

Gender Matters in Elementary Education

Research-based Strategies to Meet the Distinctive Learning Needs of Boys and Girls

by Virginia Bonomo

Research indicates that gender influences how children learn. Those findings do not necessarily mean that boys learn one way and girls another. Still, there are significant differences with respect to gender and how our brains develop. Researchers have found that no single area of development influences those gender differences: rather, a combination of developmental differences affects the brain, sensory motor, and physical development. In order to teach to gender differences, educators need to be aware of them and have knowledge of effective gender-based teaching strategies.

Brain-based Gender Differences

The research has established that the male brain is on average 10 to 15 percent larger and heavier than the female brain. However, in addition to size, differences in the autonomy of the brain are present across genders. Using brain mapping, research has established that men possess on average more than six times the amount of gray matter related to general intelligence than women, while women have nearly ten times the amount of white matter related to intelligence than do men. One study also indicates that differences in the brain areas correlate with IQ between the sexes (Kaufmann and Elbel 2001). That study and an ongoing series of other studies make it evident that one part of males' brains, the inferior parietal lobe, is generally larger. That lobe is involved in spatial and mathematical reasoning, skills that boys tend to perform better than girls. The left side of the brain, which is responsible for the ability to use language and connected to verbal and written ability, develops sooner in girls, and girls therefore tend to perform better than boys in those areas (Gabriel and Schmitz 2007).

Although those differences are significant, it is important to examine how that information relates to developmental gender differences. More-recent research indicates that the significant difference between girls and boys is not the brain’s structure but the size and sequence of development in the different regions of the brain. In 2007 a longitudinal study conducted by the National Institutes of Health demonstrated consistent sex differences in the speed of the brain’s maturation (Lenroot et al. 2007). It also showed that boys’ brains develop differently than girls’ brains. Rather than develop along the same lines as girls’ brains, only slower, boys’ brains develop at a different order, time, and rate than girls’ in the areas of the brain that affect language, spatial memory, and motor coordination. While the areas involved in language and fine motor skills mature about six years earlier in girls than in boys, the areas involved in targeting and spatial memory mature some four years earlier in boys than they do in girls (Hamlon, Thatcher, and Cline 1999).

Table 1. Gender-based Differences between Girls and Boys

Girls	Boys
Girls can multitask better than boys because the female corpus callosum is 26 percent larger than the male. The corpus callosum is the nervous tissue that sends signals between the two halves of the brain.	In the male brain, a larger area is devoted to spatial mechanical functioning and half as much to verbal emotive functioning.
Girls have the ability to transition between lessons more quickly and are less apt to have attention span issues.	Boys utilize the cerebral cortex less often than girls and they access the primitive areas of the brain more often while performing the same types of activities or tasks.
The neural connectors that create listening skills are more developed in the female brain and therefore enhance listening skills, memory storage, and tone of voice discrimination in girls.	For the male brain to renew or recharge it will go into rest states, while the female brain does so without rest states or sleep.
Girls make fewer impulsive decisions than boys due to a higher serotonin level.	Boys have less serotonin and less oxytocin, which makes them more impulsive and less likely to sit still to talk to someone.
The female brain has 15 percent more blood flow than the male brain, allowing for enhanced integrated learning.	Boys structure or compartmentalize learning due to the fact that they have less blood flow to the brain.
Because girls have more cortical areas devoted to verbal functioning, they are better at sensory memory, sitting still, listening, tonality, and the complexities of reading and writing (the skills and behaviors that tend to be rewarded in school).	Boys’ brains are better suited to symbols, abstractions, and pictures. Boys in general learn higher math and physics better than girls. Boys prefer video games for the physical movement and destruction. Boys get into more trouble for not listening, moving around, sleeping in class, and incomplete assignments.

