

## *From the Editor*

### **Passing the Baton at the Intersection of Acronymium and Heritage Roads**

Over the course of my 44 year career I have been interested in polymers. However, as my teaching responsibilities changed, my connection with the technical literature in polymers peaked and waned. If I needed to reconnect with what was happening in that field I knew that it would take several months of reading trade magazines before I could become literate (a truly valid use of the term “literacy”?) about the latest polymer acronyms. This occurred most recently when I began my current position at Millersville University about five years ago. As with my past reentries, I once again became a subscriber to *Modern Plastics*. To my pleasant surprise every acronym is now defined parenthetically in the articles. This dispelled a bit of my feeling that acronyms and esoteric words were two of the many ways in which a discipline or field of study builds a wall around itself, preserving the knowledge niche inside exclusively for those who have somehow earned the right to dwell there.

Long before I began my career, professionals in the field worked hard to establish what is now known as technology education as an essential part of the education of everyone. The bottom line in this quest for acceptance is often defined by the extent to which technology education is a required subject in the schools. Over the years we have both gained and lost in this quest. At this point it is probably a safe supposition that fewer students have a technology education experience now than they did when I began my career.

STEM (Science, Technology, Engineering, and Mathematics) programs have become pervasive in education these days. STEM programs are parallel in some respects to “green” products and “organic” foods – they are everywhere. The promotion and support of STEM has resulted in an unprecedented feeling of elation about finally being recognized as a valuable player in education since the T stands for Technology and technology is what we are all about. The growth of STEM has certainly helped us move forward in many ways, but there have been some unanticipated consequences as well – at least those in our field did not expect them. Even now, many leaders in STEM initiatives have decided that the T does not represent the technology that we know and love but rather it is educational technology, used to augment the teaching-learning process. Moreover, STEM curricula and co-curricular projects have been developed that most of us clearly feel belong in our field, but are not. Science is increasingly

using design and make activities to teach about science and technology in concert. In a sense, this should not necessarily be surprising to us since STEM projects have been supported with funding from government agencies, such as the National Science Foundation, that do not necessarily require any connection with our field. Moreover, we made the decision that our curriculum standards would not be exclusive to our field, but would serve all those who wished to develop technological literacy among our citizenry. We could have tried to be territorial about this, as has been the case with many of those required subjects to which we aspire to be like – and I have to admit it requires a lot of lip-biting not to do so. However, the principled end is to develop a universal understanding of technology among everyone, a goal that every citizen should support regardless of what sector of education will actually make it happen.

I have found myself on occasion using a word without giving much thought to what the word really means or implies. This is the case with the word exclusive, one that I have already used several times above. I have stayed at “exclusive” hotels, responded to advertisements for “exclusive” offers, and have attended “exclusive” celebrations and events. What I did not think about is what the word really means, that it *excludes* certain individuals.

Despite the fact that we have not realized the T in STEM like we had hoped, arguably STEM is an exclusive movement in education. Even though others in the movement may not see us properly dressed for the occasion, we nevertheless have at least earned admittance. However, all the other subjects in the school, those that the authors of *Technically Speaking* proposed to be among the deliverers of technological literacy – the non-technical subjects in the school – are excluded. It was written:

The committee urges that these initiatives be continued, and, in addition, attempts should be made to include technology content in other subjects, such as social studies, civics, history, geography, art, language arts, and even literature (National Academy of Engineering and National Research Council, 2002, p. 104).

Art educators exemplify one group who feel like we have felt many times in the past, like they are on “outside looking in.” Platz (2006), is one example of an art educator who proposed that STEM be changed to STEAM in order to include art in the acronym. The same argument that Platz used for inclusion pertains equally to other subjects such as social studies, humanities, and virtually all the subjects not included in STEM.

