AC 2009-137: HUMAN BEHAVIOR SKILLS AND EMOTIONAL INTELLIGENCE IN ENGINEERING

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Abstract

This past decade has been characterized by a series of changes in engineering education, including the incorporation of human behavior skills into the list of learning outcomes required for engineering program accreditation. This paper describes the efforts of a college of engineering at a large university in the mid-west to improve the human behavior skills and capabilities of undergraduate students through an emotional intelligence course. We describe our approach, our conceptual model, and some of the progress we have made to date.

Introduction

Human behavior skills can mean different things to different individuals, however, what engineering educators typically refer to as "soft" or "non-technical skills" is what we call human behavior skills. Many authors in the literature have emphasized the human behavior skills engineers need in order to apply their technical expertise successfully. For example, Selinger (2003) noted that non-technical skills, such as making decisions, setting priorities, working in teams, running meetings, and negotiating, that every engineer needs to be more effective in the workplace and happier in life. Orsted (2000) stressed the importance of human behavior skills, which govern behavior at meetings, towards colleagues, on the phone, and the way problems and conflict are approached are needed by engineers in the daily interaction with others. In addition, Hissey (2000) pointed out human behavior skills, such as teamwork, communication, leadership, and interpersonal skills that have a career enhancing value and may save engineers from downsizing. In addition, Moon et al (2007) pointed out human behavior skills and attributes such as communication, social, presentation, interpersonal, leadership, management, and team-working skills that engineers need to confront new challenges in the ever-changing and multidisciplinary field that constitutes engineering in today's global environment. Additionally, Manseur (2003) refers to the need of a "broad education that goes beyond traditional engineering topics and includes areas such as ethics, team work, oral communication, life-long learning, and an awareness of the impact of engineering on society to name just a few" (p.1). Goldberg (2006) noted that preparing engineers for organizational and people-related challenges assists them in being more effective throughout their careers. All the authors mentioned above have brought attention to the human behavior related skills that engineers need in order to successfully apply their technical knowledge in today's ever-changing and multidisciplinary world. They have expressed that human behavior skills are of particular relevance in the formation and success of the modern engineer.

"Emotional Intelligence is the ability to (1) perceive, appraise, and express emotion; (2) access and/or generate feelings when they facilitate thought; and (3) regulate emotional to promote emotional and intellectual growth" (Mayer and Salovey, 1997). Goleman (1998) defined emotional intelligence as "the capacity for recognizing our own feelings and those of others, for motivating ourselves, and for managing emotions well in ourselves and in our relationships" (p.317) . The relevance of these skills for engineering students and for professionals has been well documented. Schutte et al. (1998) found a stronger correlation between emotional intelligence and student GPA than between SAT scores and GPA. Numerous studies in industry have demonstrated the relationship between emotional intelligence competencies and exceptional job performance (Goleman & Cherniss, 2001; Boyatis, 2006; and Kelley, 2000)

Emotional Intelligence Competencies are learned capabilities based on emotional intelligence that contribute to effective performance in all aspects of life and in multiple environments including at home, work, school, or other social contexts (Hay Group, 2002). Goleman (2000) described four areas of emotional intelligence competencies and their interrelationship. Self awareness makes possible both self management and social awareness. Both social awareness and self-management are required to effectively manage our relationships. The specific competencies for each area of emotional intelligence are shown in Figure 1.

Figure 1. Four Main Areas of Emotional Intelligence

Self-Awareness	**Social-Awareness**
>Emotional Self-Awareness >Accurate Self-Assessment >Self-Confidence	>Empathy >Organizational Awareness >Service Orientation
Self-Management	**Relationship-Management**
>Emotional Self-Control >Trustworthiness >Conscientiousness >Adaptability >Optimism >Achievement Orientation >Initiative	>Developing Others >Inspirational Leadership >Influence >Communication >Change Catalyst >Conflict Management >Building Bonds >Teamwork and Collaboration

This paper describes the efforts of a college of engineering at a large university in the mid-west to improve the human behavior skills and capabilities of undergraduate students through an emotional intelligence course. We will describe our approach, our conceptual model, and some of the progress we have made to date.

