



## The Touchstone Engineering Leadership Development Program

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Dr. Victoria Goodrich is the Director of the First-Year Engineering Program at the University of Notre Dame. She holds a BS in Chemical Engineering from the University of Oklahoma and a MS and PhD in Chemical Engineering from Notre Dame. Her research focuses primarily on Engineering Education issues, especially focused within the first-year engineering experience.

### Mr. Gary Allen Gilot P.E., University of Notre Dame

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Gary earned his Bachelor of Science degree in Civil and Environmental Engineering from Clarkson University in Upstate New York (1978), and Masters in Business Administration from Indiana University at South Bend (1985). He is a licensed Professional Engineer in Indiana (since 1982).

As Public Works Director for the City of South Bend for 12 years, and interim transition consultant post-retirement for another 2 years, Gary was responsible for an over 300 person, \$65 million per year enterprise and implementation of a \$ 40-50 million per year Capital Improvement Program.

Gary introduced innovative technology solutions and coached teamwork across silos of the large South Bend organization and fostering numerous creative collaborations.

Gary continues to serve as President of Board of Public Works in South Bend which has management oversight for the municipality.

Gary previously served as City Engineer, Director of Public Works and Utilities and President of Board of Public Works in Elkhart, Indiana for over 16 years.

Gary remains actively engaged in the community. He serves on the advisory board and is a mentor of the EnFocus (entrepreneurial focus) Michiana Venture Fellows. He serves on the Advisory Board of the Indiana University at South Bend Center for a Sustainable Future. Gary also serves on the Salvation Army Kroc Center Advisory Board.

Locally, Gary was recognized for distinguished public service by the South Bend Alumni Association. On a statewide level of recognition, Gary is a recipient of the Ivan H. Brinegar municipal management award through the Indiana Association of Cities and Towns. Nationally in August, 2010, Gary was selected as the nation's 2010 "Public Works Leader of the Year" by American City & County magazine for technology innovation.

Gary has been married to wife Debra for 34 years.

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## University of Notre Dame, College of Engineering

### Abstract

Great engineering leaders require more than great technical skills. The legendary president emeritus of the University of Notre Dame, Father Theodore Hesburgh, has spoken of a vision of leadership based on “three C’s:” competence, commitment, and compassion. The Mayor of South Bend, the city where that university resides, speaks of leadership through engagement, “where talent meets purpose.”

The Touchstone Engineering Leadership program at the University of Notre Dame seeks to deliver on these visions of leadership through a partnership between the College of Engineering, the College of Business, and the Center for Social Concerns, along with the City of South Bend Department of Public Works and other community stakeholders. The name “Touchstone” refers to the strong and recurring role that the University plays throughout the lives of students and alumni, as well as the role that it plays in the cultural and economic life of the surrounding community. The program has three distinct yet interrelated curricular offerings, each targeted towards participants at different levels of experience and mastery of leadership skills that draw from a common skills inventory and set of core values. These offerings are as follows:

- Leadership Enhancements to Existing Undergraduate Courses: Project-based first-year engineering courses and senior capstone design courses have been enhanced to include leadership modules with the goal of introducing skills to make project teams more effective. A key focus is the role of self-awareness in effective leadership (and followership). While these projects may have external stakeholders, project scope is still largely academic in nature. Students are expected to progress from a novice to apprentice level of mastery of leadership skills.
- Engineering Undergraduate Executive Education through Community Engagement: Select undergraduate students comprising largely the leadership of engineering student organizations are invited to participate in this intensive program, aimed at enhancing the effectiveness of these organizations and the leadership skills of their members. The curriculum of this program is based on the Stayer Executive Education program of the Mendoza College of Business, adapted to the “undergraduate executive” context. As part of this program, the undergraduate engineering organizations are encouraged to “bid” on community projects suggested by the South Bend Department of Public Works to apply both technical and leadership skills. These projects have a broader range of stakeholders and more complex constraints than typical academic projects, and participants are

expected to progress from an apprentice to journeyman level of mastery of leadership skills.

- Continuing Executive Engineering Leadership Education: This offering is designed to support alumni and other engineering professions through key leadership transitions throughout their careers as the progress toward a master skill level of leadership. Offered as fee-based two-day workshops held on campus, these programs include networking with students in the undergraduate executive leadership program, and also help financially support the undergraduate offerings.

