ENGINEERING MANAGEMENT: A Course for Survival

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Abstract: Engineering survival and success depends on many skills in addition to technical excellence. The class looks at topics from professionalism to ethics, from presentation to people skills, from project management to international cultures. These issues are more important than ever in an engineering environment that is very dynamic and involves frequent transitions between employers and job functions. Numerous assessments of personality styles are addressed along with needs and motivation assessments. Because of the changing international face of upper level engineers, time is invested in understanding cultural nuances and remote management. Industrial interaction is promoted by bringing in specialty topics such as quality and legal. Since the topics are very diverse, a single text was not available. The authors developed a text that was totally on-line {1}.

Introduction

Engineering management is almost an oxymoron. Engineers, by definition, are trained to deal with things and how things work. Management, by definition, is training to deal with people and how to get them to work. Those are as dissimilar as imaginable. In fact, entering university students often refer to the first semesters of the engineering program as pre-business. Is that because early engineering training is so well adapted to business and management training? The students would tell you no, it is because engineering is perceived as difficult and they are looking for something easier.

In reality, engineering is one of the best backgrounds for developing management skills. Engineers tend to be quick learners and are trained in analytical practices. A Carnegie Foundation report, using over 30 years of surveys, showed that 60% of persons with an engineering degree became managers or businessmen within 15 years. {2} Cleland and Kogaolu found that 40% of industrial executives and 34% of all top corporate managers in the US have engineering education {3} Think about that. Considering all the various degrees, that is a phenomenal statistic.

Unfortunately, many engineers maintain a lowered value for business and management because of the very early experience in their technical training. One of the realities young engineers develop is an understanding of the universal engineering symbol, $. If a project or venture cannot be converted to money and a positive cash flow, then it is unlikely to ever develop.

Because of the dichotomy between engineering and management, it is very difficult to find a truly cross-sectional book. What is the largest expense associated with a project or organization?

What is the largest asset associated with any project? If you answered people, you are ready for grasping management.

If a business-type writes the book, it is generally focused on cash flow, money management, and financial risk management, and does not adequately address the issues of project management and resolution of technical issues. If a technical-type writes the book, it focuses too much on the technical details and not enough on the people issues. If fact, very few books from any persuasion focus on people issues. There is no experience or background to address these issues.

People skills and relationships are where most engineers have the greatest shortcomings. It simply has not been part of the process or the education. In fact some naïve engineers disdain this need and study as soft science and unimportant for a technically talented person. They are doomed to stagnation. An aphorism that has been used for years is succinct.

People do business with people they like.

Dale Carnegie is perhaps the guru of modern people skills. In 1939, he wrote the seminal *How To Win Friends and Influence People*. {4} He has three mantras for success. The third seems illogical on the surface, but is the nugget of all transactions, whether in buying, selling, or people motivation.

Find out what people want and help them to get it. In the process, you will get what you want.

The real objective is to take the focus from engineering and management to the next level, leadership. The development of this perspective comes from diverse experience. The authors have terminal degrees is engineering, with previous education in management. Moreover, they have been senior executives with global corporations and are entrepreneurs who have started their own successful businesses where real money is obtained only for real services rendered.

Manager vs Leader

What is the difference in an engineer, manager, and leader? Several alternative comparisons have been used. A leader knows why, a manager knows what to do, and an engineer know how. A manager does things right, a leader does the right things. You can hire people that know how, but you must have a vision or dream to know why. A leader has a vision and takes the steps necessary to get there. A manager works for someone, a leader is working toward something. A leader lifts up, a manager holds down. Perhaps my favorite is "a manager is a leader without the vision to make things happen."

So What Is This Program?

The chapter headings identify the topics. Each area is designed for a one hour discussion. Some topics are slightly longer and more involved, so the additional material is for reference or outside reading. The material is divided into seven broad sections. These cover the gamut of areas where technical people are expected to perform. What is obviously missing is any technical discussion. It is assumed that the person has technical qualifications and is obtaining that broader experience for functioning with people.

