feature article

# teaching personal skills in technology and engineering education: is it our job?

*It is every teacher's responsibility to prepare youth to be professional and ethical in their future dealings in classrooms or the workplace.*

by Thomas R. Loveland, DTE

## Introduction

Recent papers on career and college readiness have emphasized preparation of secondary students for either future college and/or career choices (Robles, 2012, Rateau, Kaufman & Cletzer, 2015). While technologies used in business change rapidly and make the teaching of job-specific skills somewhat impractical, the foundational skills needed for success in postsecondary education and future work continue to be considered crucial at all levels of society. Foundation skills are those that cross academic and career boundaries. They include basic skills, thinking skills, and personal qualities. This article will explore the inclusion of personal qualities or characteristics that can be taught in technology and engineering education classrooms.

## Foundational Skills Rationale

Discussions about foundational skills began nationally with the release of the Secretary's Commission on Achieving Necessary Skills (SCANS) from the U.S. Department of Labor in the early 1990s (U.S. Department of Labor, 1993). This report was a result of public concern that the American educa-

**Photo 1** (above). Meade High School students Devin Hennayake, Deneen Morris, Justin Schwartz, and Rhett Coleman demonstrate self-management and collaboration soft skills while working on their engineering technology project.

tion system was out of touch with the needs of the economy. According to the SCANS Report, schools should be teaching the **basic skills** of reading, writing, arithmetic and mathematics, speaking, and listening; **thinking skills** of thinking creatively, making decisions, solving problems, knowing how to learn and reason; and **personal qualities** including individual responsibility, self-esteem, sociability, self-management, and integrity.

Other organizations and authors have identified foundational skills as well. The National Academy of Engineering (2010) identified engineering habits of mind that included systems thinking, creativity, optimism, collaboration, communication, and attention to ethical considerations. Freifeld (2013) reported in *Bridging the Skills Gap* that there is a skills gap between what is taught in science, technology, engineering, and mathematics (STEM) and what employers desire. The soft skills identified in this report were in the areas of communication and leadership. This included verbal communication and writing skills, self-motivation, learning agility, self-awareness, adaptability, critical thinking, dependability, the ability to get along with others, and problem-solving skills. Robles (2012) reported on the perceived level of importance of soft skills by business executives. The ten soft skills in order of importance included integrity, communication, courtesy, responsibility, interpersonal skills, positive attitude, professionalism, flexibility, teamwork, and work ethic.

Harris and Rogers (2008) identified sixteen nontechnical competencies and affective domain attributes through a research study of technology education professors from three universities. Selected foundational skills receiving high mean scores were effective communication, honesty, willingness to learn, open-mindedness, problem solving, following directions, public speaking, work ethic, interpersonal communication, organization, and understanding group dynamics. In a study on teaching soft skills for entrepreneurship, Robinson and Stubberud (2014) reported that important foundational skills included the ability to be creative, recognize opportunities, network effectively, and work well in teams.

Whether discussed decades ago or just recently, foundational skills continue to be viewed as an important element of human success. While it may be relatively easy to write lesson plans that include creative and critical thinking, problem solving, organization abilities, and reading abilities, it may be more difficult for a teacher to operationalize intrinsic characteristics in STEM classrooms. For the purposes of this article, the author is grouping these foundational intrinsic characteristics into six categories: self-management, collaboration, integrity, communication, optimism, and adaptability. These personal characteristics can be developed in technology and engineering classrooms and are outlined below.

### *Self-Management*

Self-management covers the personal qualities of being individually responsible, self-aware, dependable and self-motivated, having a work ethic, and an ability to follow directions. Freifeld (2013) stressed the importance of employees owning their own work and not being dependent on managers telling them what to do. Individuals who take responsibility are able to take charge of their own work, which contributes to an organization's goals. Self-managed individuals, whether in the classroom, college, or at work, are able to complete tasks without extra drama and problems. Lawanto (2005) refers to self-management in engineering education as a student's ability to plan, regulate his/her actions through constant readjusting, and evaluate his/her learning. Successful self-managed individuals are often described as task completers.

