

**Excerpts from Harry T. Roman's Latest Book (2013)**

**STEAM Education for Gifted Students! Upper Elementary Through Secondary Levels  
Combining Communication and Language Arts with Science, Technology, Engineering and  
Mathematics**

**Introduction and Inspiration**

**The Taproot of STEM**

The roots for the modern day STEM philosophy and technology education date back to the late 1800s when Thomas Edison was forging his invention factory/industrial R&D concept. It is plainly evident in the small cluster of buildings (which still stand today for public visitation) that formed the central focus of his legendary West Orange Labs in New Jersey. Here in his epicenter of creativity and invention, a one-acre nucleus of buildings formed the heart of Edison's revolutionary enterprise..... an enterprise that would come to define today's modern industrial model.

The small buildings arranged to the side of the main prototyping factory contained certain important specialty expertise and equipment that would be needed to support the multi-disciplined nature of invention. There was a physics/electrical lab, a chemistry lab, a metallurgical shop, a model making shop; and supporting all this were engineers, scientists, mathematicians, inventors, technologists, machinists, draftsmen, and electricians. Edison knew back then that bringing ideas from concept to market required a multitude of talents and skills, and he had marketing, legal, accounting, economic, and sales expertise on-hand as well.

Today's modern business structure emerges from this integrated approach Edison formed for the solving of problems, and the launching of new products. The world's greatest companies today have R&D labs like Edison did, fully understanding how R&D project management crucially drives the process of new product commercialization. Edison becomes the first industrial project manager, forming interdisciplinary project teams, often overseeing as many as 30-40 teams at once. He is the premier integrated thinker of his time, matching people, talents, resources, and disciplines to solve multi-dimensional problems creatively. It is Edison's greatest invention.

It is interesting to note how that one-acre parcel of buildings at West Orange produced enough new product ideas to keep the surrounding twenty acres of massive buildings around it busy turning out new products. Those large factory buildings are gone now, but at one time, the great inventor had 30 companies and 10,000 employees working there under the imprimatur of Thomas A. Edison Industries. This is the iron core of strength that STEM thinking can produce in the real world. It has been shown to work for 125 years, forming the foundation for the industrial revolution, and today's digital-electronic explosion. STEM is precisely what is needed in our schools to show the head and hands relevance of the school-to-work progression; and the application of knowledge to addressing world needs.

**The Importance of Communication**

What makes Thomas Edison's life so valuable to future generations was his dogged determination to document what he did. Through his five million plus documents including patents, sketches, lab notebooks, and letters, we see how important good communications were to his success. He had a profound affinity to information, and the written and spoken word. In fact, he loved information so much he built his office inside his grand laboratory library – a truly remarkable room that never fails to hush and awe visitors when they come to this incredible national park site in West Orange.

Imagine trying to instill in his workers the importance of his thoughts and ideas, attempting to communicate those nascent inventions in words, writings, and sketches. He must have honed this communication capability to a fine art, as the great inventor produced 1,093 patents in his 84-year life. He then had to communicate the value of his inventions to the public so he could sell them and keep his business enterprise running. Obtaining patents on his work and protecting his intellectual property also required solid communication skills – the ability to carefully show and convince patent examiners how his novel and unique ideas and inventions warranted patent protection. Let's not forget all the advertising and company brochures he must have labored over to distinguish his company's products from the competition.

Edison's life was a constant labor to communicate with others, be they human workers or large companies that provided him services and materials. His 4,000 laboratory notebooks themselves speak of the man's ability to condense facts and figures into cogent, hard-

hitting concepts. This is a lesson not lost on the modern business world as discussed earlier. As you and your G&T/STEM students think about the ability to communicate with others, remember what Edison did for the bulk of his life and aspire to that kind of excellence in communication. I can tell you from 36-years in engineering, that my math and technical skills were very important; but my ability to communicate well was the chief reason I became a project manager like Edison, able to convince people to give me money to develop new technologies and believe in my ideas. With these communication skills I was able to speak with authority and work with other engineers around the world.

#### **Note to G&T / STEM Teachers**

***Strongly encourage your G&T / STEM students to write and speak well. Let them know that the workplace belongs to those who can communicate effectively. Listeners admire people who can use words to inspire, and paint pictures of what is possible. Help your students appreciate and become that kind of a writer and speaker.***

The activities in the following pages I hope will combine a bit of fun and education together, encouraging young folks to realize the value of a future filled with effective communication. It is not separate and distinct from G&T/STEM. It is a fundamental part of it. Nerds who can communicate grow-up to become the Bill Gates and Steve Jobs of the world!

### **What is STEM?**

(A revision of a paper originally entitled “STEM – Its Importance and Promise for Gifted Students,” published in the Journal of the Illinois Association for Gifted Children, March, 2012)

#### **Introduction**

STEM is a potentially new educational powerhouse, and when applied properly, this curriculum integrating process can make a big difference in how our future leaders see the world and solve problems. As someone who has spent four-decades bridging the gap between schools and the world of business, I wish to explain why I think STEM is important. During my engineering career, I have worked with the schools to bring the excitement of science, invention and technology into the gifted classroom. From my vantage point, STEM is an exciting paradigm for giving our gifted children the tools to compete in the highly competitive, and often unforgiving global economy.

My perspective on the importance of integrating the curriculum goes back to high school, when I encountered a most incredible teacher who taught a new post-Sputnik era, double period, physics/chemistry course to about thirty students. We did not know it then, but we were probably the school's first identified advanced or gifted students. Dubbed “integrated science,” this course and teacher completely and forever changed my way of perceiving the world; for in that class of high achievers we would integrate science with the social, environmental, legal, economic, and historical perspectives of civilization. That teacher later became my life-long friend, mentor and colleague, motivating me to reach out to the education community; always impressing upon me the crucial need for continuous learning. He was my greatest teacher and most beloved friend; and in his joyful spirit of curriculum integration, this article echoes and celebrates the educational journey we shared.

#### **The Importance of STEM**

STEM is a philosophy grounded first and foremost in the solution of problems from a multi-faceted and inter-disciplinary perspective. However, it should not just cater to the science, technology, engineering, or math aspects of a student's education. A well-thought out STEM-based approach to education includes the integration of all subject matter that may be brought to bear on problems, such as the environmental, social, regulatory, legal, institutional, political, and economic aspects. This is how engineers solve problems large and small every day, and for this reason engineering and its study is an important part of any STEM program. Let us begin with an enumeration and discussion of how STEM makes sense for the gifted classrooms of today.

##### **1) Science/Technology/Invention**

The emphasis on STEM will make more gifted students aware of the science/technology/invention triad that has been so important to our economy and standard of living. Fully 60% of all economic growth in this country is due to scientific and technological advances, embodied in new inventions, products and engineering achievements. STEM-based problem solving will help students understand the process by which new ideas become products, and how those products are driven by consumer wants and needs. It will allow gifted students to better grasp the operation of their capitalist economy, and their function and purpose within it.

[Order this book through Amazon.com.](#)