A Different Angle for Teaching Math

By John S. Bellamy and John M. Mativo

In the field of technology, we are dealt a unique hand in this teaching game, and it will be up to us to play this hand accordingly.

At a high school level, sometimes students can perceive math as simply another step towards graduation and learn just what is needed to get by. For example, if pi (π) is presented to be a fraction (22/7) or a decimal (3.14…) it doesn't make much sense to many students. Many just learn it as a constant and have no realistic understanding of what it is. However, once demonstrated as a relationship between a diameter and a circumference of a circle, then pi can come to life. In this experience, pi depicts the ratio between the circle's circumference and its diameter. If realistic examples were used more often in classroom settings, then teachable moments would happen—and that is where inspiration can be fostered.

The purpose of this article is to provide thoughts and ideas behind the goals and lasting achievements of the technology curriculum. It focuses on creative ways to address subjects and teaching methods for middle school students. Furthermore, it will provide ideas that can take the classroom from the basics of learning to read a ruler to more advanced steps like performing the Pythagorean Theorem.

On a regular basis, it is easy to find oneself listening to arguments about the advancement of teaching. As future technology teachers, we ought to wholeheartedly believe that it will be our duty to the students to make sure basic fundamentals are learned and understood. So, however valid these individual arguments might be (and some are), a bridge between the basic and the advanced must be met. When we look to the left and to the right of the STEM initiative, we see structured curriculums that have historically built off one another. That is, science and mathematics in particular; these curricula build off of what was taught every year. In the field of technology, we are dealt a unique hand in this teaching game, and it will be up to us to play this hand accordingly. In one particular classroom discussion a colleague stated an absurd, but relatively true statement: "Not all students necessarily learn in a classroom focused on standardized tests, most 'sit, spit, and forget.'" Participants in the classroom concurred with this statement, as they themselves had experienced such in the recent past during their secondary education. One of the authors of this paper states:

> "It wasn't until I found myself in the real world that I first encountered anything I learned in a geometry classroom. Just the thought of using something I once thought completely useless and mundane was an inspiring moment. For me this moment came too late in my early years of academia. It did, however, inspire convictions I thought never possible; that is, to become a teacher of technology. If students had such breakthroughs like mine at an early age, the extension of our field could be increased dramatically. That is to say, if we as educators

can spur the minds of the youth in a path conducive to technology education, our jobs would become much easier, and the creative and intellectual minds of the students would take over and learning itself would teach the class. Moreover, I am suggesting that students can learn by themselves and be excited about new frontiers in the technology field."

He continues, "While doing some construction work, I was assigned to build a wall as a room divider. The contractor was teaching us basic things as we progressed, and one thing in particular stood out: the Pythagorean Theorem. As everyone knows, in construction, accuracy in square is vital, and in this case the same principles held true. For the first time in my life outside of my classroom, I used the Pythagorean Theorem, as shown in Figure 1, without realizing its principle."

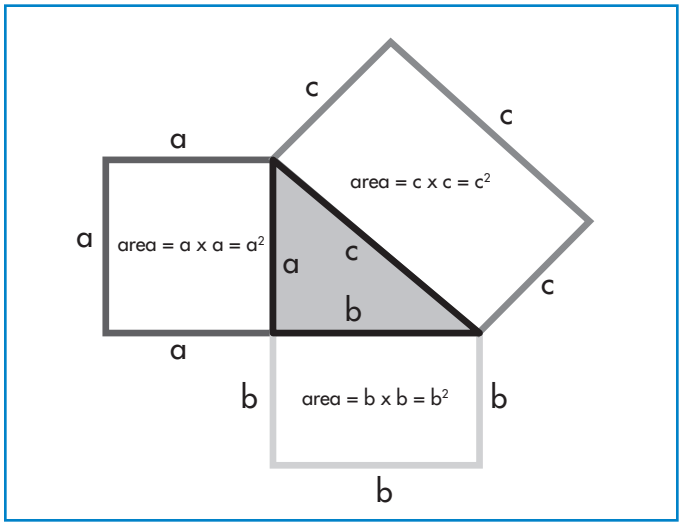

Figure 1: Pythagorean Theorem

From the edge of the wall, we measured out three feet one way and four feet the other. The distance in between was five feet, and our wall was square and construction was ready to commence. Often it is said that to hear something is one thing, but to use it is to learn it forever. The Middle School Science Systemic Change Partnership (2003) and Mourtos (2003) project this idea in practical engineering education. For me, in particular, learning is done by experiencing useful information and being able to reference the experience at a later date.

As an Engineering and Technology Education major at The University of Georgia, I find myself pondering ways to incorporate that type of learning into a classroom. For example, the following is an approach to practical teachings of the Pythagorean Theorem that can be applied at the middle-school level. This example incorporates the use of statics to my experience in wall building. The example also incorporates the use of basic fundamentals such as reading a ruler. Though it is hard to keep advanced students interested and others in constant understanding, it is important that the trivial steps are not overlooked. In the case of the Pythagorean Theorem, it is important to explain what it is. However, it is more important to explain where and how to use it. For instance, when a teacher wants to explain how things around the classroom are made or constructed, this can be done with items that exist in every classroom, such as walls or tables. Keep your subject matter in the real world and remember to show tangible real-world applications. Furthermore, remember to talk with other colleagues throughout the school to know what concepts students are learning in the mathematics and science classes in order to plan relevant experiences.

