

Chapter 2

The Practical and Ethical Concerns of Using Neuroscience to Teach Young Children and Help Them Self-Regulate

Debby Zambo

Introduction

In the 1990s, neuroscience was burgeoning because of technological advances. As technology developed, neuroscientists began to glimpse brain development and see brains functioning as they learned and performed tasks. However, with technological innovations come challenges, and nowhere is this more evident than early childhood education. Neuroscientists and others are attempting to translate what was once a specialized field filled with technical jargon and findings into understandable information teachers of young children can use. And teachers are interested in this information. Educational neuroscience (or the intersection between mind, brain, and education) is seeping into the textbooks teachers are reading, the curriculum they are receiving, and the products they are purchasing. This information has the power to help teachers understand how young children learn, self-regulate, and think, but it also has the power to radically alter how children are nurtured and taught (Stein, Chiesa, Hinton, & Fischer, 2010).

As a teacher of young children (grades K-3) with learning and self-regulation challenges, I came to value neuroscience when I took an educational psychology course for my Master's degree. My teacher was Dr. Jill Stamm (a contributor to this volume), and in her class I learned about brain structures and functions, and this helped me understand how different and unique the brains of my young students were and how this difference translated into their actions. In Dr. Stamm's class I learned about the amygdala, and how it worked with other structures to activate the fight or flight response. When I learned this, I came to understand why David, a young boy in my classroom who had been neglected and abused as an infant, hid under his desk every time he heard a loud noise. When Dr. Stamm showed our class a picture of a brain with fetal alcohol syndrome and one without it, I was able to see

D. Zambo, Ph.D. (✉)

Department of Leadership and Innovation, Arizona State University, Glendale, AZ, USA
e-mail: debby.zambo@asu.edu

the size and structural differences in these brains. Seeing these images helped me understand why Matthew, a boy in my class with fetal alcohol syndrome, struggled so hard to learn. Neuroscience helped me understand the biology of my students' learning and behaviors, and I'm sure it has done the same for countless teachers, parents, and caregivers like you.

Thanks to a teacher like Dr. Stamm, the good information she supplied, and my own experience, I came to understand the usefulness of educational neuroscience. However, when I moved from teaching young children to teaching educational psychology and child development to preservice and in-service teachers, I began to see another side of neuroscience. Even though our textbooks had chapters on brain development and talked about the limitations of neuroscience for educators and even though I provided information on brain structures and functioning in class lectures and discussions, I always heard students misusing or overextending ideas from neuroscience. Students were telling me about the hemispheric strategies they were using to remedy complex learning problems like dyslexia and autism, and they were standing by Ritalin and Adderall as the only means to help young students with attention problems learn to self-regulate. Worried about these practices, I began to wonder why so many of my students were buying into neuromyths or ideas with only a nugget of scientific truth. My students were misreading, misquoting, and overextending ideas from neuroscience and using these to confirm the biases they had. Instead of opening their minds to the valid information in their textbooks and from my lectures, my students were only paying attention to what aligned with their beliefs, forming their own folk theories, and building narratives based on the telling and retelling of their beliefs. This behavior concerned me because I knew it could have both educational and ethical implications (Farah, 2005; Organization for Economic Cooperation and Development [OECD], 2007). Fallacious beliefs about neuroscience and education could cause the students in my classes to waste valuable instructional time, treat young children unfairly, set low expectations, and spend their hard-earned money on worthless products and programs that did little good. Howard-Jones (2010) notes that neuromyths have a major influence on shaping the perceptions and views of educators, and this seemed to be the case with my students.

Realizing this, I became concerned but knew I needed data. So in 2006 a colleague and I began to investigate what preservice and in-service teachers at varying stages of their careers and other college students knew, thought, and believed about neuroscience and education. Since 2007, we have gathered data from approximately 850 individuals, and this data leads to some interesting insights. Our data from educators shows that they are interested in neuroscience and are using the Internet, television, workshops, and courses to gain information from it. Educators believe neuroscience should be a part of their training, and they believe that it will make them better teachers especially when dealing with students with special needs. Many of the teachers we surveyed believe that the products and strategies they are using help learning because there is a link to neuroscience (e.g., *Baby Einstein*, *Your Baby Can Read*, and *Brain Gym*®). For too many teachers, fads take precedence over research and facts (Zambo, 2008; Zambo & Zambo, 2009a, 2009b, 2012).

However, when it comes to believing in the value of neuroscience for teachers, our research told us not all teachers are the same. Many believe wholeheartedly, some hold reservations, and others, although few in number, see no use for neuroscience at all.

