Importance of Leadership and Innovation in Preparing the Civil Engineer of the Future

Article for Japan CE magazine

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May 2021

Do civil engineering students learn better online or in the classroom?
How do you capture the attention of a promising young engineer and help them better focus on learning?
What skills will be needed in 20 years to lead the development of the built environment?

These are questions all civil engineers, civil engineering faculty and infrastructure-related industry members should be asking to prepare engineers for the future of the profession. The Covid-19 pandemic has exposed our weaknesses to prepare future engineers and has given us guideposts for better preparation for the future.

Engineering education, like all education, has experienced a singularity of change in teaching and learning. In a two-week period last spring at NC State University, we moved to completely online classes, transitioning from mostly on-campus, in-person classes for over 35,000 students. The technology infrastructure met the demands, and faculty stepped up to the challenge, but students and families experienced a less-than-optimal learning environment. In engineering, we pride ourselves in being very technology savvy, yet our classes and experiences were no better, or perhaps even worse, than those in other disciplines.

What happened and what can we do to better prepare civil engineers for the future?

Let's start with some good news: We know how to deliver very high-quality online courses. While I do not believe these can replace face-to-face experiences, they are a valuable and suitable replacement for some of our learning activities. However, it takes significantly more up-

front effort to create and prepare a high-quality online course, and delivering it requires the same high-level commitment and time that a modern, collaborative in-person course requires.

To prepare the forward-looking civil engineer to lead the development of the future built environment, what should the ideal learning experience be?

I believe there are three major components of this experience:

- Strong technical skills
- An innovation mindset and approaches to solutions
- A comprehensive collaboration and communications framework

Many of these components are part of our accreditation requirements, yet I do not believe we have truly made the shift to think this way and to allow accreditation to validate our success. The skills component is the foundation for learning and creating engineering solutions. We need not only the typical math, mechanics and science skills but also skills in leadership, collaboration, teaming, communication, facilitation, innovation, and many more. Education is a platform to provide engineers with new and additive skills to adapt and succeed in their chosen profession.

In conjunction with the American Society for Civil Engineers (ASCE), I have been involved with efforts to help promote these educational components. Here are three examples:

Leadership Academy

Leadership is an often discussed attribute that many professionals aspire to attain, but it is generally not a core skill taught in civil engineering programs. Even more problematic, leadership is not available to practicing engineers who need it most. Some research (Fast Company, 2015) shows that a successful career is 85% dependent on leadership skills and only 15% dependent on technical skills. Both ASCE and its Structural Engineering Institute (SEI) are actively pursuing leadership opportunities for their members. SEI is currently developing the “Leadership Academy” to provide immersive learning in some of the skills that support leadership, and you can look for results and workshops in mid 2021.

Innovation Contest

For the past five years, ASCE has sponsored a civil engineering-focused Innovation Contest; I have chaired the committee for the past three years. The focus on civil engineering and the built environment is partly due to evidence that civil engineering students generally do not participate in innovation and entrepreneurial programs on their campuses. Three years ago, we expanded the contest to focus on university students and their regional meetings. In the United States, ASCE has student regions that compete annually in events such as the Concrete Canoe, Geotech Wall and, historically, the Steel Bridge. Educational research has shown that extracurricular activities contribute to over 50% of a student’s learning and experiences. As a former Student Chapter Advisor, I can attest to the value of “hands-on” activities, team

leadership immersion and these competitions as links between classroom learning and the direct experience a practicing engineer needs in order to succeed.

Three years ago, we piloted a student version of the Innovation Contest, and next year, we are piloting the "Blue Sky Innovation Contest," which will become an ASCE national student competition.

The initial success has been amazing. Students have produced innovations and solutions that have spawned new patents and fledgling companies. Over the next few years, we are expanding to include all ASCE student chapters, providing a platform for students to incorporate innovation into their learning.

Future World Vision

Another major project led by ASCE is the Future World Vision (FWV) effort. Initiated by the Industrial Leaders Council (ILC), ASCE embarked on a project to envision the future of the built environment in the year 2070. The project involves deep research on trends, future scenarios and possible demands of the built environment. The result is being developed into an interactive tool to allow engineers to think about and explore possible future states and to collaborate on solutions. The goal is to involve the engineering community in a collaborative exploration of skills, tools and technologies that the future civil engineer will need to support society and the built environment.

The current version includes two "cities" — the floating city and the megacity. The floating city is a response to rising ocean levels and the flooding of coastal regions. The megacity is a response to the trend toward population movement to major city environments to access jobs, education, services and entertainment. These are two demonstrations of possible future scenarios where civil engineers will need to develop solutions that support the needs of society.

These three examples illustrate how our civil engineering societies can support and enhance the growth and education of engineers. In each example, there is a partnership with industry, education and governments that prepares the professionals needed to drive innovation in the built environment and to make our cities more livable.

Reference:

Fast Company, 06-22-15
Why Emotionally Intelligent People Are More Successful,
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