Outcomes over the first two years of this program include enhancements to existing courses reaching over 500 students, undergraduate executive education programs with over 50 students, and continuing education for alumni and others with over 15 students.

## **Introduction**

The National Academy of Engineering identified solving “complex social issues” that are unsolvable with technology alone as a grand challenge for the 21<sup>st</sup> century.<sup>[1]</sup> The changing role of the modern engineering student is evidenced by the Accreditation Board for Engineering and Technology’s (ABET) Student Outcomes.<sup>[2]</sup> Recognizing the importance of engineers engaging with community, industry and academic employers alike have identified a strong need to develop teamwork and communication skills in engineering graduates in order for them to succeed.<sup>[3]</sup> Yet, studies still report that students are graduating without these crucial skills.<sup>[4,5]</sup> These reports among others have demonstrated the importance of better preparing undergraduate students with the leadership skills they will need after graduation. Within recent years, a number of schools have been actively pursuing adding leadership initiatives for their students, including the addition of an engineering leadership minor<sup>[6,7]</sup> or a smaller scale engineering leadership program.<sup>[8]</sup> Common themes include: course or seminar work on leadership theory and completing some project that applies these newly learned skills. Clearly many institutes of higher education seek to develop the intellect and these important skills for their students. Therefore, the University of Notre Dame developed the Touchstone Engineering Leadership Program to complement their intellectual development as many other programs have demonstrated, but also to use the campus character to shape our undergraduate leadership students. The Touchstone Engineering Leadership program seeks to develop engineering leaders with a distinctive Catholic character, a loyal sense of family, and a commitment to lifelong learning. Our aim is to produce a different breed of engineering leader that the world needs and to accomplish our mission to be, in the words of the University’s founder, Father Edward Sorin, “a powerful force for good” in the world.

When developing a project focus for the new Touchstone Program, the university focused on best practices already established in community engagement programs. Student learning outcomes resulting from community-engaged/service-learning opportunities are exemplified in the best practices of existing engineering programs, including Purdue University’s Engineering

Projects in Community Service (EPICS). EPICS has been successful in developing teamwork, communication, project management, ethics, multidisciplinary understanding, and other integral skills in students by providing educational opportunities that include sustained relationships with community partners, inter-disciplinary teams, access to content experts and faculty advisors, and course credits.<sup>[9]</sup> Further, EPICS students met many of the ABET Engineering Criteria (EC) 2000 learning outcomes.<sup>[10]</sup> Similarly, other groups, such as EFELTS (Tufts) and Engineers Without Borders chapters (EWB, multiple universities) have made significant strides to start community engaged engineering experiences at their campuses to encourage students to learn by doing and solving real community needs.

By implementing this full program, the College of Engineering and our University of Notre Dame seeks to be a place that satisfies more than our intellectual appetite, but also our powerful innate yearning to grow, discover and make our unique contribution as profession and vocation in the world.

### **Related Work Networking**

We attended two conferences that we used to augment research and aid networking on best practices in engineering education approach in two focus areas: 1. Engineering Leadership, and, 2. Community Engagement.

#### Engineering Leadership Programs Research

The Engineering Leadership conference selected was one held by the Community of Practice in Leadership Education in Twenty-first century Engineering (COMPLETE) at Rice University with engineering leadership programs present and presenting. COMPLETE 2014 offered a chance to network with 14 other universities with Engineering Leadership programs.

There is much in common in terms of the challenges to changing the status quo in how engineering education is done. Leadership is viewed as important, but extra-curricular with rigorous engineering curriculum making it difficult to insert leadership classes while displacing core engineering curriculum.

Feedback from alumni and business is that leadership is much more emphasized in practice than it is in academic preparation. A key comment from an industry presenter who hires a lot of engineers: “Engineers are hired for technical skills. Engineers are fired for poor people skills. Engineers are promoted for leadership and management skills.”

Johnson Space Center 2.0 has many dimensions of Leadership they evaluate: Leading Change, Leading people, **Results-driven Leadership**, Business acumen derived leadership, Collaboration-building Leadership and **Discipline Competency or Expert Leadership**. Their feedback is colleges of engineering are producing leaders who are good at the two in bold, but the market needs them to produce engineering leaders who

excel at the other dimensions of effective leaders. This informs our curriculum as we scope with our partners in Executive Education.

