

A Review of Emotional Intelligence by Daniel Goleman: Implications for Technical Education

Dick Culver

Watson School of Engineering and Applied Science
SUNY-Binghamton

Abstract: Goleman's book, Emotional Intelligence, holds some valuable lessons as we attempt to design more effective educational programs. Goleman takes a more holistic approach to defining intelligence than the traditional IQ, which focuses on cognitive intelligence. By incorporating the cognitive AND affective dimensions of intelligence, he demonstrates that, to be successful in life, it takes more than just being "smart." We are all aware of "smart" students who flunk out of college, or those who graduate near the top of their class only to be a failure in the work place. Goleman shows that the seeds of what he calls emotional intelligence are sown early in life, and affect not only how the person gets along with others, but also how they succeed in academic pursuits. In contrast to cognitive intelligence, which is "God given", emotional intelligence can be strengthened later in life with proper tutoring and commitment.

Goleman's ideas are a valuable complement to the author's earlier studies of Perry's model of intellectual and ethical development in college students. This paper describes Goleman's hypotheses and suggests how they might impact technical education.

Introduction

Learning is an emotional process. If you doubt this, recall the excitement you felt when you finally succeeded in working a really difficult problem or finished a major paper. Remember the dread of entering an exam room when you weren't sure about the material. If there is no emotion, there probably isn't much learning going on. Consider the nodding heads in the typical large lecture.

If learning is under the control of the emotions, then it behooves us to understand how we can use them to enhance learning in our students. It is also important to help students know how their "emotional intelligence" works to help or hinder their success as a college student. Fortunately, in the past fifteen years, significant new insights as to how the brain produces emotions have been discovered and the way in which they affect performance in all aspects of life has begun to emerge.

This research has been made accessible to the public in Daniel Goleman's book, Emotional

Intelligence.^[1] Goleman presents convincing evidence that the emotional intelligence quotient (EQ) is just as important in academic success as cognitive intelligence, as measured by IQ or SAT scores. A person with a low IQ may never be able to understand an abstract concept, but there are numerous examples of people with high IQ who never finish high school. A study of high school valedictorians and salutatorians found that only one in four made it to the "top" of their profession in their professional lives. As Goleman states, "The SAT may primarily be a good measure of a person's aptitude for being a college professor." EQ, on the other hand, seems to be a good indicator for success in a variety of endeavors and, with a reasonable IQ, is a good measure of success in college. The good news is that, while IQ seems to be genetically endowed, there is evidence that EQ can be enhanced with proper training and learning environment. So, what is EQ?

Emotions and Emotional Intelligence

An emotion is a physiological response to a situation that is too important to leave to intellect alone, such as danger, painful loss, persisting toward a goal despite frustrations, bonding with a mate, building a family. In effect, we have two minds, one that thinks and one that feels. The brain evolved over a million years to deal with the major challenges of survival - whether to fight or flee, ignore, or embrace the approaching challenge. Although our day-to-day challenges seldom relate to those faced by the caveman, social problems such as road rage, drive-by shootings, and in-your face taunts on the sports field give evidence to emotions out of the control of rational thought.^[1]

While we use hundreds of words to describe emotions, they are commonly related to about eight basic emotions: anger, fear, happiness, sadness, love, surprise, disgust, and shame. Paul Eckman, head of the Human Interaction Laboratory at the University of California, has found that there are characteristic facial expressions to describe the first four of these, which have been found to be consistent in all cultures, including primitive ones with no access to the outside world.^[2]

We cannot remain in a high emotional state for long. Eckman states that the full heat of emotion

lasts for just seconds. At a less intense level, we may have moods that last for hours or days. At an even more fundamental level, we all have basic temperaments that shape our view of life and our role in it. Some people are naturally cheerful or optimistic, while others are negative or pessimistic. These temperaments shape our beliefs about ourselves and the world around us. Goleman suggests that a student with a positive disposition would see an F on a math test as evidence that he needs to work harder, while another may see it as evidence that he is stupid.

Amygdala: The Emotional Sentinel

Researchers like Eckman have identified the physiological process for the emotional rush. When an external stimulus is received by one of our senses (eye, ear, taste, nose, touch) it goes first to the thalamus, where it is translated into the language of the brain. Most of the message goes to the neocortex, the seat of rational thought, where it is analyzed and assessed for meaning and appropriate response. If that response is emotional, a signal goes to the amygdala, a small almond-shaped region in the brain, to activate the emotional centers. But a small portion of the original signal also goes straight from the thalamus to the amygdala, allowing a faster (but less precise) response. Thus, the amygdala can trigger an emotional response before the cortical centers have fully understood what is happening. The amygdala houses memories and response repertoires that we enact without quite realizing why we do so. This fast response can be life saving in desperate situations, but can also result in inappropriate action.

