WHY MIND, BRAIN, AND EDUCATION SCIENCE IS THE “NEW” BRAIN-BASED EDUCATION

Abstract

The complex problems faced in education today need equally elaborate solutions. This article explains how Mind, Brain, and Education (MBE) science combines perspectives from neuroscience, psychology, and pedagogy that contribute to a better understanding of how humans learn, and consequently, how we should teach. Better than neuroeducation, more powerful than cognitive psychology and easier to understand than cognitive neuroscience, MBE is a paradigm shift in our understanding of the teaching profession.

The following is an excerpt from Mind, Brain, and Education Science: A comprehensive guide to the new brain-based teaching (W.W. Norton) a book based on over 4,500 studies and with contributions from the world’s leaders in MBE Science.

“All animals learn; very few teach.”


Teaching was a simpler craft in generations past. Only the wealthy and well-prepared aspired education past grade school a hundred years ago. Today the Universal Declaration of Human Rights (Article 26) suggests that all people (rich, poor, intelligent, and challenged) are equally entitled to a place in our classrooms. Not only do students come with a far greater spectrum of abilities, but also there are also more children than ever before in our classrooms begging for the attention and guidance they need to help them reach their own potential. This wealth of differences provides us with dynamics never before seen in the history of education and offers the promise of richer learning experiences, if we know how to take advantage of the situation and not lament the challenge. The resources and cross-germination of many disciplines, as found in Mind, Brain, and Education science, can offer such a perspective.

MBE science began as a cross-disciplinary venture between cognitive neuroscience and developmental psychology, but then it reached further beyond these parameters to integrate education via educational psychology and educational
neuroscience (Figure 1.1). However, to actually become its own academic discipline, MBE science went through what Hideaki Koizumi, a leading MBE proponent in Japan, (1999) calls a transdisciplinary developmental process, as noted in Figure 1.2.

Figure 1.1. MBE Science as a Multidisciplinary Field

Source: Interpretation of Tokuhama-Espinosa’s transdisciplinary field by Nakagawa, (2008), redrawn by Bramwell 2010.

Figure 1.2. MBE Science: Transdisciplinarity
Similar to other evolutionary processes, MBE science drew from the dominant “genes” of its parents to produce a better-adapted being. That is, rather than including anything and everything that falls under the labels of education, neuroscience, and psychology as a whole, MBE science is a careful selection of only the best information that can inform the new science of teaching and learning. The development of MBE science results in a new and innovative way to consider old problems in education and offers evidence-based solutions for the classroom. This new vision takes into the account the different histories, philosophies, and most especially, the different epistemological lenses through which common problems in neuroscience, psychology, and education are approached.

Given that the new science of teaching and learning was born of these three parent disciplines, it bears the “cultural baggage” of its parents. This means that the history as well as the philosophy—and subsequently the epistemologies—of these three disciplines influence the existence of MBE science. As Samuels (2009) put it in a recent Mind, Brain, and Education journal article, “Historically, science and education have demonstrated separate, but interwoven, influences on society; philosophically, the values by which they operate are often in opposition; and epistemologically, the disciplines have relied on different conceptualizations of knowledge” (p. 45). This means that MBE faces three important challenges, which are mentioned below after a brief explanation of the discipline’s “birth.”
What MBE Science Is and Is Not

Although it is not hard to agree that MBE science exists, it is harder to agree what it actually is. One way to consider this new discipline is to think of MBE as a “baby” born to adolescent parents. Many teen parents need to work hard to try to define their own place in the world while at the same time help nurture a new offspring and guide his or her growth: This basically results in children raising children. One of the parent disciplines, cognitive neuroscience, was “born” itself about 25 years ago.\(^1\) Education for the masses is also a relative latecomer to the global stage, only becoming truly universalized in the late 1890s.\(^2\) Psychology is a contemporary of the goal of universal education, being just slightly older in foundation.\(^3\) In 2010, this makes education and psychology about 125 years old each. Though 125 might seem old in human terms, these disciplines are mere adolescents in light of other academic disciplines, such as biology or philosophy, which are over a thousand years old. Now, while a three-way “marriage” between a 25-year-old, and two 125-year-olds might sound odd, it is a good metaphor for understanding, more or less, what happened with MBE science: Three “young” disciplines intersected and their product was Mind, Brain, and Education science.

