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An Approach to Teaching People Skills in Senior Design Project Courses

Dr. Robert G. Batson P.E., University of Alabama

Bob Batson is a professor of construction engineering at The University of Alabama. His Ph.D. training was in operations research, and he has developed expertise in applied statistics over the past thirty years. He currently teaches the required courses in project management, safety engineering, engineering management, and engineering statistics within the undergraduate programs of the Civil, Construction, and Environmental Engineering Department, and graduate courses in operations research and supply chain management. His research interests include project risk management, quality management, supply chain management, maintenance management, and safety management. Since joining the University in 1984 he has held research contracts and grants worth over \$2.4M, with organizations such as Mercedes-Benz, American Cast Iron Pipe Company, BellSouth, NSF, NASA, the Federal Aviation Administration, Army Aviation and Missile Command, and Alabama DOT. He served as Head of the Department of Industrial Engineering during 1994-99 and 2005-2010. He also was Director of the IE Design Clinic from 1998-2010, directing senior design projects with local industrial and service organizations.

Bob has published over 140 articles, chapters in textbooks, and technical reports, many in the area of process planning and improvement, and has been an invited speaker or panelist at numerous technical symposia. He is co-author of the textbook *Applied Integer Programming*, published by Wiley in 2010.

From 1979-84, Bob was a senior operations research analyst with Lockheed Corporation. At Lockheed, he worked in conceptual and preliminary design of aircraft and missiles, performing mission effectiveness, cost, and risk analysis. He received a Ph.D. in Mathematics and an M.S.I.E. from Alabama in 1979, and a B.S. in Mathematics/Physics from Alabama in 1972. Since 1996, Bob has been a Registered Professional Engineer in quality engineering in the State of California. He is past-president of the ASEE Southeastern Section. He is past-Chairman of the Birmingham Section of the American Society for Quality, an ASQ Certified Quality Engineer, an ASQ Certified Reliability Engineer, and was elected Fellow of ASQ in 1996. He is a senior member of the Institute of Industrial Engineers, received the IIE Aerospace Division Award in 1989, is Past-President of the Birmingham Chapter of IIE, and has served IIE as an ABET Program Evaluator for the past fifteen years.

An Approach to Teaching People Skills in Senior Design Project Courses

Introduction

The premise of this paper is that most engineering students are ill-prepared for the demands their careers will place on them to interact with other people one-on-one, within teams, and within organizations—organizations that are often global in character. The senior design project provides an opportunity (literally a last chance) for graduating seniors to recognize and develop people skills needed for success. Because the project is intended to simulate real engineering practice, the faculty member can observe each student's people skill level in project context and at a minimum provide insights and coaching to each student in order to improve those skills before graduation.

The term people skills for professionals (synonymous with social skills, or soft skills) refer to a collection of skills including:

- Communication skills (verbalization, listening, writing, reading)
- Creativity in professional settings
- Adaptability to situations encountered on the job
- Collaboration (teaming) skills
- Leadership skills.

So, people skills for professionals are about working with and relating to other people encountered at work. There are two lines of thought about development of those skills in engineering students:

- Each student has a Myers-Briggs personality type, and their particular type dictates the ease or difficulty they will encounter as an entry-level employee—the faculty can do little to affect such outcomes;
- Engineering students, though naïve about the extent to which people skills will affect their job success, are quick learners and their attitudes and behaviors can be modified through exposure to factual information, proven methods, and coaching by a mentor. As a senior design course instructor, I integrated into a two-semester senior design experience the goal of improving each student's people skills in the following dimensions:
 - One-on-one people skills toward a socially astute and adaptive engineer
 - Teaming skills toward a creative and collaborative engineer
 - Globalization insights toward an organizationally aware engineer.

