

AC 2009-1287: A COLLEGE-WIDE PROGRAM FOR TEACHING LEADERSHIP: FRAMEWORK, MODEL, AND OUTCOMES

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A College-wide Approach for Teaching and Developing Leadership: Model, Framework and Outcomes

Introduction

In 2005 the College of Engineering and Technology at BYU began an initiative to assure that each student graduated with the ability to understand and practice leadership. This paper presents a comprehensive approach, resulting from this initiative, to define, develop, and implement the teaching of leadership in the context of engineering and technology curricula. After a rationale explaining why the college chose an emphasis on leadership, efforts in and selected results of the leadership initiative are documented, including 1) the development of a leadership model appropriate to engineering and technology education, 2) the definition of specific outcomes and curricular material related to leadership, and 3) the development of a framework for using the model and implementing leadership education throughout the college. The implementation strategy is based on Kolb's Learning Cycle and takes advantage of college, departmental and external resources to achieve the desired outcomes. Examples of the types of activities and interventions used to teach leadership are given. Organizational and tactical plans to move the leadership initiative forward in a sustainable way are also discussed.

The Call for Leadership

To be successful and effective in the current technologically dependent, multi-disciplinary, global environment requires engineers and technologists to be more than just technically competent. In fact, calls for the engineer to possess more than just technical expertise are coming from all sides - especially from industry. Today the engineer must understand business processes, thrive in cross-functional teams, and communicate effectively with and lead others both locally and globally. Duderstadt, citing the National Science Board, said "In addition to analytic skills, which are well provided by the current education system, companies want engineers with passion, some systems thinking, an ability to innovate, an ability to work in multicultural environments, an ability to understand the business context of engineering, interdisciplinary skills, communication skills, leadership skills, an ability to adapt to changing conditions, and an eagerness for lifelong learning. This is a different kind of engineer from the norm that is being produced now."¹

This is not a new but a repeated call. Ten years earlier, Farr, commenting on this need said, "Many recent reports from business and industry list leadership as one of the areas that must be shaped by engineering curricula to meet the needs of a modern industrial society. Also, a recurring theme from American business and industry is that leadership must emerge at all levels if we are to maintain our competitive edge. Because of the changing nature of modern engineering, young technical or staff engineers must grow into leadership roles faster than their predecessors."² In general the current engineering education system has been primarily concerned with the development of technical expertise and has not taught or promoted leadership education and development in a systematic way. Since the 1990's industry has, been encouraging educational institutions to spend more effort on the development of communication and leadership skills in their graduates. A study completed in 1995 by American Society of

Engineering Management indicated that of all the “perceived gaps in the value of the organization versus preparedness for new BS engineers,” that of leadership skills was the largest.³ Another report published in 1994 by the American Society of Engineering Education acknowledged leadership education as one of the areas in need of special attention in order to meet modern industrial needs.⁴ These calls for more attention to development of leadership continue in professional journals and have found support in other clarion calls such as *The Engineer of 2020*⁵ and *Rising Above the Gathering Storm*.⁶

It has been said that “an engineer is hired for his or her technical skills, fired for poor people skills, and promoted for leadership and management skills.”⁷ The contemporary environment requires engineers to understand business processes, be able to contribute to cross-functional teams and have “soft” skills in order to relate to peers, superiors and subordinates both in the office and across the globe. One engineering VP was quoted as saying, “We look for people who can lead a team, someone who can get a small team-four to six people-motivated and a person who can quickly learn which people are best at doing what. It’s hard enough to find a good engineer; one who can lead a team and speak well in front of customers is really hard.”⁸ Engineering graduates themselves have noticed that they are not well prepared for these challenges. In regards to the many “soft skills” required, one engineering student wrote, “Although many courses involve the use of these skills, they rarely include an explicit effort to teach them. It is assumed that students will pick them up as needed. It does not follow that students are learning them well. An overall plan for development of skills is needed for control of assessment and to know that improvement is required at each stage, so it can be addressed explicitly.”⁹

