

THE EVIDENCE SUGGESTS OTHERWISE | April 2007

MILLION DOLLAR BABIES:
Why Infants Can't Be Hardwired for Success

By Sara Mead

About the Author

SARA MEAD is a senior policy analyst at Education Sector. She can be reached at smead@educationsector.org.

About Education Sector

Education Sector is an independent education policy think tank devoted to developing innovative solutions to the nation's most pressing educational problems. We are nonprofit and nonpartisan, both a dependable source of sound thinking on policy and an honest broker of evidence in key education debates throughout the United States.

© Copyright 2007 Education Sector. All rights reserved.

1201 Connecticut Ave., N.W., Suite 850, Washington, D.C. 20036
202.552.2840 • www.educationsector.org

In the late 1990s and early 2000s, Georgia hospitals sent every newborn baby home with a classical music CD, courtesy of former Governor Zell Miller and his belief that Mozart and Bach promote brain growth and intellectual development in young children. “Listening to music at a very early age,” Miller suggested, “affects the spatial-temporal reasoning that underlies math and engineering and even chess.”¹

The Georgia governor has been far from alone in preaching the importance of Bach for babies. Over the past decade, it has become conventional wisdom in many education circles that sufficient stimulation in the first three years of life can go a long way toward hardwiring the brain for success. Bookstores are brimming with books with titles like *Smart-Wiring Your Baby’s Brain*, states have launched Smart Start programs, and a booming, multi-billion dollar industry led by companies such as Baby Einstein and Brainy Baby has tapped into parental angst over doing enough for their kids with foreign-language classes for newborns, toddler day spas, and a host of other products and services aimed at unleashing a baby’s inner genius.

Lawmakers have been swayed by the argument that if they invest in building brainier babies, they’ll collect dividends later in the kids’ lives in the form of savings on job training, corrections and welfare. As the advocacy group Kansas Action for Children has argued: “While more than 85 percent of a child’s core brain structure is formed by age five, only 2.5 percent of state and federal investments in education and development have occurred by that time.”²

More darkly, some have seized on the importance of early brain development in an effort to excuse elementary and secondary schools from the difficult task of working hard on behalf of all students—on the grounds that by the time many students get to school they are already hopelessly and permanently behind.

There’s a problem, however, with the new conventional wisdom about building brighter babies: It’s based on misinterpretations and misapplications of brain research. While neural connections in babies’ brains grow rapidly in the early years, adults can’t make newborns smarter or more successful by having them listen to

Beethoven or play with Einstein-inspired blocks. Nor is there any neuroscience evidence that suggests that the earliest years are a singular window for growth that slams shut once children turn three. To the contrary, the social programs with the strongest evidence of positive long-term impacts, including high-quality preschool programs, take place outside the zero-to-three window.

The new now-or-never stance toward child development has drawn sharp rebukes from leading neuroscientists such as Harvard University’s Carla Shatz.³ And the Campaign for a Commercial-Free Childhood, an advocacy group, has filed a complaint with the Federal Trade Commission alleging that Disney (which now owns Baby Einstein), Brainy Babies LLC and other makers of learning products for very young children, have no hard evidence to support the implications of their advertising—that their products will make tots smarter.

Shatz and other experts say that the first three years of children’s lives are undeniably important. But they reject the claim that they are the most important years, much less the only years that really matter, in a child’s mental development.

But hardly anyone’s listening. State and federal governments have poured millions of dollars into programs focused on children from birth through age three, many of which have little evidence of effectiveness. And many parents are in a state of near-paralysis over whether they are sufficiently stimulating their babies’ brains.

The Zero-to-Three Narrative

Look in the parenting section of any major bookstore, and you’ll find scores of books that promise to help parents

turn their newborns into smarter, happier, more successful adults by providing them with research-based stimulation and activities. There's *Smart-Wiring Your Baby's Brain*; *Why Love Matters: How Affection Shapes a Baby's Brain*; and *Raise a Smarter Child by Kindergarten*.

Of course, parenting advice is hardly a new phenomenon. Thinkers since Plato have offered child rearing tips, and the modern genre can trace its roots to Erasmus of Rotterdam's 1530 "On Civility in Children." But the current genre of brain-based child development literature is a fairly recent trend. Over the past 20 years, the growth of neuroscience technologies like Positron Emissions Topography (PET Scan) and Magnetic Resonance Imaging (MRI) have allowed scientists to glimpse inside functioning human brains, and the resulting findings have sparked an explosion of popular interest in the brain and how it works. Educators and parents have been particularly intrigued by this new research and its potential to offer insight into how young children learn.