John Doerr, Benefactor at Rice: Looking to develop engineering leaders who:

1. Are good at talent attraction and retention in effective teams,
2. Have implementation skills, proven abilities to get things done well,
3. Model great behaviors,
4. Make decisions quickly on incomplete information,
5. Bring out motivation in others on the team.

Bernard Gordon, Benefactor at MIT, Tufts, and two others wanted to train and develop engineers who:

1. Get things done on time,
2. Get things done on budget
3. Get things done per specification.
4. Have competitive business spirit and want to always outperform their last project.

A few ideas worth complimenting and borrowing with credit:

1. Have freshman do an idealized “best self” autobiography. Then have them do a leadership trait assessment of where they fall short and coach them to readings and experiential learning to practice and get better at the aspects that hold them back. That was used at Rice and one other university well.
2. Video student leader doing a couple inspirational talks on something they are passionate about---speaking from the heart---no notes and no power point. Have a professional communications coach from the university review this constructively with feedback on how better to connect and influence and tell powerful stories.
3. To teach how to be effective team leaders Northwestern has automated the engineering student team performance assessment surveys and computation of 360 degree reviews and planning the work and working the plan to be effective in project teams through PM charters. It was the best example of a breakout session at this conference on engineering leadership training that had data to back its assertions.

### Community Engagement Programs Research

The Community Engagement one was a North American universities 2 day workshop conference on service learning in engineering education hosted by Purdue featuring over 80 attendees associated with EPICS(Purdue), EFELTS(Tufts) and EWB(several) or higher education institutions starting community engaged engineering learn by doing and solving real community needs kinds of programs.

The Purdue session was a wealth of information. There were good tools for assessment and alignment with ABET a-k criteria. There was a sense of growing momentum...pioneers were so happy to have a large gathering of like-minded faculty and staff from across North America interested in service learning in engineering. They suggested a Community of Community Engagement Practitioners. They noted that ASEE's Community Engagement division was the quickest new division to grow to 200 members. Great communication, collaboration, networking and using collective wisdom assessment tools were ideas that came out of this. In the course of hearing from each program, what works, learning from failures, key factors for sustainability (note EPICS at Purdue for nearly 20 years) participants gained great insights. They also left with a standardized business model canvas for the inspiration of an idea for their university. They were also told realistically that it is 1 % inspiration and 99% perspiration to launch and sustain such a program. They offered advice on success factors for execution on great community engaged service learning programs.

Recognizing the value in such networking we have connected with University of Louisville and plan a visit to study and see what replicable measures of their community engagement in Louisville's challenged neighborhoods could enhance our signature community engagement.

### **Descriptions and Results of Engineering Leadership Development**

As described above, Engineering Leadership Development encompasses a three part process: (1) enhancements to undergraduate courses, (2) a 1 credit hour leadership seminar course, and (3) continuing education for young alumni. Each of these three development exercises were presented this year. The following section describes each offering and some initial results available at this time. Much credit for the leadership learning curriculum goes to Stayer faculty Peter A. DeLisle, PhD. Peter DeLisle is the retired Leslie B. Crane Chair of Leadership Studies and Director of The Posey Leadership Institute at Austin College. Dr. DeLisle's background in education includes award-winning teaching in engineering, education and commerce. He has held the William B. Severns Chair in Human Behavior in the College of Engineering at the University of Illinois in Urbana and is a member of the executive education faculty at the University of Notre Dame. He has also served as a program manager for the Center for Creative Leadership. Dr. DeLisle's industry experience includes executive leadership at Hewlett-Packard Company and Convex Computer of Dallas. He has helped found three successful companies and acted as an advisor, consultant and teacher of leaders in more than two hundred companies and communities over the last 30 years. He has served as an advisor to the National Science Foundation, the National Research Council, the Accreditation Board for Engineering and Technology, the E.M. Kauffman Foundation for Entrepreneurial Leadership, and the Texas Association of School Boards. He holds a Doctor of Philosophy in Human Resource Development Leadership and Phi Kappa Phi from the College of Education at the University of Texas in Austin.

Leadership Enhancements to Existing Undergraduate Courses:

Several courses have incorporated leadership enhancement materials within their regularly offered course. To gain buy-in from course instructors, we developed a 6 item toolkit of topics that could be covered within a leadership enhancement module. Instructors from all disciplines in the College of Engineering were provided with this list and sample exercises so that they could find content which most closely matched course objectives.