In addition to the need for more leadership skills in the workplace, there is also a need for engineers to provide more leadership role in society. This need arises from the fact that, “the issues with which engineers engage have become more and more multidimensional, interacting with public policy and public perceptions, business and legal complexities, and government policies and regulations, among others. This is the natural result of technology becoming more and more pervasive in society and politics.”¹⁰ This there is a shockingly low number of P.E.s (professional engineers) participating in regulatory and political affairs. In 2005, of the 535 members of Congress only five of them were P.E.s.¹¹ Of the approximately 6,000 state legislative seats in the United States in 1997, only 36 of them were registered P.E.s. Weingardt states that this low involvement is because technical people tend to “keep to [them]selves, talk only to [them]selves, and stay ensconced in the ivory tower of their immediate colleagues and professional associations.”¹²

Duderstadt summarizes and rebukes this condition stating, “Today’s engineers no longer hold the leadership positions in business and government that were once claimed by their predecessors in the 19th and 20th century, in part because neither the profession nor the educational system supporting it have kept pace with the changing nature of both our knowledge-intensive society and the global marketplace.”¹³ This rebuke of the inability of academia and profession to see the broader role of engineering and technology is followed by a charge to make a choice to step up to leadership. Charles Vest, former President of MIT said, “The world is changing remarkably fast, and leadership in science and engineering will drive it. Where will this leadership come from? China? India? The United States? The choice is ours to make.”¹⁴ These calls and many

others like them are not the only evidence of the increasing need for leadership in technical areas. One need only look at the rapidly changing landscape of global competition, the flattening of industry organizational charts and continued reliance on multi- and inter-disciplinary teams in global and domestic environments.

Over 50% of engineers serve in a management or leadership position during their career, many having taken their first steps in management within 5 or 6 years of graduation.¹⁵ Engineering education is strongly focused on the development of technical skills over management/leadership skills. As a result, engineers moving into management and leadership positions face a very difficult transitional period.¹⁶ The pain can be eased, the potential for success increased and the possibility for influence enhanced by teaching our students that they can and should lead.

A Leadership Initiative at BYU

Motivated by a combination of these national calls to produce engineering leaders, the mission of the university, and the unique capabilities and background of our student body, the Fulton College of Engineering and Technology at Brigham Young University articulated a strategic plan that included an emphasis on developing leadership capabilities in our students. The college mission statement contains the stated intent to produce graduates “who will become outstanding leaders throughout the world.” Other areas of strategic focus include innovation, global competence and character, all of which are needed to prepare engineers and technologists for success in the 21st century.

In order to implement the leadership portion of this strategic plan, the college has moved to design and implement a college-wide approach to teach leadership principles and develop leadership capabilities in students. This approach has been designed not only to influence the students, but also to develop the skills and materials needed by faculty to effectively teach leadership. The approach is built around the use of 1) a common model for understanding leadership, 2) the availability of curricular materials to support the teaching of the model and the practice of model principles, and 3) a framework for developing leadership focused on the attainment of specified student learning outcomes.

A Model for Understanding Leadership

There are three key reasons why the construction and articulation of a model was important to the initiative: 1) to clarify and define the basic set of principles and concepts that are important in the work of leadership for the college; 2) to provide a common language and image from which both students and faculty can learn about, talk of, and teach leadership; and 3) to guide the development of leadership curriculum materials and teaching methods.

Models of leadership are many and varied. It was not our intent to summarize all models or even set forth a model for general consumption or dissemination. The model was and is intended to focus the efforts of our college to define and meet leadership outcomes. For example, as will be discussed in a later section, the model serves as a visual outline for a class that is being taught in the college that includes the dimensions of leadership shown in the model.

The model, shown in Figure 1, emerges from three critical dimensions of leadership: (a) the leader as person, (b) the leader in organizational systems, and (c) the leader in global cultural systems. Real and complete leadership occurs at the intersection of the three sets, although some elements of leadership and/or management also occur within the intersection of pairs of areas. This model generally describes the primary areas and functions that are deemed important for faculty and students in the Fulton College at Brigham Young University to understand and study, and that support and integrate the strategic leadership initiative encouraged by the college.



