Building a functional multiple intelligences theory to advance educational neuroscience

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Building a functional multiple intelligences theory to advance educational neuroscience

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A key goal of educational neuroscience is to conduct constrained experimental research that is theory-driven and yet also clearly related to educators’ complex set of questions and concerns. However, the fields of education, cognitive psychology, and neuroscience use different levels of description to characterize human ability. An important advance in research in educational neuroscience would be the identification of a cognitive and neurocognitive framework at a level of description relatively intuitive to educators. I argue that the theory of multiple intelligences (MI; Gardner, 1983), a conception of the mind that motivated a past generation of teachers, may provide such an opportunity. I critique MI for doing little to clarify for teachers a core misunderstanding, specifically that MI was only an anatomical map of the mind but not a functional theory that detailed how the mind actually processes information. In an attempt to build a “functional MI” theory, I integrate into MI basic principles of cognitive and neural functioning, namely interregional neural facilitation and inhibition. In so doing I hope to forge a path toward constrained experimental research that bears upon teachers’ concerns about teaching and learning.

Keywords: functional multiple intelligences, fMI, multiple intelligences, learning, education, cognitive inhibition, educational neuroscience

The nascent field of educational neuroscience challenges scientists to conduct well defined research with relevance to learning processes. However, the fields of education, cognitive psychology, and neuroscience use different levels of description to characterize human ability. In this context it has been relatively difficult to conduct constrained research that remains theory-driven and also maintains its relevance to educators’ complex set of concerns.

To this point, researchers and theorists have set forth broad suggestions about how to build the educational neuroscience community. For example, Fischer et al. (2007) have called for “reciprocal interactions” among neuroscience and education. Researchers have been cautioned to pay more than “lip service” to the different levels of description that characterize the different disciplines comprising educational neuroscience (Anderson and Reid, 2009).

Many researchers hope for “bilingual” (Byrnes and Fox, 1998; Mason, 2009) or “multilingual” scholars (Ansari and Coch, 2006) engaged in “bidirectional” work (Ansari, 2003; Ansari and Coch, 2006; Szücs and Göswami, 2007) that merely “sending information across bridges is not the answer” and instead the field needs “a new colony of interdisciplinary researchers.”

For the neurocognitive research community, an important step beyond these broad suggestions would be the identification of a cognitive framework at a level of description relatively intuitive to educators. If such a cognitive framework exists, then it may be used to shape educators’ questions and concerns into theory-driven, testable neurocognitive research that may advance the education neuroscience field.

In this paper I will suggest that the theory of multiple intelligences (MI; Gardner, 1983), a conception of the mind that motivated a past generation of teachers, may provide cognitive neuroscientists with a framework in which to conduct rigorous educational neuroscience research. However, I will argue that MI prodded teachers to misconstrue the nature of a scientific theory of cognition; teachers took strongly to MI’s value-based claims of the “plurality of intellect,” yet largely failed to recognize that MI did not offer a description of how cognitive processes actually operate nor how an individual child’s mind learns. Finally, I will attempt to integrate into MI basic principles of cognitive and neural functioning, and in so doing I hope to forge a path toward constrained experimental research that bears upon teachers’ concerns about teaching and learning.

ANATOMICAL MODEL vs. FUNCTIONAL THEORY

Gardner (1993) never intended MI to be applied to education. Though it may come as a surprise to many progressive educators, the MI model was created “not as a program for developing a certain kind of mind or nurturing a certain kind of human being,” Gardner (1993) has written, but rather to explain “the evolution and topography of the human mind.” That is, MI was a map of sorts, seeking to explain what the mind consists of, but not how it works. As such, MI did not address issues critical to the practical and applied needs of educators; beyond recognizing that an intelligence merely exists, MI did not characterize how any one intelligence actually operates, how these intelligences functionally interact with one another, nor how best to teach any one intelligence.

If MI does not, in fact, make any claims about how minds operate nor how to nurture them, what then can explain the affinity educators had for MI immediately upon its introduction in 1983? For space considerations, this question is ultimately beyond the
The Functional MI (fMI) Theory I Propose Focuses on Neurocognitive Connectivity. A functional theory will build upon an anatomical or structural map by characterizing the patterns of connectivity among relatively autonomous intelligences. The fMI theory makes two conceptual moves, one qualitative and one quantitative. First, I ask about the quality, or nature, of the interactions between intelligences. Are the interactions between any two intelligences facilitatory, inhibitory, or neutral? Second, I ask about the quantity, or strength, of interactions across intelligences: Is one intelligence relatively more strongly or weakly connected to other intelligences? These questions are of practical consequence for effective classroom instruction that is focused on how minds learn.

If each intelligence is “relatively independent yet interacting” (Gardner and Moran, 2006) and subserved by specific neurocognitive structures (Gardner, 1998), then a functional theory would predict that any two intelligences can interact in one of three basic ways. In lay terms we would say they may work together, compete, or be indifferent to each other. I will use the terms facilitation and inhibition to describe the former two, indicating that one intelligence can improve the functioning of another, or that one intelligence can impair another. In neurological...
terms we know that, on the very short timescale at which neurons operate, any two brain regions may be connected such that when one region activates it sends an electrical projection to another region that can excite those downstream neurons, or instead inhibit, or reduce, the electrical firing of those neurons.

What might be the utility of a functional MI theory centered on a facilitation–inhibition connectivity paradigm? In short, it will help us predict whether an instructional activity largely employing one intelligence is likely to improve, or instead impair, ability in another intelligence. For example, research on the phenomenon known as verbal overshadowing (Schoolder and Engelder-Schoolder, 1990) has shown that people asked to speak about non-verbal experiences (e.g., face recognition or emotions) often perform more poorly on subsequent tests of memory or analysis [for a review, see Cerruti and Wilkey (2011)]. In one study, young children asked to speak about emotions after watching an emotionally disturbing video performed more poorly on a subsequent learning task compared to a control group (Rice et al., 2007). Given especially how much classroom instruction is verbal, teachers will benefit from understanding when employing verbal cognitive processes helps, and when it hinders, the operations of other cognitive processes. In my experience as a middle school teacher over a decade, I observed that teachers very largely assumed that intelligences facilitate one another, but they did not recognize the real possibility that activity in one part of the mind can in fact inhibit another.

A functional MI theory can also help frame functional and structural neurocognitive experiments. Functional magnetic resonance imaging (fMRI) studies can compare activity in occipital regions of the brain dedicated to visualization when a child verbalizes about a visual geometry problem to a no-visualization condition. Studies of brain structures may avail themselves of a technology such as diffusion tensor imaging (DTI), which measures fractional anisotropy (FA), thought to be a correlate of the extent of myelination in a region and thus an indicator of speed or efficiency of neural connectivity between two brain regions. Higher FA between two regions known to instantiate the core modules of the brain is home to relatively autonomous information processing mechanisms. Such an approach owes much to experimental psychology and neuropsychology, fields that have often been critical of MI (Kornhaber and Gardner, 2006). My core intention is plain: to advance the utility of MI to both teachers and researchers by building a functional theory of MI. I have argued that as the field of educational neuroscience grows MI may be a particularly useful foundation upon which to build a proper scientific theory of neurocognitive learning processes—one that is at a level of description teachers find to be fairly intuitive. For researchers, a functional theory will help organize experimental research in mind, brain, and education, three disciplines that examine cognition and behavior at different levels of description. For teachers, specification of the functional properties of intelligences will help guide instructional decisions about how a child’s mind learns.

REFERENCES


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