The technology classroom is the ideal place for reinforcement of other subjects throughout the entire school. Other subjects teach on paper how things work, and ideas and theories behind why things work. As technology teachers, we can show students hands-on examples of the actual processes that comprise the theories or ideas. I think that it is important not to forget that we can inspire students while teaching them. Students want to learn, and it is our duty to provide them with the tools they need to accomplish their goals. Again, we are in a unique position as technology teachers. Our hands are not as bound as is the case in other areas of study. Regardless of what you think about standardized tests, there are many teachers who teach students what they need to know to pass these types of tests and push them to learn only those things. Since our society is built around what looks good on paper, the results continue to look the way they are meant to look to powers that be. However, the level of retention is questionable at best.

Real-life situations are the key to learning; that's why it is important to remember the importance of communication in our classrooms. If there is a subject that wasn't particularly clear in the past, try explaining how it was learned and think of ways to get the students' hands on tangible items that replicate that learning process. Though impressive, learning doesn't have to take the form of expensive wind tunnels and CNC machines. Learning can be accomplished by using something as simple as two 2x4s and a tape measure as described in Figure 2 and as shown in Figure 3 or another appropriate device. Appropriate technologies are catching on and carry a wide definition. As educators we must take an

active role in helping our students understand these points without taking the fun out of learning. An arduous task though it may be, simple, straightforward, creative, and most importantly, realistic ideas can be incorporated into the technology classroom. Placing oneself in the shoes of a student and thinking the same way he or she would, ideas can be attained and goals accomplished.

In an effort to further real-world examples into the classroom, try to incorporate real-world professionals from time to time. Whenever knowledgeable people describe their jobs, students pay special attention and are given a way to relate what they have learned. Invite experts to your classroom whenever possible. There are many ways in which students learn, and our job as educators is to challenge our students in ways that make them want to learn. Take time with your students to listen to what they have to say; if we're not careful, we may find ourselves becoming the students.

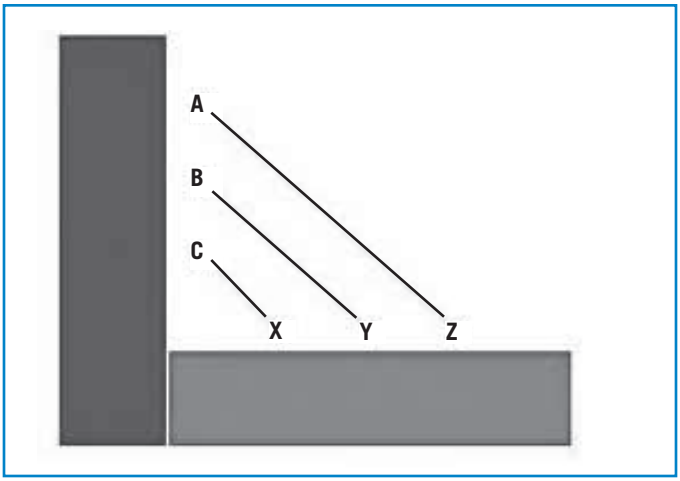

Figure 2: Sketch for teaching triangles

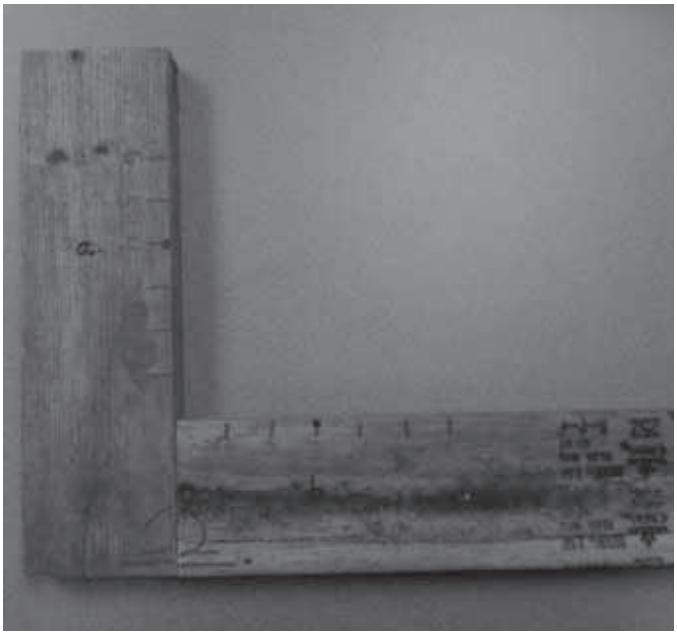
Figure 3: A 2 x 4 teaching aid for triangles

Class projects	Teaching aids	Homework
Pythagorean Theorem	2x4s with different measurement points	Have the students measure things around their house
Reading a ruler	2x4s marked like a ruler in different fractions	Measure different items to the smallest fraction of an inch

Conclusion

Real-life demonstrations and experiences with math and science principles are best learned in a technology education setting. Students will both learn and retain the concepts through applying them in a practical setting. Technology teachers should be satisfied that they can facilitate complex concept learning by students through regular curricula. The laboratory setting should be looked upon as a critical learning area in which sound math and science concepts and principles are brought to life.

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