Believers see neuroscientists as experts and accept neuroscience because of its reliance on new technologies. Believers think neuroscientists can tell them what and how to teach, and because of this they want this information. Believers attend workshops, take courses, and buy DVDs to help them learn about the brain, and they share this information with each other. Believers see neuroscience as the most current and up-to-date information teachers can receive. They believe neuroscience is especially valuable to help them know how to teach students with special needs. To this group, neuroscience can be used to diagnose learning problems and understand how to differentiate instruction for different learning styles.

Believers with reservations were fewer in number than believers. These teachers always started saying something positive about neuroscience and education but stopped midstream and changed their mind. Believers with reservations thought information from neuroscience was useful, but as they began to articulate their reasoning, they always became less sure. Believers with reservations accepted neuroscience but felt it was only part of the information they needed. When it came to teaching and learning, they wanted information from educational psychology, psychiatry, and child development as well.

Whereas the believers saw neuroscientists leading them in the right direction, believers with reservations did not believe they were capable of understanding the vocabulary and technical ideas neuroscience posed. They said things like: “Teachers are not neuroscientists or doctors. They need someone to help them sort ideas out.” Believers with reservations would not mind learning about neuroscience, but they wanted this information to be focused on their students’ needs.

In contrast to these groups, nonbelievers were cautionary and hesitant. These teachers were not going to accept information from neuroscience without evidence and facts. Nonbelievers wanted results from carefully controlled studies, and they wanted to know how conclusions were drawn. Nonbelievers saw neuroscience as a cult-like fad and advocated for the human side of teaching. To them children were more than what was captured in brain scans. This group believed the interactions between teachers and students mattered more than an image on a screen (Zambo & Zambo, 2011).

Our data told us teachers were interested in neuroscience, but not all teachers were the same and this had implications. It told us that many preservice and in-service teachers were interested in neuroscience, consuming this information, and had hopes that it would make them better at their work. Wanting to understand the differences between believers and nonbelievers and what was so alluring about neuroscience to so many preservice teachers, we replicated one of McCabe and Castel’s (2008) experiments. Like these researchers we gave students a fallacious passage about the positive effects of television on mathematical learning and supplied evidence for this claim with an fMRI (functioning resonance magnetic imaging) image, a graph, or nothing at all. With these three conditions we found that the

students both in and out of education, in our college like McCabe and Castel's, could be misled with information from neuroscience, especially when an image was involved. From this work we found our participants, like McCabe and Castle's, thought the article with the fMRI image was more credible than the articles with a graph or no image. Participants also linked fallacies about learning to neuroscience. They believed neuroscience confirmed the reality of learning styles, the importance of multisensory learning, and the fact boys were active hands-on learners. This study helped us understand the neuromyths that can be perpetrated when the direct implications of neuroscience for educators are "oversold" (Zambo, Zambo, & Sidlik, [In press](#)).

Being intrigued by the fact our respondents felt that neuroscience was especially useful to understand and teach students with special needs, we investigated what a group of preservice teachers knew about attention deficit hyperactivity disorder (ADHD) and what they thought about medical science and neuroscience in terms of helping them educate students with this disorder. In this study we had a general questionnaire and manipulated the type of information participants received. Half of our participants saw an fMRI image and read about ADHD from a neuroscience perspective (e.g., faulty neuroreceptors responding to the neurotransmitter dopamine). And the other half saw an image of a premature infant and read about ADHD from a medical perspective (e.g., infants being born prematurely and weighing less than 3.3 lb often develop ADHD).

Data from this study showed that preservice teachers really know a lot about the students with ADHD. They know children with ADHD are hyperactive, excitable, impulsive, irritable, and seldom tired, and that medication suppresses some of these symptoms for some children. They also know these characteristics inhibit a student's learning. They know children with attention challenges are distractible, have trouble focusing/concentrating, are off task much of the time, struggle to process information, and have social and family problems. When asked where they learned this information, they said they, their friends, or their family members have ADHD, celebrities on television talk about it, and it is discussed in their courses (especially special education courses).

Data from the two conditions (neuroscience and medical science) showed slight differences. Participants who saw the fMRI image and read information from neuroscience believed it was useful to help them. These participants felt neuroscience could help them identify students with ADHD earlier, advocate for their needs, understand how their brain works, and understand why they behave in certain ways. Participants in the neuroscience condition also thought neuroscience would help them teach these students. They thought neuroscience could help them learn how to create learning environments conducive to these students' needs, create and teach better lessons, and know how to redirect students so they would remain on task.

In comparison, participants who saw the image of the premature infant and read information from medical science also saw it as useful but in slightly different ways. Participants in this group thought medical science would help them understand the cause, signs, and symptoms of ADHD, if medications were working, and know how to manage students.

