5 Biological Differences in Learning

CHAPTER OUTLINE

Two generations ago, it was very politically incorrect to talk about how male and female brains were different. Today, it's old hat, and after years of research, dozens of eminent scientists have noted physical differences between the male and female brains. These structural differences may account for behavioral, developmental, and cognitive-processing differences between males and females. And while many differences are reliable, keep in mind two things. First, all differences

are on an overlapping bell-shaped curve with both genders. This means that while some brains are more "extreme" male or female, there is an overlapping area where some males have more "female" brains and some females have more "male" brains. Second, many of the differences that have been discovered are anatomical, structural, or chemical. But these differences suggest links only to behavioral differences. We are not yet at the point where we can definitively say a bigger corpus callosum in females means more intuitive behaviors. This chapter fleshes out some of the differences.

The essential understanding here is that our brains are unique, and, while some may still consider it politically incorrect and others may stick to their old understandings, the neuroscientists who study gender differences agree with the model of differences. What is in dispute is how different the male and female brains actually are and what that implies for educational policymaking. For some, it's easy; simply have same-sex schools. For others, it raises questions about who should teach, class size, and instructional strategies.

IT'S NOT THE BRAIN SIZE THAT COUNTS . . .

For starters, in general, males have 10 to 15 percent larger brains than females. When a control for body size is established, studies still indicate that male brains are, on average, 100 grams heavier (Ankey, 1992). In addition, men have about four billion more cortical neurons than women do (Pakenberg & Gundersen, 1997).

The corpus callosum was originally thought to be much thicker in females than in males; however, recent research has debunked the earlier studies (Driesen & Raz, 1995). Another, lesser known bundle of interhemispheric fibers, the anterior commissure (see Figure 5.1), however, is clearly larger in female brains (Allen & Gorski, 1991). This advantage may allow females to tie together verbal and nonverbal information more efficiently. Variances within the same gender group do exist, but certainly not to the same extent as those found between the sexes.

Developmental neuroanatomists have found that, in the early years, brain growth rates vary from a few months to five years both within and across gender groups. Some believe that this may be the reason boys generally outperform girls on spatial task measures and girls outperform boys in verbal and reading skills early in life. Other functional differences show up as well (see Figure 5.2).

Functional Differences

Although we can acknowledge the physiological differences between the genders and note performance variances overall, additional research is necessary before we can draw more definitive conclusions. Additional functional differences that impact learners of both sexes are outlined in the next couple of pages. Be aware, however, that these are general differences and not absolutes.

Figure 5.1 Interhemispheric connections

In females, the anterior commissure is generally larger and carries more interhemispheric neural traffic

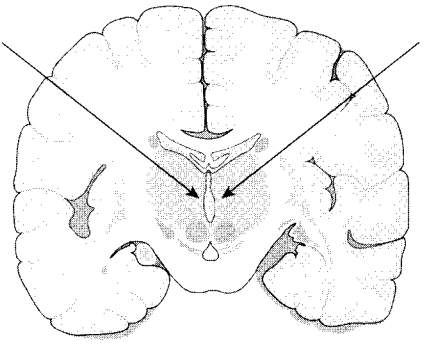


Figure 5.2 Gender differences in performing skills and tasks

Females generally outperform males in the following skills/tasks:

- fine motor skills—ability to move fingers rapidly in unison
- computation tests
- multitasking
- recalling the position of objects in an array
- spelling
- fluency of word generation
- tasks that require being sensitive to external stimuli (except visual stimuli)
- remembering landmarks along a route
- use of verbal memory
- appreciation of depth and perceptual speed
- reading body language/facial expressions

Males generally outperform females in the following skills/tasks:

- targeting skills
- working vocabulary
- extended focus and concentration
- mathematical reasoning and problem-solving aptitude
- navigation with geometric properties of space
- verbal intelligence
- habit formation and maintenance
- most spatial tasks

We should not confuse equality of opportunity with equality of outcome. Often the most objective criteria for a standardized test (e.g., SAT, LSAT) may result in higher scores for males or females due to general differences. Some advocate altering aptitude tests so that scores don't waver widely across genders, calling that the true "unbiased" measure. The PSAT, for instance, adopted a policy that, instead of weighting the math and verbal scores evenly, used an index called *two times the verbal score plus the math* to try to raise girls' scores. Adding a writing

skills subtest to the PSAT has also been tried. These alterations, however, have still not offset boys' generally higher scores in math (Arenson, 1998).