The amygdala matures very quickly in an infant's brain. The interactions between the infant and caretakers during the first years lay down a set of emotional responses, a blueprint for emotional life. More slowly, the neocortex, which is the source of rational thought, evolves based on cognitive training. It is because of this more gradual and extensive development of the neocortex that human beings are capable of the higher levels of rational reasoning unique to our species.

The connection between the amygdala and the neocortex is critical to the functioning of the human mind. A brilliant corporate lawyer developed a brain tumor. When the tumor was removed, the link between the cortex and the amygdala was destroyed. Although he appeared just as bright in analyzing complex data, he lost his job and marriage because he could not make a decision. Decision making is tied to the emotions since it is value-based. It is the design exercises in engineering programs, which require decision making. Donald Woods defines "problem solving", where ill-defined

problems require value-based decisions, as distinct from "exercise solving" which refers to "recalling" familiar solutions to previously-solved problems. [3]

Emotional Intelligence

Properly used, the emotions are an essential tool for successful and fulfilling life. But out of control, emotions can result in disaster. In our day-to-day life, they affect our relations with other people, our self-identity, and our ability to complete a task. To be effective, our cognitive processes must be in control of our emotions, so that they work for us rather than against us. Salovey[4] combined the work of several researchers to define the following measures of effective use of emotion, i.e. Emotional Intelligence (paraphrasing Goleman):

1. *Knowing one's emotions:* Self-awareness – recognizing a feeling as it happens – is the keystone of EQ. The ability to monitor feelings from moment to moment, cognitively as well as affectually, is crucial to psychological insight and self-understanding. An inability to read our true feelings leaves us at their mercy.
2. *Managing emotions:* Handling feelings so they are appropriate is an ability that builds self-awareness. Having the capacity to soothe oneself, shake off rampant anxiety, gloom or irritability is critical to recovery from life's setbacks and upsets.
3. *Motivating Oneself:* Marshaling emotions in the service of a goal is essential for paying attention, for self-motivation and mastery, and for creativity. Emotional self-control – delaying gratification and stifling impulsiveness – underlies accomplishment of every sort. And being able to get into the "flow state" (to be described below) enables outstanding performance of all kinds. People with this skill are more highly productive and effective at whatever they undertake.
4. *Recognizing emotions in others:* Empathy, another ability that builds on emotional self-awareness, is the fundamental "people skill." People who are empathic are attuned to the subtle social signals that indicate what others need or want. Empathy kindles altruism, which is the basis for social morality.
5. *Handling Relationships:* The art of relationships is, in large part, skill in managing emotions in others. This ability undergirds leadership and interpersonal effectiveness.

People differ in their abilities in each of these five EQ domains; some of us are quite adept at handling our own anxiety but not at soothing someone else's. But, the cognitive region of the brain is flexible and is constantly learning. Lapses in emotional skills can be remedied: each of these domains represents a body of habit and response that,

with the right effort, can be improved. This capacity for long-term growth of emotional control is the basis for emerging educational programs, such as the Self Science curriculum described below.

Academic Excellence

Perhaps the most important element of EQ for effective academic performance is delaying gratification. Goleman describes an experiment in which four-year olds were given a challenge: "You can have one marshmallow now but, if you will wait until I have run an errand, you can have two marshmallows." Some grabbed the marshmallow as soon as the experimenter left the room, while others waited as long as twenty minutes. This ability to resist impulse proved to be critical in subsequent academic success. Those children who deferred gratification at the age of four, were more socially competent as adolescents, less likely to freeze under stress, accepted challenges, were self-reliant and dependable; they took initiative and plunged into projects. When the four year-olds who grabbed the marshmallow immediately reached adolescence, they were shy, stubborn and indecisive; they would tend to overreact to irritations with a sharp temper. Upon high school graduation, those who delayed taking the marshmallow had SAT scores over 200 points higher than those who did not, even though there was little evidence of a difference in IQ at the age of four.

Perry's Scheme

In my previous work using Perry's model for intellectual development in the college years, we found that intellectual growth was by no means assured simply by being in college.[5] Perry talked about the emotional risk inherent in moving from one position to another, particularly in the fundamental change which occurs in reaching for position five – *Contextual Relativism*. Perry said that people learn best in their pleasure zone – between panic and boredom.[6] Similarly, Goleman describes optimum performance as occurring when people are in "flow," an emotional state in which the individual is grappling with a challenge which is within reach but requires total concentration.

People who experience flow find it an invigorating state, described as spontaneous joy, even rapture. Athletes achieve maximum performance in flow, as do artists, writers, composers, and musicians. Interestingly, the emotional energy level is low when a person is in flow, because no energy is being expended on anxiety or peripheral concerns. A mechanical analogy would be that of a system which is being excited at its natural frequency. A minimum of effort is required to keep it moving since all input energy is going into reinforcing the desired motion.

