Translating Engineering Soft Skills to the K-12 Classroom

A call to action more than a decade ago shifted educational efforts in science, technology, engineering, and mathematics. The clarion call pointed to major shortfalls in both the quality and quantity of Americans educated in the STEM disciplines, and spawned STEM education efforts targeting kindergarten through 12th grade (K-12) students. As a response, the Next Generation Science Standards were developed and included integrated engineering practices; thus, promising instructional models for teaching engineering in K-12 classrooms emerged. Ongoing efforts in engineering education have supported the acquisition of a wide range of knowledge and skills associated with comprehending and using STEM knowledge to accomplish real world problem solving through design, troubleshooting, and analysis activities. However, research has shown that curriculum and pedagogical approaches are not enough.

Although the introduction of engineering education into K-12 classrooms presents a number of opportunities for STEM learning, it also raises issues regarding authentic talent development in the STEM fields including engineering disciplines (Adams et al., n.d.). The plethora of initiatives focused on increasing teachers’ STEM knowledge through professional development, and institutional challenges such as curricular standards and high-stakes assessments drive STEM education in K-12 classrooms. However, an agenda for research, policy, and practice targeting the identification and development of talent in STEM disciplines has emerged (Subotnik, et al., 2009).

New concepts in the last decade of the twentieth century facilitated new approaches to identifying and developing giftedness in young people through a talent development model. The construct of talent development involves identifying and promoting domain-specific abilities (e.g., the sciences or mathematics) into competencies that lead to emerging expertise. Even with a body of research supporting a talent development model for STEM disciplines, ‘soft’ skills such as personality traits and interpersonal skills are not considered; thus leaving us with an incomplete profile of characteristics that are often expressed by workforce engineers. As American education ramps up its efforts to meet the demand of highly qualified STEM workers, it is imperative that teachers become better at identifying and honing talent including students who express traits that make them probable candidates for engineering careers.

Profiling engineer soft skills: Personality traits and emotional and social competence. Five personality traits are the best accepted and most commonly used to describe personality in academic psychology. They are: (a) Openness; (b) Conscientiousness; (c) Extraversion; (d) Agreeableness; and (e) Neuroticism. Within this psychological context, personality traits of engineers have been historically explored to some degree. As early as 1960, Carroll Izard reported that things and processes appeal to engineers more than do people. A study conducted in 1998 found that construction and design engineers share similar predominant introverted personality traits, preferring to focus their energy on the internal world of ideas and possibilities (Johnson & Singh, 1998). These indicators suggest that common personality traits exist among engineers and contribute to a profile of engineers.

Similarly positioned within the realm of psychology, emotional and social competence is found to contribute to one’s thinking and behavior. Research indicates that emotional and social competence such as communication and interpersonal skills affects one’s creativity / innovation, problem-solving capacity, futuristic thinking, continuous learning capacity, and personal effectiveness (Balaji & Somashekar, 2009). Twelve competencies across four domains (self-awareness, social awareness, self-management, and relationship management) are associated with emotional and social competence. A clear distinction is drawn between so called ‘hard’ technical or scientific skills’ such as the ability to solve mathematical problems, the ability to design systems, or proficiency in a computer programming; and ‘soft skills’ which relate to the way people connect and interact with others, more specifically referred to as interpersonal skills. While ‘hard’ intellectual skills still dominate in STEM disciplines, there appears to have been a transition in the workplace where it was suggested that emotional and social competencies are just as important in the engineering workforce (Balaji & Somashekar).

Thirty years ago, Howard Gardner’s work recognized that intrapersonal and interpersonal intelligences were just as important as the type of intelligence typically measured by IQ, while later studies have declared them to be even more important. For example, Feist and Barron (1996) wrote that social and emotional abilities were four times more important than IQ in determining professional success and prestige, while engineering successful guru Bill Chou proclaimed that hard skills help us qualify for a job but soft skills dictate our capacity for growth.

As we spend time attempting to identify STEM talent in our K-12 classroom, we need to start considering other important traits. Who are the probable candidates to enter a STEM career like engineering? As we begin to learn more about these “soft skills,” we are more likely to be success in fostering the next generation of engineers. TNP

References
Adams, C., Chamberlain, S., Gavin, M. K., Shultz, C., Sheffield, L. J.,...
tual and psychosocial needs of our racially and culturally diverse gifted learners:

- Accept and fully integrate social justice ideologies (history and daily impact of implicit bias, microaggressions, codeswitching, color blindness, white privilege, etc) into gifted education training programs.
- Ensure that all teachers of the gifted have knowledge of basic social justice terminologies and their histories
- Allow time during training for teachers to have open conversations about their belief systems as related to systemic practices related to identification of gifted students (Who can be gifted?)
- Create panel discussions with racially and culturally diverse students as panelists to share their experiences with gifted and advanced learner classrooms;
- Ensure that all curriculum and instructional materials are representative, culturally responsive, and historically authentic;
- Incorporate rich and frequent visits/engagements by teachers in racially and culturally diverse communities, including hosting gifted education information sessions at community sites; and
- As teacher leaders, gifted education personnel should be prepared to become trainers and lead the efforts in the anti-bias awareness and training in their school communities

As shown in the Figure 1, ideally, a school's instructional programs for gifted students from racially and culturally diverse origins should integrate instructional rigor, culturally responsive strategies and resources, and social justice ideologies to meet the needs of a changing student population. The suggestions offered in this brief column provide a beginning for what should be a major paradigm shift in our programming and services for the best and brightest from all communities. We have so much more to do to ensure that gifted programs are ‘socially just’ for all of our students. THP

Resources

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as students explain and defend their new, unique, or varied ways of relating problems to prior knowledge or other problems, strategies for approaching solving the problem, or mathematical insights, ideas, or questions that can be communicated to others. THP

References

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