What neuroscientists have shown is that dramatic physical changes are taking place in the brains of young children. At birth, infants have slightly fewer synapses than a typical adult. (Synapses are the connections between neurons, or brain cells, and scientists have found that they impact behavior and learning.) Within the first few months, newborns begin forming new synaptic connections at a very rapid rate, and a toddler actually has many more synapses than an adult. But sometime after the first year of life, the process of building new synapses stops, and the brain begins pruning synaptic connections, an activity that continues over several years until the brain reaches maturity.⁴

Early childhood advocates have used these findings to argue that children's early experiences have a critical impact on their brains and set the limits of their intellectual potential. The media eagerly covered these conclusions, with scores of articles about the implications of the new neuroscience research.⁵ Particularly influential was "Your Child's Brain," a 1996 *Newsweek* cover story by Sharon Begley:

When a baby comes into the world her brain is a jumble of neurons, all waiting to be woven into the intricate tapestry of the mind. Some of the neurons have already been hard-wired, by the genes in the fertilized egg, into circuits

that command breathing or control heartbeat, regulate body temperature or produce reflexes. But trillions upon trillions are more like Pentium chips in a computer before the factory uploads the software. They are pure and of almost infinite potential, un-programmed circuits that might one day compose rap songs and do calculus, erupt in fury and melt in ecstasy. If the neurons are used, they become integrated into the circuitry of the brain by connecting to other neurons; if they are not used, they may die. It is the experiences of childhood, determining which neurons are used, that wire the circuits of the brain as surely as a programmer at a keyboard reconfigures the circuits in a computer. Which keys are typed—which experiences a child has—determines whether the child grows up to be intelligent or dull, fearful or self-assured, articulate or tongue-tied. Early experiences are so powerful, says pediatric neurologist Harry Chugani of Wayne State University, that "they can completely change the way a person turns out."⁶

Early childhood development gurus also promised that the right kind of stimulation during the first three years of life would ensure that a child's brain is properly wired, boosting his or her intellectual potential and preventing the dangerous emotional scars that negative stimulation can cause. They also argued the flipside to this appealing promise: If parents miss this chance to shape their infants' and toddlers' brain development, they will lose forever the opportunity and do lasting damage to their children's potential. "Once wired," Begley writes, "there are limits to the brain's ability to create itself. Time limits. Called critical periods they are windows of opportunity that nature flings open, starting before birth, and then slams shut, one by one, with every additional candle on the child's birthday cake."⁷

Child advocates used this argument to offer policymakers a compelling promise: Investments in early childhood development can inoculate children against negative influences, prevent a host of social problems and save the public billions of dollars. In the words of Hollywood director and child advocate Rob Reiner: "If we're going to have a real impact on societal ills—crime, teen pregnancy, drug abuse, welfare—we're going to have to focus in on the first three years of life. It's problem-solving through the prism of zero to three."⁸

Reiner made this point at a 1997 White House Conference on Early Childhood Development and Learning. It was one of many events that year that dramatically increased public and policymaker attention to early childhood development. That spring, television network ABC aired “I Am Your Child,” a celebrity-loaded special, produced by Reiner, that focused on early childhood development, and Reiner launched the I Am Your Child Foundation to provide parenting resources and advocacy for early childhood programs. *Newsweek* also devoted an entire magazine to early child development during the first three years of life.⁹

During the 1990s, the importance of a child’s first three years became a widely accepted fact in public discourse. This newfound attention to early learning also influenced policy decisions at the local, state and federal levels. States like California, Georgia and North Carolina passed legislation to provide young children with rich and stimulating learning environments. At the federal level, President Bill Clinton created the Early Head Start program to provide early care and education services to poor children from birth to age three, in response to fears that Head Start, which primarily serves four-year-olds, started too late to significantly impact children’s development. Early Head Start’s funding tripled in the late 1990s, and it currently serves 62,000 children at a cost of \$684 million.¹⁰

The work of Reiner and other early childhood advocates in the late 1990s could serve as a case study on how to leverage research, popular press and advocacy to produce real changes in public opinion and social policy. Unfortunately, the effort went far beyond what neuroscience actually says about early childhood, with significant consequences for parents and the public.

Mistakes Behind the Argument

Arguments about the importance of the first three years are compelling because they have roots in scientific evidence about the brain and its development. But they rest fundamentally on mistakes about what that evidence means. Three major fallacies deserve particular attention.

