

Leadership Education for Engineering Students

David J. Bayless* and T. Richard Robe

Robe Leadership Institute in the Russ College of Engineering and Technology at Ohio University
bayless@ohio.edu, robe@ohio.edu

Abstract - The interdependency of technical and social problem solving has increased the needs for engineers, inherent problem solvers, to improve the development of their “soft skills.” Our ability to compete and innovate in an ever flattening world depends on engineers to bring envisioned solutions to fruition by leading. Yet for the most part, engineering students are not exposed to formal studies in leadership. Instead, most engineering curricula focus on developing communications skills and anticipate that the graduate will acquire leadership skills either directly through their employer training or via observation and “on-the-job” action. This deferral to employers for leadership development could possibly put the engineer at a disadvantage compared to other graduating majors where leadership is emphasized (e.g. Business), but also put the competitiveness of our workforce that depends on realization of technical innovations to spur job creation. In response to this need, Ohio University’s Russ College of Engineering and Technology established the T. Richard and Eleanora K. Robe Leadership Institute (RLI) in 1996. Since its founding, the Institute has promoted and encouraged effective leadership for college students, faculty, and staff through a wide variety of leadership activities, classes, and guest speakers that would allow them to reach beyond their professional competence. The focus on learning leadership concepts, styles, self-realization, and personal interactions with established leaders develops the student’s own leadership style and prepares them to maximize future leadership opportunities. This paper will present the pedagogy used by the RLI in the annual leadership course offered to the Russ College’s most promising student leaders. This course includes literature survey on leadership concepts, study of emotional intelligence and personal leadership styles, team building, and discussions/interactions with invited leaders, along with journals for reflection on each course activity. Details of the course structure, pedagogy, assignments, interaction with speakers, and leadership awards given by the RLI will be presented.

Index Terms – Leadership education, leadership models, leadership survey.

INTRODUCTION

Leadership education in a college setting takes many forms, often varying greatly between academic disciplines. Business administration, psychology, education, public policy and political science are often thought of as classical homes for academic training in leadership as applied to their

specific fields. Engineering has often neglected leadership education and/or training, being seen academically as a “soft skill” not relevant to the discipline. While not true in all cases, anecdotal evidence suggests that the term “leadership studies” implies training for managerial roles and thus has a negative connotation among engineering faculty that believe we should strive for excellence in engineering, not business.

Yet, many engineering leaders consider it vital for engineers to understand and develop leadership for future individual and societal success. [1,2] From the desire to produce engineers who can lead in the private and public policy sectors to a real need for leadership in technical commercial ventures, several institutions have developed engineering leadership courses, certificates, minors, and integrated curriculum-wide programs. As described by Bayless et al., most of these efforts involve development of skill sets to improve managerial skills in a technical field or successful entrepreneurship. [3]

Leadership studies in the Robe Leadership Institute focuses on understanding of leadership concepts, emotional intelligence, personal leadership styles, team building, and self-realization to make a better engineer. RLI uses the tools of personal interaction, discussions with established leaders, and the use of journals for reflection on each course activity to develop the student’s own leadership style and potential as future engineering innovators.

RLI uses many of the same strategies that are used to teach engineering courses. The engineering principle-centered approach of RLI is important to the overall development of future engineering leaders for three perceived reasons:

- (1) Leadership skills are critical for accomplishing goals as an engineer and innovator. Innovation and development stop at the idea stage if you are not able to convince people to invest time and capital into the effort.
- (2) Engineers are innovators by training with academic development to be logical problem solvers. As a group, we often fail to understand that decision making is not always, or often, data-driven. Emotions, tolerance for risk, perceptions, and relationships drive human decisions. The failure to understand these elements can lead to premature death of innovative solutions.
- (3) While leaders may be, at least in part, born, they are also developed. Leadership should be fostered with the same effort as critical thinking skills in our students.

DESCRIPTION OF THE RLI MODEL

The RLI Leadership Seminar is a ten-week, four-hour course (quarter system) offered in the fall of each academic year.