Hearing

The female ear is better able to pick up nuances of voice, music, and other sounds. In addition, females retain better hearing longer in life. At 85 decibels, females perceive the volume twice as loud as males do. Females have greater vocal clarity and are one-sixth as likely as males to be monotone. They learn to speak earlier and learn languages more quickly. Three-quarters of university students majoring in foreign languages are female. Women excel at verbal memory and process language faster and more accurately. Infant girls are comforted by singing and speech to a greater degree than males are. In contrast to this summary of research, however, Klutky (1990) says that females have shown no significant auditory advantage in his studies.

Vision

Males have better distance vision and depth perception, while females excel at peripheral vision. Men see better in brighter light, while women's eyesight is superior at night.

Females are more sensitive to the red end of the spectrum; they excel at visual memory, are superior at interpreting facial clues and context, and exhibit greater ability to recognize faces and remember names. In repeated studies, women were able to store more random and irrelevant visual information than men were (Velle, 1992; Williams & Anderson, 1997).

Touch

Females have a more diffused and sensitive sense of touch. They react faster and more acutely to pain, yet can withstand pain over a longer duration than males can. Males react more to extremes of temperature. Females have greater sensitivity in their fingers and hands. They are superior in performing new motor combinations and in fine motor dexterity.

Activity

Male infants play more with objects, and more often, than females do. Females are more responsive to playmates. The directional choice, called *circling behavior,* is opposite for men and women. In other words, when right-handed males walk over to a table to pick up an object, they are more likely to return by turning to their right; right-handed females are more likely to return by circling around to their left.

Smell and Taste

Women have a stronger sense of smell and are much more responsive to aromas, odors, and subtle changes in smell. They are more sensitive to bitter flavors and prefer sweet flavors. A significant advantage in olfactory memory was found

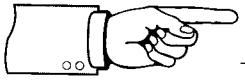
by Klutky (1990). Differences in the brain also relate to the effects of contaminants from beauty products. And by using neuroradiological imaging to assess brain shrinkage, Harper and Kril (1990) found that women are more susceptible to the damaging effects of alcohol than males are.

Problem Solving

Kimura and Hampson (1993) say that males and females have very different ways of approaching and solving problems. For decades, Kimura has been a pioneer in studying the anatomical and functional differences between the sexes. But what does this tell us about learning? Although there are some documented functional differences between the genders, there are also cultural and social biases that begin impacting us at birth. While some parents and administrators have opted for same-sex schools to better meet their students' needs, the effectiveness of such an intervention on cognition and social skills is unknown. There are some things, however, that educators can do in coeducational school settings to support gender differences in the learning environment.

Gender Tips for Teachers

- Be aware of how gender differences may impact learners.
- Be patient with learners who may not show the same brain development that others do (especially with boys who usually learn language skills one to two years later than girls do, or girls who are not as skilled in the spatial or physical tasks as early as boys are).
- Respect differences and appreciate each learner's uniqueness. Use differences as opportunities to teach about respecting our own and others' developmental time lines. Refrain from labeling students "slow learners" or "hyperactive."



What This Means to You

Becoming familiar with gender differences and their potential impact on learners is a good way to move toward meeting the gender-specific needs of all learners. Equal education does not mean that everything should be done the same; it means providing equal opportunity. There are real, physical differences between the sexes. Many male/female behaviors make much more sense when considered in the context of brain development. Eliminate groupings by age or grade. They tend to cause feelings of inadequacy because learners are being measured against those with developmental advantages instead of by effort. Change expectations. Keep students in age clusters, such as ages 2–4, 5–7, 8–10, 11–13, and 14–17. Become informed. Learn the differences between culturally reinforced stereotypes and real physical differences. Keep expectations high, and avoid stereotyping. Many problems may not be problems at all; they may simply be an expression of the natural time line along which one's developmental process unfolds.