From the Editor

Anomalies, Anachronisms, and Beliefs

From the time I was about six years old, I fell in love with *Popular Science Magazine*. My mother used this to her advantage, as it became part of her reward system for my good behavior. In fact, I had every issue dating from 1946 until the smell of that old paper and their sheer weight caused me to part with them in the 70s. Even now, when I see the front covers of those old magazines at vendors' displays in shopping malls or on the Web, they conjure up memories of my excitement about the future – that was the intrigue of that magazine for me: excitement about the future in the "world of science."

From when I was about six years old, when someone would ask me what I was going to be when I grew up, I almost always replied that I wanted to be a scientist. I had no idea what I was really saying; I just wanted to be involved in what I saw between the covers of *Popular Science*. My illusion of the nature of science continued well into high school. Though I value and appreciate my elementary and secondary education in parochial schools, the experience was almost devoid of science until I took chemistry and physics my last two years in high school. As is unfortunately still true in a number of schools today, the laboratory aspect of those two courses was almost non-existent. Yet, when I went to college and majored in general science along with industrial arts, I discovered that I was really not at a disadvantage relative to my peers who had a solid, laboratory-based, science experience in their secondary school years. I still reflect on why I was not disadvantaged and the implications that it has for both science education and technology education. Of course, the most plausible explanation is that I was never tested on *doing* science, only on how well I could perform on paper and pencil tests. We have seen what the current emphasis on this sort of testing has done in narrowing educational opportunity and removing motivation.

I cannot help but think that if *Popular Science* had been called *Popular Technology*, as it should have been in my opinion, then my career investigations would have been more logical as well as efficient. I often think the same thing when I see all the technology that is aired on *The Science Channel*. Roger Bybee, Executive Director of the prestigious and long-standing Biological Sciences Curriculum Study, and keynote speaker at one of the general sessions at the recent ITEA Conference in Baltimore, elicited a smile from me as I am sure he did from others when he mentioned the term "rocket scientist" and the clichés that have developed from it. He stated that it is a misnomer since most of

what people do who work with rockets is technology, not science. "I am not a rocket technologist, but…"

Bybee's words about what is science and what is not were encouraging, especially considering his outstanding record of contributions to both science and technology, particularly in the area of curriculum. At the same time, though, it is disconcerting – a better word might be discouraging – to observe how many others at the Conference in key positions in government, business, and industry related to technology still do not realize who we are, what our purposes are, and how we can uniquely contribute. Then a part of my brain, with tongue in cheek, caused me to think of this as an advantage: that we could be whatever we want to be relative to the constituency with whom we happen to be working. I have been down this path before, but this time the roles are reversed a bit. We can change to meet whatever purpose or intent that others see for us. We are adaptable, like a screwdriver can be used to pry, and we are flexible, like the discovery that Avon's Skin-So-Soft not only moisturizes the skin but keeps the mosquitoes away as well.

Coincidentally, when I arrived home from the Conference, I read an account in our little community newspaper that featured a science fair entry of a fourth grade student. The topic of his science investigation was "What brand of fishing line will hold the most weight?" This set me aback for two reasons. One was because of the fact that I felt his investigation was clearly technology and not science, reaffirming what Bybee had said. The second was because I was teaching a course in industrial materials testing on an individualized basis to a college senior. The final project he proposed was to "Determine the strength of various types of fishing line under various loading conditions." While there is some irony in this, both the elementary student and the college student were deeply interested in the outcome of their work and were highly motivated to engage in the necessary research because they both involved *doing*. The rhetorical question is, were these projects science, technology, or engineering?

Speaking of engineering, I left the Baltimore conference realizing that engineering is clearly the predominate theme in technology education right now and integrating engineering principles is clearly the initiative in which the field is now engaged. It is no wonder, since the National Science Foundation has been promoting education about engineering at the secondary level for several years, engineering groups have taken an interest in promoting engineering-related careers at the K-12 level, competitive events for students have been developed by engineers that fit well into technology education curricula, engineers played a significant role in the development of our curriculum standards, and the government has been emphasizing engineering-related careers to bolster the economy. Moreover, some technology education teacher educators now have joint or "honorary" appointments in engineering at their respective institutions.

Acceptance of engineering by our profession ranges from, "engineering is not what we are about" to "let's change our name to 'engineering education.'" The engineering concepts taught and experiences provided in the schools range from engineering-like activities in which students sort of randomly "fall into" learning the underlying concepts, without the teachers necessarily knowing what

concepts into which they were tripping their students, to actual preparation for careers in engineering and related fields, with college level course credit given to those high school students who are successful in meeting the requirements of the program. In between these two extremes, though, are some awesome programs that get students excited about what they are learning first, and then use this excitement to motivate them to learn and understand the underlying mathematics and science principles. It is illogical to think that engineering is not a part of technology and technology education. Jerry Streichler mentioned this at the Conference in his last speech as Executive Director of the Epsilon Pi Tau Honorary, reminding us that technology includes far more than just engineering.

Personally, I have always thought that engineering is something that an engineer does, just as I have thought that accounting is what an accountant does, and dentistry is what a dentist does. Occasionally I have used engineering in a casual way, such as "engineering a solution" to a problem like stringing a garden hose so that it does not damage adjacent flowers, just as I might tell a student who has an injury that I will "doctor" it up by putting a bandage on it. By and large, though, engineering in my mind denotes a career. Foster (2005) wrote an excellent treatise on this subject, making a distinction between engineering as a career versus engineering as a process.