The course helps students understand the basis for their leadership styles and helps them understand the various roles involved in being an engineering leader and innovator. Bayless et al. described the results of twelve years of RLI experience. [3] This paper focuses on the processes and pedagogy of the RLI leadership seminar, mostly through the experiential reflections of Dr. Dick Robe from his years of creating and refining the RLI model of leadership studies for engineering students.

RLI approaches leadership education in a compatible way for students who have been grounded in engineering education for several years thereby making it very different from the way leadership education is approached in the social sciences, education, business, communications, etc. Through the various "means" used in the RLI Seminar through readings, discussions, exercises, speakers, etc., the students are asked to observe and understand leadership basics & principles much in the same way they study the principles of engineering. Following this then the emphasis is on the importance of "execution" of these principles just as done with laboratories and senior design projects.

Most of the engineering curriculum has been focused on producing technical excellence in one's field. This is very important and not diminished by saying that engineering technical competence is "absolutely necessary but not sufficient" for carrying out the professional responsibilities of today's engineers. Anecdotal evidence from engineering executives indicates that to be successful, one must learn how to work with and through other people. This includes learning to be an effective follower/ team member as well as an effective leader. Another way of saying this is that leaders must learn to have other people dependent upon them and at the same time be dependent on others themselves. The RLI seminar is designed and conducted to understand this.

The RLI seminar has been designed to help the engineering student start the journey of learning about effective leadership over the course a lifetime. Learning to be an intelligent observer and student of leadership events is helpful to this process, and the seminar helps the students get started on this earlier rather than later.

I. Selection of Students

The RLI seminar actually starts with the selection of students. Students are selected in the spring prior to the fall seminar. Undergraduate students who will be in their last year of academic work are eligible. In rare circumstances, graduate students are considered. Department Chairs and RLI advisory board members from each engineering department are asked to recommend students for the class. In addition, the RLI Director visits student organizations seeking interested students to apply. Finally, RLI Scholars from the previous year are asked for recommendations; they generally hold student leadership roles and more easily identify "rising stars" within their organizations.

Once the recommendations are made, students are asked to prepare their schedule for the fall quarter including the

seminar. This is done to prevent time conflicts and to ensure that each candidate understands the seriousness of the attendance policy.

The students must be fully committed to attending and participating in all activities and discussions. This is done to emphasize that they will not only be letting themselves down but most importantly they will be letting their fellow class members down if they are not fully engaged. This stems from the "mindset" needed by a successful leader to work hard and be engaged so they don't let fail their followers. In other words the RLI seminar is not just a class where each student is working hard for their own individual grade; it emphasizes and requires dedication and commitment from the participating students much as a sports team.

To further maximize the potential of the leadership studies class, leadership experience among the students is important. Students must have some leadership experience, preferably in leading a team of volunteers, to provide a framework for reflecting upon their class experiences. While all students could benefit from such education, the ones who have sought out leadership roles will have the experiences (mistakes) to analyze as the class progresses, making their understanding more complete than for someone without the requisite leadership experiences.

Selected candidates meeting these criteria are then interviewed by the RLI Director, who asks questions about their previous leadership roles and what they would hope to gain from the class. The candidates are also told of the expectations for the class, including no excused absences, the culture of the class as a team, the substantial required reading, the general class assignments, expected time requirements, and the expectation for them to apply the concepts learned in their duties as student organization leaders. The selected students are then given readings and an assignment to critically evaluate aspects of the readings before the start of class in the Fall. [4-8]

II. Leadership Readings

The assigned summer readings are designed to help the student understand the terminology, concepts and framework of successful leadership. While the readings may vary from year to year, there are some constants. At least one selection is chosen to introduce the concept of emotional intelligence and personal leadership style. One selection focuses on different types of leadership styles. Often it is Blaine Lee's discussion of "coercive", "utility (fairness)", and "principle-centered (honor)" leadership. This is important, because a focus of the seminar is on "leading with honor," which is the best and most difficult.