This work over the years maps a trend in educators' thinking and beliefs about neuroscience. It is safe to say that students in teacher preparation programs and teachers working in schools are being exposed to information from neuroscience. When it comes to believing in the benefits of neuroscience, however, educators fall along a continuum such that some accept unquestioningly that neuroscience can offer ways to improve their instruction (particularly for students with special needs) and manage students in the classroom, while others view brain research with considerable skepticism. While there is little doubt that neuroscience—particularly when it is combined with other disciplines like human development, cognitive science, and behavioral science—can illuminate the biological basis of learning, confirm developmental differences, and help educators, parents, and caregivers understand how a brain learns; it is also clear that for many educators, how to use this information, where it fits, and what is valid are not totally clear (della Chiesa, Christoph, & Hinton, 2009). Neuroscience can be used to create false hopes and market products that have little or no salutary effects (Dubinsky, 2010; Howard-Jones, 2010; Stamm, 2007; Wolfe, 2001; Willis, 2006). Calling it “a bridge too far,” long-time critic John T. Bruer (1999, 2006) has warned educators to take a cautionary stance in applying neuroscience to their field. Likewise, Bear, Connors, and Paradis (2007) note that when it comes to neuroscience, educators are often overzealous. Others echoed similar sentiments and conducted research as to why neuroscience is so alluring. In their work, McCabe and Castel (2008) and Weisberg, Keil, Goodstein, Rawson, and Gray (2008) found fMRI images to be persuasive and lead to misunderstandings. To these researchers, images appeal to intuitive, reductionist notions of learning, and educators need to be careful when they think about the complex process of learning. More recently, Sylvan and Christodoulou (2010) found neuroscience being used to create learning theories and principles, develop strategies to change behaviors, and create products that claim to have explicit brain links. These researchers concluded that each of these uses of neuroscience makes sense if they match the educational needs of children, are cost-effective, align with other scientifically based research, and produce observable behavioral effects. Hruby and Goswami (2011) offer solutions to the problems facing the neuroscience education interface by calling for varied disciplines (brain, social, cognitive, cultural) to converge. Neuroscientists can help educators understand how the brain decodes and comprehends language if methodological and conceptual challenges are aligned. Given these potentials and concerns, it is important that teachers and other caregivers realize that:

- Some information from neuroscience is being overextended, misinterpreted, and oversimplified, and this has implications.
- There are curricula, books, and products that purport to use findings from neuroscience to promote improved learning without any scientific backing.
- 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.

- Neuromyths exist and are difficult to change because they fit reductionist and intuitive notions of how the brain works.
- Images from new technologies can be persuasive and misleading.
- If interpreted literally, and in isolation, neuroscience can reduce learning, behavior, and emotions to biological processes alone.

Teachers want to be effective, are looking for new ideas and strategies, and are turning to neuroscience for insight and support. However, if teachers are sold faulty information and bad ideas, they may unfairly determine the trajectory of children, offer unnecessary or unethical treatments, and reduce learning and behavior to processes devoid of the need for human contact. The gap between neuroscience and education is being forged—but educators need to be cautious. Teaching is a moral enterprise, and teachers must not only consider what science can provide but they must also consider the ethics involved. Scientific answers come from tools and techniques that are detached, systematic, and precise. Moral questions come from the application of these tools and findings on young children's lives (Gopnik, 2009).

The remainder of this chapter is devoted to explaining some ethical issues neuroscience brings to educators, parents, and caregivers of young children. It begins with overarching ethical concerns related to neuroscience then transitions into the ethics and morals of teaching and caring for young children. This chapter ends with insights into how moral judgments are made and links this decision-making process to practical implications of neuroscience and young children. Due to the fact that moral issues are complex, this chapter cannot supply all the answers. However, it should provoke thought and reflection, and when necessary encourage preemptive actions so the identity, destiny, and development of young children will flourish and grow.

Ethical and Moral Issues Arising from Neuroscience

Neuroscience is affecting all of us in many ways (Goswami, 2004; Hruby & Goswami, 2011). Baby boomers are benefitting from treatments designed to maintain mental acuity, and young children are benefitting from early interventions. The mind and brain have always been of interest to philosophers, but because of technological breakthroughs, the brain has become the focal point of more and more research and writings. In the past 50 years, more information about the brain has been distributed to laypersons than in the past, and this trend is likely to continue to grow (Stamm, 2007; Stein et al., 2010). More findings will likely lead to more interest, more treatments, and fewer calls for restraint. Neuroscience is seeping into our lives and the lives of our young children, and because of this ethical and moral concerns are beginning to surface more and more. Neuroscience can be used for good or bad purposes, and because of this the field of neuroethics was born. Neuroethics sits at the intersection between neuroscience and the ethical, legal, and social implications it brings. To Racine and Illes (2006) neuroethics focuses on the right and wrong, good and bad treatment of, perfection of, or unwelcome invasion of, and worrisome manipulation of the human brain. Gazzaniga (2005, 2011) extended the idea with