Adapted from Sax 2006, 192

Sensory-Perception-based Differences

Sex differences are prevalent not only in brain-based research but in sensory-perception research as well. Studies have found significant differences in the ways boys and girls hear, see, and smell. Only recently have researchers begun examining sensory perception and sex differences in education. In 2001, Dr. Edwin Lephart, the director of neuroscience at Brigham Young University, became the first to search for sex differences by examining dead animals' eyeballs. He found dramatic differences in how the eye is constructed in the male versus in the female: for instance, the visual cortices are fundamentally different.

In addition to such contrasts in construction, the male eye is drawn to cooler colors such as silver, black, blue, and gray, and boys tend to draw pictures of moving objects. In contrast, the female eye is drawn to textures and colors. It is also oriented toward warmer colors—reds, yellow, and oranges. Girls tend to draw more-detailed visuals with faces and people; boys draw more object-based pictures (Sax 2006). In addition, a comprehensive study of newborn infants demonstrated that female infants responded to faces and male infants responded favorably to moving objects, such as mobiles placed above the cribs (Killgore, Oki, and Yurgelun-Todd 2001).



260

Although consideration of sensory perception is relatively new, the first evaluation of hearing in girls versus boys was conducted in the 1960s. The study found that girls hear better than boys, especially in higher ranges—frequencies above 2 kHz (Corso 1963). A later study found that among 350 newborn babies, the girls' hearing was more sensitive than boys', especially in the 1000–1400 Hz range, which is critical for speech discrimination (Cassidy and Ditty 2001). In addition, more-recent studies have confirmed girls' superior hearing at higher frequencies. That may be due to girls' shorter, stiffer cochleae, which provide a more-sensitive response to frequency (Corso 1963). The research also concludes that such differences increase as children get older. Girls interpret a loud speaking tone as yelling; thinking the speaker is angry, they may tune out. Girls' more-finely tuned aural structure makes them more sensitive to sounds than boys are (Kaufmann 2009).

In addition to hearing and sight, a female's sense of smell under certain conditions is at least one hundred thousand times more sensitive than a male's. Such differences can prove significant in determining interest and success in the classroom environment (Dalton 2006, cited in Sax 2006).

Physical Differences

The autonomic nervous system maintains blood pressure, body temperature, and internal homeostasis. It is divided into two parts: 1) the sympathetic nervous system, which is responsible for the “fight or flight” response (the adrenalin-mediated cascade of accelerated heart rate, vasoconstriction, dilated pupils, etc., triggered by violence or confrontation, which prepares the organism to fight or to run away), and 2) the parasympathetic nervous system, responsible for “rest and digest,” i.e., mediating digestion and underlying the slower heart rate, vasodilatation, and increased continuous blood flow (flushing) that in turn affect the response to higher ambient temperatures (Sax 2006).

Studies are demonstrating a gender-related difference in the organization of the two systems. Apparently, the female autonomic system is influenced more by the parasympathetic nervous system; in contrast, the male sympathetic nervous system has a greater influence on the control of autonomic responses. The greatest probable effect of those divisions pertaining to gender is that exposure to threats or confrontations sharpens males' senses and exhilarates them. Most females exposed to such stimuli feel dizzy and may have trouble expressing themselves or reacting.

Consider a situation in which a teacher calls upon a child and expects a quick answer: how differently will the boys and girls react?

Knowledge of those differences can sway teaching strategies to enhance student success.

Table 2. Autonomic Differences between Girls and Boys

	Girls	Boys
The response to a stressful situation is activated by different parts of the nervous system depending upon gender.	Girls' responses derive from the parasympathetic part of the autonomic nervous system.	Boys' responses derive from the sympathetic part of the autonomic nervous system.
What is the primary humoral difference between the two genders?	Acetylcholine	Adrenalin
What is the reaction when the system is activated?	The female will react by freezing or feel unable to move or react physically to the situation.	The male tends to feel a sense of excitement and the senses are enhanced.
How will the students feel?	The female tends to feel sick or nauseated and feel stress.	The male will enjoy the experience.