The summer readings are often the first time the students have seen, organized in coherent fashion, that leading with honor requires "competence", "character" and "vision" along with "knowing and dealing with self," "continuously listening & learning from those around you," "communicating and inspiring a shared vision with others," and finally "to enlist, engage & empower followers." The

added value of the summer readings is that it helps the engineering students begin to observe, think, analyze, and remember the most important elements required for “leading with honor.”

III. Speaker Invitations

The heart of the fall seminar is the interaction between the RLI Scholars and the guest speakers for two+ hour “interview” sessions. Because these speakers are often active CEOs, presidents, or executives of various operations, and because there are typically ten speakers per seminar, scheduling is critical. The order of speakers significantly matters to the development of the scholars. More seasoned leaders have developed methods for “teaching” leadership to the students should be scheduled later in the seminar. Less experienced leaders or leaders who are comfortable making a specific point (or points) to emphasize recent learning in the classroom are scheduled earlier in the seminar. The order of guest speakers will create a leadership story and proper reinforcement of concepts to maximize learning of leadership characteristics and development for the students.

Speakers need to be interviewed in advance of being invited because not all outstanding leaders with excellent leadership experiences are effective at conveying the lessons they have learned. Some haven’t learned to articulate what they have learned even though they have outstanding records of leadership, and with them it is difficult for the students to benefit fully from their sessions even with good questions.

IV. Seminar Structure and Learning Outcomes

Before the first day of class, students are given electronic access to the class information and their own electronic journal (e-board) for their daily leadership reflections. The class information includes the syllabus and structure of the seminar, expected daily activities, brief biographies of the visiting speakers, and pictures of scholars.

The course learning outcomes are also explicitly given to the students before the class. They include

- Differentiate between leadership and management.
- Learn the fundamentals of leadership and the skills needed to become real and effective leaders.
- Learn lessons of leadership by listening to and asking probing questions from a select group of speakers who have served in various leadership roles in their careers.
- Interact and bond with other members of the class.
- Improve the class with your studies, reflection on the class, and recommendations.
- Learn to be better observers and learners of leadership lessons in all your current and future venues.

V. Class Assignments and Activities

In addition to the requirement that the students make daily electronic journal entries, and the critical reviews of the leadership texts assigned over the summer, the students are

also asked to prepare an autobiography of themselves before the first day of class. The autobiography is the first of several assignments to help the students more fully understand themselves and their leadership styles. The value and benefit of each student writing about their own lives helps them take a hard analytical look at themselves and to start to understand the importance of “getting to know themselves” relating directly to “emotional intelligence” and “understanding and dealing with self.” This exercise also helps the instructor learn more about each student.

The first two lectures of the class are devoted to reviewing the general principles of leadership as found in the summer reading and discussions of the autobiographies. As the class is highly interactive, the discussion is generally student-led, with the instructor acting as facilitator. These discussions are critical for the students to develop a common framework for understanding leadership and learning about other members of the “team.” At the conclusion of the review of the summer reading, the students are provided an overview power-point presentation summarizing some of the key leadership characteristics and concepts.

The pace of the discussion and overall seminar has been described as “fast and furious.” Without proper context and personal experiences, understanding is limited and it is likely to overwhelm some students. That is one of the key reasons that students with previous leadership experience, not just leadership potential, are selected for the seminar. That leadership experience gives each scholar context to the abstract discussions of leadership characteristics and styles.

As soon as can be scheduled after the first week, the students participate in a four-hour team-building exercise, often referred to locally as the “Challenge Course.” The exercise, run by Ohio University’s Campus Recreation Department, is one of the most important events of the entire class. Generally speaking, before the exercise, the students know little about almost everyone else in the class. After the course, the class with this intense common experience comes closer together, making it easier for them to envision themselves as a team and thereby consequently resulting in class discussions immediately improving.

The Challenge Course was not used for the first couple of years. Once it became part of the seminar, it was very apparent that it helped with the effectiveness of the class discussions. The students now knew each other and were more open in sharing their views with each other. In other words, without something similar to the ropes course, it would take much longer to get the students working together as a class unit and trusting each other.

