

Excerpt from Harry T. Roman's Latest Book: *Invention, Innovation and Creative Thinking in the Gifted Classroom* (2014)

Background –Technology Education

Technology education or tech ed is about the study of the human-designed world, containing both process and content components. Its process is a defined, step-wise approach to problem solving; and its content base are all the other subjects of the academic day.....blending both together into a high quality, multi-dimensional, multi-disciplinary solution. It is very similar to what engineers do in their daily work; and well-suited for the gifted classroom. Many gifted education teachers are discovering the value of technology education in the classroom.

Since its inception in the 1980s as a bona fide branch of modern school curricula, technology education has embraced STEM education and taught the vital importance of invention as a head and hands activity. Tech ed teachers also recognize the huge contributions of inventors like Thomas Edison to the whole concept of STEM and invention. These teachers value and highly promote the concept of sustainability and alternate technology design, and evaluating new technologies beyond just the technology itself by assessing its impacts on society. The business community is very much interested in students who take tech ed courses because they prepare them for the highly unstructured problem solving workplace of the business world.

Superb magazines like Techdirections, www.techdirections.com/, and The Technology and Engineering Teacher, the flagship publication for the International Technology Education and Engineering Association (ITEEA) www.iteaconnect.org/, are excellent resources for the STEM-oriented teacher. There are also state organizations like the New Jersey Technology Education and Engineering Association (NJTEEA) in my home state. Check out a local technology education association in your state and talk with them. You will find a great wealth of information and advice about conducting head and hands activities in your class. If you have a technology education department in your school, by all means talk to each other! Check out your district and neighboring ones as well.

Invention and STEM

Invention and project management are very similar. An inventor manages a very complex project/process involving manpower, money, resources, and time schedules –just like an engineer would do when creating a new product, or designing and constructing a new building or bridge. The inventive process is inherently STEM-based, requiring the inventor/engineer to think in a multi-dimensional / multi-disciplinary fashion. Since project management is a highly prized skill in the world of work, having G&T students involved in inventive activities is a highly relevant school-to-work activity. This is exactly the kind of thinking the modern world of work will demand of employees.

The roots for modern day project management and STEM are sunk deep into the soil of West Orange, New Jersey, for here the world's greatest inventor forged both, and unleashed a torrent of creativity and innovation that is still accelerating through time. By codifying the process of invention, Thomas Edison took this process from a cottage industry performed in garages, barns, basements and attics, and transformed it into an industrial powerhouse. Today, we call it R&D. During 2012, United States companies, universities, and the federal government spent \$440 billion dollars on R&D of all kinds.

Edison's Four Great Inventions
Light bulb and electric utility industry
Recorded sound
Motion pictures
R&D labs

Edison's technical and economic legacy from West Orange is still a powerful force in our nation's economy. His creations and industries account for about 10% of our current annual gross national product, or about \$1.5 trillion per year. This makes Edison and his methods highly relevant for your gifted students to study. The Voice of America projects that Edison's accomplishments today account for one-fourth of all the jobs on the planet!

The men who worked with Edison were practicing STEM-based project management long before it had a name. The heart of the legendary West Orange labs was a three-story building and factory where craftsman, engineers, toolmakers, technicians and highly skilled workmen

made the new product prototypes as they were designed by Edison himself and his teams of “muckers.” Team members for the brainpower of each new product and project were drawn from his specialty buildings located just across the courtyard from the large building. There were buildings housing men skilled in physics and electricity, chemistry, model-making, metallurgy and materials—and also experts on economics, mathematics, engineering, and marketing. Here was the germinating core of inter-disciplinary team building that has grown into the mainstay of business today. Modern day project management was born here.

The factory and specialty buildings occupied perhaps an acre or so of the West Orange Labs; but the creative output of these facilities generated enough new products to keep 20 acres of factories surrounding it busy making products for the marketplace. That is a manufacturing leverage of about 20:1. Edison also had satellite plants, occupying untold acres around New Jersey and in other states, that also made things for him, or chemicals he needed in support of his West Orange activities. This shows the power that focused R&D can produce. No one understood this better than Edison. This was his greatest invention... a process that we sometimes refer to as technology driven “progress.”

In its heyday, about 250 employees occupied the invention factory and specialty buildings and about 10,000 people worked in the factory structures surrounding it. A small city, devoted to technological development had grown out of what once was farmland, not so much different from how Silicon Valley in California sprang from the fruit tree orchards once there!

Undoubtedly, the great explosion of invention and commercial development of the late 1800s (the industrial revolution) was propelled by the likes of Edison and many other inventors who realized how to turn invention into a commercial endeavor. Many of the great United States companies inaugurated their R&D Labs between the very late 1800s into the early 1920s. Edison’s West Orange Labs are considered to be the “mother ship of American innovation.”

The Legacy of Inventive Thinking

1792	United States Patent Office Created
1793	The 5000 th patent was issued (Edison is born in 1847)
1935	2,000,000 th patent was issued (Edison dies in 1931)
1976	4,000,000 th patent issued
1999	6,000,000 th patent issued
2011	8,000,000 th patent issued

Classroom Activities

- 1) Design a new classroom desk and chair set-up.
- 2) Design a new method for taxing individual income; and defend your reasons for your design.
- 3) Design a roadway through your favorite park in town and use that roadway to enhance the park and minimize its impact on park users.
- 4) Design a suit of clothes for military use that houses an onboard computer and sensors to monitor the health and safety of the soldier.
- 5) Design a solar panel system that also doubles as an awning for windows.
- 6) Design a pipe crawling robot for use in pipes of 4-6 inches in diameter.
- 7) Create a new food snack that uses three main ingredients, of which the students may choose any three.
- 8) Create an educational math game involving dice, cards, and a spinner board
- 9) Design a fire-fighting robot for use in chemical fires.
- 10) Design a device that police could use to stop a fleeing car, and thus avoid dangerous high-speed car chases.