Creative achievements depend on single-minded immersion, such as occurs in flow. A study of students in a high school of sciences found that students who were most successful were in flow 40 percent of the time when doing their studying. Low achievers with the same score on a math proficiency test found that study provided flow only 16 percent of the time. More often than not, study created anxiety, with demands outreaching the students' ability.[7] Therefore, a learning environment in which students are challenged at an appropriate level, which can produce flow, will be more productive. Descriptions of the individualized active learning activities used in cooperative learning suggest that it promotes this type of concentration.[8]

Growth and Change

While the intellectual growth that Perry describes can be considered cognitive development, the actual process of facing the challenges associated with that growth is clearly affective. Perry speaks with compassion about the agonizing that students endure as they give up a simple explanation for a more complex and useful understanding of life's challenges.[6] A hallmark of people who have achieved Perry position 5 is the ability for meta-thinking, the ability to step outside oneself and think about the process that is being used to approach the problem - the ability to look at a problem from multiple perspectives. This requires the self-awareness described in EQ. Perry talks about growth occurring in spurts of new discovery and achievement followed by a stabilizing period in which the new insights and capabilities are assimilated into other phases of one's life. This relates to The EQ ability of emotional self-control, to stay with the task until the new plateau has been achieved.

Many of the self-help programs have been developed to assist people in gaining control of their emotions. This is different from suppressing the emotions. Rather, the goal is to get in touch with feelings, to know what causes them and to take appropriate action in response to them. Conflict resolution, performance training, test anxiety reduction, stress management, etc. are all designed to identify the source of stress and focus it productively in order to respond to the situation in a way that will solve the problem rather than making it worse. The old adage, "Count to ten when angry," is designed to give the neocortex time to process the incoming information and decide on a reasoned response rather than lashing out verbally or physically in response to the initial emotional rush. Aikido, a form of martial art in which the respondent moves back or to the side in order to allow the initial attack to be absorbed or to pass by is designed with this in mind.

In Transactional Analysis, the goal is to identify the portion of the mind -Parent, Adult, or Child - which is receiving the message in order to identify an appropriate response which avoids playing psychological games. [9] Keeping the Adult in control allows the Child to play appropriately.

In Emotional Intelligence, Goleman explains that some people are “naturals” at high levels of emotional functioning. For most of us, deficits can result in limitations in performance and satisfaction in one or more parts of our life. For the “naturals”, as with people who have a high IQ, a natural athlete, artist, or musician, appropriate emotional responses come easily without thinking. As we work to strengthen our emotional functioning, the new behavior is learned and so must be applied consciously until it is mastered. Studies of “expert” behavior describe four levels of functioning: unconscious incompetence, conscious incompetence, conscious competence and, at the highest level, unconscious competence. At the lowest level, a person is not aware of his inability to perform a particular task. When he becomes aware of the limitation and chooses to learn the skill required to complete the task, he is at level two. After study and practice, he achieves conscious mastery. With continued practice, he eventually reaches a point where he can perform the desired task without thinking about it.[10]

As we look at our own students, we can see a parallel. Those who do well spend long hours at their homework with a high level of concentration. They have developed a high level of problem solving ability, so they are efficient in learning new material and processes. They can apply these skills to a wide variety of subjects. By contrast, the marginal students learn less efficiently and, typically, minimally. They learn enough to pass a test, but without the satisfaction of real mastery. Studying is an unpleasant and anxious time. Copying another’s homework promotes feelings of guilt, which reinforce the negative associations with study and the topic being studied. Instead, they get their positive feelings from socializing or, at the more extreme level, by drinking or using drugs. [11]

Social Competence

Looking at the ABET 2000 criteria, it is clear that promoting EQ underlies success in achieving the successful engineering program.[8] ABET 2000 identifies 11 competencies that the students should have achieved by graduation. Two competencies deal with knowing science, math and engineering and solving engineering problems. These require the motivation to persevere in study until mastery is attained. Design of experiments and system design require the decision making skills

referred to by Woods.[3] Functioning on multidisciplinary teams, communicating effectively and engaging in life-long learning require effective people skills. Understanding contemporary issues and the impact of engineering solutions on society, behaving in an ethical and professional manner are skills based on empathy.

