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The emerging role of educational neuroscience in education reform

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A B S T R A C T

In the early 90s a movement began in education called "brain-based learning" that attempted to link neuroscience and education. However, many in both science and education felt it was untenable to make this leap. While early attempts to bridge the fields sparked controversy, it can now be argued that neuroscience does have a role to play in education reform. This paper explores suggestions for the appropriate training of the Educational Neuroscientist, broad interventions based on Educational Neuroscience that could reform curriculum, and emerging ways the Educational Neuroscientist can inform professional development of educators.

El papel emergente de la neurociencia educativa en la reforma de la educación

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R E S U M E N

A principios de los años 90 surgió un movimiento en educación llamado "aprendizaje basado en el cerebro" que trataba de unir neurociencia y educación. No obstante, muchas personas tanto en ciencia como en educación, pensaban que no era viable dar tal salto. Mientras que los primeros intentos por tender puentes entre estos campos suscitó controversia, puede decirse ahora que la neurociencia sí tiene un papel que jugar en la reforma de la educación. Este artículo explora propuestas para el adecuado entrenamiento del neurocientífico educativo, intervenciones amplias sustentadas en la neurociencia educativa que podrían reformar el currículum y de qué nuevas maneras podría contribuir neurocientífico educativo al desarrollo profesional de los educadores.

It has been over 20 years since "brain-based learning" emerged, initiated by teachers to make inferences from findings in neuroscience to classroom practice. Bruer (1997) called this movement a "bridge too far" because the practitioners were lacking in scientific understanding and making untenable leaps (Fischer, Goswami, & Geake, 2010; Goswami, 2006; Pickering & Howard-Jones, 2007). Scientists began joining the movement to inform professional development, but lacked classroom teaching experience, especially K-12. The field was treated both with skepticism and with competitiveness, as educational psychologists, cognitive psychologists, educators, neurologists, and neuroscientists debated who should advise educators. Others felt that a bridge between the fields should not exist at all (James S. McDonnell Foundation, 2007). Debate and discussion ensued (Blakemore, 2005; Byrnes, 2001; Della Sala & Anderson, 2012; Fischer, 2009; Howard-Jones, 2010; Royal Society, 2007; Tokuhama-Espinosa, 2010).

As the movement gained popularity, cross-talk began emerging between disciplines. Publications and presentations by scientists to teachers informed educators in more depth, leading to more credibility, although neuromyths still persisted. Now, almost two decades after Bruer's "bridge too far", a credible bridge is being made between neuroscience and education, including Master's and PhD programs being offered in Educational Neuroscience. However, these programs are inconsistent in recruitment, qualifications, and training. School systems and universities are not

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recognizing this new field of expertise and seeking input and, instead, get information from those unqualified in either neuroscience or K-16 education. Neuroscientists lament that we know certain things about how to improve learning but the field of education is not responding. “Brain” presenters are hired for keynotes and professional development with no experience or credentials in neuroscience. Neuromyths still abound (Howard-Jones, 2014). A clearer conception of the definition and training of an Educational Neuroscientist, awareness of curriculum interventions that are well-supported by research, and examples of potential educational professional development from neuroscience that could lead to educational reform can help us strengthen and advance this bridge between education and neuroscience.

As someone with credentials and experience in both fields and who has presented to teachers at events with other teachers and scientists, I can see across both sides of this bridge. Scientists believe they are the ones qualified to speak to teachers about translating the research while teachers believe that they can better make implications for the classroom. Educational psychologists believe they are more qualified. And so the turf battle continues. However, the issue is not just what we know, but what are we going to *do*?We need perspectives from research *and* practice to reform education. Has neuroscience revealed interventions to reduce the achievement gap?Can we credibly conduct professional development on the brain and learning?As with any new field of endeavor, there is a shake-out period where initial enthusiasm may lead to overgeneralizations, but as we come to recognize this field of Educational Neuroscience as an authentic field, training will improve and information will flow both ways, such that both research and practice benefit.