specific implications related to social issues like mental illness, mental degeneration, and mortality. To Gazzaniga, neuroscience should help everyone develop a brain-based philosophy of life. However, this is not easy because we tend to focus on ideas that align with our beliefs and allow our beliefs and emotions to cloud our judgment. To develop a brain-based philosophy, we need valid information and time for deep and reflective thought. Beliefs are not easy to change and neuroscience and ethics do not easily mix. Some findings from neuroscience are difficult to consider because they make us question the very fabric of who we are, who we can become, and how we will live our lives.

New technological developments and the spread of information are bringing two concerns to everyone. The first concern asks what neuroscience can be used to do or its technical capabilities (e.g., use brain images to determine personalities, prescribe drugs to alter brain chemistry, and utilize treatments to enhance functioning). The second concern focuses on what can be learned from neuroscience or its practical implications (e.g., use the biological basis of cognition, behavior, and personality). Buller (2005) has coined terminology for such concerns, referring to them as the “ethics of neuroscience” and the “neuroscience of ethics.” To him, caution should accompany any scientific advancement. Without it, things can go awry.

If educators, parents, and caregivers fail to act fairly and responsibly, keep information confidential, or consider the safety and unintended consequences of treatments neuroscience can bring to the lives of children, neuroscience will be used in unethical ways. An example of this comes from medication and young children diagnosed with attention deficits. Neuroscience has revealed that the neurotransmitter dopamine is lower in individuals with attention challenges, and because of this they have trouble with self-regulation and are impulsive and quick to grab at rewards. Regulatory problems are being translated into biological functions, and psychopharmacology is being used to remedy difficulties (Stein et al., 2010). Medications like methylphenidate (Ritalin) and amphetamine (Adderall) slow the reuptake of dopamine and decrease symptoms in 70–90 % of cases. In the past 10 years, more and more children, at younger ages, and adolescents are being medicated because their parents and teachers want them to succeed academically, socially, and emotionally. Unfortunately, medication is often the only treatment some young children receive despite the fact that absolute proof of its benefits is not available at this time, and little is known about its effects on children and adolescents (Farah, 2005). While there is no doubt that medication helps many young children, there are also unintended side effects like weight loss, sleeplessness, and cloudy minds (Chau, 2007). Neuroscientists, physicians, psychiatrists, psychologists, and social workers warn that medication alone is typically not enough to treat attention challenges. Medical interventions need to be coupled with behavioral, social, and emotional support. So while medicine is a piece of the puzzle, it is not the entire solution. Locating an attention problem solely in a child’s brain and treating it with a brain-altering medication get quick results but do not offer a cure or help a child understand his/her challenges. Medication focuses on changing behaviors. It does not increase self-awareness or heal a body or mind (Farah, 2005; McCabe et al., 2005; Morse, 2006; Stein et al., 2010). Neuroscience tells us that interaction

is key. If we place young children on medication and fail to interact or talk with them, their esteem and self-worth will become damaged.

The intent of this chapter is not to criticize or condone the use of medication. It is, however, intended to make educators, parents, and caregivers aware of the moral questions that can arise like: Can using medication cause psychological harm to a young child (e.g., lower esteem and motivation)? Will a young child on medication be robbed of his/her identity? When it comes to medication, what are our responsibilities? Answering these questions determines how systems and families intervene in children's lives. Given the fact that the minds and personalities of young children are just forming, medical interventions could rob children of their identities and make them incapable of assuming authorship of their own lives. Habermas (2003) noted that the careless use of biomedical advances could undermine the organismic conditions that allow for ethical self-understanding and responsible agency. In the wake of biotechnologies that allow adults to directly intervene in children's neurobiology, teachers, parents, and caregivers need to reflect on their actions and ensure that all children are allowed to be themselves and have a voice in their lives (Dubinsky, 2010; Stein et al., 2010; Mahoney, 2009).

Moral and ethical issues are surfacing and affecting children, teachers, parents, and society, and as caregivers we must begin to take note. Our beliefs and decisions have consequences because young children depend on us.

Education as an Ethical/Moral Enterprise

In 2005, Bullough set out to investigate the ethical and moral matters being investigated and reported in education. To do this he reviewed research articles published, including the well-respected peer-reviewed journal *Teaching and Teacher Education*. To organize this review he asked the following questions:

1. In what sense is teaching an ethical and moral enterprise?
2. What is the nature of the ethical issues confronting teachers and how do they think about them?
3. What must teacher educators do to help teachers learn how to make moral decisions?