Regarding the Myers-Briggs (MB) personality types and work-life, Kroeger and Thuesen [1] explained how the 16 Jungian personality types determine one's success on the job. In particular, it is often noted that two types, ESFP and ENFP have the strongest people skills due to their E = Extaversion (focus on people and external environment), F = Feeling (make decisions based on human values and empathy for others), and P = Perceiving (react to events in a flexible, spontaneous way). The S = Sensing types and N = Intuitive types among E_FPs are evenly divided (about 5% each) in entry-level employees according to Kroeger and Thuesen. A study at North Carolina State by Felder, Felder, and Dietz [2] found 11% of a sample of engineering students were of these two personality types. As is well-known in the engineering community,

this same 2002 study confirmed that ISTJ (Introverted, Sensing, Thinking, Judging) types had by far the highest proportion of engineering students (21%) among the sixteen MB types. In the use of MB typing in my senior design classes, consistently 45-50% of the students were either ISTJ or ESTJ, whereas Kroeger and Thuesen identified 35% among all entry-level employees. Another study by Rosati [3] of the 1865 engineering students at the University of Western Ontario (UWO) discovered that UWO engineering graduates were concentrated in the I_TJ types, opposite the two people-oriented types mentioned above: 46% of UWO engineering graduates were TJs and only 13% were FPs, whereas 40% of all entry-level workers are TJ and 24% are FP. So, TJ types are somewhat over-represented in engineering graduates and FPs appear to be significantly under-represented. The conclusion is: whether one believes such quantitative summaries or simply listens to middle and upper managers on your industrial advisory board, *individuals entering the engineering profession generally need to improve their people skills*, and one can argue that engineering teams and organizations could have “blind spots” due the sparse distribution of FP types among them.

Regarding the potential to develop people skills among students, there is a long-standing belief in the U.S. educational and corporate communities that people skills can be recognized, learned, and improved through classes, webinars, and popular books about these abilities. Role-playing is often suggested as a non-threatening way to practice new people skills. In other words, something can be done to smooth rough edges and hone these skills in anyone willing to attempt improvement. However, it is unusual for an engineering program to take on the roll of provider of such training for its entire senior class, as reported here.

The purpose of this paper is to describe our approach to improving people skills using the *experiential learning* [4] that takes place during senior design projects—this is instead of role-playing in an artificial setting. This paper will explain the approach taken, the reference texts used, class time consumed, and how our two-semester approach could be adapted to the more typical one-semester design project found in the senior year of most ABET-accredited engineering degree curricula. It is the combination of readily available and world-renowned training materials (readers) and the experiential aspects of the senior design project that create the opportunity for this final finishing or polishing of the students before they are graduated and employed. Furthermore, with students’ attention focused on job interviews and subsequent start-up of their careers, they are at their “most receptive” to any information and coaching that will improve their people skills. In no way does the author imply this is the only approach that could be taken, nor that the “readers” he used are the only materials available to accomplish the objectives of 1)Self-knowledge development; 2)One-on-one people skills development; 3) Teaming skills development; and, 4)Globalization and business insights development.

People-skills Development Approach Used (Two-semester Design Projects)

In a two-semester design experience, the BSIE degree at the University of Alabama (UA) required two three-hour senior design courses in sequence. In the first semester’s Senior Design I, the student completes an individual design project of narrow scope, in order to become familiar with the client company, to build a working relationship with at least one engineering professional in the company, and to solve a narrow scope problem of value to this engineer. In Senior Design II, the students were grouped into teams, generally at the same client company for whom they did their individual project. This minimized the start-up time for the team project, with students ready to begin interaction with a familiar organization, but now working for a

middle manager with a broader, more difficult design problem than involved in their individual project. In fact, ideally the individual projects provided insight into the broader problem (already identified) to be tackled in Senior Design II.