STEM has appeared so much in educational circles and has been used in so many ways that one has to wonder if it has lost its value. STEM has been mentioned several times in our local newspaper without any definition of what it means, as though the readership already knows what it is. What are the valid hallmarks of a STEM program? Is the exclusiveness of STEM defensible? Has STEM really made a positive difference in the education of our youth? Would students enrolled in STEM programs have pursued careers related to STEM anyway? Does the general public, including the parents of school-age children, know what STEM means or is the acronym really known only by those inside

the education knowledge niche? Do the titles and acronyms we continue to develop in general serve a valid purpose in improving communication with those we serve, or are they really the means to simply make us feel better about ourselves?

Certainly students need to be more competent in mathematics and science than they are now. We are committed to the belief that everyone should be technologically literate and we hope that this ideal will reach fruition. Though the data are mixed, perhaps there is a need for more engineers, scientists, and mathematicians than we are currently preparing. However, most consumers will not purchase products unless they are aesthetically pleasing. Everyone needs to be knowledgeable about civics, society, and history in order to responsibly participate in our democracy, albeit our technological democracy. Everyone one needs to have improved communication skills. Moreover, I am convinced by the students with whom I have worked over the years that not everyone who wants to work in engineering or technology needs to know calculus or how to model phenomena mathematically in order to solve technical (or technological) problems, develop creative solutions, and consequently be successful in STEM-related careers and contribute to society. In this regard, Charles F. Kettering, the inventor of the automobile self-starter and head of research and development for General Motors, always comes to my mind. After he had successfully developed the self-starter, he presented his work at a meeting of the American Institute of Electrical Engineers. According to all the theories and formulae of the time, the motor of the self-starter was far too small and the battery and associated wiring were significantly undersized for it to work properly. During the meeting, one engineer stood up and said:

No wonder this man can make a self starter. He transgresses every fundamental law of electrical engineering. If you want to make a self starter that way you are welcome to it. I am an honorable electrical engineer, and I refuse to do that. (Boyd, 1957, p. 76)

Kettering, an engineer himself, remarked, “All human development, no matter what form it takes, must be outside the rules; otherwise we would never have anything new” (Boyd, 1957, p. 76). Apparently no one at the meeting other than Kettering thought about the short time the self starter operates in order to start the engine. It is imperative that we do not create a curriculum that results in the exclusion of the creative minds of students who have a multitude of interests that span all disciplines, who will become the innovators of the future.

It is unfortunate that few manuscripts have been published recently in our literature about the history of our field, as though our current practices and proposals for the future, either by intent or oversight, are completely disconnected from our heritage. An exception is the article by Scott Warner in this issue. It seems imperative that our current leaders, especially those not grounded in technology education, look to some of our leaders from the past, especially those who argued that technology cannot be studied in isolation from other disciplines – that one of its unique potentials is to unify virtually all disciplines and enable students to make sense of the larger world as a result.

Whenever I get together with my “old cronies” the conversation inevitably ends up being a discussion of whether or not the field is headed in the right direction. It seems to me that we have always been at a crossroad. While I was an undergrad at Montana State University, the crossroad was general education versus vocational education. Then it was hand tools versus machine tools, manual drafting versus computer-assisted drafting, letterpress versus offset press, traditional versus contemporary, modular versus conventional, and so forth.

When I think about where we are now, logic tells me the following story. We decided that our focus was going to be on technological literacy and then developed curriculum standards to achieve this goal. Very significant organizations and individuals rallied around this cause and continue to do so – some understanding who we are and others who do not. Two very influential and powerful groups, the National Academy of Engineering and the National Research Council, stated:

Short of the widespread adoption of dedicated courses in technology – an unlikely scenario in the committee’s view – the inclusion of technology subject matter in other academic areas is one of the surest ways of increasing the visibility of technology in U.S. schools. (NAE & NRC, 2002, p. 104).

The widespread adoption they mentioned has not, in fact, happened. What has been happening, though, is that their vision of the inclusion of technological content in the “other academic areas,” especially science, is beginning to be realized. At the other end of the spectrum are courses that could be classified as neo-vocational – “neo” meaning vocational education that goes to the baccalaureate degree level. Project Lead the Way is one example of this approach.