Desired Skills Define

To improve human behavior skills the first effort was to define what those skills are and how they might apply within the college of engineering. The definition of these skills was developed using a variety of methods: 1) in-depth literature review; 2) respected individuals or experts reflect on the skills they have observed in successful people and describe those skills (ABET, 2004; Illinois Leadership Initiative, 2004); 3) a rigorous competency assessment was done that studied and documented the skills or competencies that differentiate average performers from outstanding performers; and 4) the application of theoretical models (leadership and emotional intelligent) to specific skills and behaviors.

Then we built out a set of desired skills using a combination of the approaches listed above. We started with the ABET skills, added input from alumni and respected advisors, compared those skills with ideas and concepts from leadership and emotional intelligence theories, and agreed on a set that we would try to build. Figure 2 describes the topics and the associated skills. This model is important because it identifies some of the foundational skills and then the works to build the additional skills that employers and organizations say are critical for success in the workplace.

The Initial Course

Our initial step was to integrate these concepts into a course titled: Interpersonal Skills and Emotional Intelligence. That we would establish such a course in the College of Engineering was an usual feat and then that we would actually try to have students practice and improve their "human behavior skills" is another.

Topics during the first half of the semester are within the triangle. Starting at the bottom and working up, these themes build upon each other and form the foundation of the course. During the second half of the semester, special topics found in the circles on the outside the triangle are covered in clockwise order and emphasize skill development. The course concludes with a look at the importance of perpetual learning.

The course starts with the bottom half of the triangle focusing on values and beliefs. Then we move into the middle section where self-awareness is the key skill, supported by motivation and attribution theories. We then focus on putting skills into action with goal setting. The next section of the course builds interpersonal skills, with empathy being the key skill supported by communication skills and rapport building. These skills culminate in trust—which is essential for all human and organization interactions. Finally, we focus on the issues surrounding teams: influence, collaboration and cooperation, conflict and negotiation, diversity, change and leadership and followership. In our view—and consistent with emotional intelligence literature—human behavior skill development best proceeds in this order. While it is possible to start with the higher level skills, having those skills without the foundation values, self-awareness and empathy results in less powerful and professional implementation.

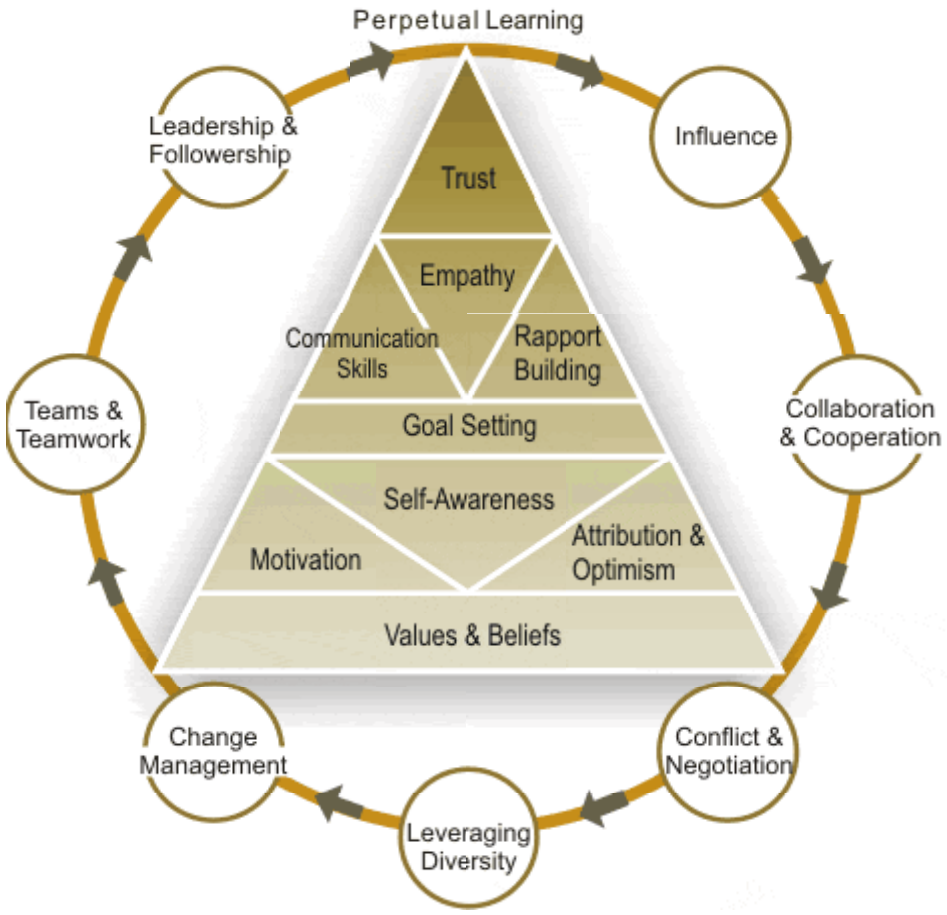
A set of desired skills forms the basis of many developmental activities. An individual is encouraged to ask: "How do my skills and abilities compare to this desired set?" This step assumes the individual is motivated to ask the question and then to do something with the information once it is obtained. That is not always the case and there are many reasons why an individual will not proceed from one step to the next.