#### Engineering Leadership Program-Leadership Enhancements to Existing Undergraduate Courses:

1. Leader Effectiveness: Examining the key determinants of the student's ability to influence others
2. People & Productivity: Addressing the human factors that directly effect getting things done
3. Problem-solving and Innovation: Critical skills need to address complex problems and new challenges
4. Program Leadership and High Performance Teams: Proven practices for exceptional results with groups
5. Conflict and Collaboration: Relentless pursuit of excellence while sustain effective relationships with others
6. Ethical Practices: Building and sustaining a safe and honest environment for design and development

While leadership can be taught in the context of almost any engineering course, this has been especially useful in project-based courses with a teamwork component, specifically a first-year engineering course and senior design courses.

#### *First Year Engineering Course*

In the fall 2014 semester, a leadership module was presented to the first-year engineering course for the first time. The first year course is a required course for all students intending to major in engineering. With an enrollment of over 540 students this fall including every engineering discipline, presenting to the first-year course offered a unique chance to expose all engineering students to the idea of leadership within the context of their engineering education. The course is organized as 12 sections of ~45 students each. The leadership module was planned for the week after a group project had just completed and at the start of a new group project so that students could draw on their project experience as a means of internalizing some of the leadership lessons which they could then apply to a new group experience.

Before starting the module with the students, the course instructors were engaged in a “teach the teachers” pre-session. Each pre-session focused on how to proctor a hands-on exercise for the students and appropriate follow-up questions for a post-activity wrap up. Members of the Engineering Leadership workshop team provided the initial lesson to the students. Two sections of the class were combined for an interactive discussion of a simple leadership model. In this offering, the lecture centered on the JoHari Window (Open Self-known to all, Hidden Self-

known to only our self unless we choose to share, Blind Self-known to everyone but us—like how your voice sounds to others discovered the first time you hear your recorded voice and Future Self-known to none) as well as the Competent-Conscious and Not Competent-Not Conscious matrix show in Figure 1 below.

**Figure 1.** Competence/Consciousness Matrix

	Competent	Not Competent
Conscious	Conscious, Competent	Conscious, Not Competent
Not Conscious	Not Conscious, Competent	Not Conscious, Not Competent

Students were highly engaged through the lecture with the instructor as he first described a modified matrix, using a fictitious, humorous example (“cute/ugly” vs “smart/dumb”). Through this Consciousness-Competence Matrix, students were led through the four stages of competence – from not knowing that you do not know all the way to knowing something so well it is “second nature” to perform. After this discussion, students were tasked with completing an exercise which was led by their normal course instructors. The objective of the exercise was to put students through an experience when they were “fully aware they don’t have a clue” and have to work to reach a competent level. The basics of the exercise, as it was provided to the instructors, was:

*Students should complete this exercise in pairs. Before beginning, each student is asked to write a short, declarative statement without sharing that with his/her partner. Next they are told one member of the pair will send a message while the other must receive it. However, the sender is not allowed to speak, grunt, or in any way verbalize the message and the receiver must keep his/her eyes closed so that visual cues, gestures, and body language aren’t used.*

For most groups, they quickly determined a protocol for communicating their message. Generally, this relied on the receiver articulating the protocol to the sender and the sender providing feedback through taps, letter tracing, or similar tactics. At the completion of the exercise, course instructors and the Engineering Leadership team led a discussion about communication in groups. Main points included creating and using communication protocols to ensure that senders have a voice in what happens in the team.



After the first offering, all parties agreed that this was a positive experience for the students. The course staff used the experience of the one day module as a talking point for groups during the second project. This, or a similar leadership module, is expected to be used in the next academic year and additional optional content will be made available to the first-year students during the spring 2015 semester.