The Form-Is-Function Fallacy

Early childhood advocates often assume that findings about the shape, size or activity of brain structures

say something useful about how people learn, think or behave. But if the brain shows more activity or growth during a certain activity, it does not necessarily mean that more learning or thinking is going on. The fallacy of drawing this type of conclusion is an old one. In Victorian times, people used to claim that because females had smaller brains, they had less intellectual aptitude. That has been proven false.¹¹ Before scientists can extrapolate implications for human behavior from brain research, they must first establish a chain of causal relationships. If the chain is not established, people should not try to draw implications for education or parenting.

The most significant instance of the form-is-function fallacy as it relates to early childhood involves the rapid growth of synapses. Some early childhood advocates have misinterpreted the significance of the rapid development of synapses, arguing that the increased number of young children’s synapses means that they have greater learning capacity than older people. This is not accurate. While synaptic connections are important, the number of connections does not tell us anything about learning capacity. And even if we knew how to create more synapses, it might not be helpful to do so: Neuroscientists point out that the process of synaptic pruning is necessary to establish a properly functioning adult brain.¹² The reality is that we don’t know enough about synapses to make any recommendations about whether the development of more synaptic connections should be encouraged. And we most certainly don’t know enough about neural connections to suggest specialized learning toys or educational approaches that might develop them.¹³ We are, in short, far from knowing how to build a better brain.

The More-Is-Better Fallacy

It would be foolish to conclude that because one vitamin is better for you than no vitamins, swallowing an entire bottle of vitamins must be even healthier. However, early childhood advocates often make the same logical mistake when they interpret neuroscience findings. For instance, studies show that children who were severely abused or neglected in early childhood suffer developmental delays and other problems.¹⁴ But early childhood advocates don’t simply tell parents not to neglect their children; they encourage them to provide their children with extra stimulation in order to promote brain development. “Based in part on such observations,” writes Harvard’s

Shatz, referring to research on neglected and abused children, “some people favor enriched environments for young children, in the hopes of enhancing development. Yet current studies provide no clear evidence that such extra stimulation is helpful.”¹⁵

Child advocates also cite experiments in which animals that lived in more stimulating environments—with toys and other animals—developed more synapses per neuron than those that lived alone in sterile lab cages. They argue that these studies show that enriched environments enhance brain growth. But, as author John Bruer points out, the environments that wild animals live in are more like the enriched environment than the lab cage one. Thus, this experiment simply repeats the finding that severe deprivation hurts development; it does not show that a more engaging environment produces smarter animals—and it definitely does not show that extra stimulation produces smarter children.¹⁶

The Critical-Periods Fallacy

Perhaps the biggest misuse of neuroscience research is the idea of a critical window of development for young children. According to supporters, this stage starts at birth and ends at about three years of age. Once the period is over, advocates say, the opportunity for further child development is over, and a child’s potential is locked.¹⁷

The idea of a developmental critical period comes from a series of experiments conducted during the 1960s by David Hubel and Torsten Weisel. As part of the research, the scientists sewed shut one of a newborn kitten’s eyes. A few months later, they reopened the eyes and found that the kittens were virtually blind in the eye, because the parts of the brain that normally receive input from the eye had not developed properly. Sewing shut an adult cat’s eye for the same amount of time did not have the same effect, however, because adult cats had already developed the brain connections needed to process input from the eye. From this and similar research, neuroscientists drew the conclusion that there are critical periods in the development of certain sensory functions during which a lack of stimulation can prevent development.¹⁸

Early childhood advocates took this idea and applied it to children, arguing that society needs to provide a rich, stimulating environment for babies and toddlers before

they lose their ability to learn. But this is a very dangerous leap. The critical period identified by Hubel and Weisel was a critical period for the development of very specific visual functions in kittens, not a generalized critical period for all aspects of development. Research has also shown that critical periods occur for very specific sensory and motor functions, not for entire sensory systems. And no researcher has found a critical period for culturally transmitted knowledge and skills such as vocabulary, reading or math.¹⁹

More importantly, the critical periods that do exist for sensory and other abilities are more complex than a door slamming shut at a particular point in time. In fact, researchers discovered that under the right circumstances kittens could regain some of the visual abilities they had lost because their eyes had been sewn shut.

The Cost of Exaggeration

Should we care if the neuroscience evidence is misused? The answer, for some early childhood advocates, is “No.” Overselling the evidence is not a big deal, they say, because it advances worthy causes: Parents pay more attention to their babies, and the government invests more in programs for young children. But this argument is shortsighted and ignores the negative consequences of exaggerating the importance of the first three years.

Parents have been the most obvious victims of the zero-to-three hype because it hits them with a striking threat: The experiences you provide your child during the first three years hardwire the brain and forever set your child’s intellectual potential. Fail to provide the right stimulation during early childhood and your child will suffer devastating consequences. Pass on baby water aerobics, in other words, and you can say goodbye to college.