Results from Bullough's investigation indicated that the authors of manuscripts in this journal believed teaching was a moral enterprise. To them, what teachers did and how teachers thought and acted were morally laden. The manuscripts written for this journal revealed the status and power teachers' held over children's lives and explained how, ethically, this could be either good or bad. Teachers could use their power to track children, set low expectations, or teach in ways that imparted only their point of view. Power could stifle ideas and exclude certain points of view. To be moral, teachers needed to listen to the voices of their students, respect their opinions, and care about the cognitive, physical, social, and moral development of every child. Unfortunately, this is not always easy because

teaching is embedded in a political world full of uncertainties, difficult choices, and fast change. Neuroscience is changing the way children are viewed, and today's teachers are facing issues that 10 years ago would never have come into play. Caring for each child's free will, identity, and self-worth are a few of the many and complex issues today's teachers are facing, and not all teachers respond the same way. Life experience, values, and convictions help a teacher and others in children's lives respond with sensitivity and care.

So if teaching brings power and demands ethical thinking, what can teacher educators do? Will incorporating ethics in teacher training matter and if so how should ethics be taught? Looking at the articles in his review, Bullough found a consensus that teacher training, at all stages of development, should include ways to develop the moral and ethical reasoning of teachers. To achieve this goal, Bullough supplied a set of promising practices such as using case studies focused on moral issues (e.g., due process, authority, the hidden curriculum), teaching a moral vocabulary, and offering time in teacher preparation to discuss and reflect on moral issues that matter in children's lives and their lives as teachers. Yet, even with this type of instruction, Bullough acknowledged that old ways of thinking are difficult to change. Ethical and moral development takes time and experience. It is "hard won" (p. 13).

This statement is powerful, and Bullough concluded saying that even though the works he reviewed were published in a top-tier educational journal, they focused on a limited number of ethical issues, failed to capture the complexity of moral issues teachers face, and failed to translate theory into practice. To him, there a gap remains in our understanding of ethical issues. In Bullough's eyes too many educational researchers and teachers are speaking metaphorically about ethical issues instead of talking about real problems and reflecting on their practice through an ethical lens. Teachers confront injustices and teaching is a moral occupation.

Another individual who has written about the ethics of teaching is Nell Noddings (1999, 2005a, 2005b). Noddings advocates teaching the "whole child," and to her, this means focusing on each child's physical, moral, social, emotional, spiritual, and aesthetic development. To Noddings, the purpose of school is to produce graduates who are thoughtful citizens with consciousness and the ability to think and act with care. To Noddings the development of these qualities should be embedded in each subject. They should not be fragmented or added-on. Noddings' ideas have practical application. For example, as children learn about science, they can also read poems about the effects of their behaviors on the environment and read biographies of scientists who have advocated moral ideals. Activities like these can make science more interesting and help children understand the social and ethical consequences of their actions. Once children become aware that they have influence, they will act to make things right.

In a similar vein to Noddings, Brunkhorst (2005) wrote that the values teachers have were a key part of the moral actions they take. Brunkhorst investigated teachers' values and discovered that teachers with strong values are enthusiastic about their subject matter and know how to teach it in a way that encourages creativity, interest, and talent. Teachers with strong values instill curiosity and an undying passion for deep learning, and they do not gloss over difficult issues or moral challenges.

A practical way to teach values is to model an ethical stance through one's actions and words by showing genuine respect for each child, his/her family, and the community in which they live. Ethical teachers model ways to be empathetic and understanding. They go the extra mile if they see a family or child in need. These teachers approach life with honesty, dignity, and self-respect and inspire students to do the same.

Bruce Law (2005) has similar beliefs to Noddings and Brunkhorst, but instead of focusing on developing moral individuals, he promotes developing moral schools. To Law, schools should be humane places, and to make them this way, he believes a collective intentionality, or shared vision to make the world a better place, must be forged between administrators, teachers, and children. A practical way to achieve this vision is to reflect on one's biases, privileges, convictions, and perspectives. To Law, the good of others should become a school's primary concern, and administrators, teachers, and students need to collaborate to make this a reality.

This brief review of education as a moral enterprise is by no means exhaustive. There are countless others who have written on the ethics, morality, and values of teachers, education, and schools (e.g., Beckner, 2004; Campbell, 2004; Colnerud, 2006; Noddings, 2005a, 2005b). This brief review was written to show the importance of thinking about teaching as a moral enterprise, what ethical practice means, and how schools, teachers, and children can work together to become moral individuals. As noted earlier, these ideas apply outside of school as well.