The people-skills development approach we recommend is fairly simple: Weekly class meetings where project teams report their progress and problems invariably convince students that new people skills are needed, even for the smoothest operators among them; students with lesser people skills often are found to be searching for help dealing with particular individuals (at the client, on their assigned team), dealing with their entire design project team, and dealing with the client organization as a whole. An approach to teaching people skills in senior design that has been used by the author for many years includes the following:

1. **Self-knowledge development:** Give each student a Myers-Briggs Type Indicator questionnaire (available on-line) so the student recognizes the current, innate strengths and weaknesses of their personality type. Typing was accomplished during first week of first semester, when the students are preparing to meet the corporate individual (engineer or first-level manager) who will be their client for the first semester's individual design project, necessarily of limited scope. Each student was provided access to a 31-page pamphlet *Introduction to Type* [5] by Isabel Briggs Myers (one of two developers of the MB types) and the *Type Talk at Work* text [1] by Kroeger and Thuesen to delve more deeply into the implications of their personality type that time would permit in class. Of course, there is a wealth of information on each type, available on-line.
2. **One-on-one people skills development:** Read through the simple pocket book Dale Carnegie's *How to Win Friends and Influence People* [6]. As instructor, I would play the role of discussion leader, using examples from the book, my own experience, and the student's initial interactions with their individual design project client. It should be noted that I was not attempting to teach a communication skills course (one was already part of their curriculum). The reader interested in this line of research is referred to the article by Riemer [7]—a broad article on communication skills for engineers, including an explanation of emotional intelligence which is closely related to the extent and maturity of one's people skills.
3. **Teaming skills development:** Read through the simple pocket book *The Team Memory Jogger* [8]. As instructor, I would play the role of discussion leader, using examples from the book, my own experience, and the student's initial interactions with their design project team. Students also are made aware of the personality types on their respective project teams. It was my goal in creating these teams to assure that each of the MB letter codes (e.g., I vs. E) were represented in at least one team member; sometimes there would not be enough diversity in the senior design course (for instance, not enough N = Intuitive types to spread around). In my role as project administrator for each team, I could sometimes spot weaknesses and through questioning/suggestions make up for "blind spots" I noticed.
4. **Globalization and business insights development:** Read through the best-seller *The World is Flat* [9] by Thomas Friedman. Examples in the book from well-known global corporations are used, leading to a need to uncover and discuss the suppliers and customers for their project's client company—at least those where this information, and subsequent customer-supplier relationships, might come to bear on the solution to the project team's design problem.

Resource and Time Issues

In teaching a two-semester industrial engineering senior design project course, we were able to use class time to read and immediately apply the simple lessons found in three readily available paperback “readers”: Dale Carnegie’s *How to Win Friends and Influence People* [6], Oriel’s *The Team Memory Jogger* [8], and Thomas Friedman’s *The World is Flat* [9]. The first of these was used in Semester 1, when students did individual projects of narrow scope with their client company; literally, they were working one-on-one with a company representative (typically, an engineer or first-level manager). These projects were intended to orient the student to their company and the larger problem to be assigned as their team project in Semester 2. The other two readers were used in Semester 2, when students were forming their teams and deciding operational norms, and were attempting to understand their client’s organization from more of a perspective of middle manager—often dealing with the client’s information systems, customers, and suppliers.

In this section, we will answer the following questions: 1) Why these particular books, in this order? 2) What were the costs, in terms of class meeting time and student expense? 3) Was this approach effective? For example, the lessons were introduced “just in time” for the students’ project needs, and there was no artificial role-playing—the lessons were intended to be applied in each student’s relationship with individuals and groups in project context, and in understanding the global, information-based organizations represented by the client and their suppliers and customers.

Why these particular books, in this order? Certain books make their way into extreme popularity with engineering professionals in the U.S., and last through multiple editions and printings to become best-sellers. That is how I came to use the three books mentioned in the above section. The first edition of *How to Win Friends and Influence People* [6] was published in 1937, in response to Dale Carnegie’s discovery that a wide variety of business people attended and benefitted from his courses on Human Relations in New York City. It became one of the all-time international best sellers, translated into almost every known language, with continuing popularity into the 1980s. The Revised Edition was published in 1981 by his wife and daughter, with the only changes being updated examples with name and events better known to its readers. With over 15,000,000 copies sold, it is still considered a readable, enjoyable masterpiece guide to applied human relations—consistent with industrial psychology and corporate practices. This text was used in the second third of the three-semester-hour Senior Design I course, the first third being devoted to learning the steps in the “systematic design process” and the last third being devoted to how to write a project final report and prepare an executive briefing. So, I estimate we spent two hourly classes for five weeks (approximately 10 hours) discussing the Dale Carnegie book.