Figure 1. The Three Dimensions of Leadership

Though the visual model itself does not suggest a priority, we believe, and most experts and leadership theories concur, that the development of the personal characteristics of integrity, virtue and competence must occur first and continue to be emphasized throughout one's life. After this, one must work to learn about, and gain expertise and experience in organizations and understanding the broader world and cultures.

Personal Characteristics and Development: This essential aspect of true leadership is embodied in two key ideas. First, the leader strives to actively develop fundamental characteristics and attributes of truth and character. At BYU, as a religious institution, we believe these attributes are first of all defined by the attributes of Deity. Other great time-tried and proven leaders are also studied and emulated. Second, the leader employs a single, consistent standard of conduct in his/her private life and public life. A leader must be competent in their stewardship in order to engender the respect and trust of those whom he/she leads. However, competence in isolation does not constitute leadership. A great leader learns to listen, observe, and contemplate; from this quietness and introspection the leader discerns the nature of personal commitment and development required for a life of service to others and the world. Important characteristics on

which this deeply personal capacity is founded for faculty and students in BYU's Fulton College include:

- Integrity
- Competence
- Humility, Courage, Faith, Patience, Wisdom
- Personal fitness and health
- Self-awareness

What is your leadership/management style? Do you lead or manage?

What are the primary lenses through which you see the world?

Organizations: Leaders lead within a context and personal visions and values become shared visions and values within that context. Leaders who influence organizations positively must develop an understanding of the theoretical and practical workings of organizations. Mature leadership must be innovative and principle-based in order to develop strategies for transforming organizations at fundamental levels. Leaders, therefore, understand how to work within and with the principles and skills of:

- Teams and team building
- Awareness of organizational politics and structure (policies and procedures)
- Managing conflict and conflict resolution
- Understanding and use of power, authority and influences
- Managing and measuring performance
- Communication and interpersonal skills
- Project management

Global (Holistic) Understanding: Effective leadership occurs within the context of global, meaning general or comprehensive, systems. This has always been true, but the nature of the modern society adds emphasis to this dimension of leadership. The complexity of modern, worldwide systems is reflected in the changing ethnic composition of organizations, the potential of political change to quickly alter environments and situations, and the extent to which international issues, including trade, business, and employment, affect local conditions. William Wulf, former President of the National Academy of Engineering said, "...engineering is now practiced in a global, holistic business context, and engineers must design under constraints that reflect that context. In the future, understanding other cultures, speaking other languages, and communicating with people from marketing and finance will be just as fundamental to the practice of engineering as physics and calculus" (italics added).¹⁷ In addition, a holistic understanding helps to enable creative problem solving and innovation. Therefore, effective leadership for engineers and technologists requires:

- Holistic (system) thinking
- An understanding of and appreciation for cultures and societies
- An understanding of national and international politics, business and economics
- Creative problem solving and innovation
- Sensitivity to and appreciation of diversity
- An ability and desire to be agents of positive change

Curricular Materials

The method of choice for giving attention to a topic of priority in an academic institution is to develop and offer a class on the subject or topic. A course titled “Moral leadership in a Technological World” has been developed and is being taught by faculty in our college. It has been approved for General Education credit thereby adding validity to the course material from a University organizational standpoint and providing incentive for the students to take the course by receiving credit towards graduation. The course is focused on the three dimensions of leadership outlined in the model described earlier. Integrity and ethics as the basics in the development of good leaders is core to the course purpose and the first topic addressed. In addition, time is spent on topics such as leadership theory, project management, team dynamics, development and leadership, and organizational culture. The third focus on the course is to discuss leadership and ethics within the context of global challenges such as sustainability, security, energy production, etc.