ABET 2000 is a behaviorally-based set of criteria. Understanding the emotional state of the student and the particular emotional skills required to achieve the stated competencies is critical to designing a successful curriculum. As with our earlier work with Perry’s scheme, which provided a road map for student development, EQ suggests the type of emotional skills required for top performance. The ABET criteria associated with academic performance, such as knowing and being able to solve analytical problems, are fairly obvious. But there are others which are tied to social dimensions: life long learning, team building, social implications of engineering, all of which require empathy and handling relationships. The McMaster Problem Solving instructional program is one of the most effective at addressing these issues.[3]

While we are only beginning to realize the need to teach these topics in engineering programs, industry has dealt with them for a long time. Modern industrial management systems are team-based. They are win-win models in which the team sets goals for collective achievement and everyone wins.[9] Competition is defined in terms of the excellence of the product. It is understood that all world-class products are the result of a shared technology in which competitors borrow (not steal) from each other. This is a mature and socially responsible model for performance and human relationships. It reflects a healthy respect for ones competitors. This approach requires self-confidence, managing emotions, empathy, and communication skill in order to collaborate for a better result.

Incorporating EQ in the Curriculum

Academic programs which incorporate Emotional Intelligence training as part of the curriculum are being created at forward-looking schools such as the Nueva School in California.[14] The “Self Science” curriculum at Nueva deals with the following topics:

Self-awareness: observing yourself and recognizing your feelings, building a vocabulary of feelings; knowing the relationship between thoughts, feelings, and reactions.

Personal decision-making: examining your actions and knowing their consequences; knowing if thought or feeling is ruling a decision; applying these insights to issues such as sex or drugs.

Managing feelings: monitoring “self-talk” to catch negative messages such as internal put-downs; realizing what is behind a feeling (e.g. the hurt that underlies anger); finding ways to handle fears and anxieties, anger, and sadness

Handling stress: learning to value exercise, guided imagery, and relaxation methods

Empathy: understanding others’ feeling and concerns and being able to relate to their perspective; appreciating the differences in how people feel about things

Communications: talking about feelings effectively; becoming a good listener and question-asker; distinguishing between what someone does or says and your own reactions or judgements about it; sending “I” messages instead of blame

Self-disclosure: valuing openness and building trust in a relationship; knowing when it’s safe to risk talking about your private feelings

Insight: identifying patterns in your emotional life and reactions; recognizing similar patterns in others

Self-Acceptance: feeling pride and seeing yourself in a positive light; recognizing your strengths and weaknesses; being able to laugh at yourself

Personal responsibility: taking responsibility; recognizing the consequences of your decisions and actions, accepting your feelings and moods, following through on commitments (e.g., to studying)

Assertiveness: stating your concerns and feelings without anger or passivity

Group dynamics: cooperation; knowing when and how to lead, when to follow

Conflict resolution: how to fight fair with other kids, with parents, with teachers; the win/win model for negotiating compromise.

EQ and Academic Survival

Our engineering students, as a group, come from a responsible segment of the youth culture, but they are still part of it. It is easy to assume that they do not suffer the problems that we hear about on the news. But they still are influenced by the messages that are being sent to them by TV, movies, the Internet and their peers. Youth today are, according to educational research, over-stimulated.[15] They tend to have short attention spans, and are more likely to respond emotionally to a challenge than in previous generations. Curricula like Self Science and the new “Danger High” computer multi-media game are being used to help youth deal with the challenges in their environment.[16]

One of the most stressful times in a person’s life is the first year of college. A freshman is away from home for the first time. They have to make new friends and don’t know what the social code is. They are in large, impersonal classes, studying material that may be beyond their ability. A large number make very low grades on their first exams,

particularly in subjects like math and physics. If they have never dealt with academic failure before, this may be thrown on top of the pile of emotional drivers that already have them confused and frightened. It is not surprising that they are tempted to turn to drink and/or drugs to ease the pain and confusion, or sleep in for half the day, missing classes and getting further behind in their work. They are clearly out of their pleasure zone. Knowing how to control their emotions is critical to survival of that early period of transition to college. Of course, for some that is not a problem.

Dan Budny’s research shows that students’ first semester grades are the best predictor of satisfactory completion of the college degree, much better than SAT scores or class rank in high school.[17] I contend that their ability to excel in the first semester is in large part a measure of their EQ. Students with a high EQ are prepared to deal with the challenges of the new environment, setting up a responsible schedule and study plan, meeting new people, and dealing with the frustrations and anxieties of being out of control of the new environment. For those that are not well prepared for this, the college has an opportunity to provide programmed support so that they have a chance of survival. The student has to show some responsibility in taking advantage of what is provided, but an impersonal program will doom many potential engineers to leaving the program before they get started.

With Goleman’s clear description of EQ, we have a new insight into what such a program should provide and the reasons for it. In a future paper, I will survey some of the innovative programs being developed in engineering schools across the country and indicate how they are working to promote a more effective EQ in their students.

16. "Danger High," Multimedia Program available in high schools, described in PBS program on youth violence.

17. Budny, Daniel, Goranka Bjedov, and William, LeBold, "Assessment of the Impact of The Freshman Engineering Course," Proc. - Frontiers in Education Conf., Pittsburgh, 1997.

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