This union gets even more complicated. Aside from being a teen marriage, this is a mixed teen marriage. Mixed marriages between two disciplines (called hybrid disciplines) have become more common in recent years, but this is not to say that unions of this type are without their criticisms. Mixed marriages can be rejected and even accused of “diluting” once-pure entities. Mixed marriages require compromises from both sides as well as a new type of communication, sometimes at the sacrifice of elements of one or all involved. In the best cases these mixes are fruitful unions, but they demand continual maintenance, more so than homogeneous coalitions. Why? Because each of the parents comes with the weight of its history, philosophies, epistemologies and ways of viewing the world—which can coincide but may often collide.\(^4\)

As well as being a transdisciplinary discipline, MBE science is a cross-cultural entity.\(^5\) The discipline was conceptualized literally around the world at almost the same time in numerous countries.\(^6\) Between 2002 and 2009, countries as varied as Japan, the United States, Canada, Australia, Germany, Holland, the United Kingdom, Italy, and France launched initiatives to promote the discipline. The international collaboration implies that the developing standards for the discipline are based on cross-cultural acceptance of certain norms and shared values.

---

2 See Samuels (2009) for an excellent review.
3 See Wundt (1879) and James (1890) in Butler & Bowdon (2007).
4 It also bears remembering that mixed marriages have been limited to two partners; Mind, Brain, and Education science is an even more complex amalgamation because three “parents” are involved.
5 Samuels (2009).
6 Fischer (2009).
MBE’s strength is also its greatest weakness. Viewpoints, knowledge schemas, and values that are usually complementary, but which can also sometimes be contradictory, contribute to this discipline. The contradictory aspect offers an explanation of (but not an excuse for) some problems MBE faced in the early years. Samuels (2009) recently wrote about the MBE challenge, saying, “Transdisciplinarity is a perspective on knowledge creation that integrates disciplines at the level of a particular issues. It is an approach ideally suited for finding complex solutions to complex problems” (p. 46). This book begins with the premise that solutions to problems in education today require the more sophisticated and complex approach offered by MBE science.

**Challenges in Teaching and in Becoming a Mind, Brain, and Education Scientist**

First, the greatest challenge to new professionals in MBE science is to accept the different historical roots of the three disciplines. This means that those working as teachers need to appreciate that some information from psychology and from neuroscience will have different foci, goals, methods, and procedures than those found in education, but they are equally useful to learning how to teach better. Similarly, psychologists practicing in the new discipline need to recognize that information from neuroscience and education is valuable, despite differences in histories. And neuroscientists, used to a different type of experimental rigor in their research, will have to learn to appreciate the importance of qualitative studies and the impact that studies from education and psychology can have on the new discipline.

Second, we have to recognize and accept that the multiple foundations have impacted the philosophies through which professionals in each of the three disciplines views the world. MBE scientists have a somewhat broader view, therefore, because they can apply multiple lenses through which to view the same problem. Classroom discipline, learning problems, instructional practices, and evaluation methods (among other teaching–learning issues) can now be approached in an innovative way using the multiple viewpoints provided by the new science of teaching and learning.

Finally and most importantly, we must understand that the respective histories and philosophies of the three parent disciplines explain why each embraces different epistemologies. These epistemologies focus the lens through which problems are viewed. "A mode of knowing arises from the way we answer two questions at the heart of the educational mission: How do we know what we know? And by what warrant can we call our knowledge true? Our answers may be largely tacit, even unconscious, but they are continually communicated in the way we teach and learn” (Palmer, 1997, pp. 50–51).

The academic lens through which we see the world influences what is viewed as knowledge, how it is acquired, who among us knows, and why we know what we
do. MBE scientists, by their very nature, have a broader worldview than those rooted in just one discipline. Whether you are a teacher, neuroscientist, or psychologist—or someone working in a related field—you are invited to join this paradigm shift in thinking about the way we educate. Stephen Jay Gould once said, “Nothing is more dangerous than a dogmatic worldview—nothing more constraining, more blinding to innovation, more destructive of openness to novelty” (1995, p. 96). A new take on old problems needs open minds.

Who Are MBE Scientists?

In some instances this label will mean *teachers* who are integrating cognitive neuroscience and psychological foundations into their practice. In other cases it will mean *psychologists* who seek to bridge the hard and soft sciences. In yet others it will mean *neuroscientists* who dare to bring laboratory findings into the classroom. While many educators, psychologists, and neuroscientists remain pure practitioners within their single discipline, a growing number of others straddle the three academic fields of education, psychology, and cognitive neuroscience that wear the new MBE hat. This article does not claim that work as a “purist” is any less valuable than work in the transdisciplinary discipline of MBE science; it does, however, acknowledge the need for new professionals who speak the language, walk the talk, and can work seamlessly as MBE specialists as well.