### *Senior Capstone Design*

Similarly we have used leader skills training modules in the senior capstone design class based on the six elements described above. Again, teaching these leader skills modules typically made use of team exercises that allowed students to gain first-hand experience of the lessons that were described. An example of one exercise that the senior students completed is described below:

*Students are asked to imagine that they are on a small boat and lost at sea. They are provided a list of items that could be taken with them on the lifeboat and asked to individually pick out the most important items that they should take to aid in rescue and survival. After individually selecting the items, students are asked to rank the item importance as a team. Teams must agree on a final ranking before the exercise can continue. Finally, an instructor provides answers for the item ranking (as determined by experts in sea search and rescue operations).*

Inevitably the collective wisdom of the group in a consensus rational exercise does better than any particular smart student. Through the exercise, students see the value of talking things out to consensus in a group and tapping into the collective experience and wisdom. Ideally, an insight they can immediately apply in project teams by practicing methods to draw out the whole team's collective wisdom.

### *Senior Design Projects*

Finally, we have introduced engineering leadership engagement projects to the senior Civil Engineering Capstone Design Course. Specifically, the project centered on a local creek, called Bowman Creek, that the City of South Bend Public Works has identified as having pollution and flow impaired water flow issues. The project goals were provided to the course and several City Public Works seasoned Engineers mentored the student projects on creek design solutions. Specific project goals were to address impairment and to enhance a park and school property while restoring conditions that would support aquatic life in the creek and enhance quality of life for residents who live in the neighborhood.

### Engineering Undergraduate Executive Education Seminar:

Select undergraduate students comprising largely the leadership of engineering student organizations were invited to participate in this intensive program, aimed at enhancing the effectiveness of their organizations and the leadership skills of their members. In total, 12 students participated in the program. The students ranged from first-years all the way to seniors

with various current levels of involvement in engineering organizations. However, all students were asked to draw on current or past group experiences.

The curriculum of this program is based on the alliance with Stayer Executive Education program of the Mendoza College of Business, adapted to the “undergraduate executive” context. This group completed a 1 credit hour, pass/fail “Engineering Leadership Seminar” which had a total of approximately 20 contact hours with course staff. The contact hours took place in the form of an initial retreat, guest lectures, and group coaching sessions. Details of these events include:

1. One two hour Retreat- A retreat is used as the kick-off event of the seminar. Topics of focus include: 4 C’s of Competence, Compassion, Commitment and Character. 4 Themes (Self-Awareness, Ingenuity, Heroic Goals, and other-centered Love unlocking human potential). Core Values (Accountability, Leadership in Excellence, Integrity, Leadership in Mission, and Teamwork) and self-discovery alignment
2. Leadership Skills Learning Workshop deep dives- Students attend three 4 hour sessions where we teach a model of leader effectiveness, skills inventory, a leader profile that is useful with engineers (KAI), and various exercises to drive home the learning. Leadership Models and Behaviors, Interpersonal Effectiveness, Developing Professional Competence, Teams and Interdependent Work Groups, Innovation and Cognitive Problem-Solving and Ethics and Decision-Making are significant skills we teach.
3. Leadership Speaker Series – A series of speakers are presented throughout the semester. These distinguished engineering, civic and business leaders range from a hospital executive to a business engineer executive to a CEO of a large technology dependent mining industry to Mayor Pete Buttigieg (Rhodes Scholar) Mayor of South Bend as Civic leader encouraging community application of engineering talent to serve purposes that stir student passions.
4. Community Engagement has stepped up to signature project status for Bowman Creek area in South Bend as strategically connected and purposeful engagement carried out over the long haul service spikes, project based learning, multi-disciplinary teams.
5. Developing spirit, heart and hands that reach out to help along with ingenuity and intellect development—experiential learning on complex real world challenges in the community as a microcosm of the world.
6. Engineering Leader Coaching and Mentoring Relationships for class projects, club projects, community engagement projects or personal growth coaching. Students are encouraged to share group experiences in personalized sessions with the seminar instructors and receive coaching on ways to apply leadership exercises they are currently learning.