So where does that leave us? It seems that if both ends of the spectrum are realized, then we are left in the middle, arguably where we have been for decades. What students can we attract in this middle ground? If we play our cards right, we may be able to attract the same wide range of students that the industrial arts days attracted a few decades ago: Students who are interested in technology but could not afford the class time or did not want the depth of vocational education. Students who wanted to learn skills and understanding to make them wise consumers of the products they would buy. Students who wanted to express themselves creatively through making something useful and tangible, developing some life-long leisure interests along the way. Students who wanted to understand more about the human-made world in which they live. Students who wanted to be freed from the hours of seat work that they endured for most of the rest of their school day. In fact, these are the ideals that make up much of our heritage.

We have tried so hard to get respect for what we do. However, it seems that most of the criticism to which we have tried to respond has come from within the educational and academic community rather than outside. Starting at the university level, some professors in our field tried to “academicize” their programs, reducing the practical experiences they provided to their students,

attempting to make them more like those of their colleagues across the campus, and hoping to consequently reduce the vulnerability of their program. If successful, they then promoted the same approach for the public schools.

The need to be more “academic” spread to the teachers. Ironically, as this was happening, it seemed like those we were trying to emulate were desperately seeking ways to provide more hands-on learning experiences for their students, as if the two were headed in opposite directions. In retrospect, it appears as though some teacher educators and teachers alike abandoned their fundamental beliefs, trying to fit into the rest of the academic community, forgetting about the unique experiences that they could provide to their students – experiences that no other part of the educational enterprise could even hope of providing.

Several things have occurred recently that made me give pause to what we are doing. One was what I read in *Shop Class as Soul Craft* (Crawford, 2009) that I cited in my last From the Editor. Since that time, several other things have occurred that have caused me to reflect. One was the happenstance of hearing the audio portion at the end of an episode of the *Cool Tools* series on the DIY Network that aired on January 11, 2010 in which the speaker said that his organization, The Crucible, was formed because students no longer were learning how to work with tools and materials in school because “shop classes” had been eliminated.

The Crucible is a non-profit educational facility that fosters a collaboration of Arts, Industry and Community. Through training in the fine and industrial arts, The Crucible promotes creative expression, reuse of materials and innovative design while serving as an accessible arts venue for the general public....The Crucible has thrived and grown to become the largest nonprofit industrial arts education facility in the United States. Together, we have brought the positive creative force of art into our community, each year introducing more people to the rewards of creating with their hands and imagination.  
(<http://www.thecrucible.org/home>)

Dean Kamen was recently honored with the Engineering: Inspired Problem Solving award by *Popular Mechanics* magazine. Dean founded the FIRST robotics contest with which many of us in technology education are familiar and in which our students have participated. He is an engineer and an inventor of wide repute. The two-wheeled Segway vehicle is among his many inventions. In an article associated with the award it was written:

Dean Kamen’s first visit to a machine shop was a revelation. He was too young to drive, so he bummed a ride. The smell of oil, the glistening equipment, the grinders throwing sparks – so this is how precision parts were made. When Kamen started his first company, while still in high school, he outfitted his own machine shop in his basement. ‘Each time I bought a tool,’ he says, ‘I extended my capability to do something, to make something’ (Ward, 2009, p. 71).

In the interview included in the article, Kamen was asked if there was enough hands-on learning in the schools. He stated that most of what students learn in school is at a high level of abstraction, especially in mathematics and science. He said it was akin to trying to teach someone how to play football by teaching

all the rules and strategies over the course of 12 years of schooling, but never letting them “touch the ball or play the game” (Ward, 2009, p. 73).