Developing Skills

The course is a blend of concepts, theories and practices that encourage engineering students to apply their intellect and problem solving skills to the issues of human behavior. Understanding themselves and others and being able to use that understanding to get better results in their interactions and in their engineering projects is the ultimate objective. While there is certainly an intellectual and theoretical side of the course, there is also a side of the course that demands practice, use, and skill acquisition. For many engineering students the conceptual side is fairly straightforward, but the practice and skill building are quite foreign and somewhat daunting.

While the topics of the course are described in Figure 2, the overall progression of the course follows a skill development model outlined in Figure 3. The initial emphasis of the course on values results in the creation of a personal mission statement that attempts to capture the values and direction in a person's life. The personal mission statement focuses on what you want to be, your contributions and achievements, and on your values and principles.

Figure 2. Course Topics



Given the backdrop of a personal mission statement, member of the class begin to assess their skills and capabilities compared to their overall goals. There are many assessments and activities in the course to give students a sense of their capabilities and to allow them to give self assessments. We are able to use the Emotional Competency Inventory—University Edition (ECI-U) to do both a self assessment and to get feedback from others (Hay Group, 2008). Feedback from others is critical to real assessment and to improvement. In fact, part of the course encourages students to seek feedback (both formal and informal) from many sources.

Figure 3: Course Approach

Desired Skills

Assess Skills ECI-U

Personal Development Plan
(set goals, make commitments)

Opportunities to Learn and
Enhance Skills

Document Skill Improvement
Personal Development Plan Update
Portfolio

Reassess Skill Improvement

Results:
Improved Jobs, Careers, Families & Communities

Based on the Personal Mission Statement and on the competency assessment (ECI-U), we ask students to create a personal development plan that set 3-5 goals, with action plans, that they will accomplish during the semester. These goals are often personal and related to their personal lives. Some of the goals are also a direct result of the assessments we have done in class. The personal development plan has two major purposes: 1) give an experience of students setting goals and improving their personal capabilities and 2) providing a powerful example that can be used beyond the course.

Throughout the semester there are in class activities and assignments that provide students the opportunity to learn and practice the skills. For example, the students participate in a team building lab were they have the opportunity to partake in different stages of team development. They also participate in a service project that allows them to work as a team in developing worthwhile learning activities for a group of special needs students in a local high school. The students also complete an empathetic listening assignment, which allows them to build a foundation in interpersonal skills related to influence, collaboration, negotiation, communication, as well as other skills. There are also many assigned reflections that encourage the students to examine their actions and experiences and begin to increase their abilities to analyze their own behaviors and experiment (practice) with new behaviors.

Toward the end of the course students complete two assignments where they have the opportunity to demonstrate that they have developed their skills and abilities. The first is an assessment of their personal development plan. Did they do what they said they would do? This assessment of their plan is accompanied by explanations of what worked, what did not work and why. In addition, the reported plan also includes plan for the future beyond the course. While there is not an effective way to follow up on those commitments, making new commitments reinforces the development plan concept beyond the course.