### *Collaboration*

The second personal characteristic is collaboration. This is described as one's sociability, ability to work on teams and to get along with others. In *Advancing Excellence in Technological Literacy* (*AETL*) (ITEA, 2003), there is a program standard that addresses this attribute. Class activities with work teams are part of *AETL* P4-A: *Create and manage learning environments that are supportive of student interactions and student abilities to question, inquire, design, invent, and innovate.* Loveland and Dunn (2014) stress that collaboration skills are important in the global world in which we live and work, with transnational work teams common in industry. Lawanto (2005) reports that engineering education students need to develop collaboration skills to succeed in team-based environments to solve open-ended engineering problems. These skills go beyond individual technical skills to include management of organization through team-building skills.

### *Integrity*

Individuals with personal integrity pay attention to ethics in their work and personal relationships, are honest, and show respect for diverse cultures. These individuals are culturally sensitive by being respectful of the many cultures represented in schools, colleges, and the workplace. *AETL* (2003) Standard P1-E: *Assure that the program incorporates suitable cognitive, psychomotor and affective learning elements* includes prompts about teachers encouraging students to develop perspective and empathy in class activities. Individuals with personal integrity are careful about what they post in social media and how they respond in emails, Facebook, and Twitter.

### *Communication*

Communication is a process that people use to inform, educate, persuade, control, manage, and entertain. As a personal attribute valued in schools, colleges, and the workplace, communication is a person's ability to listen to others attentively, discuss their own ideas in a cooperative way, be able to write responses to

inquiries that are understandable, and make presentations to groups. Harris and Rogers (2008) indicate that the most sought-after attribute in students as indicated by university professors was being able to communicate effectively through writing and proper grammar. Individuals are considered to be good communicators if they meet these criteria.

### *Optimism*

Optimism is tied to one's self esteem and is seen by others as friendliness or having a positive attitude. Robles (2012) describes outward examples of optimism as enthusiasm, encouraging of others, being happy and confident. Loveland and Dunn (2014) report that optimistic individuals see the world as a positive place, and this attitude can provide them with benefits. In engineering, optimism is linked to motivation and persistence in solving engineering problems.

### *Adaptability*

The final personal quality is the individual's adaptability or open-mindedness. How flexible is a person when presented with contrary information or other ways of doing things? Does the person come across to others as rigid in his/her beliefs? Can they adjust to new realities and be teachable? Harris and Rogers (2008) reported two competencies with high means that university professors deemed worthy in technology education: a willingness to learn and being open-minded to new concepts and ideas.

## Developing Personal Characteristics in Technology Education

There are ways to enhance and promote these positive character traits in technology and engineering education students in order to have a positive impact on their lives and to prepare them for future college or career choices. The nature of technology and engineering classrooms lends them to group design activities in lab settings. Teachers can help develop student abilities to work effectively by requiring negotiation of solutions in projects (Robinson & Stubberub, 2014). According to Fox-Turnbull (2012), action and activity are social undertakings that involve social activities with other people, and the activities are culturally situated. The teacher uses guided participation to challenge, constrain, and support student learners through problem-solving lessons. This type of teaching provides students with social experience in working with others in appropriate ways to promote group goals (Fox-Turnbull, 2014).

Self-management can be enhanced in technology and engineering classrooms through structured activities with firm deadlines. The teacher can model how to backdate the starting time and indicate progress checks in the planning stage with students. More assessment points linked to meeting deadlines can reward project completers to help motivate students. Self-management can be increased by giving students choices within activities and by assigning manager responsibilities. Lawanto (2005) described an engineering education project involving the design and construction of a hydraulic bicycle. Self-management and collaboration were assessed by criteria related to team management and meeting administrative tasks. The results indicated increased equalitarian spirit, cooperativeness among the students, and completion of tasks from working together on this open-ended engineering project. One indication of self-management is coming to class on time.

