

Progress Report on the Bernard M. Gordon – MIT Engineering Leadership Program

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Introduction

IN MAY 2009, MY fellow co-director Ed Crawley (Ford Professor of Aeronautical and Astronautical Engineering), and I, wrote an article in the *Faculty Newsletter* [Vol. XXI, No. 4] describing a new program housed in the School of Engineering: The Bernard M. Gordon - MIT Engineering Leadership Program (Gordon ELP). At the time, we had been in existence for almost two years and had 14 students. After spending a solid year planning program pedagogy, we had enthusiasm and high hopes – but few results to report.

The purpose of this article is to describe the background and philosophy of the program, to provide a status update, and to report some encouraging assessment results concerning how the Gordon ELP is advancing the confidence (self-efficacy) of MIT engineering undergraduates.

Program Background and Philosophy

In early 2008, with initial funding from a \$20M pledge (with a matching requirement) to the School of Engineering by the Gordon Foundation (headed by MIT alumnus Bernard M. Gordon, '48, MS '49), we worked with prominent educators, MIT alumni, industry leaders, military leaders, community leaders, and those from other leadership programs at MIT to design, develop, and implement an integrated undergraduate program in engineering leadership.

This group started with the premise – strongly validated by the industry leaders – that engineers design and build things that meet the needs of customers, benefi-

ciaries, and ultimately society. As a consensus of this group, we generated our guiding pedagogical document, *The Capabilities of Effective Engineering Leaders*. (For an explanation of *The Capabilities of Effective Engineering Leaders*, see the Program Website web.mit.edu/gordonelp.)

Guided by *The Capabilities of Effective Engineering Leaders*, the Gordon ELP seeks to educate and develop the character of outstanding MIT students as the potential future leaders (not necessarily entrepreneurs) of engineering practice and development. In this program, we define *engineering leadership* as the technical leadership of change: the *innovative* conception, design, and *implementation* of new products/processes/projects/materials/molecules/software/systems, supported by the *invention* of enabling technologies, to meet the needs of customers and society.

The capabilities of engineering leadership upon which our curriculum is built are based on the Four Capabilities model, developed at the MIT Sloan School of Management (Ancona 2007), and anchored in the scholarship of leadership. The educational task of our program is to provide opportunities for all engineering undergraduate students to further develop, deepen, and broaden their engineering leadership capabilities.

Program Specifics: The GEL Program Today

The Gordon ELP is designed to augment MIT's educational commons by providing engineering undergraduates with the design thinking, system

thinking, teamwork skills, and engineering leadership skills that are vital to an effective engineering career (in either industry or academia).

The Gordon Engineering Leader (GEL) component combines:

- immersive experiences on and off campus in which students practice, observe, and discuss engineering leadership, with
- courses that provide conceptual and analytical models and frameworks that support engineering leadership, and
- reflection, evaluation, and feedback from faculty, peers, and experienced engineering industry mentors on lessons learned from leadership activities.

The GEL program can begin as early as the sophomore year, with students participating in UPOP (the Undergraduate Practice Opportunities Program). Over 500 sophomores have applied for this year's program. UPOP students are introduced to engineering practice, receive personalized coaching, a summer internship, post-internship reflective activities, and hone basic interpersonal proficiencies such as effective networking. Participating in UPOP is not required for application to the GEL program, but it is recommended and many students have found it useful.

Although we hope to expand to serve all MIT students, both undergraduate and graduate, the existing GEL funding is des-

ignated for engineering undergraduates. In February preceding their junior and senior year, engineering students can apply for the GEL Year One (GEL1) program consisting of short subjects in engineering leadership and engineering innovation and design, weekly hands-on Engineering Leadership Labs (ELs), and projects, mentorships, and a personal leadership development plan. GELs participate in guided reflection on their successes and discover opportunities for improvement. Mentors, faculty, staff, peers, and program alumni provide guidance in reflecting on and learning from leadership experiences. The time commitment of GEL1 is equivalent to an MIT concentration.

Students who successfully complete the GEL1 requirements may apply for the more intensive GEL Year Two (GEL2) program of two additional short subjects in project engineering and planning, and human and organizational contexts, more weekly ELs, and projects, an Internship Plus, additional mentoring and coaching, more leadership roles, and a compelling final presentation of their personal leadership development plan. The time commitment of the two-year program (GEL2) is equivalent to an MIT minor.

In our short subjects, weekly ELs, and other activities, it is important to note that we are not *lecturing* students about leadership; rather, we are developing their ability to “*be*” effective engineering leaders by immersing them in an environment of intensive practice in engineering leadership or team member roles and giving them active, candid feedback, coaching, and mentoring on their effectiveness.