The team concept is a fundamental building block of the seminar. Not only is the concept of team used to emphasize the importance of participation and interaction, but it is critical in the early guest lectures. It is usually very intimidating for the students to ask probing and sometimes uncomfortable questions of company executives that could be their boss’s boss next year. Understanding that they are a team takes the pressure off the individual student and makes it easier to learn together. Further, the team culture

emphasizes that no one wants to be the weak link in the discussion, and therefore encourages the participants to prepare thoroughly for each speaker and assignment so that they can make a relevant contribution to the overall effort in validating their understanding of leadership.

In addition to autobiographical work, students are asked to research and analyze the leadership of a historical figure. Dr. Robe focused on discipline specific leaders, while currently, any historical leader (that is approved by the RLI Director) is acceptable. The students are asked to write a paper on the leadership and accomplishments of their selection and present it orally to the class in approximately 15 minutes at the end of the quarter. This exercise was intended to help the students understand the value of learning about leadership from biographies. Further, for the discipline specific focus, it was to know one of their field's own leaders that might be of value to them later in their professional careers. Also by reporting to the class at the end of the term and letting the other students ask questions about the chosen leader, the other students benefited from the work of all the other students in the class. It also was a final exercise in promoting the asking of good questions, a most important skill for any leader.

Students also spend significant time on development of emotional intelligence, with at least two behavior inventories (such as True Colors, Myers-Briggs Type Indicator test) and discuss both results in class. Building strong interpersonal skills requires that the students understand their character (behavior pattern) first so that they recognize their own strengths and weaknesses. Also from this, they learn the styles of others and how these other styles often interact with their own personal style. It often is overwhelming, but does give the student some framework for the application of different leadership styles based on the personalities of their followers, as well as teach them why they often make decisions in the fashion that they do. It also serves as a prelude for analysis of the guest speakers to follow.

Before the guest speakers are interviewed, a significant discussion of the differences between leadership and management are presented. This element differentiates the two aspects in several ways, but also emphasizes the inherent symbiotic relationship. Successful leaders cultivate quality managers to execute their vision. Therefore leaders must be knowledgeable of the role of managers and help foster them as potential leaders for their organization. Yet it is highly stressed that leadership can be demonstrated by non-management personnel (anyone) and that leadership and entrepreneurial spirit must be fostered in any organizational member indicating potential, regardless of title.

VI. Guest Speakers

As mentioned previously, the key component of the seminar experience is the interaction between the students and the guest speakers. By the time of the first speaker, the students have developed a framework for understanding leadership styles and are very eager to engage the speakers.

Following the Challenge Course, the instructor begins preparing the students to interview the upcoming guest speakers; discussing proper etiquette, as well as general types of questions they could pose to learn more about the leadership style of each speaker. Immediately after that preparation, a "practice" guest speaker comes to the class, usually discussing the importance of emotional intelligence to quality leadership and finalizing the discussion on the work each student has done to classify their leadership style.

The preparation of the students to ask good questions is culminated in asking one student to introduce a speaker for the session. This gives the students valuable experience of talking to the speaker before the seminar and relates to some of the skills one has to have as a leader.

What makes the seminar truly successful is the willingness of the speakers to educate the next generation of leaders. Nearly to a person, the speakers share the belief in the importance of leadership development – not only for their organization, but for the nation. Furthermore, most of them are highly invigorated by sharing their personal experiences with the students and love to be invited back in the future. Few of them have ever before been asked to speak about their personal experiences and have only spoken previously about their organizations, products and services. Most of them are happy to share what they have learned about life and leadership and welcome this special opportunity to share all this with the students.

This makes for an ideal learning experience – a group of eager future leaders interviewing a seasoned leader who wants to share "real world" experiences with the students and further their knowledge of leadership. It far surpasses any learning the students could gain through reading, as mentioned in numerous end of class surveys. However, it is important to remember that speakers should be scheduled to meet with seminar class only after readings, discussions, and other preparations have been made to assure that the students are prepared to fully benefit from the speakers.

