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Howard-Jones, Paul. (2010) *Introducing Neuroeducational Research: Neuroscience, Education and the Brain from Contexts to Practice*. London and New York: Routledge.

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Neuroscience is a new frontier for educational researchers, some calling it, "neuro-education," others, "educational neuroscience." Writing in a recent issue of *Neuron*, Thomas J. Carew and Susan H. Magsamen (2010) claim that the marriage will be a fruitful one which will "create a better understanding of how we learn." (p. 685) Their vision of the nature of the relationship is succinctly captured by this sentence:

Educators must pull research findings out of the lab and put them to use in the classroom, and researchers need to distill their results for teachers' purposes. (p. 686)

It seems difficult to gainsay the assertion that a better understanding of how we learn must lead to better educational methods, for isn't learning central to

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education? And yet at the same time it's difficult to envision just how neuroscience will or even can, impact education. Will information about dendrites, synapses or brain regions guide us to more effective ways to teach children to read for meaning, to solve quadratic equations, to discriminate between "it's" and "its," to understand the Periodic Table or the First Amendment?

In *Introducing Neuroeducational Research: Neuroscience, education and the brain from contexts to practice*, **Paul Howard-Jones** hopes to answer these questions. He wants to dispel both the doubts of the skeptics and the zeal of the enthusiasts who have jumped on this latest bandwagon. Howard-Jones, a senior lecturer at the Graduate School of Education at the University of Bristol, is unusually well equipped to write one of the first textbooks for educators wishing to acquaint themselves with the current state of and future prospects for the relationship between the two fields. He understands the world of neuroscience, continuing to conduct research that makes use of new techniques such as brain-imaging, and he understands the world of teachers and classrooms, having worked and done research with teachers and teacher trainees. Among researchers in education, Howard-Jones appears to be unusually widely read in both fields and he is appreciative of the diverse genres of investigation pursued by colleagues, ranging from rigorous laboratory experiments to qualitative studies in classroom settings. Regrettably, I do not find Howard-Jones to be a gifted writer. His book is designed as a school text, and it manifests the lack of vitality and individual panache characteristic of the genre. There are also a couple of small errors, as in the mislabeling of Figure 8.1. (p. 142)



Able to bridge both worlds himself, Howard-Jones points out some of the pitfalls facing those initiated into one world who address those initiated into the other, typically with little understanding of the norms and concepts guiding it. Neuroscientists tend to see learning in individualistic ways, not attuned to the ethical and social complexities of education, says Howard. Teachers, on the other hand, tend to be oblivious to the nuances and qualifiers that issue from the neuroscientific community. They are liable to look for and be seduced by half-truths parading as scientific findings, findings ripe for

exploitation by marketers wishing to cash in on the latest educational fashion —neuromyths, Howard-Jones calls them, a term coined by physician Norman Crockard (p. 20). Among prominent myths Howard-Jones identifies are Howard Garner's theory of multiple intelligences and the concept of diverse "learning styles."

There's little doubt that many of the programs and pedagogical approaches that are labeled as "brain based," are not consonant with knowledge accrued by neuroscientists in the laboratory, but I must say I find the concept of a "neuromyth" a slippery one, for a number of reasons. (1) Among the sciences, neuroscience has advanced especially fast in the last 30 years, and it is not surprising that what was accepted then is no longer current. Gardner did base his theory, in part, on what was known about brain localization when he was writing. While I have criticized Gardner myself, the recent discoveries related to dyslexia, dyscalcula, and amusia, seem to me to be consistent with Gardner's proposal. Let me note as well that although some conceptions of "learning style" may lack validity, perhaps not all do. A recent article in the *Journal of Neuroscience* is entitled "The Neural Correlates of Visual and Verbal Cognitive Styles." (Kraemer, 2009). (2) Theories that are only partially true may yet have great utility, just as Route 1 down the California Coast may be represented as a straight line on a state map even though it contains hairpin turns and steep grades. (3) Even if we stipulate that the notion of general intelligence (g) is valid—a highly contested proposition—while the theory of multiple intelligences is invalid, the former's application in schools may have been more damaging than the latter's. IQ theory was often used in the United States to deprive young people of educational opportunities. Gardner's theory, by contrast, suggested to many teachers that most students had strengths that could be built on even if their IQ scores did not predict academic success.