To be an MBE scientist involves a particular set of professional responsibilities that differs from those of the “pure” fields of education, psychology, and the neurosciences. Aside from adhering to the combined standards of education, psychology, and cognitive neuroscience, MBE professionals adopt certain unique attitudes. Some of these attitudes were described in a review of the monumental work conducted by the Organisation for Economic Co-Operation and Development (2002, 2007) to define the new learning science. Bruno della Chiesa, Vanessa Christoph, and Christina Hinton (2009) delineate certain characteristics of the experts in the new discipline who were helpful in their research. I propose that these same characteristics are useful, at the least, and absolutely required, at an extreme, of all new MBE scientists. Three of the most important characteristics are described below.

First, MBE professionals are “willing to share knowledge with those outside their discipline rather than just their peers” in their original disciplines of formation. This means (1) neuroscientists who are willing to share their findings with educators, for example, (2) psychologists who stimulate research questions in the neurosciences, and (3) educators who suggest research questions in psychology.

Second, MBE scientists recognize the need to “adapt their ‘language’ and context to the audience to make their knowledge comprehensible” to those outside

---

7 Hay (2008).
8 della Chiesa, Christoph, & Hinton (2009, p. 20).
of their original discipline of formation.\textsuperscript{9} That is, MBE professionals understand the need to develop a common vocabulary to enhance interdisciplinary communication\textsuperscript{10}—which can be seen in the teacher who writes for a psychology audience (or vice versa), or a neuroscientist who can explain his or her findings to educators (or vice versa). One of the greatest challenges in stimulating collaboration between professionals in neuroscience, education, and psychology is the absence of a shared language (see more on this point in Appendix A).

Third, MBE scientists generally accept, and perhaps are most compelled by, the belief that “connecting information across fields is advantageous for both others and themselves,” and they accept the importance of nurturing their own practice with information from other fields.\textsuperscript{11} For example, this belief can be seen in the neuroscientists who understand that the value of their lab work increases when it can actually be applied in the classroom, or the teachers who pose testable questions to cognitive scientists.

This last point also tacitly implies another key aspect of MBE science. All three fields (neuroscience, psychology, and education) are on equal footing and contribute in identical parts to the new discipline’s research, practice, and policies. For this reason all three fields inform as well as learn from one another. This perspective differs from that of other disciplines, which are often unilaterally independent. For example, in educational neuroscience, neuroscience informs education (not usually vice versa). In educational psychology, psychology informs education (not usually the other way around). The flow of information in MBE science is, by definition, three-way (see Figure 1.3):

\begin{figure}
\centering
\includegraphics[width=0.5\textwidth]{Figure_1.3.png}
\caption{The Flow of Information in MBE Science}
\end{figure}

\textsuperscript{9} della Chiesa, Christoph, \& Hinton (2009, p. 20).
\textsuperscript{10} Heinze (2003).
\textsuperscript{11} della Chiesa, Christoph, \& Hinton (2009, p. 20).
This three-way flow means that for a concept to be accepted in the new
discipline, educators, psychologists, and neuroscientists must confirm their
hypotheses not only in their own disciplines, but also within the other two. MBE
science is the formal bridge linking the fields of neuroscience, psychology, and
education that has been missing for decades. We need teachers who know about
the brain and how it learns best, and we need neuroscientists and psychologists
who can envision the application of their work in school settings. Why? Because
education is full of complex problems that have not been addressed successfully
enough through pedagogical approaches alone.

Gardner writes about the need for the mind of the future to be able to
synthesize and judge the quality of information that currently exists in the world. There is so much information that bombards individuals on a daily basis (in MBE
science and otherwise), that teacher training now needs to include explicitly taught
skills on how to sort the wheat from the chaff; that is, determine what is “good”
information and what is “bad.” This sorting can be achieved, in part, through a
clear synthesis of the information.

Synthesizing information is a complex process that requires the ability to
take in a variety of information sources, understand the main concepts within each,
and then judge their applicability to the topic at hand. Teachers must be armed with
excellent critical thinking skills in order to be able to pass such abilities onto their
students. The process of synthesis plays an important role in MBE science, which is
related to the ability to assess and judge information. This means that MBE science
is vulnerable if teachers aren’t able to think critically. The ability to transcend
disciplines and synthesize data is crucial for professionals in the discipline.