One of the preeminent notions that started in high school for me and continues to pervade my psyche today is the value of a sound general education and technology education's role in it. I can say with fair certainty that the majority of teachers I helped prepare at the five institutions at which I have worked over the course of my career shared these general education beliefs with me. I drew deep lines in the wet concrete of my young mind between general and vocational education in those early years of preparing for my career as a teacher. As my experience accumulated, that line in the concrete began to wear away, the wear accelerating when I realized that the ultimate purpose of an educational experience is whatever the student ends up making of it rather than what we plan it to be. For the eighth grader to whom I taught woodworking in 1970 who later became a skilled woodworker, the experience was vocational. About that same time I surveyed 40 of my former students enrolled in a high school vocational automobile mechanics program and found that 82% had no intention of making automobile mechanics their career. They were there for general education purposes. Nonetheless, I remained steadfast in the *intent* of the educational programs I was delivering. That is, they were to be, foremost, good general education experiences for all, not just for boys and not just for those bound for careers in industry and technology. That was my ideal and it remains true today. I also felt convinced that this was the ideal of my profession as well.

Over the course of my career I have struggled to deal with anomalies between what I perceived as the ideals of our profession and the practice I observed, attempting to fit them in their proper place in my cognitive structure. The first major anomaly occurred upon receiving my baccalaureate degree and realized that, though I learned a lot and enjoyed my studies tremendously, I felt

that I really knew little more about *industry*, than when I started the program. Addressing this anomaly became nearly a career long quest.

"Drafting" is another anomaly that has continued for at least 40 years. Every so often the drafting issue raises its head. It generally starts with the question of, "So just what is the difference between drafting in a technology education program and drafting in a vocational program?" The person continues, noting that the same textbook and equipment are used in both programs. The modern version is the fact that the same CAD software and textbooks are used in both technology education and vocational education. In either situation, I have consistently lost the argument, due to insufficient evidence, that the difference is in the *intent* of the program: one is for general education purposes and the other is to prepare people for careers in drafting. The real difference is often reduced down to the greater instructional time spent in the vocational version – and, what the student ultimately ended up doing with the experience. Where both programs go awry, though, is when the teacher gets so caught up in all the capabilities and nuances of the software that the students never have a chance to apply what they learned in an authentic problem solving context.

So why does this anomaly occur? There are several possible explanations. One is that there is not a textbook that addresses a technical area like CAD from a technological literacy perspective; our profession is too small, as well, to allow publishers to address our unique needs. Secondly, there is probably a logical sequence of learning experiences to teach fundamental concepts, concepts that one needs to master regardless of the intent of the course. The third reason could well be the real *raison d'être*. When a student ends up being employed right out of a technology education drafting program, it is indeed a significant event: accolades come from the administration and the teacher can use it as a recruiting tool for prospective students. Even though job placement was not the intent, when it happens it is rewarding and celebratory.

I often try to draw parallels in my mind between technology education and the core subjects in the school, forgetting that they are required experiences for the most part and we are not. One of the reasons for the anomaly between our ideals and practice is determined by "market share" – our share being the number of students we can attract to enroll in our courses. Leaders in our profession have tried to move away from material-based courses like woodworking for decades. Such courses exist as long as they can attract an adequate market share, regardless of whether or not they are consistent with the ideals of the profession. Now such courses no longer attract students like they used to and teachers are struggling to reorient their programs. A related anomaly is the fact that students aspiring to become technology education teachers cannot afford to take but a few, if any, high school courses in technology and still remain competitive in meeting college entrance requirements. Is it possible for a student seeking college admission to take too many mathematics and science courses?

Drafting, on the other hand, is a different sort of anomaly. When the profession moved away from material and occupational specific courses toward conceptual organizers, I watched with interest how it was all going to play out.

The idea of teaching a broad-based, conceptual course in communication as opposed to drafting/CAD, has really never caught on. In my opinion, this is related to market share: the teachers feared that if they moved away from an almost exclusive, albeit specific, emphasis on drafting and CAD, that they would lose market share. These fears were probably justified and still are, since many of the students enrolled in the drafting/CAD courses aspire for careers in engineering and architecture – or they have vocational intents to become drafters/CAD operators upon graduation from high school and could not afford the class time to enroll in a bona fide vocational program and still meet the requirements to graduate. The ideals of a broad-based communication course simply did not meet the realities of the market.

As I have written between these covers before, our connections to engineering offer wonderful opportunities for us and the students we serve. There is, however, cognitive dissonance for me when the definitive purpose of a particular program is to specifically prepare students for a career in engineering or engineering technology, especially when such preparation begins at the ninth or tenth grade level – an age range at which research has consistently shown that students have a very low career maturity. I cannot fit such preparation into our ideals of developing the technological *literacy* of those we serve or our general education purposes. I am not saying it is necessarily wrong, but it is an anomaly to the expressed ideals of our profession.

So, when we cut all the political chaff away, what do we really believe? What do we feel is good, and right, and just, and beautiful for our profession – and ourselves? We need to continue to examine our personal beliefs and reflect on the extent to which there is consistency among them, the ideals of our profession, and our actual practice. I am convinced more than ever that our profession would be much more powerful and would have much greater integrity if we all were more engaged with one another through our professional associations. If even half the technology education teachers in the US, for example, were participative members of ITEA, we would be in a much better position to withstand and react to the winds that continue to buffet us and to decide which bandwagons on which we really should be jumping. More importantly, we could take control of our profession and move it forward based on what we, collectively, believe. Adapting the words of George Sheehan (2006), the physician and author, "Success means having the courage, the determination, and the will to become the person and the profession you believe were meant to be." We need to believe in the value of what we do, and we need to do that in which we believe.

JEL

References

Foster, P. N. (2005). Engineering: Noun or verb? *Tech Directions*, *65*(3), 19-20.

George Sheehan Quotes, (n.d.). Retrieved June 1, 2006 from http://www.brainyquote.com/quotes/authors/g/george_sheehan.html