Adapted from Sax 2006, 190–200

Biological Differences

Research conducted on ambient temperature in the classroom has reached some surprising conclusions. A professor was shocked to visit a prominent all-boys school and find it uncomfortably chilly. Appalled to find such conditions in an expensive school, she asked the headmaster about the temperature. He replied, “If you turn up the heat, the boys go to sleep. Not literally asleep, but they might as well be. If it’s too warm in the classroom, the boys get sluggish and their eyelids get heavy. If you keep it just a little chilly, the boys learn better” (Sax 2006). Ergonomic specialists have found that the ideal ambient temperature is about 71 F for young men, as opposed to 77 for women. Because the study group wore bathing suits, the ideal temperature in school clothes would most likely be about 2 F lower, or 69 for boys and 75 for girls. Keep in mind that the researchers excluded students who might have been overweight or underweight, because the conditions would have skewed their ambient temperatures (Beshir and Ramsey 1981). Given that temperature is a factor in attentiveness, an educator should consider how that might impact late-spring or early-fall afternoon lessons.

How Is This Relevant to Education? Strategies for Teaching with Respect to Gender Differences

Although dozens of studies published in the past five years have demonstrated dramatic sex differences in brain-based,

sensory-perception-based, and autonomic function, the educational literature has not emphasized the studies and their potential significance for education. Dr. Bruce Perry, a Houston neurologist, believes that our current educational system creates an environment that is biologically disrespectful, even if well intended (Gurian and Stevens 2005).

What, then, will encourage the educational system to respect gender differences? Educators should be educating themselves about gender differences in all areas of development and then building upon that knowledge with sound instructional design and implementation strategies for teaching with respect to gender differences. As they apply their knowledge of the brain, sensory perception, and physically based differences to an action classroom plan, they need to realize how those differences develop in children. The following table shares some actions educators could witness in girls and boys. Keep in mind that there can be many variations among the sexes as well: some boys may tend to have the usual girls' traits and vice versa.

Table 3. Brain-based Genetic Differences in Girls and Boys

Girls Usually	Boys Usually
Hear better than boys.	Have 35 percent less hearing than girls due to the cochlea length in the ear.
Can discriminate between objects better than boys.	Locate objects better than girls.
Focus on faces and warm colors.	Focus on movement and cold colors.
Use the advanced portion of the brain.	Use more of the primitive parts of their brains.
Can explain and describe their feelings.	Find it difficult to talk about feelings.
Develop language and fine motor skills about six years earlier than boys.	Develop targeting and spatial memory about four years earlier than girls.
Multitask well and make easy transitions.	Focus on a task and transition more slowly.
Friendships are focused on other girls.	Friendships are focused on a shared activity.
Find conversation important.	Find conversation unnecessary.
Self-revelation and sharing are precious parts of a friendship.	Self-revelation is to be avoided if possible.
Enjoy a close relationship with a teacher.	May not ask for help to avoid being perceived as "sucking up" to a teacher.
Like to be faced, looked in the eye, and smiled at.	Avoid eye contact and prefer you sit beside them.
Retain sensory memory details well.	Don't retain sensory details.
Do not deal with moderate stress well.	Deal with moderate stress well.
Want to be with friends when under stress.	Want to be alone when under stress.
Feel sick or nauseated when faced with threat and confrontation.	Feel excited when faced with threat and confrontation.
Prefer to read fiction.	Prefer nonfiction.

Adapted from Gurian 2003

Based on the research conducted and reviewed on gender differences, educators need to consider implementing strategies that will successfully engage both boys and girls in the classroom. Here are some suggested strategies:

BOYS

- Be brief and involve them actively in the lesson. Encourage them with quick praise, cut down on written tasks, and use models and rubrics they can follow. Challenge them—boys thrive on competition.
- Keep a close eye on boys, but let them play. Without a physical outlet, their aggressiveness will show up elsewhere inappropriately. Thus, provide large spaces for boys when possible.
- Lessons should be kinesthetic and experiential. Use a variety of manipulatives. Be aware of ambient temperature—try to keep the boys from warmer areas in the classroom. Males do not hear as well as girls, so move them closer to the instruction.