What will constitute a credible and authentic field?An editorial in *Nature Neuroscience* (The science of education reform, 2006) argues that all translational efforts should be reviewed as rigorously as other basic science findings and compares translating into implications for educational practice to drug company regulatory processes involving large clinical trials. To what standard should Educational Neuroscience be held? Teaching is not as much like medicine as it is the practice of psychology. For example, if psychologists recommend the technique of “reframing” as a viable tool in the psychologists’ toolbox, is this based on large clinical trials? Teaching is an art and a science. We cannot underestimate the ability of good teachers to take this information and use it wisely as part of their background knowledge and their strategy toolbox for reaching diverse and struggling learners.

Defining and Training the Educational Neuroscientist

To support this bridge, we need a specialist with a foot on each side, a hybrid (Howard-Jones, 2010), with both experience and credentials in both neuroscience and education, as one alone is not sufficient. Scientists have two inherent weaknesses. First, I have been told repeatedly by educators that scientists have difficulty speaking to teachers, although some are outstanding speakers. There is a standard method of presenting scientific information at conferences and many use that presentation style with teachers, failing to understand the teachers’ perspectives and needs or the “cultural conditions and concepts of education” as Paul Howard-Jones calls it (Howard-Jones, 2014). Secondly, they have not taught unmotivated or struggling learners – earlygrades, high school, or college developmental courses. They can’t make a leap into practice if they have not practiced in this field (Pickering & Howard-Jones, 2007). “Translational efforts should be guided by determining what problems teachers currently face in the classroom, and should be evaluated based in part on their experience of what works” (The science of education reform, 2006).

Teachers, on the other hand, can innocently make untenable and unquestioned leaps from research to practice because they are usually not reading the scientific body of literature, but are getting information second and third hand, learning from a presenter who may have learned from a presenter or read a few books written for lay audiences or basic science articles they can’t understand without the broader information. Recently I was asked to co-present with another “brain research presenter” at a conference. I asked her what her training in neuroscience was and got this response:

I have been a. . . teacher for (redacted) years. I fell into presenting brain research just two years ago after becoming fascinated by the research and adding it to one of my presentations... Apparently, that part intrigued many and I have been asked to do presentations on it since.

I looked at her information, and it contained incorrect information with untenable leaps, but the audiences are enthralled with brain terms and would not know the difference. The scientifically untrained often fail to realize what research was done on animals or what studies are so limited as to be useless in translation. They can’t answer questions in a credible way without a broad knowledge of the scientific body of literature and without having been exposed to scientific discourse, ways of thinking and critiquing, and limitations in design and execution of neurobiological research. Otherwise, neuromyths get perpetuated, teachers are taught strategies that are not credible, or the new information is not conveyed in a way that informs educators’ understanding and practice. However, with proper education and lab experience, they would be able to do this.

What we need is a blend of all of these currently competing specialties – a person educated across disciplines (Howard-Jones, 2010). The issue is not *whether* neuroscience information can be translated, but *how* we are training people to do this translation. An overarching and consistent view of the requirements and role of the educational neuroscientist is required in order to move from research to practice in a useful and credible manner. If we are going to take this new field seriously, then a new training program must be developed that is as rigorous as the training for other specialties, and not just providing a few cross-disciplinary courses to someone trained in either education or science. For example, in some institutions the training begins with scientists who then are taught some education theory. As explained earlier, this has limitations. Two strands are necessary, recruiting both scientists and teachers in a rigorous program of cross-training.

The training of scientists must include a student teaching practicum, and not in specialized laboratory schools which are often associated with a university and high socioeconomic status students, but in the trenches of schools with poverty and struggling learners, with a teacher in the program as a guide. Alternatively, experienced classroom teachers would be put through a specialized neuroscience program, conducting research in a neuroscience lab with a scientist in the program. Many rigorous educational programs require a practicum, and so should this program. The program should include literature from both domains and discussion in groups consisting of scientists and educators to share perspectives and styles of thinking and speaking. I am guessing that both scientists and educators may balk at this rigorous program, but better to have fewer well-trained and credentialed Educational Neuroscientists than having a valuable new discipline deemed as not credible or effective. Graduates then have credentials and experience in both education and neuroscience. They can see research through the eyes of a teacher and teaching through the eyes of a researcher.

Dual perspectives and experiences would provide valuable insight into scientific and educational research design (Fischer, 2009; Fischer et al., 2010; Hinton & Fischer, 2008) as well as implementation of new insights to education reform. Research questions