Preparing speakers for their sessions is important, but do not script them. The most important thing is to get them to effectively interact with the students by having an open, honest and straightforward interchange with the students and responding to their questions with stories about their real life's experiences both at work and at home.

As a general rule have your new speakers among the first set of speakers and your best most experienced ones toward the end of the seminar. In the beginning of the seminar the students are not fully prepared and experienced enough to fully question and benefit from the most experienced speakers. Thus, it can be a waste of an experienced speaker's knowledge and experiences. However, sometime it is helpful to have one of your more experienced speakers in during the beginning if they can indeed help in the students' development in asking and benefiting from the questioning process.

To deliver the right messages about leadership, there needs to be diversity of speakers in age, gender, venues and experiences. The order and selection of speakers can help

the students better understand that “they too can do it” but that they must continuously work at it because one doesn’t get there in one or just a few steps. It’s a lifetime process.

A side benefit to inviting speakers for the seminar is that many of the college’s successful alumni can be invited back to the campus to speak with this special group of engineering students and often become so engaged that they become generous donors without even being asked. This should not be the reason and purpose of inviting them but it clearly is a fringe benefit of having the seminar.

In addition to the classroom interviews, the speakers generally agree to attend a supper with 3-6 of the students from the class in a less formal environment. This setting generally facilitates more open discussion of personal experiences, and often leads to a greater sense of awareness for the students of what it means to be a leader. Anecdotal evidence from student journals indicates that opinions of the speaker’s styles may change dramatically over the course of the supper because of the different setting.

Daily reflection and periodic discussion of the speakers is important. This discussion helps the students articulate what they have learned and also most importantly helps students learn from each other. Also it helps each student learn the importance of listening to others and not get too fixed on just their own points of views. Two class periods and several assignments are devoted to critically evaluating the speaker’s styles, leadership characteristics, and lessons learned from the interviews. This generally requires the students to not only evaluate their daily journal reflections, but also to review the key aspects of the summer reading to frame their responses.

The classroom discussion is held after the students submit initial answers to the critical review questions. The students then hold an open discussion on each question, allowing everyone to make their answers known and present justifications for those answers. These review sessions tend to be quite lively, with very well-reasoned debates. Students generally have reflected that these sessions helped them focus their understanding of the speakers to a level beyond even what they attained through their journal reflections.

An important aspect of the first speaker discussion is that the students then prepare to benefit even more from the next set of speakers which follow and generally ask better more probing questions of the speakers. One measure of whether the seminar class is successful is to observe whether the questioning of the speakers gets better and better as the quarter/semester progresses.

VII. Seminar Conclusion and Practice

RLI students are required to take on and report on a couple of personal leadership events during the period of the seminar. The benefits of this include the perspective that leadership comes in discreet events and that these small events can be very important and helpful to others! At the end of the quarter student select one of these events to share

with the Director and what they learned from their reported leadership event.

The capstone event of the RLI Seminar is the exit interview of the individual scholars with the RLI Director. The students are given a general listing of questions to prepare themselves for the interview. They are told it is comprehensive and anything may be asked to probe their understanding of leadership. It is also recorded (as are all the guest speaker interviews) and available for future scholars to review. This interview covers details the students may have addressed in their daily journal reflections or in their papers or about a key leadership concept described by one of the speakers. While it is not meant to fully assess the student’s comprehension of the material, it does give a strong indication of the effort the student has put into the class, and it assists the instructor in helping the student address perceived deficiencies in both their understanding and in their current leadership development.

VIII. Outreach

While the course may end with the final interviews, the work of the course goes on throughout the year. In addition to encouraging the students to take active leadership roles for the remainder of the year, the students are also asked to identify future RLI Scholars. This is very important, as they are more easily able to identify the “up and coming” leaders in the college than faculty, both because of their recent learning and their interactions with other students.

