Closing Thoughts: Remaining Optimistic, Cautious, and Active

Debby Zambo and Leslie Haley Wasserman

As part of Springer's *Educating the Young Child* series, this volume brings together a group of distinguished educators and researchers who have a common vision and goal: the appropriate, ethical, and useful application of neuroscience to education. This is an important focus because now, more than any other time in history, we have the tools to peer into the brain and understand how it functions and why certain behaviors are seen. New technologies are helping neuroscientists understand the biological and environmental forces that affect the brain, and as teachers, we are becoming aware of this information, and interested in it, because it is part of our world. With the rise of information technologies, new ideas from neuroscience are being spread at an incredibly rapid rate to places never dreamed possible (Stamm, 2007; Stein, della Chiesa, Hinton, & Fischer, 2010). As Jarvis (1999) notes, everything seems to be changing and the expression "I don't know what the world is coming to" has never appeared to be more true or real. Change is here, and it can be exhilarating and intimidating at the same time. As things change, we as educators roll with it and accept, and confront the challenges change brings. Change is not always bad because it forces us to become more reflective about our practice and consider how research and technological advances can make us better at our jobs. As workers in an information society, our jobs have become transparent and we are being held accountable. Our jobs demand continual assessment and upgrade, and the application of findings from neuroscience can be just the thing we need. Some neuroscientists are collaborating with educators and working to convert their specialized field and technical jargon into useable strategies and ideas. We as teachers have become fascinated, dazzled, excited,

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and bewildered by neuroscience, even if we are not quite sure what those fMRI images mean or what they can really bring to us. As teachers of young children, we want information from neuroscience to help us teach better so that each and every one of our students learns. We want to be good teachers, and because of this, we are attending workshops on the application of neuroscience to our classrooms and reading about neuroscience in educational journals, the popular press, and on the Internet. We want the newest, evidence-based approaches because we care about young children and have been entrusted with educating them. Yet, not all the information we receive is accurate, valid, and reliable, and turning ideas from neuroscience into practical strategies has created both frustration and debate in the field of learning and teacher preparation. The authors in this volume recognize these debates and have worked to take a cautious but optimistic stance and bring the best, most applicable, and dependable scientific information to you. In this volume, you have learned about the smallest brain parts and largest brain structures, brain development, the importance of nature and nurture, and how important early intervention and lifelong learning are to healthy brains. Contributors to this volume have provided practical ideas like Universal Design concepts, Mind Brain Education, and ways to teach all children including those who struggle with print, have autism, and are twice exceptional. Each chapter is unique, and collectively they point us in the right direction. As the editors of this volume, we would like to close with the following summation of ideas.

It Is Time to Be Optimistic

The authors of this volume have continually called for transdisciplinary conversations or consilience. Several authors have noted the positive changes that are happening because neuroscientists, educators, psychologists, sociologists, and others are working together to develop a common language and scientific understanding of the brain, how it functions, the environment it needs, and how to teach in ways so children learn. In this volume, a few well-researched principles underlying learning and behavior have been provided, and this information adds a layer of understanding to your practical knowledge. We believe teachers know a lot because they work with children every day, and neuroscience can add a fresh breath of air to this work. Learning the neurocognitive basis of learning has the potential to help early childhood teachers teach all children and appreciate individual talents and needs. A few key ideas presented in include:

- Good teachers are effective because they teach the way the brain learns.
- Experiences shape brain development.
- Young children need mediated learning (floortime).
- Humans are hardwired to imitate.
- Relevance, patterns, and emotions matter.
- Repetition leads to automaticity.

- Providing multiple representations, allowing children to express what they know in multiple ways, and providing multiple ways to become engaged are good strategies because of the way the brain processes information.
- Attachment and synchrony build trust and learning.

These ideas stem from neuroscience, cognitive science, developmental perspectives, and more. The authors of this volume have provided a multi-voiced perspective and strategies that are practical and useful in classrooms.

It Is Time to Be Cautious

Even though neuroscience brings much promise, teachers still must proceed with caution and care because it is alluring, evolving quickly, and, in many instances, spreading false ideas. Teachers of young children are reading about the brain in teacher journals, hearing about it on television, and watching videos of it on the Internet. In today's information-rich society, teachers know more about the brain than ever before, and because of this, it is important to remain open to new information but skeptical at the same time. Information about the brain is helping confirm many of the things we already known about children and teaching, but it has also found its way into the hands of unscrupulous manufacturers. The authors in this volume remind you that:

- There are curricula, books, and products that purport to utilize findings from neuroscience to promote improved learning without any scientific backing.
- Evidence-based teaching methods need to be supported with research on neural mechanisms and the neurobiological basis of learning.
- Emotional catch phrases are being used to pose quick and easy answers to complex learning and behavioral challenges.
- Testimonials are not the same as empirical facts gathered by researchers with reliable and valid tools.
- To make sense of the brain, learning, and environmental effects on the brain, a comprehensive and compelling metaphor needs to be developed.