This threat leads parents to waste billions of dollars every year on products that promise to help them foster brain development. The merchandise from Baby Einstein, Brainy Baby and other companies subtly—and sometimes not so subtly—references neuroscience findings about the importance of the first three years. Brainy Baby, for instance, advertises its materials with the slogan “a little genius in the making!” and sells “right brain” and “left brain” educational videos.²⁰ The Baby Prodigy company explicitly claims its product will help parents raise a

“smarter, happier” baby. The text on the back of a Baby Prodigy DVD case reads, “Did you know you can actually help to enhance the development of your baby’s brain? The first 30 months of life is the period when a child’s brain undergoes its most critical stages of evolution. ... Together we can help to make your child the next Baby Prodigy!”²¹

For the companies, the products have been a boon. The toys are sold at stiff prices—a set of 12 Baby Einstein DVDs costs \$179.99—and there is a seemingly endless demand. The educational baby toy industry, virtually nonexistent a generation ago, is now a multi-billion dollar business and continues to grow rapidly.²² For parents, however, the money spent on these educational toys might be better off in a college savings account or used to meet other family needs.

Zero-to-three advocates have convinced state and federal lawmakers to funnel millions into early childhood interventions—many of which have shown little result. The Comprehensive Child Development Program, for instance, a federally funded pilot program that used a case management approach to intervene as early as possible in the lives of very at-risk infants, demonstrated no positive impacts for children or their families, even though it cost nearly \$16,000 per participating family per year.²³ State policymakers have also invested in programs that seek to foster young children’s development by teaching their parents about child development. But research has raised serious questions about the effectiveness of many of these programs.²⁴

Even if neuroscience evidence did show unequivocally that the years from zero to three are the most important for children’s development—and it does not—that wouldn’t tell us how, or even if, governments can intervene effectively during that time to improve child development or life outcomes. In other words, neuroscience research—with its heavy reliance on PET scans, MRIs and studies of lab rats—is meant to help academics understand how the brain works; it is not meant to inform social policy.

Importantly, by misusing the neuroscience research, early childhood advocates might undermine the very thing they so desperately desire: more funding for young kids. By not focusing on effectiveness, early childhood advocates encourage policymakers to make sloppy decisions about how to invest in young children, and over time the

failure of unproductive programs may undermine public support for all types of early childhood investments. This is particularly shortsighted since we have strong evidence that some early interventions are highly effective. Dozens of research studies, for instance, have shown that high-quality preschool can significantly improve life outcomes.

Overselling the importance of the first three years also has serious implications for education policy. The key debate of the accountability era is whether or not it is reasonable to expect schools to close the large achievement gaps that currently exist between poor and affluent students and between white and black or Hispanic students. But if, as the supporters for zero to three contend, the brain becomes hardwired in the first three years of life, then schools shouldn’t be responsible for closing achievement gaps: Learning abilities are set in a child’s brain before they enter kindergarten, and little can be done to alter them. As Richard Rothstein writes in his book *Class and Schools*, which argues that public schools cannot close achievement gaps, “Most of the social class difference in average academic potential exists by the time children are three years old.”²⁵

And it’s not just schools that are let off the accountability hook. By this argument, even preschool programs can’t be expected to do too much for children: “The gains a toddler makes in Head Start are so often evanescent [because] this intensive instruction begins too late to fundamentally rewire the brain.”²⁶

These views are dangerously deterministic—and do not jibe with the research. For one, the door for learning does not slam shut at age three. Indeed, recent neuroscience research has shown that the mind is amazingly supple and continues to develop well into old age.²⁷ The zero-to-three hype also overlooks evidence about interventions, most notably high-quality preschool programs, that significantly improve outcomes after the age of three. Reviewing the evidence on early childhood intervention programs, economist Janet Currie concludes that it does not prescribe an optimal age for early childhood interventions.²⁸ In fact, some of the programs with the strongest evidence of positive effects are high-quality preschool programs serving four-year-olds. Some high-quality intervention programs for at-risk youth have shown significant positive impacts even though they focused on children and adolescents well-past the age of three.²⁹ Further, researchers have shown that achievement gaps

are not merely a function of irrevocable cognitive deficits or “bad brain wiring” but the outcome of ineffective schools, low-quality curriculum and bad teaching.³⁰

In the end, the state of neuroscience research isn’t robust enough to inform the decisions of parents or policymakers—and early childhood proponents shouldn’t extrapolate beyond the evidence to justify new programs and extra funding. Indeed, until neuroscientists have more reliable data, parents and policymakers should make decisions using the thing that kicked off this whole process: their brains.