Focused and well-respected readings, video clips, studies pertinent to the topics and other accepted and validly sourced material serve as the core curricular material for the course. Students from all disciplines in the college are joined by students representing a variety of majors from every other college in the university to enhance the multidisciplinary nature of the course. This diversity adds value not only to the students from the college, but also serves to provide a positive view of the role of engineers and technologists in the world to students of other disciplines. Table 1 shows the topics of the course for a given semester.

Table 1 List of topics for course on moral leadership

General Topic(s) for the course	Selected Assignment(s)
Integrity and Ethics readings and case studies	Reading and case reviews and critiques
Deep learning, Self-awareness, Learning Styles	MTBI, 360
Teamwork issues, Project Management	Small Helms (international team project)
Universal values, relativism and standards of leadership	Kidder Universal Values Survey
Dilemma resolution Procedure and cases studies	Case reviews and critiques
Leadership Theories, Leading and Managing, Leadership and Power	Development of Personal Leadership theory
Technology and Society, technology Literacy	Reading Reviews
Globalization, Global Issues (Energy, “flat” world, famine and food, etc.)	Takings Sides Team global issues report

A Framework for Implementing Leadership Education

As mentioned previously, leadership is a critical component of the mission and strategy of the Fulton College. Consequently, a decision was made to implement leadership instruction and

outcomes on a college-wide basis. Our approach was derived from the Kolb Learning Cycle¹⁸ shown in Figure 2. A framework was established for the college by aligning each of the quadrants in the Learning Cycle with a specific year in a student's program of study. The result is shown in Table 2 where the first year is focused on motivation (Why?), the second on content (What?), the third on application/coaching (How?) and the fourth on open-ended application (What if? or What can I make of this?). The framework also includes outcomes for each of the years, possible activities, and potential methods of assessment. The outcomes were generated and reviewed by stakeholders at the learning, teaching and administrative levels related to the leadership effort. The outcomes for the second year (sophomore) correspond to those targeted for the class on Moral Leadership, which will likely be the primary vehicle for the second-year instruction (What?). While it is anticipated that some of the details will change with time and experience as implementation proceeds, the framework provides a pedagogically based strategy for moving our entire college forward in this area. Similar frameworks are being developed for global competence and ethics, two additional areas where a common effort across the college makes sense.

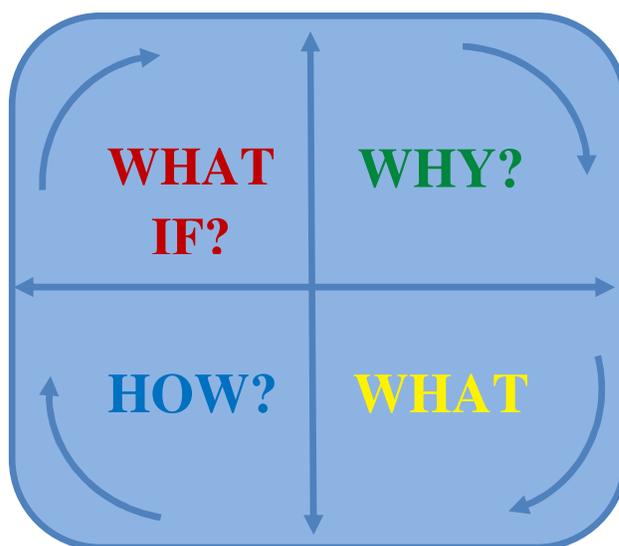


Figure 2. Kolb's Learning Cycle

A leadership seminar presented by the college leadership has been put into place as a required element of the freshman seminars for all of our students. We did this for the first time last Fall semester and it was very well received. We are now working with all of the units in the college to put the sophomore content in place. For most departments and programs in the college this is, or will be, addressed through the Moral Leadership class as mentioned above and described in the previous section. The course is already being offered on an optional basis and has been approved for general education credit. The current plan is to begin phasing in the course on a broader basis in Fall 2009. A college leadership committee has been formed and has worked to establish leadership outcomes and instructional materials. This committee will be developing resources for use in the third and fourth years by departments where leadership application will be integrated into the existing curricular structure. The departmental implementation in upper

Table 2. Framework for Teaching Leadership

division courses may also be complemented by common college-sponsored activities as appropriate.

