

## **Lean on Campus: Lean Education Academic Network (LEAN) to Advance Lean in Academia**

By George Taninecz

Lean has been the prominent improvement focus throughout manufacturing for more than a decade, and implementations are now occurring in all business fields, ranging from healthcare to retail. Yet on the campuses of many colleges and universities, lean hardly shows up in undergraduate or graduate curricula and faculty fail or are hesitant to teach principles that business is embracing — and students leave higher education with a minimal understanding of lean. That may change as lean-minded professors have joined forces with the Lean Enterprise Institute (LEI) to form the Lean Education Academic Network (LEAN), educators dedicated to implementing and continuously improving lean education in academia.

Bohdan “Bo” W. Oppenheim, professor and graduate director of Mechanical Engineering at Loyola Marymount University (LMU), Los Angeles, estimates that only a minority of universities teach lean: “Most engineering faculty are not aware of lean yet, and those that are aware, don’t understand it fully.” Where it is taught, it’s often focused on volume manufacturing and does not address intellectual areas such as product development or systems engineering. He hopes LEAN can affect a change to where most graduates with engineering or business interests leave schools with a “rudimentary understanding of lean” and lean becomes a mainstream body of knowledge.

“Lean needs to be broader in its distribution,” says William Parr, professor of Statistics, Operations and Management Sciences at the University of Tennessee (UT), Knoxville. He says lean is more available at UT than at many colleges, but estimates only 40% of undergraduates learn of lean. “When you go out in industry now, you’ll find a base level knowledge of lean. If we’re going to put people in the employment market, we need to meet or beat that base level.” Parr, too, believes that many of his colleagues are not aware of lean or it’s not a “hot button” for their schools, but “that’s a mistake long-term. This is not the only model — life is not nearly so simple — but this is a dominant model that people getting a degree in any business field need to know more about it.”

Both Loyola and UT are at the high end of lean in academia, as is The Ohio State University (OSU), where lean is taught as an MBA class as well as in modules throughout the Fisher College of Business. Peter Ward thinks that OSU’s lean curriculum is as developed as any in the country — but he’s not certain. “It’s hard for me to know what the norm is, and one of the things that is going to come out of LEAN is that we’re going to start to have discussions about what ought to go into the curriculum,” says Ward, chair and professor of Management Sciences at OSU and director of the LEAN Steering Committee. Ward is joined on the LEAN steering committee by Oppenheim; Parr; Art Hill, University of Minnesota; Joachim Knuf, University of Kentucky; Ross Robson, Utah State University; and Helen Zak, COO of LEI.

“The current state of lean teaching is very similar to the current state of lean implementation out in industry — some islands of excellence, but a huge sea of opportunity,” says Zak. “A lot of people trying to do the right thing, but in isolation. There really isn’t any North Star that we’ve

found so far in the education world of somebody that's doing everything right or has a comprehensive lean enterprise program.”

In keeping with LEI's mission to disseminate lean around the world, the Mass.-based nonprofit organization has been working “to get the next generation of leaders equipped with lean thinking,” notes Zak, and led to its position as a founding sponsor and advisor of LEAN. “Our role is to help LEAN in any way we can, with money, connections, resources, and marketing, and to help find other organizations that have similar missions to collaborate with. LEI hopes the network will define the current state of lean in academia and develop the action plan to achieve a future state, which would include some lean curricula in graduate and undergraduate education as the general rule and not the exception.”

### **LEAN Kickoff and Sharing**

OSU hosted the kickoff meeting for LEAN in Columbus in August 2005, attended by approximately 30 professors and LEI leaders. A follow-up meeting was held Jan. 20-21 at Loyola Marymount University. Two objectives emerged from the sessions: develop a database for sharing teaching materials and develop an approach to find out what businesses were looking for in lean graduates. Attendees also realized the spectrum of lean teaching — even among the like-minded individuals gathered — was quite diverse. Ward says consensus of the current state is that few lean university “programs” exist around the country, but more common are “individuals who are teaching lean” in some operations classes or, at best, as standalone classes.

Any university has obstacles to developing a new program, such as limited curriculum space and accreditation hurdles. Lean programs also face the limited availability of and access to good teaching materials. Many professors may want to bring lean to students, but are reticent to do so without the support that proven classroom materials can provide.

“Teaching materials are a tremendous issue,” says Ward. “We just don't have enough of them, and we don't have a mechanism for sharing teaching materials.” While there are industry materials widely available, he notes, they tend to be at least day-long exercises — “we get the students for an hour and a half” — and assume students already have some understanding of lean.

“I think that each of us that's been [teaching lean] awhile has simulations or cases we've written that we're really proud of, however, the sum of the parts is a lot better than what any one of us is doing,” says Parr. “One of our goals is to at least make each other aware what's going on so that we can improve. Not just through presentations, such as at [LEAN meetings], but by the database we're constructing of lean resources.”