The second text *The Team Memory Jogger* [8] deals with teaming skills in the very simple, accessible format of a pocket guide, organized as follows:

- Chapter 1: Preparing to Be an Effective Team Member
- Chapter 2: Getting a Good Start
- Chapter 3: Getting Work Done in Teams
- Chapter 4: Knowing When and How to End
- Chapter 5: Problems With the Team (and how to solve them).

This publication is one of many in the Memory Jogger pocket book series developed by GOAL/QPC during the quality revolution of the 1980s. It mixes simple artwork with deep insights into how to make teaming work. For instance, being a team member includes taking responsibility, following through on commitments, contributing to discussions, and giving and accepting feedback; problems within teams (these occur in senior design teams regularly) include handling conflict, dealing with power and authority, lack of focus, and uneven participation. This book also contains some great guidelines for making meetings effective. Faculty members certainly have horror tales about poorly executed meetings; should students be any different? This text was used in the first half of the Senior Design II three-semester-hour course, each chapter being simple enough to cover in 1-2 meetings, for a total of 5-10 hours.

Regarding self-efficacy—perception of one’s own academic competence—academic skills development does occur in the team context as students gain experience and learn from each other [10]. The teaming skills in the *Team Memory Jogger* [8] should enhance this type of development in student team members with limited experience or lack of confidence in their technical abilities.

Moving from individual and team concerns, to concerns with the client and that organization’s customers and suppliers, a great way to understand the modern corporation working with its networks of suppliers and customers in today’s global economy is to simply read and appreciate Friedman’s *The World is Flat: A Brief History of the Twenty-first Century* [9] with the 1st Edition in 1995 with 2nd and 3rd Editions to follow. We used the updated and expanded Release 3.0 paperback printing from its publication in 2005. Supply chains and the information flows that accompany design, development, production and distribution of products and services in such chains are the focus of this text. This text was used in the second half of the Senior Design II three-semester-hour course, and gave students background and terminology to discuss supply chain and IT issues with their client. We spent about one hour per chapter in discussions, so perhaps a total of 12-14 hours or 6-7 weeks (the paperback edition is over 600 pages long, 3-4 times longer than the other two readers).

In summary, all three of these books were introduced at appropriate times in the two-semester senior design sequence, as the students viewpoint grew from one-on-one, to team, to intra-organization and inter-organization issues. Having real exposure to the contents of these texts, and taking them along to their first job for future reference, were intended to impact careers in a positive way.

What were the costs, in terms of class meeting time and student expense? Senior design projects, with students traveling to and from the client generally one afternoon per week, are a huge time drain on the students. On top of perhaps five hours of travel per week, the students have to meet as a team at least two hours per week back on campus, and finally there were scheduled three hourly class meetings with the instructor, for a total of ten hours. One of those hours was used for teams to make verbal progress & problem reports to the class. The other two hours were when I would summarize a chapter in the current reader, and attempt to stimulate discussion from the group about what we had read. So, to include these people skills developmental texts in the course, I estimate we used 10-20 hours of class time each semester. As I told the students as I held up my copy of *How to Win Friends and Influence People* [6], possessing and using this book could be the key to raises, promotions, indeed the success of your engineering career. It has often be said that engineers think “just one more technical course, just

one more computer skill” and I will be successful, when in reality it is the people skills that often make or break an engineering career, or the start of a managerial career.

The expense of these materials is truly minimal. Given the \$100-200 price range for most hardback engineering texts, these three paperbacks have a price range of \$10-20 per copy new, with a total expense to the student of less than \$50.

