Bridging the Knowledge Gap

KEEN Program Director Doug Melton on entrepreneurially minded learning from a student and faculty perspective

My introduction to engineering began during a particularly warm Kansas summer at Wichita State University. The collection of pre-freshmen met in a non-air conditioned classroom. Our assignment was to span a two-foot gap with a model balsa-wood-and-glue bridge that would support commerce between two fictitious cities.

Left to our own devices, our group guessed at what design would best support the test weight. Our final product depended upon extensive truss work and dubious connections despite all the glue. My takeaway was that 45-degree trusses were the key to success. Eager to win and please the professor, we built a bridge that easily withstood the tests.

In retrospect, I wish we had inquired about the changing demographics of the fictitious cities and the nature of the commerce between them. What economic model would justify the construction of a new bridge? What would be the budget? Were there other alternatives?

I wonder how our engineering professor would have reacted. Would he have encouraged our curiosity – or suggested we pursue an alternate major? Perhaps he would have guided us to contextual information to make the scenario more authentic. Unfortunately, we focused only on developing "know-how" without the "know-why." This approach characterized my entire undergraduate engineering education. Something was missing.

Colleges of engineering within KEEN are redefining engineering education as the creation of value through the artful application of science and technology. These schools are fostering an entrepreneurial mindset in their engineering undergraduates. Emphasis on value creation is intrinsically connected to the "why" part of any engineering equation. Faculty members in KEEN now teach the "know-why" alongside the "know-how." Their work is creating lasting change.

Bridge construction is analogous to engineering education. Working from each side of a knowledge gap, instructor and student construct a bridge of understanding. Selection of a pedagogical approach is akin to selecting a building method. Pedagogy may build upon deeply rooted pylons of fundamentals or be suspended by connections to a project. Given the diversity of material, and students, a faculty member can be effective by taking advantage of a variety of pedagogical approaches, which lend themselves to engineering education and are often used in combination. The table below highlights well-known pedagogies, as well as one that is emergent: entrepreneurially minded learning (EML).

EML can be found increasingly on campus and in literature. In an introduction to a thematic journal issue on the topic, Karim Moustaghfir and Nada Trunk Širca [2010] wrote the following regarding entrepreneurial learning:

> *"Entrepreneurial Learning has recently emerged as a new practice involving both entrepreneurship and higher education processes. …Building on an educational case study, Rae (2009) defines entrepreneurial learning as learning to recognize and act on opportunities, and interact socially to initiate, organize and manage ventures."*
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> *"[Entrepreneurial learning] is a dynamic process of awareness, reflection, association, and application that involves transforming experience and knowledge into functional learning outcomes (Rae 2006)."*
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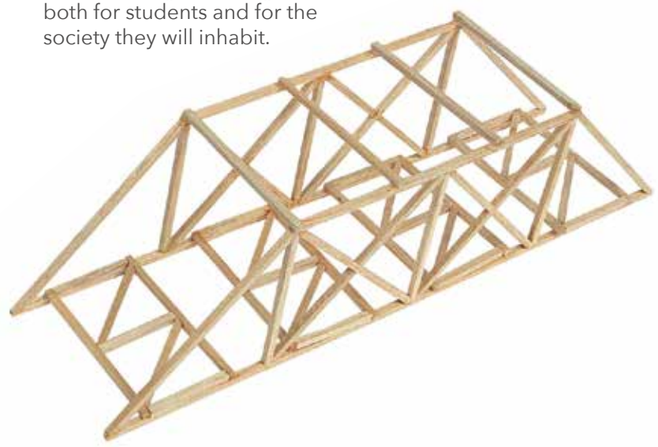
> *"Entrepreneurial learning is hence complex and interconnected with a somewhat ad hoc approach to formal learning and a heavy reliance on experiential learning (Warren 2004). … This learning cannot and should not be divorced from the specific context, including organizational context, within which it takes place."*

This student-centered pedagogy allows students to learn through the experience of identifying opportunities to create value. They develop both thinking strategies and domain knowledge. This approach originates from a school of thought where engineering, business, and societal interests converge. EML encompasses all modes of opportunity identification, including gap analysis, recognition of a mismatch between supply and demand, creative use of new or existing technologies, new opportunities arising from societal and economic trends, etc.

One EML learning mode redefines problems as opportunities to create valuable solutions for a new or existing market (perhaps incorporating problem-based learning). The goal is to help students develop methods of integrating knowledge, identifying opportunities, performing self-directed and continuous learning, and learning effective skills that support enterprising behavior. EML is a style of constructivist and active learning, and the constructs differ markedly from traditional classroom teaching.

Is there really a need for another pedagogical approach? Definitely. EML fills an important gap in the suite of tools available to engineering instructors. Emphasizing the creation of value in engineering students' education provides a much needed bridge to a bright future, both for students and for the society they will inhabit.



	PEDAGOGY	EMPHASIS
SBL	**Subject-Based Learning**	Students learn in a variety of settings, but the focus is mastery of domain knowledge.
EL	**Experiential Learning**	Students learn through direct experience in a domain (learn by doing).
PBL	**Project-Based Learning**	Students learn domain and contextual knowledge from an instructional approach utilizing multifaceted projects as a central organizing strategy.
ACL	**Active/Collaborative Learning**	Students learn through peer interaction.
CBL	**Case-Based Learning**	Students learn domain knowledge and decision-making processes employed by experienced professionals in a historical case.
PBL	**Problem-Based Learning**	Students determine the information, strategies, and domain knowledge required to solve the problem.
EML	**Entrepreneurially Minded Learning**	Students learn to create value, gathering and assimilating information to discover opportunities or insights for further action.