwell, Jan L. Plass and Mark J. Keitges, "Engaged Learning with Digital Media: The Points of Viewing Theory," in *Handbook of Psychology*, eds. W.M. Reynolds and G.E. Miller (New York: Wiley and Sons, 2013), 343–346.

7. See A.M. Glenberg, T. Gutierrez, J.R. Levin, S. Japuntich, and M.P. Kaschak, "Activity and Imagined Activity Can Enhance Young Children's Reading Comprehension," *Journal of Educational Psychology* 96, no. 3 (2004): 424–436; and A.M. Glenberg, A. Goldberg, and X. Zhu, "Improving Early Reading Comprehension Using Embodied CAI," *Instructional Science* 39 (2009): 27–39.

8. Goldman et al., "Engaged Learning," 345.

9. Ibid., 344.

10. Alison Ross, *The Aesthetic Paths of Philosophy: Presentation in Kant, Heidegger, Lacoue-Labarthe, and Nancy* (Stanford: Stanford University Press, 2007), 4.

11. Ibid., 24.

12. Ibid., 3.

13. Chemero, *Radical Embodied*, 145.

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