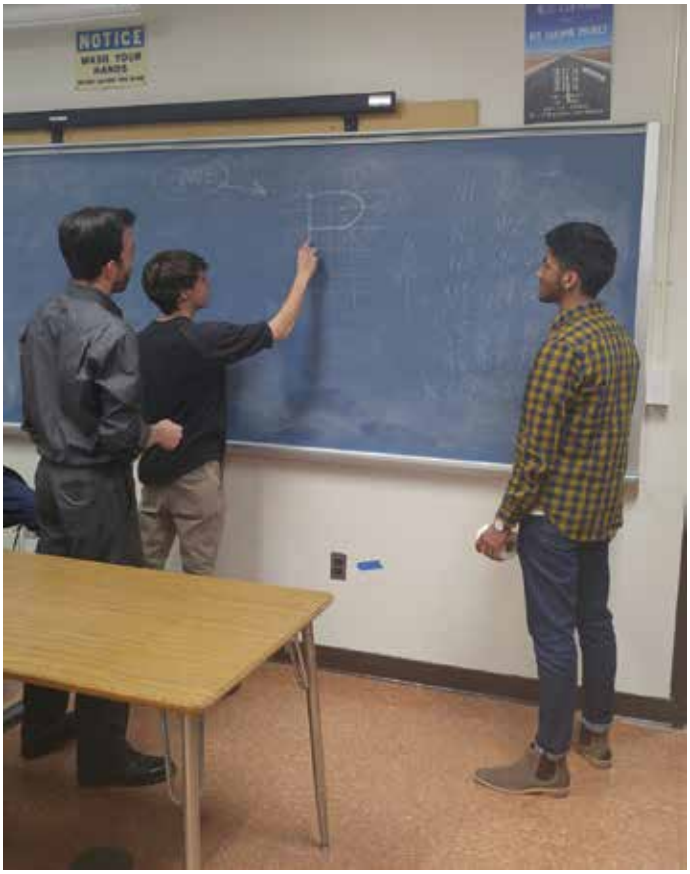


**Photo 2.** Meade High School Technology and Engineering teacher Kevin Koperski listens as Rhett Coleman and Devin Hennayake explain their out-of-the-box solution to a problem, demonstrating optimism and adaptability.

Another example of teaching self-management might be a teacher inviting guest speakers from new industries to discuss the speed with which new products must move from development to distribution in order to increase or hold market share. An example question might be to inquire about what would happen if Apple Computer halved the amount of time before a new iPhone release. What are the responsibilities of its employees in this heightened deadline environment?

Collaboration can be embedded in class activities by increasing the number of small-team activities and projects. Just increasing the number may not enhance a student's personal qualities of collaboration, though, particularly if allowed to choose their own

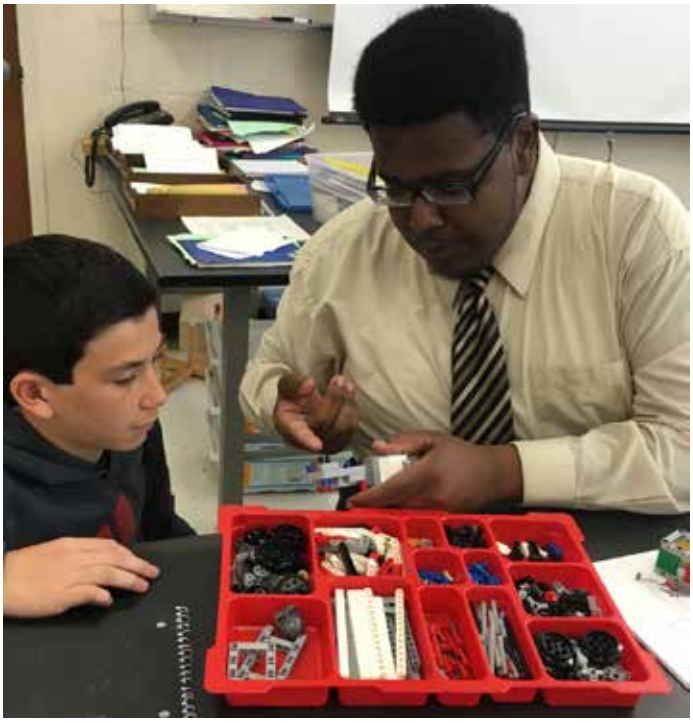

**Photo 3.** Charles Evans, Technology Education teacher at East Middle School in Westminster, MD works with his student John Alcorn (left) on how to communicate his thinking about the design process on a class project.