Style
- Who do you think you are?
- Leadership and success
- Personality temperament
- Personality style
- Leadership style
- Leadership foundations
- Character: Leaders have values
- Motivation

Communication
- Culture & leadership
- Communication
- Presentation
- Non-verbal communication
- Kinesics
- Graphology
- Negotiation

Business
- Change: Paradigm shifts
- Nature of business
- Organizational structure
- Organizational resources
- Purpose, vision, plan

Legal
- Quality
- Iso 9000
- Law and Government
- Litigation
- Contracts

Ethics
- Ethics and professionalism
- Global leadership

Projects
- Project management
- Project schedule and cost
- Time value of money
- Oops, What happens when things go wrong

Profile
- Benjamin Franklin Junto
- Aphorisms

Discussion

Each of the seven categories is very diverse. A brief discussion is in order in addition to the topic headings.

Style. Each leader, manager, and engineer has a particular style. In psychological circles these are grouped into four categories. One is not better than another, but each has its assets and negatives.

These differences are the source for much of the conflict and the lack of performance within an organization. Although the style is as inherent as color of eyes, with training anyone can compensate for their weaknesses.

In a society that is presented as relativistic in many circles, the concept of character is anathema. Nevertheless, character is crucial to long term success of the individual and the organization. Character can be defined and is defined by traditional concepts that have prevailed through history.

Communication. Communication is presenting your idea in the most effective way and getting feedback. It is more about listening than about speaking. Communication is perhaps the weakest link for technical professionals who aspire to management and leadership. Communication is more important than technical information. If you cannot communicate what you know, then you do not have knowledge. You only have personal information. If you can communicate effectively, you can overcome many challenges.

Numerous vehicles are used to transmit a message. These include books, papers, articles, reports, memos, emails, letters, lectures, presentations, phone calls, audio recordings, video recordings, handshake, backslap, and other forms of touch. Messages come to us through the eye gate, ear gate, and touch sensors.

Business. The first part of the treatise focuses on the history of economic technology. The background necessarily looks at the life cycle of technology and extending the life cycle of a business as technology changes.

Next comes the theory of technology growth and its impact on the theory of economics. Costs place limits on technology and constrain its growth. However, the shift in costs from technology efficiency opens new options. People placement becomes one of the more emotional consequences of changes and development.

The shifts are seen in the future of technology and techno-specialists, education, and organizations. This addresses the world we necessarily work in, not the world, as we would like it to be. To survive, it is critical that techno-specialists understand that the technical aspects represent only a portion of time and effort. Skill with people is ever more important.

Legal. The legal topic involves all outside structural constraints on how am individual or an organization can or must perform. The risk management issues include safety, environmental, and quality. These are constraints that force a technical solution other than the most cost effective or highest performance. The legal structure is framed in the context of history, civics, and how this has created the present litigious environment where every product is subject to scrutiny by vested interests.

Ethics. Sir Francis Bacon (1561–1626) was an English philosopher and politician during the time of James I. One of his works *The Advancement of Learning* addressed the subject of morality. “For the end of logic is to teach a form of argument to secure reason, and not to entrap it; the end of morality is to procure the affections to obey reason, and not to invade it…” Bacon asserted that it was reasonable and logical to pursue morality.

The founding fathers unequivocally had a philosophy of ethics. The first President, George Washington wrote about these concepts in his First Inaugural Address. "There is no truth more thoroughly established than that there exists in the economy and course of nature an indissoluble union between virtue and happiness."

A question that is occasionally raised is whether it is possible to teach ethics or morality. The contention is that morality is the product of familial and cultural development and cannot be taught. That really begs the question. What are the family and culture doing to instill this sense of morality other than teaching? Ethics are absolute. They do not change with time or society. Although they may not be uniformly appreciated and applied, they still exist.

Projects. Most engineering management courses and books focus on this topic. It is relegated to the end of the book, since these functions cannot effectively be instilled without the earlier topics. Projects are unique in an organization. They exist for a set time and purpose. They have a definable cost, schedule, and task. A project manager must have the skills of any manager. Additionally, he must have a fair understanding of the technical issues.

There are two major qualifications of a project manager. Project management requires skill with people, dollars, and technology. Project management is the trade-off between time, money, and quality. These are not conflicting, but rather are complementary criteria. Collegiate education seldom addresses all of these skills coherently. Most formal education will address only one of the issues to the exclusion of others.

