

**Forest Fire Suppression:
Learning How to Learn and Deciding What to Learn**

Earl F. Burkholder, PS, PE

NMSU Emeritus Faculty

November 18, 2010

This article uses a story to look at one part of a much bigger issue. Cut-to-the-chase: I will continue to promote the benefits of education in support of the surveying profession. An intellectual foundation based upon knowledge of fundamental concepts is essential.

Some things can be readily proven; others must be postulated, discussed, tested, and reformulated before being accepted. During my career I have devoted a lot of attention to mathematics and geometrical relationships related to surveying. Those concepts are based upon algebra, geometry, trigonometry, calculus, statistics, and the like. Using theorems, logic and deductions one can start with an assumption and build a rather impressive collection of tools for handling survey data. In that environment, the correctness of a solution can be proven. Those mathematical concepts and processes are embodied in the book I wrote, “The 3-D Global Spatial Data Model.” However, there is more to life (and successful professional practice) than geometry, equations, and numbers. There are legal issues, ethical questions, business practices, and economic considerations that are just as important as the underlying sciences of mathematics and measurements. In that arena, right and wrong answers are not so easily identified.

One could say learning involves using both sides of the brain – the left side of the brain being analytical with the right side of the brain being more intuitive and holistic. Some persons are decidedly right-brain or left-brain focused while others have the ability to use both sides effectively. I have worked much of my life as a left-brain person but I find myself devoting more and more attention to right-brain issues. The frustration for me is that right-brain issues have more gray areas of overlap while left-brain issues are easier to categorize as black or white. Now I spend a lot more time trying to understand my convictions in light of some right-brain challenges facing the surveying profession. For example, what is the role of surveying in society given the relentless onslaught of electronic gadgets and the burgeoning use of digital spatial data? I believe surveying is making valuable contributions to society but I also see evidence that surveying is being overwhelmed by the talented efforts of many spatial data users whose priorities are not necessarily aligned with, even sometimes are at odds with, those of the surveying profession. I see quality education as the best way for surveyors to earn an equal seat at the spatial data users table.

Let me illustrate with a story. First, as background, I recommend the book, “A Whole New Mind” by Daniel Pink (2006) and available in paper back for a nominal \$15 from your favorite book store. The book is a fairly easy read, begins with a description of right/left brain issues, and includes an insightful description of what it takes to be a successful professional in what Pink calls the coming “Conceptual Age.” One of the aptitudes he describes for adapting to change is the use of stories. That is my excuse for including the following.

I grew up on a dairy farm in Virginia but my professional career was born in Michigan where I started with an entry-level job as a draftsman and eventually earned a degree in civil engineering from the University of Michigan. I owe much to those (and other) circumstances, but one of the most important lessons I've ever learned occurred on a summer surveying job with the U.S. Forest Service in Leadville, Colorado. Even as summer employees, I and other college students were taught how to fight forest fires.

Having grown up on a farm, I was no dummy with regard to the use of hand tools and putting out fire with water. But I was impressed by the training approach used by my employer. The instructor, our crew chief, started out by asking us college students if we could write the chemical reaction equation for fire. I had already taken a college level chemistry course but I was not able to provide an acceptable answer. He continued - and this was the part he insisted that we understand. The chemical reaction for combustion requires three elements – fuel, heat, and oxygen. If any one of those elements is removed, the fire will go out. Understanding that concept is essential for effective forest fire suppression.

Let me hasten to add that most of our training consisted of using hand tools such as shovels, machetes, chain saws, and the like. We were also drilled incessantly on working safely and using the right tool for the job. Using water to remove heat from a fire was not ignored but, high in the Rockies, there is little water routinely available for fighting fires. Our training focused on removing the fuel. We were expected to be prepared to respond to a call for fire-fighting assistance on short notice. No, I and the crew on which I worked that summer were never sent out on a major fire. Of course, the training we received was beneficial and justified because it prepared us to work effectively and safely on our normal duties within the San Isabel National Forest.

Now let's connect some dots. Our eligibility for that summer job was not prefaced on our ability to write the equation for combustion or that we understand the elements needed to support a fire. Instead, our crew chief prepared us for productive activities by drilling us on respect for hand tools, proper body alignment and movements when using the tools, and working safely. But, our training and practice were greatly enhanced by what he taught us about why it was necessary to remove fuel from the path of a fire. If we had actually gone out on a fire detail we were prepared to understand the “why” as well as the “how” for effective fire suppression. On the other hand, understanding the combustion equation was essential knowledge for the full-time foresters (professionals) who supervised our efforts and who were responsible for policies directed at managing a productive forest.

How does all of this apply to surveying? I am currently working on a Surveying Body of Knowledge Committee chaired by Dr. Josh Greenfeld. It is a challenging task. There seems to be an infinite list of things a surveyor should know and be able to do. My question is “which of those items is learning or understanding the combustion equation and which are categorized as learning how to handle the tools?” The manufacturers and vendors provide surveyors an endless array of tools that can be used to accomplish an equally endless list of tasks. Learning to use the tools is essential and employers expect a 4-year surveying graduate to know how to perform many surveying tasks. But, I worry

that we, surveying educators, are tempted to spend too much time on learning to use the tools at the expense of gaining an understanding of the combustion equation.

Of course, education and training are both essential and some educational programs seem to spend more time teaching the “how” than the “why.” Even though that can be justified depending upon the stated mission of the individual program, an appropriate balance between education and training is critical. But, when defining the surveying body of knowledge, I believe we should focus more attention on the knowledge related to the “why” than on the “how.” The “why” list is quite different from and much shorter than the “how” list.

But, making two separate lists oversimplifies the issue. With the lists in hand, we also need to consider how education and training interact with the spatial data information cycle as described by Professor Hazelton in an article in the April 2010 issue of the ACSM Bulletin, “Surveying: Beyond Mere Existence.” In that article he describes data flow from measurement to information to knowledge to understanding to (problem solving in) the real world. In order to understand that interaction, educators (and professional leaders) should also understand and accommodate learner variations in background, motivation, ability, skill, knowledge, wisdom, and even cultural/social values. Oh my . . . Maybe I should just back off and retire to the orderly left-brain arena where issues are more clear-cut. No, at least for now, turning back is not an option.

Thesis: With the pervasive intrusion of computers and other electronic gadgets in our lives, with the digital revolution impacting most facets of modern surveying practice, and with the current proposal to separate NSPS from ACSM; the surveying profession is facing a challenge of self-identity that can only be solved by coming to grips with learning, understanding, and applying fundamental concepts. Yes, competent technicians who can use the tools are essential to any successful practice, but the future of the surveying profession depends upon well educated knowledgeable professionals who understand the fundamental concepts and who provide the leadership necessary for surveying to interact successfully with other disciplines on an equal level.

What should surveying educators be teaching and what should students be learning? That question needs to be asked and discussed collectively. But, at the individual level, each person needs to learn how to learn, to make some critical decisions about what to learn, and to find and/or develop the motivation needed to apply their knowledge. The role of one or more mentors in that process is another topic deserving consideration. For now, each reader is encouraged to study the issues and to contribute constructively to the discussion.