Neuroscience, Educators, and Ethical Decisions

Teaching young children at a preschool, at home, or at a community center is a moral endeavor, and as science moves forward the ethical challenges educators and caregivers face will continue to grow and change. Neuroscience is seeping into all of our lives and changing what we know and think about children. Child rearing and neuroscience are entwined and, given modern advances, will become more entwined in the future (OECD, 2007). Today's teachers and parents are using facts from neuroscience to understand children, make instructional decisions, and confirm and disconfirm the beliefs and ideas they have (Zambo, 2008, 2009a, 2009b, 2011). Neuroscience is reforming practice and policy, and because of this, more and more ethical concerns are coming into view and ethical decisions can be perplexing. When it comes to young children and neuroscience, how does an adult know what to believe? How does one judge what is right or wrong, what is just or unfair? Where can one find reliable information? Whose ideas matter most? Neuroethics brings questions like these into focus, and this is important because of the power adults have on the lives of young children. Moral questions have been asked for centuries, and philosophers have uncovered five approaches used to deal with them.

A Utilitarian Approach to Moral Decisions

Individuals with a utilitarian approach question the future effects and benefits of new ideas in terms of the greater good. Individuals with this approach believe in preventing harmful acts, punishing offenders, and rehabilitating those who can be saved. To individuals with this approach, those who cause harm should be punished. No treatment should be used for manipulative or selfish reasons.

A Rights Approach to Moral Decisions

Individuals using a rights approach question how ideas respect rights. Individuals with this approach believe in the freedom to choose. They believe everyone has the right to decide what they want to do with their lives and the right to have their choices honored. To them everyone deserves:

- Truth and information
- What has been agreed upon or promised
- Privacy, or the right to do, believe, and say what they choose in their personal lives as long as they do not violate the rights of others
- Safety and the right not to be harmed or injured unless they freely and knowingly do something to deserve punishment or freely and knowingly choose to risk injuries to themselves

Individuals with a rights approach condone individual choices and the privacy and safety of everyone. When it comes to neuroscience, they would place an individual's right to know and make decisions over any scientific advances.

A Fairness or Justice Approach to Moral Decisions

Individuals with a fairness approach focus on justice and equity. Individuals with a fairness approach ask who benefits from findings and who is left out? To them favoritism and discrimination are wrong. Individuals with a fairness approach would ask whose voices are being heard and whose are being left out? The work of Noddings (1999, 2005a, 2005b) in the previous section captures a fairness approach and leads to understanding how individuals with this perspective would view neuroscience. Who would benefit and who would lose would be their main concern.

A Common-Good Approach to Moral Decisions

Individuals with a common-good approach focus on connections. Individuals with this approach assume individuals are inextricably linked to each other, the

community, and the wider world. Individuals with a common-good approach see communities as vital. To them communities should be built upon common goals and values. When it comes to any advances, individuals with this approach consider how social policies, systems, institutions, and environments ensure the development of everyone. Law's (2005) idea of moral schools fits a common-good approach and leads to understanding how individuals with a common-good approach would approach neuroscience. To them neuroscience should be use for the good of every child, adolescent, and adult.

A Virtue Approach to Moral Decisions

Individuals with a virtue approach focus on becoming or being virtuous. Individuals with this approach ask questions like: "What kind of person should I be? How can I develop virtue within myself and my community?" Individuals with a virtue approach ask these questions because they believe everyone should develop and live up to certain ideals. Virtue to them is nurtured with reflection, honesty, compassion, and integrity. Bullough's (2005) view of the moral development of teachers and Brunkhorst's (2005) view of teacher's values fit a virtue approach. When it comes to neuroscience, individuals with this approach would reflect on their beliefs and values.

These five approaches provide insight into the ways individuals approach moral decisions and can be used to raise questions about how the findings from neuroscience can be used fairly, for the common good, and for the betterment of every child. Findings from neuroscience should be stirring ethical questions about the very nature of education and childcare like:

- How are we using findings from neuroscience to influence how we think about, and interact with, the young children in our care?
- How might we use neuroscience with children who depend on adults?
- How might we use neuroscience to better the lives and learning of young children? Is the autonomy and identity of children being respected?
- Can information/main messages from neuroscience be used to teach young children and help them develop self-regulation?
- Are we implementing strategies suggested by neuroscience to help young children reach their full potential?
- How might we use neuroscience fairly, equitably, and justly?
- Are we using neuroscience to understand the abilities and disabilities of young children? Can neuroscience be used to avoid deterministic views, labels, and stereotypes?
- What responsibility do manufacturers have when they say their products or strategies are based on neuroscience? Should there be sanctions when advertising purports scientific findings from neuroscience but are completely false?
- How can we avoid perpetrating neuromyths?