partners. Kelley (2013) suggests technology teachers be purposeful in their approach to grouping students in design teams. Teachers need to teach students how to work effectively in small groups. One strategy is to group students by diverse personality traits as indicated from personality profile test results. Other strategies to enhance collaboration could include creating global projects by working with classrooms in other parts of the country or the world. A technology education teacher in Florida successfully ran a Japan Florida Teens Meet Project (JFTMP) for five years with a Japanese high school class. Projects included multilanguage dramatic anti-smoking videos and a scale model International Space Station built by transnational student teams. The American students' attitudes and abilities increased substantially from working with diverse cultures on this long-term project.

Technology teachers can develop other lesson plans, depending on their program area, that deliberately place students in contact with and in a support role for disadvantaged people in their communities. Service projects like Habitat for Humanity, raising funds or awareness for not-for-profit organizations, developing technological solutions for assistive learning, and other projects can teach technological literacy while including elements of social ethics. Student lives and beliefs regarding integrity can be transformed by these service projects. Student participation in Technology Student Association in-school activities and competitions at district, regional, state, and national levels helps to develop leadership skills, particularly pertaining to the personal characteristic of collaboration.

Communication, especially in public, can be a daunting prospect for youth. To stand up and confidently present a point of view before a group of peers or adults can be stressful. Providing opportunities for small-group presentations can help youth develop these skills to communicate in social situations. Kelley (2013) pointed out that technology education classrooms are natural places for student oral presentations of design results and portfolios. Developing good listening skills in youth is just as important. Other activities that increase communication skills include having students organize a field trip, hold a class debate, and arrange simulated employment interviews. Freifeld (2013) reports that the current educational system does not teach the communication, problem solving, and critical thinking that are required for successful employment. While difficult in most academic subject areas, these skills can be taught effectively in technology and engineering education.

Optimism can be contagious in a technology and engineering classroom through the example set by the teacher. If teachers are optimistic and friendly and provide positive encouragement to their students as they learn and develop, this will help students to be positive. How can projects and learning activities be adapted to help students be more positive? Areas in which teachers have an impact are sequencing lessons to build skills, organizing learning activities to maintain momentum, including formative feedback throughout the process, and designing fair assessments that reward accomplishment and effort. Sometimes thinking outside the box to develop eye-catching and exciting learning activities can promote optimism. Holding celebrations of student accomplishments and posting pictures of successful students in the classroom can help to promote a positive environment.

Adaptability or open-mindedness can be enhanced in people through technological projects and lessons. Strategies to increase inherent flexibility can include problem-solving discussions based on authentic life situations and having students role-play work settings (Robles, 2012). Rateau et al (2015) suggest having students work in teams to solve problems in order to understand divergent perspectives. Harris and Rogers (2008) point out that the use of design activities can force students to work outside of their comfort zones. This experience of adjusting to new things and other ideas to accomplish goals can promote personal flexibility. Teachers should try to teach students that there is value in change.

## Summary

Soft skills development in school settings is often difficult to quantify and assess. The results of projects and learning may not bear fruit for many years. Should technology and engineering teachers decide to forgo this part of teaching, they are doing a disservice to their students and society at large. It is every teacher's responsibility to prepare youth to be professional and

ethical in their future dealings in classrooms or the workplace. Fortunately, technology and engineering classrooms offer excellent opportunities to inculcate these social and personal skills in students.

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