The students are also asked to join the ranks of the RLI Alumni via the RLI Alumni Directory. The RLI Alumni Directory, which is accessed on-line through the RLI website, is designed to help the graduates of the seminar to stay connected to the RLI program in the Russ College as well as network with their fellow graduates.

The RLI also sponsors yearly leadership awards for students, both at the departmental and college levels. The college award is named for Mr. Gerald Loehr, who was instrumental in the establishment of the RLI.

SUMMARY

While the prescribed method of the RLI may or may not work for your particular engineering school, the heart of any good leadership studies course for engineers focuses on the themes of competence, character and vision as being at the core of attracting and retaining followers when leading with honor. This is done through reading, exercises and use of leadership speakers. It is critical that students understand that competence is “knowing what one is doing” in the venue where the leading is taking place. Character includes integrity, honesty, personal values and religious faith, commitment, persistence and sacrifice, courage (intellectual and physical), confidence, self-knowledge, compassion, patience, humility, self-control, vigor (both physical and mental), with integrity and one’s word being good as the key stones of them all. Vision includes both near-term and long-

term conceptualization of a solution; a reality not yet come to fruition.

ACKNOWLEDGMENT

The authors would sincerely like to thank the Russ College Board of Visitors and the fund-raising efforts of Pamela Siemer for establishing and endowing the Robe Leadership Institute, notably from the contributions of the late Gerald Loehr, who also endowed the leadership awards given to yearly to Russ College students. We would also like to thank all the leadership speakers who have generously volunteered their time to mentor the classes of Robe Scholars throughout the years. Special thanks go to Mr. Richard Daubenmire, former VP of Personal Computer Manufacturing and private consultant for 26 years working with IBM, who has kindly discussed leadership with every RLI class since its inception. We would also like to thank each of the Robe Scholars for their dedication to this learning experience and for fostering future scholars.

REFERENCES

- [1] National Academy of Engineering. 2004. *The Engineer of 2020: Visions of Engineering in the New Century*. The National Academies Press, p. 50.
- [2] "ABET Engineering Accreditation Criteria." 2009. <http://www.abet.org/forms.shtml>. Accessed: 16 March 2009.
- [3] Bayless, D., J. Mitchell and T. R. Robe, "Engineering Leadership Studies and the Robe Leadership Institute Model in the Russ College of Engineering and Technology at Ohio University." in *Frontiers in Education Conference*. 18-21 October 2009. *Proceedings of the 39th*

Annual Frontiers in Education Conference, 2009. Piscataway, NJ: IEEE, paper 1175.

- [4] Lee, Blaine. 1997. *The Power Principle*. New York: Fireside (Simon & Schuster), pp. 1-348.
- [5] Maxwell, John C. 2002. *Leadership 101: What Every Leader Needs to Know*. Nashville, TN: Thomas Nelson Publishers, pp. 1-108.
- [6] Sample, Steven. 2002. *The Contrarian's Guide to Leadership*. San Francisco: Jossey-Bass, pp. 1-192.
- [7] Bolton, Robert and D. G. Bolton. 1996. *People Styles at Work: Making Bad Relationships Good and Good Relationships Better*. New York: Amacom, pp. 3-46.
- [8] Goleman, Daniel. March-April 2000. "Leadership that Gets Results." *Harvard Business Review*. Vol. 78 (2), pp. 78-90.

AUTHOR INFORMATION

David Bayless is the current Director of the Robe Leadership Institute and Loehr Professor of Mechanical Engineering at Ohio University. He is also director of the Ohio Coal Research Center and a former employee of American Electric Power and an officer in the U.S. Navy.

T. Richard Robe is the founding Director of the Robe Leadership Institute (1996-Dec. 2004), Dean Emeritus of the Russ College of Engineering and Technology (1980-1996), Moss Professor of Engineering Education Emeritus in the Russ College, and currently serves on the RLI Advisory Board as well as an advisor to the NAE Selection Committee for the Fritz J. and Dolores H. Russ Prize, robe@ohio.edu.