Was this approach effective? The students would often write on their course evaluations that at first, they were skeptical of the value of these outside reading and discussions, but soon saw the value directly in the progress of their senior design courses. The students who were more confident in their individual and team people skills, would comment on the value of reading and discussing Friedman’s book in depth, rather than just reciting its title or some synopsis they had read in the popular press. Students who were very technically-oriented or perhaps were not sure how to deal with certain interpersonal situations (at work, or in general) would comment that the Dale Carnegie method opened their eyes to mistakes they needed to avoid, and affirmative steps they needed to take in the future. Many of the students had struggled with officer or committee chair duties in high school or the university, had attended poorly executed meetings, and had no idea how to make their design team work efficiently and effectively. The teaming guide provided steps to avoid team problems (or resolve them if they occurred) and how to properly carry out team functions all the way to final report and presentation. Both the students and I agreed that without this little pocket book, moving from individual responsibility an engineering student assumes, to team responsibility for results, would have been a much more trying experience. Project clients over the years were particularly complimentary about the professionalism of the students they involved into their company activities. Senior exit interviews and alumni surveys always pointed to these few hours devoted to people skill development as one of the most valuable parts of their engineering education. Here is an unsolicited comment received in 2015, from a May 2010 alumni of the program: “Thank you for the time and effort that you put into us as students in the now defunct—but always valiant—Industrial Engineering department. For me personally, I cannot thank you enough for the experiences with Johnson Controls that you put us through and for the knowledge you instilled in us through several worthwhile lessons and novels. I am a better engineer in my career because of your guidance. And have increased my salary by 36%.”

Adaptation to Single-semester Design Project

While our approach worked well in the two-semester, six credit hour senior design experience at our institution, it could be adapted to those departments that employ a single, team-based senior design project. Assuming three hourly class meetings per week, with one of those devoted to progress and problem reporting, there are 30 hours maximum in a semester available to cover the following topics, with a suggested schedule and time allocation as follows:

- Myers-Briggs Personality Typing for personal exploration and to help the instructor establish balanced teams (2 hours)
- Systematic Design Process to be used by the team (5 hours)
- *Team Memory Jogger* to help teams deal with processes and problems (5 hours)
- *How to Win Friends and Influence People* to help students self-assess their strengths and weaknesses going forward (8 hours)

- *The World is Flat*—review a synopsis of the book, with perhaps a video of a Friedman lecture; the interested student could be encouraged to continue into text (5 hours)
- Writing a Final Project Report; Preparing an Executive Briefing (5 hours)

This seems to me to be the order things should be presented, to develop individual, team, and modern business insights while assuring 20 hours devoted to the project team, and 10 hours to the each student's people skills insights and development. It is a squeeze, but feasible. To adjust this busy schedule, one could move the 8-hour Dale Carnegie training to a single day in the few days before classes begin, or the first Saturday afterwards. Note that the total pages read and discussed in the three readers during the two-semester senior design experience amounted to 845 pages total. Using a synopsis or video of Friedman cuts the total pages the students would be asked to consume essentially by 50%, to approximately 400 pages.

Conclusions

In this paper, we have described the rationale, approach, reading materials, and time devoted to development of people skills among seniors enrolled in a two-semester senior design experience in Industrial Engineering at one institution. We have stated that other materials might work just as well as the ones chosen, but are confident in the quality of materials described. We have shown how it would be feasible to reduce the material slightly and still be able to achieve the same goals within the time constraints of a one-semester senior design project. Benefits to the design project client and in particular, to the students' future career were described. Admittedly, the preparation and in-class moderation of discussions is a burden on the design course instructor, especially the first time it is attempted. Perhaps this calls for a team of two instructors, one to play the role of project administrator and technical consultant to the students, the other to play to role of people skills development facilitator. Being able to observe the students in their design consultant roles, as individual designers and in team conferences, provided opportunities for coaching (such as during trips back to campus after interactions with client personnel) and was also beneficial to me when I played the role of discussion leader.

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