The speaker series features people who model the behaviors and skills of leadership as well as the 4 C's of leadership we emphasize (Competence, Compassion, Commitment and Character). We have had Retired Air Force Major General Joseph A. "Bud" Ahearn who is a distinguished alumnus and a driving force behind our leadership program development and member of the Engineering Advisory Council talk on the vision of the engineer leader for the future. We have had retired IBM Executive Robert Dunn, an alumnus and faculty member talk on Leadership VIPI or Values and Vision, Influence, Positive outlook and Integrity as a zero-multiplier. We have had Beacon Health Systems and Memorial Hospital CEO Phillip Newbold with a national reputation for innovation in healthcare talk about whole person development, competencies and the importance of broad and persistent curiosity about how the world works. We have had Rhodes Scholar South Bend Mayor Pete Buttigieg encourage engineering students who learn the how of designing and building things to ask the why questions and suggest for life to be fulfilling "Talent must meet Purpose". We had retired Newmont Mining CEO Wayne Murdy, an Engineering Advisory Council member, who had mining operations around the globe speak of the negative or potentially exploitive impacts of engineering and the powerful opportunity to bring technology tools and know how to subsistence farmers and fishermen to raise quality of life and economic prosperity and do social good when carefully listening and working with empowerment of indigenous people. We had IBM Systems & Technology Group General Manager, System Z Pat Toole, an engineering alumnus, speak on leading engineers and Ignatius Spirituality-appealing to some of our quiet engineering student leaders in formation. The wisdom shared clearly touched chords with our engineering students as evidenced in their written reflections and post discussions with staff in mentoring sessions.

As we begin our Spring 2015 program, students are being encouraged to compete in multidisciplinary teams on a specific pilot scope on Bowman Creek as a community project suggested by the South Bend Department of Public Works to apply both technical and leadership skills. These projects have a broader range of stakeholders and more complex constraints than typical academic projects, and participants are expected to progress from an apprentice to journeyman level of mastery of leadership skills.

In all, the first offering of this extensive leadership seminar was successful. Throughout the experience, students were engaged in the material and were active participants at the events that were held. Feedback was taken from the students in the form of an optional survey after the completion of the semester. A total of 7 (out of 12) participants completed the survey. Seven questions were asked with 1-5 Likert Scale with a 5 being the best response. Although there is currently a small number of responses to work from, the lowest rating on any question was a 3, indicating that students see some value in the seminar experience.

**Table 1.** Survey Responses of students after completing the Engineering Leadership 1 credit course

Question Topic	Average Value	Standard Deviation
Q1. Was the Engineering Leadership Development material new and insightful to you	4.57	0.79
Q2. Do you have new skills in human understanding and being self-aware that you expect to be able to put to good use?	4.71	0.75
Q3. Do you have new skills or insights you will use to influence project teams?	4.71	0.75
Q4. Do you have new skills or insights you will use to influence the direction, strategies, goals, and culture of student organizations or clubs?	4.57	0.79
Q5. Do you have any new skills you will use to better serve future clients and society	4.43	0.78
Q6. As you progress in your career, will you seek more insight to leadership and management?	5	0
Q7. Have we impacted your sense of competence and confidence in your ability to fulfill a leadership role in your life, your engineering profession, and organizations you serve?*	4.83	0.41

\*n=6, one student did not provide a ranking for this question

As described before, all responses were neutral to strongly positive in their rankings. In addition, students were asked to comment on any question to provide us with more information. Many of these answers yielded poignant reflections on benefit of the engineering leader development experience. A few examples that are indicative of the comments received are detailed below.

On course content:

*All of the Pete DeLisle (instructor) content and the majority of the distinguished leader lectures were both new and thought provoking in terms of engineering leadership, general team leadership, and personal management.*

On self-discovery and skills gained:

*I better recognize the importance of knowing myself – particularly answering the question of what is important to me, why I choose to do what I do, and how I appear to others.*

*I know now that I need to observe and learn how each individual on the team acts, responds to different situations, and is motivated. I also know that I need to lead by not being an authoritative member but by being a member people look up to and respect. I can persuade people without telling people.*

On how they plan to use skills gained:

*Getting to know how to better motivate people and will help with knowing how to lead a team to take-on the end of the year senior capstone project.*

*I have already been able to put some of the skills I learned into play with my engineering group projects.*

*I learned that self and peer evaluations can really help you to see some hidden aspects of your personality that is either good or that needs some improvement. I would like to have 360 evaluations at least a couple of times throughout the second semester of our project to keep everyone accountable and to make each person aware of their performance, contribution and the group's attitude towards their performance and contribution*

Lessons learned from specific events:

*In their talks, I also found a high value in learning how they balanced their personal and company ethics with their business or profit interests... I am in a time of my life where I am starting to think what career I would like to pursue in my life, and I thought that Mayor Pete Buttigieg had a great message to help me frame how I should think about building a personal career that will be fulfilling.*

