

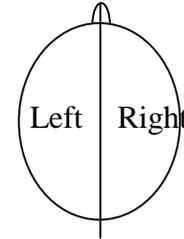
The Second Friday - How We Learn What We Learn

We learn, think, and behave by using select portions of our brain. The learning and problem solving processes are often described as our cognitive abilities, or simply cognitive thinking to differentiate from emotional reactions or other human characteristics (skill abilities, motor functions, etc. although these too have roots in cognitive thinking in early childhood).

Cognitive thinking is the internal mental processes of thought such as visual processing, memory, problem solving, and language. Cognitive thinking had its foundations in the work of Wilhelm Wundt¹², Gestalt psychology and in the work of Jean Piaget³, who provided a theory of stages/phases that describe children's cognitive development.

Learning heat transfer (or any engineering subject... or any subject) involves use of our cognitive abilities! There is no easy way to learn. We learn by practice, problem solving, and, most important, trial and error. Oftentimes, we learn more by making mistakes, realizing those mistakes, and correcting them.

1. Read the problem statement
2. Decipher pertinent information, discard non-pertinent material
3. Apply basic or fundamental principles and laws
4. Sketch out the problem graphically
5. Make mistakes, correct them, and arrive at a solution
6. Redo the problem (practice, rote learning)



Use Your Whole Brain

We can simplistically divide the brain into two halves; the left brain and the right brain. Our left brain functions involve logical, sequential, orderly thought. Mathematics, problem solving, engineering, are typical left brain functions. Our right brain functions involve music, art, dance, language, emotion, politics, personal relationships, non-verbal communication, creativity, innovation, entrepreneurship, etc. Often, engineering students and engineers use only the logical sequential left portion of their brain. That's why engineers are often viewed as introverted, with a seemingly black-white, right-wrong view of the world. This is why we, as educators, require engineering students to take humanities and social science coursework to compliment the overly dominant left-brain engineering material. Liberal arts majors, on the other hand, are the reverse, oftentimes with an obscure or naïve view of science, mathematics, and engineering.

Brain Tests

There are a number of 'tests' which indicate our cognitive and social abilities (Myers-Briggs Type Indicator, Herman-Miller Brain Dominance, IQ tests of all sorts). These tests may or may not reveal our true abilities. Oftentimes, results are easily misinterpreted. Unlike engineering, psychology is an inexact science.

Use both portions of your brain! You can use visual reasoning to help you solve engineering problems. Sketch, think in three dimensions, and graphically resolve. Exercise your right brain; read, learn another language, play a musical instrument, sing, build your personal relationship skills, debate, listen to others, interpret and **understand their emotion**. Too, physical exercise is essential not only for physical fitness but also for mental stability and health. Can you do problems easier and faster with a good physical program in your daily routine? Of course.

Politics and Management

Finally, here is a thought question about politics and management. Why do engineers make poor managers and politicians? What can be done to change this perception?

Education is not teaching students what they do not know, it is teaching students how to behave as they do not behave. – James Ruskin

The gem cannot be polished without friction, nor a person without trials – Chinese proverb

The creative is the place where no one else has ever been. You have to leave the city of your comfort and go into the wilderness of your intuition. What you'll discover will be wonderful. What you'll discover is yourself."- Alan Alda

¹ Wilhelm Maximilian Wundt (Stanford Encyclopedia of Philosophy)

² Butler-Bowdon, Tom. *50 Psychology Classics*, (2007): p. 2.

³ Munari, Alberto (1994). "JEAN PIAGET (1896–1980)". *Prospects: the quarterly review of comparative education* XXIV (1/2): 311–327.