Velocity of Learning Revisited

By Tom Glardon, P.E.

I read eagerly the Structural Forum column in the July 2013 issue, *Increasing the Velocity of Knowledge*, by Gene Frodsham, MS, S.E. As a professional educator and professional engineer, I hoped that he had insights that I could use. I am constantly faced with clientele that ask me to teach them the same material faster – always faster. Do not teach me cost estimating in five days; teach it to me in five hours. Do not take four hours to teach me basic timber design; show me in four minutes. So I need a way to increase the velocity of knowledge. Indeed, he had good ideas to propose.

However, I need to temper these good ideas with a cold dose of reality. The human operating system, regardless of the beliefs of popular culture and the amazing digital effects that are now routine, is still working on version 1.0. The 10-year-olds of today have the same brain capacity that our founding fathers had. We certainly have different tools available to us, and we have been trained to learn through different media, but we constantly face the fact that the human mind processes cognitive learning in certain ways.

According to the most common model (Bloom's Taxonomy), **knowledge** and (to some degree) **comprehension** learning are fairly well-supported by our digital tools, from automated systems to modeling software to Internet knowledge bases. Mr. Frodsham and his virtual environments seem to focus at this level; note his title: "Increasing the Velocity of *Knowledge*." Throughout the article, he has great ideas on how to make knowledge – or, perhaps more appropriately, information – more accessible and more mobile for engineers. These are excellent points! We need to better prepare our engineers for constantly evolving sciences and environment by making them more information-proficient.

However, returning to our cognitive learning model, **analysis** and **synthesis** learning is much more difficult to teach and inevitably takes time. I can lecture to achieve knowledge, but to achieve analysis and synthesis takes exercises, case studies, research, and projects – and not just one exposure, but multiple exposures in a variety of scenarios and environments. *Analysis* in the cognitive model involves examining and breaking a complex problem into its parts to determine the elements, relationships and organization. *Synthesis* involves such skills as hypothesis, design, organization, planning, and experiment based on a set of abstract relations. These are not skills that you can explain to someone and they simply repeat; students must practice, experience, and develop them.

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This skill set is the definition of an engineer: when faced with a real-world situation, we can break it into its elements to determine how we can solve it using our wide variety of tools. From this analysis, we then hypothesize, potentially test it, and then design and plan the solution. I joke in my structural classes that our undergraduate degrees teach students how to distribute arrows pointing at a beam on a teeter-totter and a rolling pin. I then show the students a building and ask them to tell me where they should be putting the arrows and where they might find a teeter-totter or a rolling pin. The skill set of the engineer is to explore the real world and to determine how to apply the tools that we have learned.

In this cognitive process, the digital tools are simply tools. It does not matter if we use software or a slide rule, I need the engineer to be able to solve problems. I do not need an engineer to be able to load data into a computer program and produce a result; I need the engineer to determine what the problem is and then decide which computer program to use. I recall a project of mine in which the consultant team faced an apparently failed floor fastening system. The five seasoned professional engineers were not standing around scratching their heads over how to use modeling software. Instead, they were deliberating over what the problem was (analysis) and what the possible solutions were (synthesis). From that point on, the technical design was simply running the numbers.

Regarding the move toward a bachelor's degree plus 30 hours for future professional engineers, I am not sure what Mr. Frodsham's point is. I do not see us being able to make it an associate's degree plus 15 YouTube videos. The issue is that the BS, as important as it is, only provides the beginning of any professional engineer's skill set. We must set standards for proficiency, and education credit is one such standard. Mr. Frodsham appears to agree that we need to set high standards, but his thought appears to be that engineers can attain the necessary 'knowledge' through non-traditional methods.

I applaud Mr. Frodsham's concepts of how to "digitize" our learning environment. I encourage him to become an educator and help us get there! I want to work with him! The profession can certainly gain efficiencies in this direction. We are in a world where I do not need to be in a university laboratory to learn how to design timber connections. There are many high-quality, big-name master's degree programs out there that prove every day that I do not need to sit in a lecture hall to learn the material. But to suggest that students can learn the higher-level skills needed as engineers faster … I would challenge proponents of that assertion to prove it. Grand visions … but show me the money.▪

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