Because of its complexity, MBE science is difficult to define and is
multifaceted in execution. It is no wonder that several years have passed since the
first call to put parameters around the discipline. The problems and challenges
found in the parent disciplines of neuroscience, psychology, and education add to
the complexity within MBE science itself. There are many sub-disciplines within the
parent fields, and each places different emphasis on aspects of teaching and
learning, compiling the elements for consideration. Nevertheless, the complexity of
MBE science is also part of its attractiveness as an academic discipline. MBE science
is alluring in part because, after all, as Derrida (1998) claims, “if things were simple,
word would have gotten around.” (p.118). Once complexity is accepted as part and
parcel of the new discipline, then its importance is confirmed. A hundred years ago,

\[\text{Source: Tokuhama-Espinosa, 2010}\]

\[\text{12 For examples of this petition, see Fischer, Daniel, Immordino-Yang, Stern, Battro, et al. (2002);}
Goswami (2006); Hall (2005); Schall (2004).}\]

\[\text{13 Five Minds For the Future (2007)}\]

\[\text{14 James S. McDonnell Foundation (2005).}\]
one of the greatest writers of our time, Thorndike (1874–1949), said: “The intellectual evolution of the race consists in an increase in the number, delicacy, complexity, permanence and speed of formation of such associations,” (cited in Bruce, 2000, p.294) affirming that the continually more complex problems in education today require solutions that are not simplistic. This fact calls attention to the idea that if a solution to educational woes seems too simple to be true, it probably is. The caution for “Buyer beware” should guide teacher consumption of brain-based fixes.

**MBE Science Is State of the Art, Yet Nothing New**

Contemporary theories of learning can also benefit from review by MBE science. The importance of findings in all areas will multiply if they can somehow be confirmed via an interdisciplinary effort. This is a paradigm shift in thinking about teaching and learning. A decade ago it was thought that cognitive neuroscience should inform educational psychology, and vice versa. This has now expanded to a *ménage a trois*, in which education plays an equal role and all three fields must share responsibility for the advancement of teaching.

MBE scientists can either be trained in academic programs aimed at this balanced view, or they can come from any one of the three parent disciplines and learn the knowledge and skills, as well as adopt the attitudes of MBE science. Research practitioners in MBE science understand how and why interdisciplinary sharing is vital to the growth of the discipline and to reaching its goals, as mentioned in the introduction. The general research practice of an MBE professional is to identify problems common to neuroscience, psychology, and education, integrate findings, and propose new solutions. Perhaps the most difficult, yet also the most vital, quality of MBE scientists is the ability to not only understand how the epistemologies of neuroscience, psychology, and education differ, but also how a new understanding of knowing emerges through the application of MBE principles.

**Are you an MBE scientist?**

Education has never had so many tools at its disposal to improve the teaching and learning processes. These are exciting times for everyone in the discipline. Neuroscience and psychology nurture our understanding of how the brain learns and help us identify the best teaching practices possible. Although the tools of the trade are important, the greatest single change occurring, thanks to MBE science, is the transformation of the teacher role into a catalyst for societal change.

---

15 An intriguing article by K. Madigan in 2001 made the call for *Buyer beware: Too early to use brain-based strategies*, and called for caution in adapting quick fixes in education.

16 See Byrnes & Fox (1998a) and Byrnes & Fox (1998b) for this classic seminal work.
It is curious to note that in the history of epistemology we have come full circle from Grecian times. The Greeks greatly valued the global thinker, who is once again lauded in 21st-century education. Interdisciplinary thought was valued by the Greeks through the 16th century, in which the balance of science and art could make one a “Renaissance man,” however, the importance of specialization increased and was prized over generalists starting in the 17th century and continuing until just recently. The “specialist” in a certain field was seen as more important than the “general practitioner,” who is supposed to have sufficient knowledge about quite a lot of areas in his or her discipline. This view changed with the establishment of the cognitive sciences in the 1980s. The ability to think across academic disciplinary lines and to merge understandings from different fields is not only valued once again, but it is seen as the only true way of understanding the increasingly complex nature of human ideas. Teachers who can use information from neuroscience and psychology will be the real game changers in the decades to come.

References


Organisation for Economic Co-operation and Development. (2007). *The brain and learning*. Retrieved March 10, 2007, from [http://www.oecd.org/department/0,2688,en_2649_14935397_1_1_1_1_1_1_00.html](http://www.oecd.org/department/0,2688,en_2649_14935397_1_1_1_1_1_1_1_00.html).


**Books on this topic by Tracey Tokuhama-Espinosa:**