Given these facts along with the promises, we as educators of young children must remain optimistic but with a critical eye. Our minds like all others want answers, but they can also easily be fooled. Neuroscience can be alluring, and neuromyths are easily built because they fit intuitive notions of how the brain works. As teachers we want answers, and this may lead us to quick adoptions of materials and claims. We, as easily as anyone else, can build false hopes and misread, misquote, and overextend ideas to confirm the beliefs and biases we already possess. Instead of proceeding cautiously, we can jump in, believe wholeheartedly, and lose sight of what learning and teaching are about. Confirmation bias can narrow our views and leave us vulnerable to false claims that cause us to waste valuable instructional time, treat children unfairly, set low expectations, and spend hard earned money on worthless products and programs that do little good. When it comes to neuroscience, we must proceed cautiously.

It Is Time to Become Informed

Thanks to neuroscientists, teachers, psychologists, and others, explanatory theories are being developed, but it is up to each one of us to decide if they are applicable to our context and the children in our care. To understand what neuroscience is, how it can be used, and why we should use it, teachers need to be trained. Teacher preparation needs to include more courses on the dynamics of biological development, learning, and what this means to the classroom. How and why teachers use neuroscience in their classrooms should not come from emotional testimonials or simple efforts to link strategies with fMRIs. It is time to look at neuroscience with a critical eye and remember:

- The best information from neuroscience is gathered with reliable and valid tools, replicated, and combined with personal insights.
- The tools neuroscientists use are new, popular, rapidly changing, and persuasive. We need to understand these tools, the level of analysis they are able to perform, the reliability/validity of results, and what this all means to us in understandable and useable terms. In short, we need a better understanding of the science involved and the scientific method.
- Teachers and neuroscientists need a common understanding and common vocabulary.

Becoming critical consumers of information is important and will likely lead us to understand that the years of research and knowledge that has laid the path for neuroscience must not be forgotten. Neuroscience cannot tell us what or how to teach, but it can be used to confirm, enrich, and refine the theories and models of learning and behavior we already have and use. Educational psychology, cognitive psychology, and educational research explain why some teaching practices work whereas others do not. It is our responsibility to become informed and seek credible sources and credible individuals who perform this work.

It Is Time to Take Action

While advances in neuroscience are clearly exciting, exhilarating, and impressive, evidence of significant improvements in educational practices based on it is not yet evident day to day. The big picture is being revealed, and brain structures, functioning, and dysfunction are coming from well-designed research, sound methodology, and data (quantitative or qualitative) that capture academic, behavioral, and social gains. Laboratories, clinics, hospitals, and other places are doing big picture research, but no matter how good it is, teachers still need their own independent demonstrations of effectiveness in their classrooms. Findings from neuroscience reveal what is in the mind, but without behavioral data, these findings are limited to particular children, processing information in a machine, at fixed moment in time. As educators, we need to understand these limitations.

Big picture research is necessary but so is our own action research, or the study of our own practice. A typical action research cycle starts by locating a problem and then proceeds to researching a solution, trying the solution, gathering and analyzing the data we have gathered, reflecting on the findings, and determining the next steps. We can take ideas from neuroscience and put them through these steps. For example, if the children in our classroom are struggling to learn a concept, we can investigate what neuroscience says, blend this with ideas from cognitive science and development, and alter what we do. We can then design data collection tools like pretests, posttests, surveys, and observations and collect and analyze this data to see if the ideas we tried makes a difference. If teachers did this work and published it in teacher journals, a mass of ideas would be built and neuromyths could be put to rest. We are capable professionals who can perform practical research.

It Is Time to Become Advocates

The field of neuroscience is growing and has many positive implications. But it can also be used to apply labels, verify stereotypes, and narrow learning, behavior, and emotions to biological processes alone. Neuroethics sits at the intersection of neuroscience and the ethical, legal, and social implications; it brings matters because teaching is a moral profession. As teachers, we are caught in the whirlwind of changes going on around us, and we need to consider the possibilities and challenges neuroscience can bring. Every day across the world, parents entrust us with their most valued possession, their children. As teachers of young children, we know this and work diligently to find the best ways to teach. We are turning to findings from neuroscience to help us, but we must also remember that we need to use it fairly, ethically, and responsibly. Neuroscience is bringing us hope and at the same time it is bringing challenges. As scientific advances are made, we will need to consider how we will keep information confidential and ensure each child's safety. Teaching is a moral profession, and we must not forget the unintended consequences some treatments bring. Invasive interventions can make active, boisterous, inquisitive children passive so they fit in our classrooms, but they can also alter brain chemistry and rob children of their identities and true selves. Children need the correct, least invasive, and most ethical interventions possible, and neuroscientists can provide these, but as teachers we need to be at their sides explaining the consequences and advocating for children. When it comes to applying neuroscience to our classrooms, we must constantly consider what is right, wrong, good, just, and unfair.

It is an exciting time to be an educator because of the scientific breakthroughs being made, but we need to proceed with open eyes. If we are optimistic and cautious, informed, active, and advocate for reasoned policies, the children in our care will benefit, flourish, and grow into healthy, happy, human beings.

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