A LEAN website — [www.teachinglean.org](http://www.teachinglean.org) — and a database were recently established to point professors to teaching materials (articles, books, simulations, games, videos) that have proven helpful. “If someone is teaching a course on lean, they can look in the database, see what's worked well, know who contributed the material, and read some tips,” says Kathryn Marley, graduate student at OSU who established the LEAN website.

“For someone who’s finally got the ability to build a course or module on lean, this gives them a good way to get going,” says Parr. The LEAN website makes it possible for professors to share materials to the extent they’re comfortable (someone may offer outlines for a class but not be willing to contribute their full PowerPoint presentation) and establishes rules of use to ensure no one is taken advantage of.

By early December, approximately 60 individuals had registered with LEAN, generally each representing a unique institution, and links to lean resources was growing.

What professors won’t find there any time soon, though, is a definitive lean textbook – one doesn’t exist. While not all educators agree that a single textbook is necessary, development of textbooks could be a long-term LEAN objective. “If you want to reach beyond [lean practitioners who don’t mind teaching something that’s not in a book] to the people teaching operations who want to put in a three-week module on lean, you’ve got to have textbooks or short monographs that they can use as sources,” says Parr. “There is no substitute.”

### **Customer Requirements**

The other major LEAN initiative established at the August meeting — and one in keeping with lean principles — is a need to better understand what university “customers” want. “We’re training these people, and we’re training what we think are the right things,” reasons Ward. “To what extent does what we do align with what companies want in terms of people coming out of universities?”

The Voice of the Customer research project is soliciting feedback from manufacturing, service, banking, and healthcare companies that are lean or have deployed systems thinking. Peg Pennington heads the project and is a faculty member of Management Sciences at OSU and director of Continuous Improvement for OSU’s Center of Operational Excellence, a partnership with global manufacturers that includes educational programs, research, and networking opportunities.

Pennington says Voice of the Customer objectives are to find out “what are you looking for in your graduates? Do you want people coming in with a bag of tools or do you want people coming in with systems-thinking ideology. Personally, I think systems-thinking ideology because they can always follow up with more training, but we have to talk to these people and see what *they’re* looking for.”

### **Multifaceted Lean Education**

Many LEAN members concur that a range of teaching approaches is necessary to fully impart lean to students and, ultimately, satisfy business. That mix includes classroom teaching; lean experiences in industry; and research, to satisfy academic protocols and to position lean as an ongoing business model and not merely a business fad.

For example, LMU’s Oppenheim is a coordinator of the Lean Aerospace Initiative (LAI) Educational Network. LAI is a learning and research collaboration formed in 1993 by the U.S. Air Force, MIT, labor unions, and aerospace businesses to transform the industry using lean principles. He is an instructor for LAI’s Lean Academy, a 40-hour program that teaches lean to

new employees and interns of aerospace companies, and he also applies Lean Academy materials at LMU. (LMU has one graduate course serving two graduate programs — mechanical and systems engineering — that covers lean principles, manufacturing, product development, systems engineering, engineering, supply management, and the lean enterprise.)

Oppenheim also is director of the U.S. Department of Energy (DOE) Industrial Assessment Center (IAC) at LMU. Grant-funded IACs exist at 26 universities, where faculty and students assess small and mid-sized manufacturers for energy conservation and productivity improvements (i.e., application of lean). “It’s a fantastic program for students,” says Oppenheim. “It’s what brings weight to the teaching side. It’s not only theoretical formulas from some highfalutin professor preaching in front of the blackboard, but students go out with faculty into the industry, actually study what industry is doing, write recommendations on how the plants can save money in energy conservation and lean, and collect tangible data on what the industry plants implemented from our recommendations. We have documented savings among those 112 plants of almost \$35 million. Students get exposed to management styles, equipment, processes, machines, different layouts, and the different frustrations that those plants experience. It’s truly an extraordinary learning environment.”

Parr — director of the Greenwood Lean Enterprise Center at UT, a member of the LAI Education Network, and former senior scientist at Harris Semiconductor — came out of the “quality, productivity, and six sigma world” and began following lean as an allied method to improve processes. The University of Tennessee offers a lean course in its MBA program, a second course for graduates who want deeper knowledge, lean electives for undergraduates (required for some majors), and a one-week lean executive program. Parr is currently developing a lean class for senior business students, and through the Greenwood center he’s helped manufacturing and service organizations implement lean.