Endnotes

- ¹ James Salzer, “State Set to Give Newborns Music,” *Florida Times-Union* (Georgia Edition), June 20, 1998.
- ² Kansas Action for Children, “Untapped Potential,” 2004, available online at <http://www.kac.org/docs/Untapped%20Potential.pdf>.
- ³ Marcia Barinaga, “A Critical Issue for the Brain,” *Science*, June 23, 2000.
- ⁴ John T. Bruer, *The Myth of the First Three Years*, (New York: Free Press, 1999); John T. Bruer, “Education and the Brain: A Bridge too Far,” *Educational Researcher* 26, no. 8 (November 1997).
- ⁵ John T. Bruer, “Let’s Put Brain Science on the Back Burner,” *NASSP Bulletin Articles* (May 1998): 9–19, available online at <http://www.jsmf.org/about/jpubs.htm>; Pat Wingert and Martha Brant, “Your Baby’s Brain,” *Newsweek*, August 15, 2005; “In Quality Child-Rearing, There’s No Time to Waste,” *Virginian-Pilot*, April 1, 2005; “How to Boost Babies’ Brain Power,” *CNN.com*, November 14, 2002; Jan Baggerly, “Build Baby’s Brains,” *Macon Telegraph*, September 18, 2003.
- ⁶ Sharon Begley, “Your Child’s Brain,” *Newsweek*, Feb. 19, 1996.
- ⁷ Ibid.
- ⁸ Tom Feran, “TV Producer Aims at Kids’ Development,” *Cleveland Plain Dealer*, April 26, 1997.
- ⁹ “Your Child: From Birth through Age Three,” Special Issue, *Newsweek*, Spring/Summer 1997.
- ¹⁰ Early Head Start Almanac, “Funding,” available online at http://www.acf.hhs.gov/programs/hsb/programs/ehs/ehs_funding.htm.
- ¹¹ Daniel T. Willingham, “‘Brain-Based’ Learning: More Fact than Fiction,” *American Educator*, Fall 2006, available online at http://www.aft.org/pubs-reports/american_educator/issues/fall2006/cogsci.htm.
- ¹² John T. Bruer, “Education and the Brain: A Bridge too Far.”
- ¹³ Ibid.
- ¹⁴ John T. Bruer, *The Myth of the First Three Years*.
- ¹⁵ Carla J. Shatz, “The Developing Brain,” *Scientific American*, September 1992, 34.
- ¹⁶ John T. Bruer, “Education and the Brain: A Bridge too Far.”
- ¹⁷ Sharon Begley, “Your Child’s Brain.”
- ¹⁸ David H. Hubel and Torsten Weisel, *Brain and Visual Perception* (New York: Oxford University Press, 2004).
- ¹⁹ Marcia Barinaga, “A Critical Issue for the Brain.”
- ²⁰ Brainy Baby Web site, www.alittlegenius.com.
- ²¹ Baby Prodigy Web site, www.babyprodigy.com; Alissa Quart, “Extreme Parenting,” *The Atlantic Monthly*, August 1, 2006.
- ²² Elaine Pofeldt, “The Battle for Your Baby’s Brain,” *FSB: Forbes Small Business*, October 2005.
- ²³ “National Impact Evaluation of the Comprehensive Child Development Program,” Administration for Children and Families, U.S. Department of Health and Human Services, June 1997, available online at http://www.acf.hhs.gov/programs/opre/hs/comp_develop/reports/ccdp/ccdp_fullreport.pdf.
- ²⁴ Deanna S. Gomby, Patti L. Culross and Richard E. Behrman, “Home Visiting: Recent Program Evaluations—Analysis and Recommendations,” *Future of Children* (Spring/Summer 1999); “Making Investments in Young Children: What the Research on Early Care and Education Tells Us,” National Association of Child Advocates Issue Brief, December 2000.
- ²⁵ Richard Rothstein, *Class and Schools*, Economic Policy Institute, 2004.
- ²⁶ Sharon Begley, “Your Child’s Brain.”
- ²⁷ John T. Bruer, “Education and the Brain: A Bridge too Far.”
- ²⁸ Janet Currie, “Early Childhood Education Programs,” *Journal of Economic Perspectives* 15 (Spring 2001): 213–238.
- ²⁹ Washington State Institute for Public Policy, “Benefits and Costs of Prevention and Early Intervention Programs for Youth,” Sept. 17, 2004.
- ³⁰ Roland G. Fryer and Steven D. Levitt, “Understanding the Black-White Test Score Gap in the First Two Years of School,” *The Review of Economics and Statistics* 86, no. 2 (May 2004).