The Engineering Leadership Labs (ELs)

A distinguishing element of the GEL program is the inclusion of experiential learning opportunities for the development of leadership capabilities in the weekly two-hour Engineering Leadership Laboratories. GEL1s (two semesters) and GEL2s (four semesters) fully participate in ELs that are each designed to provide

The Capabilities of Effective Engineering Leaders.

Small teams of GEL1s are placed in engineering situations and challenges. The assignment of team leader rotates among the GEL1s and the GEL2 assigned to the team giving all team members several opportunities each semester to be the team leader. The situations – often designed in collaboration with practicing engineers – are set in a context that provides a feeling of authentic industry practice (e.g., setting up an assembly process for simple testing devices), and each lab is designed to practice a different leadership capability.

The team leaders are observed by faculty, staff, GEL alums, or guest engineers, a leadership capability assessment card is completed, and team leaders and evaluators give private feedback on the leader’s performance, including what went well, what did not go well, and what needs to go differently at the next leadership opportunity. In keeping with learning pedagogy, students also reflect on their performance and complete a reflection document.

GEL2s also act as a cadre, helping run most of the ELs, providing support for the GEL program outreach and team-building events, and designing and running one EL each semester entirely on their own.

Other Program Components

To serve non-GEL engineering undergraduates, the program partners with departments to promote capability development by providing activities, class sessions, materials, and workshops on leadership, teamwork, and project engineering. We can also collaborate with departments by funding and training teaching assistants to facilitate student teams in project-based courses.

Status Update

After four years, the Gordon ELP is thriving: Although a voluntary, co-curricular program, we currently have 102 students in GEL1 and 24 students who advanced last year from GEL1 to GEL2 this year.

Last year we touched a total of 1100 students through GEL1, GEL2, UPOP, and the teamwork and team leadership workshops that we conduct in a significant number of MIT’s project-oriented courses. We have received many accolades from students in the program, from the employers for their internships, and from faculty who have observed GELs in their classrooms.

Significant Increase in Leadership “Self-Efficacy”

From the inception of the Gordon ELP, we have been focused on measuring program effectiveness through a variety of direct and indirect assessment measures. All subjects in the GEL component have defined and measurable learning outcomes, as does each EL, that continue to be based on *The Capabilities of Effective Engineering Leaders*.

We assess progress against these outcomes annually for the subjects and weekly for the ELs, making programmatic changes based on the findings. In addition, each student completes an Engineering Practice requirement, which program faculty review, along with staff and outside mentors and reviewers where appropriate. GEL2s undertake an InternshipPlus under the guidance of an industry supervisor. Program staff and the industry supervisor evaluate the student’s experiences and competence. We also collect anecdotal experiences from both students and from either their industry supervisor or mentors. The Industry section of the Program Website (web.mit.edu/gordonelp/industry.html) features industry supervisor and student comments.

The GEL component also has a rigorous program of indirect assessment focused on the change in student confidence in their ability to do specific leadership tasks before and at the end of the program. The gains in student confidence cover a range of tasks that students practice in GEL, including their ability to organize teams.

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Gordon-MIT Engineering Program
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- Their confidence that they can insist that a team agree on objectives and a schedule of work rose from 66.5% to 87.2%, and confidence that they can persuade a team to set up a consistent decision-making process rose last year from 64.3% to 85.3%.
- Confidence that they can create a shared vision for a project went from 71.1% to 86.4%.
- Other domains showing substantial increase are interpersonal communication skills, assessed by asking their confidence that they can listen carefully to those who disagree with them (from 69.5% to 93.1%) and whether they know how to ask questions to

help others clarify their ideas (74.0% to 89.4%).

Comparative data supports the view that the program has an independent and consequential effect on leadership capabilities. Questions placed on the MIT graduating senior survey included the student's confidence they could "Make firm decisions and take action even if some of the facts about the best choice are not clear," and "Recognize when you should stop talking about improvements and focus on what can be fully implemented." For these and a few other capabilities that have been emphasized in the GEL program, GELs had higher confidence of accomplishing key leadership tasks than non-GELs in engineering departments, and slightly higher confidence than graduating seniors in Management.

Summary

The Gordon ELP has come a long way since 2008. MIT students appear to value the education the program provides, with program admissions increasing as follows: 14 in year 1, 35 in year 2, 70 in year 3, 115 in year 4, and 135 in year 5. We continue to review and rework our program, gathering and assessing internal and external feedback to improve the educational experience we offer students. We welcome any feedback you may have about our program or our students. We also urge you to encourage your students to apply for this program. We are confident that it will make a significant difference in their career effectiveness, both in industry and in academia. ■

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Thanks – we look forward to seeing you soon.

–The MIT Activities Committee

