

## **GIFTED EDUCATION NEWS-PAGE (VOLUME 22, NUMBER 4)**

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### **Teach all Four Letters in Your Gifted Classroom, or You Are Not Teaching STEM And if you are not, Shame on You!**

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#### **Preamble**

There is a huge temptation in the modern gifted classroom to embrace STEM half-heartedly, that is, love the Science & Mathematics and sort of fake the Technology & Engineering. This is a very bad thing to do. It's all four letters, or its not STEM at all folks.

I can understand the situation, but I certainly do not condone it. After all, you are most familiar with the Science & Mathematics and your school even has parts of the academic day already carved out with the subject labels – science and math. But this totally misses the boat. STEM is about application and integration of what has been learned. This is the point of all the change coming to schools....making the subject matter relevant so students understand how it meshes with that diaphanous and evanescent thing we call “progress”.

#### **Working the Letters**

We don't compete successfully in the global marketplace because we have the best gifted students with the highest test scores in science and math. The business world, where 90%+ of your students will earn a living, could care less about such things. They want workers and professionals who can do something with the science and math they have learned; and they can do it faster than the competition. Application always trumps raw knowledge in the workplace. The purpose of the G&T class is not to make scholars. It is to recognize the gifts and give the students the best chance of maximizing their use – applying it hopefully for the good of everyone....civilization....humanity.

That is where the Technology & Engineering come in. These are the application components which tie the Science & Mathematics into the work-a-day world. Technology is what we use to convert what we have into what we want. Translation: if we have raw resources, technology is the know-how to make these into refined, salable products. Think of a patent. It is the blueprint for how to make something. It is all about application, and patents are loaded with good old Science & Mathematics and how they support what the inventor is trying to do. Without application, Science & Mathematics are nice to know but non-essential to most folks.

In the mid-1980s, technology education burst onto the academic scene, just as the manufacturing workplace was realizing the need for a change to their factory floor. Workers needed to be aware of the entire product being made, not just a single part by a single worker in the old factory automation model. You started to hear such phrases as total quality management, system integration, and a variety of other industrial jargon, all pointing at getting workers to realize how their work affected others. Everyone was involved in the total product all the time. Technology education (tech ed) teaches young folks about the human designed world; and allows them to experience a team-based, head and hands learning environment, dipping themselves into the invention and design process, i.e., application.

Some less than enthusiastic teachers see tech ed as “souped-up” shop class. But let me remind those who do, that in shop class students did apply math and science to complete their projects, and the total product was always the goal...just like in the modern business world. There was a great deal of thinking that went on in the shop class of old. Next time workers come to your house to redo your kitchen or bathroom, you hired these technicians because you do not have the ability to do what they do and apply the math and science. Maybe you can solve a complicated calculus problem, or spout out something about Einstein's theory of relativity, but I bet if you examine the unfinished walls of your renovation when the workers leave for the day, you will see lots of math scribbling and measurements on the unpainted drywall. This is the application of math for the creation of something worthwhile.

Dear G&T teacher: This is not about Technology & Engineering trying to eclipse the importance of Science & Mathematics, or usurping the political clout or prestige of the National Science Teachers Association (NSTA). It is about getting your gifted students to see how it all fits together. Head thinking is not better than hand thinking, or more elegant. Both are valuable and in our globally economic competitiveness today, we need folks who can do both...period...dot...end of story, as the students say. End forever this ancient class warfare theme of who is more valuable to society, which has led us down the ignorant path of white collar versus blue collar. In the business world, white and blue collars work all day long together for one common purpose, high quality products and economic competitiveness.

Engineering has been a composite profession from its birth in ancient times. Engineers use math, science, technology, creativity, and invention to solve problems, big and small...and they do this while paying strict attention to the economic, social, environmental, legal and regulatory consequences of their potential actions. One can think of engineering as designing with constraints. Here is your ideal of subject integration. Great inventor-entrepreneurs like Edison, Ford, and their modern day counterparts of Steve Jobs and Dean Kamen

were/are essentially engineers, sans the formal titles. Would you think of discouraging your young G&T students from aspiring to similar feats; or surpassing the works of countless formal engineers who gave us radio, TV, computers, mass produced medicines, and the other wonders of our world? Would you besmirch the fact they applied science and math beyond the antiseptic world of scientific and mathematics journals? Of course not! Why would any G&T teacher not want to integrate the Technology & Engineering with the Science & Mathematics, nor realize the connection?

### **Historical Relevance**

Modern science and math as teachable entities are still very young, perhaps dating back to the origins of scientific thought, say the early 1500s – about 500 years old. Think about the ancients who built the pyramids over 4,000 years ago or the Roman engineers who built the great aqueducts of Rome; and the countless ones who built the gothic cathedrals and other structures of civilization before math and science were so precise, when rules of thumb, experience, or heuristics were staples in the tool chest of great builders and architects. How would you rationalize or categorize Leonardo da Vinci? Was he a head or hands thinker? Technology and engineering gave birth in a way to modern mathematics and science which have historically helped push and pull each other along. Technology and engineering are the mortar between the bricks of math and science. Never think otherwise for to do so is to short-change your gifted ones.

Man is after all a physical being, wired to use both his head and hands. Modern brain-based research keeps vindicating this. Give a child some toy blocks to play with and he will immediately build something, ignorant of all the math and science behind it. Man is an applicator by design. The thinking, organizing and Bloom's taxonomy come later with the wise guidance of parents, mentors, and teachers. But not at the expense of, or submission to the basic desire to build, design, create or invent. The math and science are there to make us better at these in-born traits, or to help us understand what went wrong. The science and math work hand in hand with the technology and engineering, making them work better at the outset and avoiding problems later. This is the message in the great and wonderful story behind *Rocket Boys* (2000) by Homer Hickam – must reading for all middle school G&T classrooms.

### **Some Things To Do – Now!**

- 1) Work the letters, S-T-E-M, and do it with commitment.
- 2) Bring engineers and technologists, scientists and mathematicians into class to discuss how their work gets applied in the real world.
- 3) Study how technology has changed the world and the great waves of it that have defined the last 200 years...like railroads, chemicals, power/energy, nuclear power...etc.
- 4) Look at the social, economic, environmental, legal and regulatory aspects of solar and wind energy and contrast them to conventional energy forms.
- 5) Do the same for hand-held communications technologies. Where is the math and science applied within?
- 6) How does a solar engineer, designing and building a solar system, apply math and science?
- 7) Talk to tech ed teachers in your school or invite such teachers into your classroom.
- 8) Attend one of their local conferences and present a paper there. Get discussions going! Form a bond between your G&T professional group and theirs.
- 9) Invite an inventor, entrepreneur, or business person into class to discuss how and why STEM makes sense for the country.
- 10) Ask your gifted students to re-design the school day, and have them discuss and justify why they would do certain things.

### **Epilog**

The history of modern education shows it to have started about 140 years ago. Its academic day was designed to mimic the then burgeoning industrial economy by parroting its very defined, atomized process of manufacturing...resulting in the pizza-pie model of 8 slices or subjects a day. Too often we see a new subject introduced as a zero-sum game where someone else's sacred cow must be gored to make room for the new one. The real answer is to change the academic day, making it into double periods, studios, and special project time with open-ended problem solving. It means we must train teachers differently as well. About one-fourth of a human life span is spent in education. It is time to make some needed changes and integrate it all together. Industry, the original model for the modern school, has moved on. So should the current academic day.