Questioning, of course, does not provide automatic answers to moral problems, but it does bring into focus the need to seek valid information and keep a critical eye on the facts we receive. Findings and treatments from neuroscience can have positive or negative effects. Interventions can help children focus, become better readers, and understand how to regulate themselves. But if we are not careful, they can also rob young children of their identities, absolve individuals of responsibility, confirm biases and hatred, and be so costly that only the rich will be able to afford them (Racine & Illes, 2006). The limits of neuroscience methodology and the complexity of relations between research and practice take center stage in the challenges we face when we try to blend neuroscience into our homes, schools, and communities (Stein et al., 2010).

In some ways we take two steps forward and one step back. But there is no doubt that things are changing and progress is being made. Findings from neuroscience are being blended with other disciplines, and helping educators, parents, and caregivers create environments conducive to learning, but this takes time and dedication to finding the true facts. To use neuroscience appropriately a causal chain of evidence needs to be clear, and teachers and caregivers must work with neuroscientists to help them turn their ideas into practical and cost-effective strategies. We must keep in mind that:

- The best information from neuroscience is gathered with reliable and valid tools, replicated, and combined with personal insights.
- We need to become better consumers of information from neuroscience.
- We need to understand that 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.
- We need understanding and common vocabulary.
- We need to be fascinated and skeptical at the same time.

Neuroscience cannot tell us what or how to care for children. However, it can be used to confirm, enrich, and refine theories and models of learning and behavior. Different vantage points, or a consilience of disciplines (e.g., human development, cognitive science, neuroscience, behavioral science), are best (Wilson, 1998). A multivoiced perspective leads to interventions that work. Even though information from neuroscience has grown, given insight, and become part of daily conversations, we must not lose sight of the fact that it is an evolving and quickly changing field.

The authors in this volume are both hopeful and skeptical at the same time. They have reflected on their practice, asked ethical questions, and taken a cautionary stance. The dangers of oversimplifying and overextending findings from neuroscience are noted along with the need for disciplines to come together in the service of children's welfare. As teachers, parents, and caregivers themselves, the authors recognize the power they have on children's lives and the power they and others have to end to neuromyths and transform valid ideas from neuroscience into the lives of young children. Our schools, homes, and communities can become fair, equitable,

and just places if we use findings from neuroscience, psychology, sociology, and education to understand each child's strengths, abilities, and needs. This volume is full of ways to use neuroscience in ethical and reasoned ways.

References

- Bear, M. F., Connors, B. W., & Paradis, M. A. (2007). *Neuroscience: Exploring the brain* (3rd ed.). Baltimore: Lippincott, Williams, and Wilkins.
- Beckner, W. (2004). *Ethics for educational leaders*. Boston: Pearson.
- Bruer, J. T. (1999). In search of...brain-based education. *Phi Delta Kappan*, 80(9), 649–657.
- Bruer, J. T. (2006). Points of view: On the implications of neuroscience research for science teaching and learning: Are there any? A skeptical theme and variations: The primacy of psychology in the science of learning. *CBE Life Sciences Education*, 5, 104–110.
- Brunkhorst, S. (2005). *How to feel satisfied in your career*. Retrieved May 8, 2005, from <http://ezinearticles.com/?How-to-Feel-Satisfied-in-Your-Career&id=34506>
- Buller, T. (2005). Brains, lies, and psychological explanations. In J. Illes (Ed.), *Neuroethics: Defining the issues in theory, practice, and policy* (pp. 51–61). New York: Oxford University Press.
- Bullough, R. V. (2005). *Ethical and moral matters in teaching and teacher education*. Retrieved from <http://dx.doi.org/10.1016/j.tate.2010.09.007>
- Campbell, E. (2004). Ethical knowledge and moral agency as the essence of applied professional ethics in teaching. *Professional Studies Review: An Interdisciplinary Journal*, 1(1), 29–38.
- Chau, V. (2007). Popping pills to study: Neuroethics in education. *Stanford Journal of Neuroscience*, 1(1), 18–20.
- Colnerud, G. (2006). Teacher ethics as a research problem: Syntheses achieved and new issues. *Teachers and Teaching: Theory and Practice*, 12(3), 365–385.
- della Chiesa, B., Christoph, V., & Hinton, C. (2009). How many brains does it take to build a new light: Knowledge management challenges of a transdisciplinary project. *Mind, Brain and Education*, 3(1), 17–26.
- Dubinsky, J. M. (2010). Neuroscience education for prekindergarten – 12 teachers. *The Journal of Neuroscience*, 30(24), 8057–8060.
- Farah, M. (2005). Neuroethics: The practical and the philosophical. *Trends in Cognitive Science*, 9, 34–40.
- Gazzaniga, M. (2005). *The ethical brain*. New York: Dana Press.
- Gazzaniga, M. S. (2011). *Who's in charge: Free will and the science of the brain*. New York: Harper Collins.
- Gopnik, A. (2009). *The philosophical baby*. New York: Farrar, Straus and Giroux.
- Goswami, U. (2004). Neuroscience and education. *British Journal of Educational Psychology*, 74, 1–14.
- Habermas, J. (2003). *The future of human nature*. Cambridge, UK: Polity Press.
- Howard-Jones, P. (2010). *Introducing neuroscience research: Neuroscience, education and the brain*. New York: Routledge.
- Hruby, G. G., & Goswami, U. (2011). Neuroscience and reading: A review for reading education researchers. *Reading Research Quarterly*, 46(2), 156–172. dx.doi.org/10.1598/RRQ.46.2.4
- Law, B. (2005). Creating moral schools: The enabling potential of critical friends groups. *Educational Horizons*, 84(1), 53–57.
- Mahoney, P. (2009). Should 'ought' be taught? *Teaching and Teacher Education*, 25(7), 983–989.
- McCabe, D. P., & Castel, A. D. (2008). Seeing is believing: The effect of brain images on judgments of scientific reasoning. *Cognition*, 107(1), 343–352. doi:[10.1016/j.cognition.2007.07.017](https://doi.org/10.1016/j.cognition.2007.07.017)
- McCabe, S. E., Knight, J. R., Teter, C. J., & Wechsler, H. (2005). Non-medical use of prescription stimulants among US college students: Prevalence and correlates from a national survey. *Addiction*, 100, 96–106.

