From the Editor

Mega-Projects, Ticky Tacky, and Our Team

My work in finalizing this issue was immediately preceded by participation in the annual conference of the Technology Education Association of Pennsylvania. This is the fourth time I have attended the event, twice as a "visitor" and twice as a "citizen." I have consistently been impressed with the solid involvement of teachers in this conference, sharing the new ideas they have developed.

This year, one of the keynote speaker slots was filled by a team of teachers from Allentown: Bruce Lubak, Robert Boehmer and Bob Yocum. They have been involved in what they call "mega-projects" for the past several years. A mega-project is a large magnitude undertaking around which students participate. For example, one of the first mega-projects described by Lubak involved the development of a scaled-down, operational roller coaster, modeled after one that was located at a nearby amusement part. Expert advice was obtained from a manager of the park. Eventually, the plans for the roller coaster were obtained from the original manufacturer. Donations of material and other resources were solicited from the community. Hours of problem solving occurred, investigating various materials, processes, mechanisms, and electronic circuits. Once other teachers in the school became aware of what was going on, several wanted to get their students involved. It became a true multidisciplinary effort in which science, mathematics, art, and other subjects within the school were integrated. There was clear potential to involve the entire school.

One of the challenging problems that the students faced was finding a place in which the roller coaster could be assembled without taking available floor space for the ongoing instructional program. Thinking divergently, the students came up with the idea of supporting the unit from the ceiling instead of the floor. Programs to machine various parts of the structure were written for a CNC milling machine and the work began. Well over 1,000 structural pieces were machined from plastic and other materials.

Once the structure was reliably operational, a "grand opening" ceremony was held with members of the community invited, along with the donors who supported the effort. The results were overwhelming. Once the value of what the students were learning became apparent, the flood gates of resources were fully opened in anticipation of future mega-projects. Since the initial effort, additional amusement ride models have been developed, among other projects. An underwater robot was the most recent project, leading to participation in a competition sponsored by NASA. Resources continue to pour in based upon the educational value perceived by the donors. The positive image of the program within the community transferred to the entire school, benefiting everyone.

As I was reflecting about what was being presented, I thought about how much the students were learning and how excited they were, and the elation they felt once the projects became operational. I also thought about how difficult it is, though, to nail down just what students were learning since it varied from student to student and from year to year. Then I thought about curriculum standards and how we typically start with the standards and then develop the instructional activities from them. With mega-projects and other similar endeavors, the teacher does not know what will unfold in terms of learning experiences until the project is underway and even then what the students learn is dynamic, changing day by day. Then I thought about science fair projects and how similar they are with respect to the dynamics of learning compared to the open ended projects we often do in technology education. I also thought about how participation in science fairs is often extracurricular or co-curricular. Then I wondered why this has been the case in the science education community. Is it due to the fact that science fair projects are so open ended that it is impossible to connect them to science curriculum standards? Or is it due to the fact the science teachers have simply not been trained pedagogically to deal effectively with multiple learning activities occurring at the same time, one of the hallmarks of technology education? Or is it simply due to the extensive energy and time that the teacher must devote to engaging students in open-ended projects? Hopefully, we can keep the rope of curriculum standards loose enough to allow our students to be involved in projects like Bruce Lubak and his colleagues have developed. Perhaps each student can have their own personal rope as we guide them down their chosen path of learning, instead of dragging them down exactly the same path.

Thinking about projects caused me to reflect back on the past. It is interesting to me that in the minds of some in our field the notion of a "project" conjures up negative images, harking back to the industrial arts days in which the teacher handed the students the plans for a project that the teacher had chosen and everyone made the same thing. I always find this notion disturbing for there is little in the literature of industrial arts that promoted this type of approach. When I left Montana State University 40 years ago to embark upon a teaching career, under the tutelage of Professor Francis Sprinkle, it was fixed in my mind that having all students do the same project was irresponsible professional practice. I have to admit, though, that I questioned the practicality of this approach during my first year of teaching in Montana when I had an average of 38 students in my classes, in a facility that measured 32 by 32 feet.