In Part II of the book, Howard-Jones considers the diverse methods of investigation relevant to education and the contested philosophical views concerning the relationship between mind and brain. In these chapters Howard Jones manifests his appreciation for the contributions of multiple modes of investigation as well as the limitations of each, taken alone. He is critical of those who hold that

neuroscience has nothing to contribute to the enhancement of education while agreeing that the biology of learning should not occupy a privileged position. Howard-Jones advances, and subsequently illustrates, an eclectic vision of educational research where not only the biological and the social sciences are deployed but where teachers' and students' subjective accounts of their own experience are introduced as well. Howard-Jones is willing, for example, to take to task educational software produced of the distinguished neuroscientist Stanislaw Dehaene for not considering feedback from the students who were exposed to it, who reportedly found it boring. (p. 118)

Despite Howard-Jones' admirable respect for diverse traditions, his discussion of learning is somewhat superficial, limited to enunciating the way each community views the concept. The most marked difference between the two views is touched on but not really analyzed. For neuroscientists, learning is equated with memory and various kinds of memory are identified. But for most teachers, especially those of a progressive bent, drawn to constructivist accounts, memory is not only not all there is to learning, it isn't even the most important part. Many teachers, at least in the U.S. would include in their conception of learning the development of dispositions to share, to control one's impulses, to contribute to the group, etc. In the cognitive sphere, many would point to children's "aha" moments when their students' see something that was confusing or hidden from them, as providing their own greatest sources of satisfaction. I would like have liked Howard-Jones to discuss whether, and if so, how neuroscience can capture these notions of learning.

Perhaps the best gauge of neuroscience's potential contribution to education is to be found in Howard-Jones' own research projects whose description occupies the final chapters in Part II of the book: The first of these projects involved sustained investigations of means to foster student creativity. In this series of experiments the subjects (primarily teacher trainees in drama education) took part in a variety of activities that included learning about the brain and cognitive psychology, participating in experiments designed to elicit more creative responses, brain imaging while producing the stories, group discussion and individual feedback through structured

interviews of the process. The primary hypothesis was that a task requiring the employment of three *unrelated* words into a short story would elicit more creative solutions than one requiring the use of three related words.

It appeared to me that the students got a lot from participating in the project, including a more nuanced understanding of the way that creativity demands both generative and analytical thinking. Howard-Jones was able to show (he avoids the word ‘prove’) that participants’ *right* hemisphere regions were involved in their efforts to be creative, even in a language processing task. This may be an interesting, even a startling finding to a neuroscientist, but I didn’t see the way it either suggested or modified the creativity-inducing strategy in any way. If the brain-region hypothesis had failed, that would have had no bearing on the success or lack of success of the pedagogical strategy. Let me add that it appears almost tautological to me that a story needing to include the words “kick,” “football,” and “goal” would almost necessarily be less creative than one needing to include the words, “cow,” “zip,” and “star.”

The second case study is focused on introducing a chance element into academic learning in order to introduce some of the excitement of gambling into education. In the first phase of the project, fifty 11-12 years olds in an inner-city primary school in Cyprus played a specially designed game to practice mental math. The game introduced an element of chance: students could decide to bet on the correctness of their answer to a math question, knowing that they had an equal chance of winning an additional point or losing one for a *correct* answer. Alternatively, if they preferred, they could refuse to gamble. Over time, the students took the gambling option more frequently, reinforcing Howard-Jones’ and collaborator S. Demetriou’s hypothesis that “a learner can find a task more emotionally appealing when an element of uncertainty is introduced that is not defined by their own ability.” (p. 168) In the second phase, teams of two 13-14 year-old students in a British science class played another learning game that introduced chance and their conversations were recorded. The conversation revealed a “close intermingling of game talk and learning talk during the game.” (p. 173) A third phase with adult volunteers

showed that the affective response to learning itself can be influenced by elements of gaming uncertainty,...”(p. 177)

A final study tried to measure the students' dopamine levels at different points in the game to establish a relationship between chance-based events, believed to be related to dopamine levels, and subsequent recall. As I understand it, the fundamental idea behind the project is to see whether the intense engagement characteristic of video games can be explained and exploited to enhance academic learning.

I have two comments here: As I mentioned with respect to the first project, it's unclear to me that the neuroscientific perspective provides any additional pedagogic leverage, though it clearly contributes to explaining why introducing chance can enhance learning. The psychological mechanism underpinning this phenomenon was already discovered, and, in fact, needed to be known in order to be correlated with brain region activation by means of brain imaging studies.

Howard-Jones realizes that the introduction of a chance element into a student's achievement score generates ethical issues, especially issues of fairness, as one student may achieve a better score than her peer simply because she is less risk averse. Howard-Jones is also aware that the role of the teacher is less clear in such a context. In translating some of his research to ordinary classrooms, Howard-Jones writes,

To ensure that the emphasis is on the teacher, we are presently using games that are not computer-based. Instead teachers are using a 'wheel of fortune' which allows chance-based events to be introduced into learning in a variety of engaging ways. (p. 179)

This raises an obvious question: If the focus is on learning, why must the emphasis be on the teacher? Perhaps the teacher can be made less central, even superfluous, and the learning can take place anywhere there is a computer. This leads me to what I feel is the greatest limitation of the book, its adoption of the framework enunciated by Carew and Magsamen cited in my introduction, namely that educational neuroscience is identical to neuroscience for classroom teachers.

In his conclusion, Howard-Jones acknowledges that neuroscience may impact education in other ways, but he devotes only a few scant paragraphs to what I see as the real revolution that neuroscience heralds in the not too distant future, the capacity to enhance cognition directly by chemical or other means.

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