*Dean Peter Kilpatrick and Father Paul Kollman talked about how failure is what you learn from, and it can be a seed for great things. You hear all the time how it is important to learn from your mistakes, but for me, and I'm sure a lot of people my age, it is hard to get past the feelings of incompetency that come with these failures. It is so important for me to become more self-aware and learn to recognize and fix my shortcomings, rather than feel like they are a means of holding me back.*

On overall leadership competence:

*The lectures also helped me understand what it takes to be a leader in the workforce and how significant of an impact a single person can have on the direction and success of a project.*

*I am a quiet person, but this has shown me that a quiet person can still be a great leader and positively impact others.*

*Before the workshop, I took leadership roles when I felt like the group needed a leader and I felt qualified. I knew I could do a decent job but I did not desire to be the leader....I have more of a desire to become a leader due to learning how much good impact a great leader can have on people's lives.*

In general, student feedback was positive when looking back at the whole of the experience. A second offering of the course is expected.

Continuing Executive Engineering Leadership Education:

Finally, the University of Notre Dame College of Engineering and Stayer Executive Education of the Mendoza College of Business partner to offer continuing professional engineering leadership development. Our purpose is to support our engineering alumni but also to reach out to other practicing engineering professions as they anticipate or work through career progression from project engineer to project manager to engineering division manager to corporate leadership. We

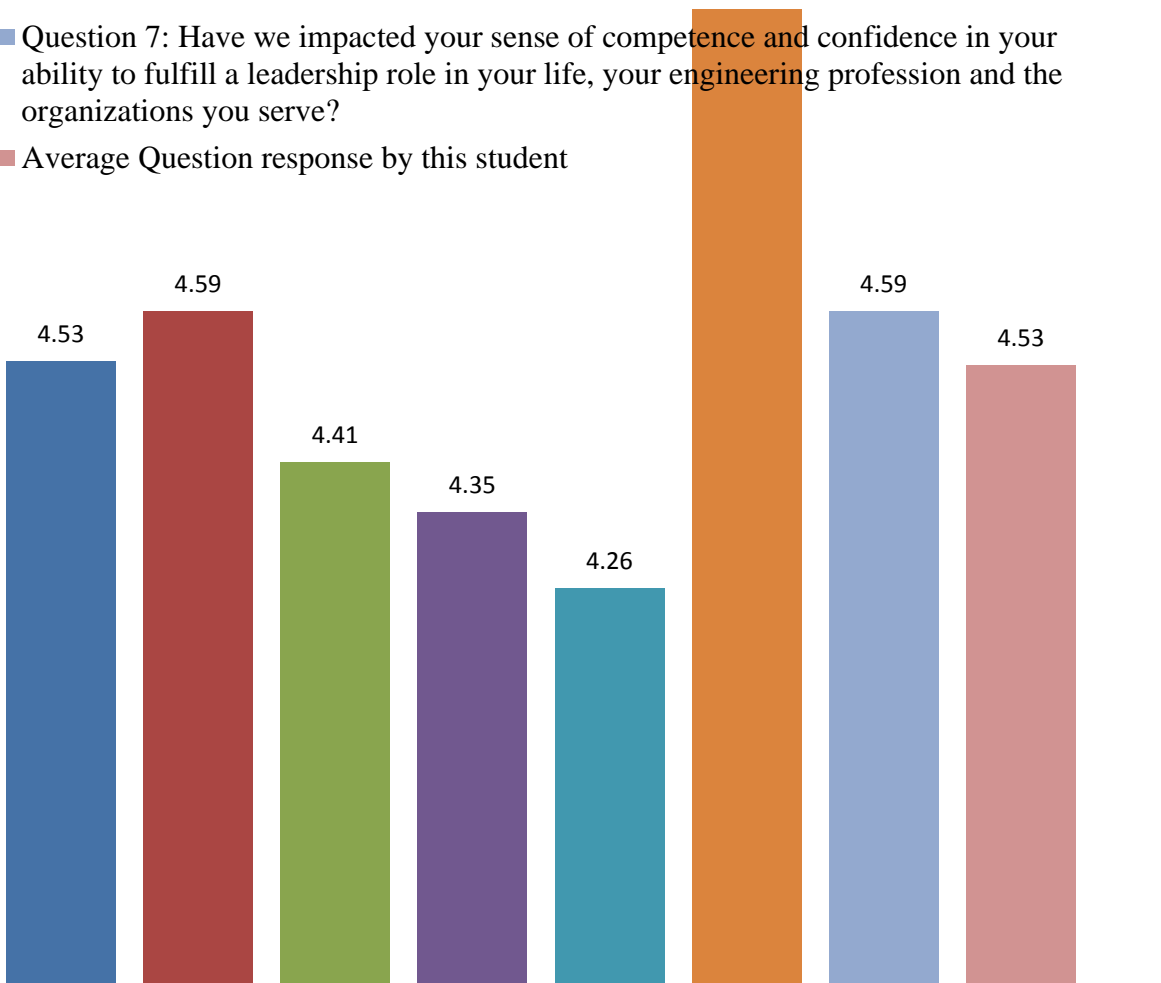
want to help engineers navigate leader skills competencies at these key leadership transitions throughout their careers as the progress toward a master skill level of leadership.