Technical training is focused on how to design or analyze a piece of equipment. Seldom does it involve the skills necessary to resolve disputes or resolve discrepancy issues. What is the role of a techno-leader in error handling? Technical specialists determine what makes things work. Therefore, they become the first responders in forensic investigations. They provide the basis for attorney's arguments during litigation. By nature and training, techno-specialists assume that they are right and their way is the correct way. However, there are usually experts on both sides of an issue. How is this discrepancy resolved?

Profile. Dr. Benjamin Franklin was unquestionably one of the most influential leaders during the development of our country and democratic government around the world. He was a very successful businessman, architect of government, diplomat, scientist, and philosopher. He had retired from his business by the age of forty. This allowed him the financial resources and time to pursue development of his other interests. One of Franklin's keys to success was the development of support societies he called Junto. He did not tell how to, but rather asked a series of questions leading to evaluation of effective principles and practices.

The final chapter is a summary of succinct concepts from each chapter, in the form of aphorisms. An aphorism is a tersely phrased statement about a truth or opinion. It is from the Latin by way of Old French and means to define. Leaders often use these brief sayings as quick reminders of principles. The aphorism list is sayings the authors have used throughout the book. Since everything we know is built on other's work, it is sometimes difficult to know if aphorisms are original, modifications of others, or are old adages.

Does It Work?

Evaluations of participants are one of the best tools to fine tune a program. The following commentary was an unsolicited analysis by one student of the course built around *Leadership Success in a World Gone Tech.*

"I have gained a greater appreciation for you over this last semester. You are brilliant at what you do and I would be very proud to have you as a mentor. It's difficult to disagree with what you have to say, despite that its entirely contrary to what business schools teach, when you demonstrate so clearly that these tools you have given us work. I think it's a shame that I did not have you as my economics professor as I probably would have gotten more sensible application and, frankly, actual instruction from you, instead of the insipidly easy busywork that I dutifully completed in my own economics class to receive my A. I would love to see you teach economics, because you would teach it properly. You opened my eyes this semester to a lot of things. Most fresh in my mind is the way that gas prices work. After doing research on my own, I found that you were absolutely correct, which has shifted my observation of politics; hearing politicians blame the oil companies for high gas prices after my researching and discovering the truth has given me a better insight into the approach many politicians take to manipulate the uninformed. You have given me confidence this semester. Believe it or not, I used to be very, very quiet and reserved, and the work you have done with me has given me confidence in my own abilities and really freed me to explore leadership roles, whereas before I would have hidden as support. I have discovered an absolute love of public speaking and have decided that I would like to do conference teaching/speaking in some capacity in my career. Because of your positive influence, I can now get up in front of a crowd, presentation unprepared and unpracticed and still pull off a respectable presentation. I don't feel nervous and actually feel animated. I also appreciate that you have supported me in allowing me to pursue my own style in presenting, despite it being very nontraditional to the usual read-off-of-the-slides format most engineers use. I am especially appreciative that you recognized and validated me as a "different" sort of student and supported me and my crazy ideas and creativity. Whereas most people try to suppress those qualities, you have encouraged them, and in effect have made me happier. You have shown me what it is to be a leader and have given me new direction in my life. I have more confidence that I could go out and be a leader, manager, and/or entrepreneur and be successful at it as well. So, thank-you very much. This engineering management class is one of my favorite courses and I hope that you keep the format the same in the future. I also wish you great luck with your book. Excellent course. "

These are excerpts from other students who have participated in the program. These include many international students.

An excellent course for all engineering and science students. Gives student ideas needed for workplace and personal life. Dr. Durham is COOL!

We should have more such courses to improve Professional skills helpful in the real world.

I thoroughly enjoyed this course. It enhanced my communication skills.

One of the best classes I attended.

Positive feed back from Instructor helped me in boosting my confidence. Course was presented in a very nice, healthy environment. All engineering students should be required to take this course. Thank you, Dr. Durham.

Great teacher!! Very friendly and encourages to express any ideas freely!

It's a very interesting course! Thank you!

What more can be said? Those of the technical persuasion that look askance at the people side of the equation are constrained in their progress. Technical students are very astute to pick up new concepts and can effectively be trained in the fine art of interpersonal skills necessary to be successful in any organization or endeavor.

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