- Morse, S. (2006). Moral and legal responsibility and the new neuroscience. In J. Illes (Ed.), *Neuroethics: Defining the issues in theory, practice, and policy* (pp. 51–61). New York: Oxford University Press.
- Noddings, N. (1999). *Justice and caring: The search for common ground in education*. New York: Teachers College Press.
- Noddings, N. (2005a). Educating the whole child. *Educational Leadership*, 63(1), 8–13.
- Noddings, N. (2005b). Caring in education. *The Encyclopedia of Informal Education*. www.infed.org/biblio/noddings_caring_in_education.htm
- Organization for Economic Cooperation and Development (OECD). (2007). *Understanding the brain: The birth of a learning science*. Paris: OECD.
- Racine, E., & Illes, J. (2006). Neuroethical responsibilities. *The Canadian Journal of Neurological Sciences*, 33, 269–277.
- Stamm, J. (2007). *Bright from the start: The simple science-backed way to nurture your child's developing mind, from birth to age 3*. New York: Gotham Books.
- Stein, Z., della Chiesa, B., Hinton, C., & Fischer, K. W. (2010). *Ethical issues in educational neuroscience: Raising children in a brave new world* (pp. 1–32). Boston: Oxford University Press.
- Sylvan, L. J., & Christodoulou, J. A. (2010). Understanding the role of neuroscience in brain based products: A guide for educators and consumers. *Mind, Brain, and Education*, 4(1), 1–7.
- Weisberg, D. S., Keil, F. C., Goodstein, E. R., Rawson, E., & Gray, J. R. (2008). The seductive allure of neuroscience explanations. *Journal of Cognitive Neuroscience*, 20(3), 470–477.
- Willis, J. (2006). *Research-based strategies to ignite student learning: Insights from a neurologist and classroom teacher*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Wilson, E. O. (1998). *Consilience: The unity of knowledge*. New York: Random House.
- Wolfe, P. (2001). Applying brain research to classroom practice. *Education Update*, 43(4), 1–2.
- Zambo, D. (2008). Childcare workers' knowledge about the brain and developmentally appropriate practice. *Early Childhood Education Journal*, 35, 571–577.
- Zambo, D., & Zambo, R. (2009a). Educators' perceptions about brain research. *Academic Exchange Quarterly*, 13(19), 89–94.
- Zambo, D., & Zambo, R. (2009b). What future teachers think about brain research. *Teaching Educational Psychology*, 2(5), 39–49.
- Zambo, D., & Zambo, R. (2011). Teachers' beliefs about neuroscience and education. *Teaching Educational Psychology*, 7(2), 25–41.
- Zambo, D., & Zambo, R. (2012). Beliefs of college students inside an outside of education. *Education Quest*, 9(1), 87–93.
- Zambo, D., Zambo, R., & Sidlik, L. (in press). Preservice Teacher's Perceptions of Neuroscience, Medical Science, and Students with ADHD.

Early Childhood and Neuroscience - Links to
Development and Learning

Wasserman, L.H.; Zambo, D. (Eds.)

2013, XII, 220 p.,

ISBN: 978-94-007-6671-6