GIRLS

- Girls work well in groups when they are facing one another or the teacher. Find activities that allow them to help the teacher. Don't protect girls from activities that may cause them to get dirty or skin their knees a bit, which could promote "learned helplessness." Safe-risk activities provide opportunities for girls to take calculated risks.
- Girls do not respond well to loud, sharp, short tones. They prefer softer voices. Girls enjoy tying lessons into emotions. They respond to descriptive phrases. Loud, repetitive noise can be distracting and disturbing to girls.
- Make it bold: girls prefer a lot of colors. Use puzzles to promote perceptual and symbolic learning. Girls' attention will focus on overheads or writing on the chalkboard. (West 2002)

Conclusion

We can conclude from the research that there are significant differences in how boys and girls learn. The cognitive differences are brain based; behavioral differences can be brain based or a result of responses from brain-based differences. The very architecture of the brain and the resultant differences in sensory perception and physical skills differ markedly between the sexes in the classroom and in society. Understanding those differences will help educators provide

a positive and encouraging environment for their students and promote teaching with respect to gender differences.

References

- Beshir, M., and J. Ramsey. 1981. "Comparison between Male and Female Subjective Estimates of Thermal Effects and Sensations." *Applied Ergonomics* 12: 29–33.
- Cassidy, J., and D. Ditty. 2001. "Gender Differences among Newborns on a Transient Otoacoustic Emissions Test for Hearing." *Journal of Music Therapy* 37: 28–35.
- Corso, J. 1963. "Aging and Auditory Thresholds in Men and Women." *Archives of Environmental Health* 61: 350–356.
- Gabriel, P., and S. Schmitz. 2007. "Gender Differences in Occupational Distributions among Workers." *Monthly Labor Review* (June).
- Gurian, M. 2003. *The Boys and Girls Learn Differently Action Guide for Teachers*. San Francisco: Jossey-Bass.
- Gurian, M., and K. Stevens. 2005. "With Boys in Mind." *Educational Leadership* (November).
- Hamlon, H., R. Thatcher, and M. Cline. 1999. "Gender Differences in the Development of EEG Coherence in Normal Children." *Developmental Neuropsychology* 16 (3): 479–506.
- Kaufmann, C. 2009. "How Boys and Girls Learn Differently." Retrieved May 21, 2010, from <<http://www.rd.com/content/printContent.do?contentID=103575>>.
- Kaufmann, C., and G. Elbel. 2001. "Frequency Dependence and Gender Effects in Visual Cortical Regions Involved in Temporal Frequency Dependent Pattern Processing." *Human Brain Mapping* 14 (1): 28–38.
- Killgore, W., M. Oki, and D. Yurgelun-Todd. 2001. "Sex-specific Developmental Changes in Amygdale Response to Affective Faces." *Neuroreport* 12: 427–433.
- Lenroot, R., N. Gogtay, D. Greenstein, E. Wells, G. Wallace, L. Clasen, J. Blumental, J. Lerch, A. Zijdenbos, A. Evans, P. Thompson, and J. Geidd. 2007. "Sexual Dimorphism of Brain Developmental Trajectories during Childhood and Adolescence." *NeuroImage* 36: 1065–1073.
- Sax, L. 2006. "Six Degrees of Separation: What Teachers Need to Know About the Emerging Science of Sex Differences." *Educational Horizons* 84 (Spring): 190–212.
- West, P. 2002. *What Is the Matter with Boys?* Sydney: Choice Books.

Virginia Bonomo is an instructor in the Department of Early Childhood and Elementary Education at Bloomsburg University of Pennsylvania.