David Hoff, wrote in response to the Kamen award, stating:

I agree 100 percent with Dean Kamen. . . . Throughout high school I looked forward to college, thinking I would finally have the chance to practice the theory I was learning. But after I got there, I did not have the opportunities I had expected – it was just more lab reports and textbook homework. I couldn’t even use the machine shops to make parts for a robot I was building on my own time. With just one semester left before I complete my B.S. in engineering, the only things I have built are a model of a lathe and a small aluminum truss.

There has to be hands-on learning in schools and universities, or students will lose interest in science and technology. (Hoff, 2010, p. 6).

Assuming, then, that we want to play a role in preparing engineers for the future in our secondary programs, does it make sense to move the theory from collegiate engineering programs down into the high schools? Or does it make more sense to provide the hands-on experiences with real tools and materials that have been our successful heritage, exciting students about engineering and technology – perhaps even exciting them to have the motivation to learn the prerequisite theory for a career in engineering. Might this not be the way to get more Dean Kamen’s and more David Hoff’s into technology and engineering?

Learning-wise, do we not typically engage in practice first and then develop a consequent interest in the theory? Do children first learn the theory of how to play with blocks before they are allowed to actually build something with them? Do we learn the theory of the internal combustion engine before we are allowed to drive an automobile? Though documentation is a necessary part of the world of business and industry, I have yet to meet a person who really enjoyed doing it. Knowing this, do we have to insist that our students document everything they learned in our classes until it extinguishes all the fun and excitement that they had?

I have been a subscriber to both *Popular Mechanics* and *Popular Science* magazines since I was in high school (and “read” *Popular Science* since I was about six years old). I have been amazed with how much attention both of these publications have been paying to education over the past couple of years. With this new emphasis, could these publications be a way to finally get the public support for what we are doing and trying to do? William Wulf is a member of the Editorial Board of Advisers of *Popular Mechanics*. He is also the President of the National Academy of Engineering and in this role served as the cochair of the Task Force charged with conducting a formal review of our curriculum standards. He has also been involved with ITEA in a number of other ways.

This issue of the *Journal of Technology Education* marks the end of my 11 year tenure as editor. The decision to step down was a very difficult one to make, more difficult than nearly any other big decision I have made in my life. I have been connected with the JTE for over 20 years and it has been a very

significant part of both my professional and personal life. It has been a labor of love in all respects and my departure will most certainly leave a huge void within me. I can already feel it and it is much like the “empty nest syndrome” that occurs when the last child leaves home to enter the “real world.”

I have been blessed to have the support of the Editorial Board and the thousands of hours they have collectively devoted to this publication. I will always be indebted to them. Marc deVries, University of Eindhoven, The Netherlands, has been on the Editorial Board since the first issue. Of course a publication cannot be successful without readers and I am thankful to all the subscribers and those who have downloaded several million articles each year. Heartfelt thanks are also due to ITEA Executive Director, Kendall Starkweather, and founding editor Mark Sanders, my former colleague at Virginia Tech. There is no doubt that I have gained in personal development, knowledge, intellectual curiosity, new friendships, and opportunities far more than the effort I have put into it.

While I was in high school I tried to “find myself” athletically. One of my ventures was running relay races. After dropping the baton twice during the handoffs, the coach decided that I needed to explore some other event. I feel confident that I can pass the baton to the next editor with confidence. However, I did place a little piece of paper inside of it with following items written on it, summarizing some of the major points I have tried to make in my From the Editor columns over the years:

- Technology education will prosper to the extent that we can provide unique, problem-based learning experiences to our students with real tools and materials.
- Students learn a wealth of knowledge in our courses in all domains: cognitive, affective, and psychomotor.
- The way we teach our students involves their emotions and consequently the experiences they have will remain with them the rest of their lives.
- The essence of what we *teach* should not be measurable with paper-and-pencil tests.
- The essence of what our students *learn* cannot be measured with paper-and-pencil tests.
- It may be impossible to ever develop a method to measure the most important things that students gain from our courses.

It has been an awesome and rewarding adventure! Thank you most sincerely!

JEL

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