Then I thought about some of our current modular curricula and it occurred to me that some of these programs have students doing exactly the same thing—it is just that they do the same thing at different times. Alas, though, it makes it very easy to connect what the students are learning with the curriculum standards, and when we add to it a computerized assessment system it makes for a nice, tidy package that is easy to manage and from which supportive evidence can be generated. The hands-on activities remain, but they can easily become nice-to-haves rather than essential parts of the learning process. The opportunity to apply what they learned through the modules in a capstone *project* may never be reached. The lyrics from an old song, written by Malvina Reynolds, then started to run through my mind:

Little boxes on the hillside,
Little boxes made of ticky-tacky,
Little boxes, little boxes,
Little boxes, all the same.
There's a green one and a pink one
And a blue one and a yellow one
And they're all made out of ticky-tacky
And they all look just the same.

Then I thought about Benjamin Bloom's classical taxonomy of educational objectives (Bloom, 1956) and the level of learning that occurs. The open-ended project clearly rose to the top of his hierarchy, at least in my mind. Then I thought about where students might experience open-ended projects in the other school subjects. I will keep thinking about this, but none has come to mind so far. And yes, here I am again with the "maintain our uniqueness at all costs" caveat again…

What a person considers to be contemporary practice in our field causes me to smile sometimes. While ridiculing past practice and some of the projects that marked eras in our history such as the "birdhouse era," the "pump handle lamp era," and the "cutting board era,"some "do not see their nose in spite of their face." Take for example a project that I like to pick on from time to time—the CO_2 powered race car, aka the Metric 500 Dragster. Could it be that the "Metric 500 Era" is the longest running in our entire history? It started with the Industrial Arts Curriculum Project in the early 70s. It will soon be an activity that spans three generations of students in our programs. On the other hand, one could argue that the design of these cars in technology education programs is analogous to teaching the laws of gravity in science and the classic experiments associated with that teaching—both are essential to the respective disciplines. Perhaps…

If taught correctly, having students design and build the car can be a rich and rewarding experience. On the other hand, the problem is often very tightly constrained. The wheelbase for the car is generally fixed, as is the location of the CO_2 cartridge. In fact, kits are available with the axle holes and cartridge hole predrilled. The students can manipulate the shape within the tight constraints, but do the aerodynamics that affect this small model of an automobile really make a difference in its performance, or is it simply the mass of the vehicle, the friction in the axles, and the alignment of the components? We might be surprised if we could scientifically analyze the factors that differentiate a winning car from one that fails.

Why have we done this project (or problem, or learning activity, or module, or what-have-you) for such a long time? I would argue that it is because it is fun! There is nothing wrong with doing something that is fun, but sometimes having fun can cloud what students are really learning from the experience—both can and should occur simultaneously, especially in our field.

There are two developments that can breathe some learning life into the Metric 500 car. One is the instructional material developed by the TechKnow Project (http://www.ncsu.edu/techknow/aboutproject.html) that includes a powerful learning unit based around the car. The second is the Jaguar F1 Team in Schools project (http://www.f1inschools.us/) in which students design their cars using 3D modeling software and then produce it using a computer controlled milling machine driven by the parameters of the solid model.

Is the CO_2 powered car a project or simply a learning activity that is fun? The answer lies with the teacher and how it is implemented. One thing for sure, though, the project method is alive and well and gaining tremendous momentum, led in part by the internationally renowned M.I.T. Distinguished Professor, Seymour Papert. The George Lucas Foundation has developed a video tape titled *Teaching in the digital age: Project-based learning and assessment* (http://www.edutopia.org/products/tdapbl.php) for which Papert served as an advisor. It highlights exemplary practices in project-based learning and offers a very convincing rationale for it. I felt elated that several of the examples were from technology education and found it interesting to learn what other subjects in the school are doing with it as well. The Lucas Foundation publishes *Edutopia*, a practical and informative publication on education in which a significant number of articles on project-based learning have appeared over the past several years.

When I first started playing football in elementary school, I intercepted a pass from the opposing team. I can still conjure up the tremendous feelings of success that I felt, hearing the "crowd" cheering as I crossed the goal line. I can also recall the emotions that I felt when I realized that I had run the wrong way and the cheers were coming from the other team!

We can continue to be an increasingly formidable team in the educational enterprise. We have the best combination of cognitive, psychomotor, and affective players available. We have a good offense and a good defense, along with experiences and abilities that none of the other teams have. We just need to be sure that we are really running in the right direction and those who are cheering for us are doing so for the right reasons.

JEL

Reference

Bloom, B. S. (Ed.). (1956). *Taxonomy of educational objectives, Vol.1: The cognitive domain.* New York: McKay.