“There’s various ways to develop faculty talent,” says Parr. “It’s tough if what you have to rely on is faculty who come in knowing [lean] because historically there hasn’t been that much graduate-level content in lean. Somehow, you’ve got to prime this pump to get it into the classroom. If the people who become professors either don’t have much lean or what they have is low level, it’s tough. Some of the best things for lean are to get them experiences. I think our faculty has been affected a lot by teaching in our executive education, but more so by our experiences working on lean implementations, working with real companies that give you the anecdotes to teach meaningfully about cell design or something because *you’ve actually done it.*”

“To be hitting on all cylinders, what we really have to do is teach our classes in the academic setting, do research in the area, and engage businesses through executive education and other ways, such as working on projects in industry — practice, theory, and teaching all combined,” says Ward, who also is director of research for the Center for Operational Excellence (COE). He and Pennington lead a COE project with the Columbus public school systems, consulting with school principals and staff about lean thinking and process mapping.

“A lot of academics don’t have lean implementation experience, and how can you teach something that you don’t fully understand?” asks Zak. “One of the intents of the network moving forward is to provide practical learning experiences for the educators.” She says LEAN members

have discussed ways to create opportunities for academics within lean consulting organizations, working on projects and kaizens and taking that education back to their classrooms.

Substantial lean teaching may come from adjunct professors and industry professionals, acknowledges Ward, but it's critical "that we have a core of the professors because that's the way we're going to get this thing to move forward, grow, and have legitimacy. It's not just about teaching, it's got to be about research as well. That's important for the legitimacy of our work, that we have a research base — it's what universities do that distinguishes us from other institutions that teach. The research informs and enriches our teaching. When it's done right, the people who are teaching 'Hello to Physics' are also doing physics. In a business school, those who are teaching 'Hello to Lean' are also learning about lean, researching it, describing it, have in-depth knowledge of it, and, ideally, have practice included as well."

### **LEAN Future State**

The LEAN meeting at LMU in January will include presentations by John Shook, a member of the LEI faculty and coauthor of *Learning to See: Value-Stream Mapping to Add Value and Eliminate Waste* (1999, LEI); faculty from the LAI Education Network; and Phillip Farrington and Gregory Harris from University of Alabama in Huntsville who have had success in growing the presence of lean in their curriculum by integrating lean principles into existing classes rather than trying to alter the curriculum and face the inherent problems of capacity, accreditation, and college politics.

Zak says some are skeptical of LEAN's ability to change the education system given university politics, functional silos, etc., "but part of this network is to recognize that there is the infrastructure and determine how we can work within that to make little changes that build up to bigger changes."

Infiltrating existing curricula is an approach supported by Ward, who would like to see an academic world where strategy people teach hoshin kanri, not hoshin kanri as part of a lean path. "I would like to see the tools that we have mainstreamed. My hope is that 20 years from now we're teaching lean but we're not calling it lean anymore — just good management. We would have really made progress when we're doing that, in that our 'lean' elective disappears and becomes our 'operations' course."

Resistance to lean comes from existing models used by professors — an economic model, accounting model, strategy model — and either their neglect of the process world or a belief that process improvements, however good, cannot offer sustainable competitive advantage, says Ward. Even in operations management there are outmoded models that continue to be used, but that is changing, particularly at OSU where lean covers point kaizen (tools such as value-stream mapping) to system kaizen (how to manage a lean program), and *Learning To See* is required reading for all business students. "Just as a student must know discounted cash flow, that student has to learn value-stream mapping and he or she has to understand mapping to be successful in our programs. That's been successful, and we've done a lot as far as reforming our classes within operations. Progress in the other areas is slow. I try to be a disciple, and hopefully the LEAN network will help us in disciplining, but there are competing models out there that continue to flourish. I would like to see our process world get equal or near equal time with the financial

world and the strategic world. If we can do that, there is lots of room for figuring out new ways for companies to succeed.”

## **For more information**

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The **Lean Education Academic Network** (LEAN) is a group of university educators dedicated to the task of implementing lean education in U.S. higher academia, as well as continuous improvement of lean education in the classroom through sharing of knowledge and teaching materials, collaboration, and networking among colleagues. LEAN seeks to engage leaders from industry and academe in developing new approaches to teaching university students lean thinking. We believe that the test of success is the number of students exposed to lean thinking and the extent to which our students are prepared to contribute to lean implementations across all enterprise functions.

The **Lean Enterprise Institute** (LEI) is a 501(c)(3) nonprofit training, publishing, and research center founded by James P. Womack PhD, in August 1997 to give people simple but powerful tools that enable them to apply a set of ideas known as lean production and lean thinking, based initially on the Toyota Production System. The institute’s global mission is to be the leading educator for maximizing value and minimizing waste. To accomplish this goal, LEI develops and advances lean principles, tools, and techniques designed to enable positive change. LEI disseminates this knowledge with the lean community through [books and workbooks](#), public and on-site [training](#), its web site, and global affiliates. For more information, including [success stories](#), visit the LEI site at [www.lean.org](http://www.lean.org) or the LEI Media Center at [www.lean.org/WhoWeAre/LEINews.cfm](http://www.lean.org/WhoWeAre/LEINews.cfm) .