Our first such offering was 2.5 days of workshops held on campus at the University of Notre Dame. We were able to achieve a pilot goal of these programs include networking with students in the undergraduate executive leadership program, and also help financially support the undergraduate offerings. Because this course is not the focus of this paper, this offering will not be heavily detailed. In brief, this offering covered concepts in: Defining Leadership, The Effectiveness Triangle, Delivering Feedback, Getting Feedback, Dealing with Conflict, Building Effective Teams, Selecting the Right Leadership Style, Cognitive Problem Solving, Planning for a Successful Future, Creating a Development Plan, Successfully Returning to an Unchanged Environment and Lessons in Innovation.

Similar to the undergraduate offering, we asked a series of seven assessment questions of the 17 students in the first class. Response rate was 100% and results are shown in the attached figure. Responses ranged from 4.26 to 4.94 with an average overall class response of 4.53 on a 5 point scale (again, where 5 is best)—clearly a strong positive response to the usefulness of the program content and the delivery.

## Survey Results Engineering Leadership Development- Alumni Executive Education

- Question 1: Was this Engineering Leadership Development material new and insightful to you?
  
- Question 2: Do you have new skills in human understanding and being self-aware that you expect to be able to put to good use?
  
- Question 3: Do you have any new skills or insights you will use to influence the effectiveness of project teams?
  
- Question 4: Do you have any new skills or insights you will use to influence the direction, strategies, goals and culture of your organization?
  
- Question 5: Do you have any new skills you will use to better serve clients and society?
  
- Question 6: As you progress in your career will you seek more insight to leadership and management in addition to maintaining fresh engineering technical competence?
  
- Question 7: Have we impacted your sense of competence and confidence in your ability to fulfill a leadership role in your life, your engineering profession and the organizations you serve?
  
- Average Question response by this student



## Conclusions and Future Work

Based on our experience in the first offering of the Engineering Leadership series, this was a positive experience and a unique opportunity to mentor students and create more fully engaged student leaders. By creating a holistic experience for students and young alumni, the university has situated itself as a touchstone for continuing education in leadership. Some of the main conclusions after this offering were:

- Using one day in-class mini-lessons was a positive experience for students. Students fully engaged with the activities throughout, and this offers a unique chance for recruitment into the full seminar program.
- The full seminar course was an overwhelmingly positive experience for the 12 students that participated. The anecdotal comments were all supportive of the need for leader skills development amongst undergraduate engineers.
- While students who took the course reported very positive experiences, recruitment of students to the program was a significant difficulty to overcome. Continued recruitment is expected to include testimonials from previous student participants to in some part overcome this.
- The alumni short-course offering was also positively received, with participants indicating that they will continue to seek leadership training throughout their careers.

Finally, we anticipate making some changes to the course offerings in future years. With all implementations of the course, we anticipate regularly collecting feedback from the participants as a means of improving the offering.

- In future years, we hope to expand the one time leadership offerings to classes throughout the engineering curriculum. So far, these offerings were focused in project based courses at the start and end of the academic career. We hope to penetrate the heavily technical sophomore and junior year classes to emphasize continual development.
- Some redesign will be necessary to meet student needs in a rigorous engineering curriculum and student life schedule that is jam-packed. One of the largest deterrents for student participation was scheduling.
- We plan to create additional cross-over experiences between alumni and current students as a means of promoting engineering leadership. This will also give current students an opportunity to learn more about engineering careers.



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