The last part of the course is a learning portfolio where students present evidence that they have improved significantly on five of the skills addressed in the course. The class is started with this goal in mind and students are very creative in providing evidence that they have improved their skills. They describe what they have done to improve the skills, provide tangible evidence that they have worked on the skills, and then have supporting documentation of their accomplishments.

Development Opportunities Beyond the Course

While a course may be interesting, systemic organizational change is possible when there are other people and opportunities to develop skills that reach people beyond a specific course. Within our university, many of the skills and the processes associated with the course have become part of the other programs and activities on the campus. Most notably the Illinois Leadership Center (2009) has incorporated many of the elements of this course and is able to reach many more students. The Leadership Center has developed several one to three day workshops that provide wonderful opportunities to explore self-awareness, teamwork, change, and integrity and to build accompanying skills. The Leadership Certificate pairs a student with a coach (faculty, staff, or alum) who works with the student to create a personal development plan and to build a portfolio that demonstrates the development of skills and abilities.

Instead of reaching 50-60 students in a specific course, the Leadership Center is able to reach over 1000 students every year. We believe that there is significant power in studying these concepts and developing skills over the semester time frame, and there are major benefits to encouraging many students to begin developing their human behavior skills and abilities.

References

ABET. (2004). *Sustaining the change: A follow-up report to the vision for change*. Retrieved February 1, 2006, from http://www.abet.org/papers.shtml

Boyatzis, R.E. (2006). Using tipping points of emotional intelligence and cognitive competencies to predict financial performance of leaders. *Psicothema*, 18, 124-131.

Goldberg, D. E. (2006). The entrepreneurial engineer: Personal, interpersonal, and organizational skills for engineers in a world or opportunity. Hoboken, NJ: John Wiley & Sons, Inc.

Goleman, D. (1998). Working with emotional intelligence. New York: Bantam Books.

Goleman, D. (1999). Engineers need emotional IQ. *Engineering. News- Record*, 242, 18, 167.

Goleman, D. (2000). *Working with emotional intelligence*. New York, NY: Bantam Books.

Hay Group. (2008). Emotional and Social Competency Inventory - University Edition. Retrieved February 4, 2009, from http://www.haygroup.com/tl/Questionnaires_Workbooks/ECI_University_Edition.aspx

Hays Group. (2002). Managing with emotional intelligence. *HayGroup Newsletter*, Vol. 2, Issue 2.

Hissey, T.W. (2000). Education and careers 2000. Enhanced skills for engineers. *Proceedings of the IEEE, 8,* 1367-1370.

Illinois Leadership Center. (2009). Retrieved November 22, 2008, from http://www.illinoisleadership.uiuc.edu/

Illinois Leadership Initiative. (2004). Retrieved February 4, 2009, from http://www.illinoisleadership.uiuc.edu/about/skills.asp

Kelley, R. E. (2000). How to be A star at work: 9 breakthrough strategies you need to succeed. New York, NY: Three Rivers Press.

Manseur, R. (2003, November). An ABET-Based seminar course. *Proceedings from the 33rd Frontiers in Education Conference,* 1-4.

Mayer, J., & Salovey, P. (1997). What is emotional intelligence. In P. Salovey and D. Sluyter (Eds.), *Emotional Development and Emotional Intelligence: Educational Implications*. New York, NY: BasicBooks

Moon, Y. B., Chaparro, T., Heras, A. (2007). Teaching professional skills to engineering students with enterprise resource planning (ERP): An international project. *International Journal of Engineering Education*, 22, 4, 759-771.

Orsted, M. (2000). Software development engineer in Microsoft. *ACM Press,* 539-540.

Schutte, N.S., Malouff, J.M., Hall, L.E., Haggerty, D.J., Cooper, J.T., Golden, C.J. (1998). Development and validation of a measure of emotional intelligence. *Personality and Individual Differences*, 25, 167-177.

Selinger, C. (2003). Stuff you don't learn in engineering school. *IEEE Spectrum, 40,* 49-52.