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Discussion forum

# Scepticism is not enough

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Educators play an important role in developing the minds and brains of their learners. Little wonder then, that most have a natural enthusiasm to learn about concepts from neuroscience and apply them in their classrooms. Such enthusiasm may be fundamentally misplaced if neuroscience can make no practical contribution to education. Yet many areas of practical educational concern are being informed by neuroscientific research, including adolescent development, development in mathematics and reading, and understanding of the contribution of sleep and nutrition to learning (Howard-Jones, 2007). Increasingly, there is also an expectation for teachers to differentiate their approach according to the needs of individual learners, and this includes a growing proportion of pupils in mainstream classes identified as suffering developmental disorders. A recent meta-analysis suggests 4–10% of school-age children suffer from ADHD, which is often controlled with powerful psychoactive drugs (Skounti et al., 2007). It seems unreasonable to suggest that an understanding of this disorder, in terms of the mind and the brain, cannot inform teachers in their approach. Teachers' common-sense notion of the importance of the brain in education is further supported by the growing numbers of neuroscientists whose claims for the educational significance of their ideas extends well beyond their grant applications. Some neuroscientists refer to educational implications in the titles of their scientific publications (Posner and Rothbart, 2005), write books aimed at educators (Blakemore and Frith, 2005), produce articles for educational journals (Kaufmann, 2008) and even develop educational products (Wilson et al., 2006).

Neuroscientists who make contact with the educational community, however, may be surprised by some of the 'neuroscientific' concepts they find already there. Decades without formal interdisciplinary communication have allowed many unscientific 'brain-based' ideas to become established in the classroom. Common educational practices and ideas presently include categorising students in terms of their hemispheric dominance, attempting to repattern their brains through co-ordination exercises and ensuring they drink 6–8 glasses of water a day to prevent brain shrinkage. To a neuroscientist, such ideas may even provide amusement, but valuable time and money, both of which schools often lack, is being spent in obeisance to these myths.

Who should take responsibility for the popularity of neuromyths? Undoubtedly, one contributory factor is the enthusiasm of teachers to understand more about learning, including at biological levels. Although such enthusiasm may not need excusing, when coupled with a lack of information about the brain in teacher training, it has made teachers a soft target for pseudoscience. Educators seeking out fresh ideas may have been undiscerning and uninformed when they have turned to neuroscience, but has neuroscience also been institutionally complacent in policing interpretations of its concepts by non-specialists?

An important feature of most neuromyths and unscientific brain-based learning programmes is that they often begin with some element of valid science. In other words, the original source of educational neuromyth is not education, but neuroscience. To take a case in point, educational kinesiology (sometimes marketed as Brain Gym®) was developed to 'balance' the hemispheres of the brain so they can work in an integrated fashion and thus improve learning (Dennison, 1981). The idea of cerebral dominance as a cause of learning difficulty can be traced back to Orton who considered reading difficulty was due to mixed cerebral dominance (Orton, 1937). Perhaps surprisingly, recent fMRI evidence confirms a shift from bilateral to left hemispheric activity with reading development, and that this shift is delayed in poor readers (Turkeltaub et al., 2003). However, Brain Gym® is also founded on theories of neurological repatterning and, more specifically, the Doman–Delacato theory of development (Dennison and

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Dennison, 1994). This proposes that efficient neurological functioning requires the acquisition of specific motor skills in the correct order (Doman, 1968), on the basis that ontogeny recapitulates phylogeny. Remedial exercises are recommended that repattern neural connections appropriately, and thus improve academic progress. It is difficult to test such a theory directly, but reviews conclude it is unsupported, contradicted or without merit (Chapanis, 1982; Cohen et al., 1970; Cummins, 1988; Robbins and Glass, 1968) and associated interventions appear ineffective (American Association of Pediatrics, 1998). Brain Gym® also draws on ideas about perceptual-motor training, i.e. that learning problems arise from inefficient integration of visual, auditory and motor skills. Again, training programs aimed at ameliorating learning difficulties through exercises that rehearse integration skills were shown to be ineffective by studies in the 1970s (Arter and Jenkins, 1979; Bochner, 1978; Cohen, 1969; Hammill et al., 1974; Kavale and Forness, 1987; Sullivan, 1972). However, these specialist articles failed to compete with the efforts of educational consultants who found repatterning appealing and could promote it in the language of teachers. Educational kinesiology took off in the 1980s and has been flourishing within education ever since. Perhaps reflecting this popularity, a paper was published as recently at 2003 in the respected journal Dyslexia that proposed the value of perceptual-motor training for reading difficulties (Reynolds et al., 2003). This article provoked a flurry of critical responses claiming a range of fatal methodological flaws (Rack, 2003; Richards et al., 2003; Singleton and Stuart, 2003; Snowling and Hulme, 2003; Stein, 2003).

What appears most noteworthy about the continuing success of many 'brain-based' educational ideas is not just the poor quality of their scientific basis. It is how long ideas can be erroneously marketed as neuroscience, provided there is no accessible interdisciplinary dialogue, expertise or forum to foster and communicate scrutiny. Sceptical communication between scientists, it would seem, is not enough and the value of interdisciplinary communication needs to be recognised by institutions within both education and neuroscience, if appropriate understanding is to be promulgated.

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Scientific skepticism is healthy. Scientists should always challenge themselves to improve their understanding. Yet this isn't what happens with climate change denial. Skeptics vigorously criticise any evidence that supports man-made global warming and yet embrace any argument, op-ed, blog or study that purports to refute global warming. This website gets skeptical about global warming skepticism. Do their arguments have any scientific basis? What does the peer reviewed scientific literature say? Skepticism itself does not define any natural line to draw where we say "that's skeptical enough." However, one may consider the reasonable case where one has some value function with which to evaluate the value of different actions. Such a function, if one existed, would naturally interact with skepticism if skepticism required any action (if one believes neurons exist, that action may include the burning of glucose).Â Skepticism has several flavours. Anyway, let's talk about being skeptical. It's probably a fallacy to ask others what to believe. Maybe a simple rule would be to be skeptical to subjective knowledge (personal, religious, metaphysical ideas) and more open to objective knowledge. But again, this can be another trap: how to know what is subjective and what is not?