Year in Program	Educational Outcome Details Students:	College Resources	Possible Department Learning Activities	Sample Assessment Tools
1	<ol style="list-style-type: none"> 1. Be familiar with the college leadership model. 2. Understand they are to lead. 3. Understand be committed to developing leadership qualities. 	<ul style="list-style-type: none"> • Presentation on Leadership in Freshman Orientation • Seminar on Leadership for first-year students 	<ul style="list-style-type: none"> • Leadership discussions in new student seminar. • Reflection on leaders that have impacted the students. 	<ul style="list-style-type: none"> • Student survey • Journals or Writing Assignments • Freshman interviews
2	<ol style="list-style-type: none"> 1. Understand several prominent leadership theories and principles of leadership. 2. Understand the most crucial characteristics of leadership and strive to develop those characteristics in their professional, public and private lives. 3. Understand the value of people and be committed to the realization of the human potential. 4. Understand the importance of developing organizational vision and be familiar with principles of strategic planning. 5. Understand the value of interpersonal relationships and of functioning in multi-disciplinary and multi-cultural teams. 	<ul style="list-style-type: none"> • EngT 231 Moral Leadership in a Technological World • Basic leadership materials for instructors and mentors including principles & models. 	<ul style="list-style-type: none"> • Participate in EngT 231 • Sophomore-level 1hr course credit on leadership 	<ul style="list-style-type: none"> • Exams • Writing Assignments • Peer Review • Observation by instructors • Other class-related assessment
3	<ol style="list-style-type: none"> 1. Successfully apply leadership principles and models in controlled academic settings including team settings. 2. Develop organizational goals and plan strategically. 	<ul style="list-style-type: none"> • Resource materials and training for instructors and mentors. • Assessment tools • Leadership mentoring by industry 	<ul style="list-style-type: none"> • Apply leadership principles as part of group projects and/or assignments • Classroom exercises on leadership • Participation in college seminar that considers directed case studies 	<ul style="list-style-type: none"> • Peer evaluation of performance in group settings. • Mentor/leadership coach evaluations
4	<ol style="list-style-type: none"> 1. Demonstrate the ability to successfully apply leadership principles and models in unstructured professional settings including team settings. 2. Demonstrate the ability to successfully establish priorities and manage organizations and projects. 	<ul style="list-style-type: none"> • Resource materials and training for instructors and mentors. • Assessment tools • Leadership mentoring activities by industry (e.g., our external advancement council) 	<ul style="list-style-type: none"> • Mentoring of students in capstone experiences • Mentoring of students in research groups • Reading of leadership text (e.g. <u>Good to Great</u>) and application to real world situations • Participation in college seminar that utilizes industrial leaders and focuses on real life experiences involving leadership 	<ul style="list-style-type: none"> • Evaluation of leadership skills by Capstone coaches. • Evaluation of leadership skills by mentors. • Evaluation of leadership performance of graduates by employers.

Conclusion:

One writer on leadership claims that “Leadership is influence.”¹⁹ Advocates of leadership in the technical fields, including engineering, state and re-state the need for engineers, technologists and other technical people to have more influence in the solving of problems and wise advancement of technology in the contemporary technology-dependent world. What is called for then, is someone who is able to direct the activities of a global enterprises with a good handle on the technical implications and understanding that other implications, social, ethical, etc. are just as important. Directing these functions requires leaders with technical savvy sufficient to understand design, operations, and supply chain systems; the coordination abilities to direct

multi-location teams; and the thinking abilities to assimilate data and information from multiple sources to make wise decisions. The efforts described in this paper will help graduates from the BYU Fulton College of Engineering and Technology to be well prepared to meet this need.

The model, supporting curriculum and implementation framework presented in this paper could serve as a guide for pursuing leadership goals in a variety of institutions. As we continue to implement the leadership framework in the programs across the college we will be monitoring its effectiveness and reporting on the results.

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