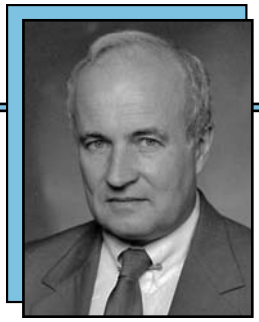

InFocus

thoughts from a member of the Editorial Board

Changing Structural Engineering Education

By Craig E. Barnes, P.E., SECB

When people my age were in college, the calculator of necessity was the slide rule. From that statement, you can determine my age and my generation. We didn't know it at the time, but the slide rule was preparing us as students for the life of an engineer with a great intuition for what made sense relative to decimal point location, units, and the correctness of an answer. A student couldn't take forever to obtain the solution to a homework assignment or a quiz answer, and there was no use for "what if" results should I tinker with this or tinker with that. Rough approximations and rounding of numbers were the norm in engineering practice.

Within a very few years of starting my career as an engineer-in-training and then as a professional engineer, Hewlett Packard produced the most amazing (slide rule) calculator. I recall waiting with anticipation as the price came down from over $700 so that I could open the piggy bank to spend $435 for my HP. Thanks to our training with the slide rule, the calculator didn't make us callus, it made us more efficient. We carried into that new electronic generation a strong understanding of the principles for getting it right.

Then came those huge chugging mainframes that produced reams of paper that no one really wanted to look through, nor had the time to; we were still using approximations to make sure that we got it right. You may recall sitting in front of the key punch after you worked out your FORTRAN code, essentially writing your own software to analyze a beam. 300 cards later, you had your "what ifs" and thought it was really great. Some of us believed that this was the utmost in technology, until software engineers began to produce subroutines that we could buy off the shelf and put into the mainframe. As technology ramped up and moved along, at warp speed, mainframes reduced to desktops, and then to laptops, and now to Blackberry size. And with each step came new problems. Small buttons and small screens remind me that my eyesight has gotten worse and my fingers have gotten larger, but that's another story.

Education has followed suit, with large computer laboratories in engineering schools that require students to work on sophisticated equipment having no idea how it was developed, and no clue about the limitations of the software they are using. This results in students and instructors having almost blind faith in a console. They apply "what ifs" to engineering problems until they think they've got it right, but they really don't know. This can be somewhat unnerving for seasoned practitioners, when reviewing the work of new hires who have just provided a W8 steel section to span some unusual length without realizing that it is going to be like a springboard. Perhaps all students should be required to utilize the slide rule for their undergraduate experiences. But that being said, technology is fast coming to the engineer's aid by putting warnings and flags on output that force the user to question what's going on. In many areas, the new technology is creating a greater reliance on the black box. But is this wrong? Are we engineering relics responding or reacting in a certain way only because our training and development process was different?

Consider now the engineering office that specializes in structural rehabilitation and restoration, and/or additions to existing structures. For projects in such an office, the black box is of little practical use. Today's engineer must understand the constraints on the designers of that time and the materials of construction, which makes the classical approaches indispensable tools and knowledge. So on the one hand, we have an engineer (or an almost engineer) that we want to be proficient in black box technology. On the other hand, we want an engineer coming out of school who is, by definition, young, yet we want him or her to be old and experienced.

Under these circumstances, schools and universities may very well perceive practitioners to be somewhat schizophrenic. Old-new, experienced-inexperienced, expensive-cheap; what do we really want? How can an educational institution respond to all of these challenges? We are not the only pressure or even the greatest pressure on educational institutions today. Consider the spiraling cost of education, the reduction in credit hours in response to political pressure, the diversity of programs to meet specialization needs, the drive to maintain the quality of instructors, and the tension between classical methods and the black box approach. We are all – student, educator, practitioner – smack dab in the center of the changing face of education.▪

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