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Excerpt from STEM ROBOTICS IN THE GIFTED CLASSROOM: MEET ROBO-MAN (ISBN 0-910609-61-6) by Harry T. Roman. COST: \$22.00 Including P&H. <http://amzn.to/1dz3SQI>

Introduction

This is my fifth book for Gifted Education Press and every one has been a joy to write. Working with the editor, Dr. Maurice Fisher, an educator himself and expert in gifted education, has significantly expanded my understanding of the field. This new book before you builds on the success of my previous STEM books, this time with a special application of STEM thinking to the very popular topic of robotics. I should like to largely repeat here what I said in the opening of my previous books, because it has proven to be so well-accepted by readers.

I have witnessed the very early days of STEM, when the teaching paradigm of technology education took its first faltering steps in the mid-1980s; and I have practiced it with a passion, building its message into everything I write about. It is both visceral and so very obvious to me.

Here are some very important things to remember about STEM as you move through this book:

-Asking high quality questions and inquiring in depth about the problem at hand is a key aspect of the STEM philosophy.

-STEM is an integrated approach to problem solving, both on a multi-dimensional and multi-disciplinary basis.

-It often works best in gifted student team-based situations; coupled with head and hands learning opportunities.

-STEM is an outgrowth of the highly successful technology education curricula, where head and hands are used in the study of the human designed world. Its taproot however, goes all the way back to Thomas Edison.

-It is not just for “techie.” STEM can be used in any kind of problem solving situation. It is about making students think. Engineers have been using a STEM approach to problem solving for many years; as have inventors.

-It is also not just for boys! Girls have a wonderful ability to think broadly, often more so than boys. There is a whole movement afoot for girls to form after-school clubs, aptly named “Fengineers”; and let me tell you these girls are terrific. I have had the honor of working with and mentoring several such clubs at nearby schools....and I have walked away very impressed.

-STEM is not about the speed of the solution to problems (although in the business world that is good to maintain competitive advantage), but rather the thoroughness or quality of the solution.

-Math and using it as a tool of inquiry and analysis is a major feature of STEM and will give students a much better appreciation for how math is relevant and important in the world.

-It is an empowering agent to push the envelope of learning and problem solving.

-Businesses highly value employees with strong STEM backgrounds. These employees often make excellent project managers.

-Creativity and imagination are important components to facilitating STEM-like thinking.

In this book, I have chosen robotics as the primary educational focus, through which I apply STEM-thinking as a way to enhance the gifted and talented student’s appreciation for problem solving. I hope you will use this volume with “wild abandon,” empowering your gifted students to use their imagination, creativity and energy to look at the world in a different, more integrated fashion. Here is information about two of my previous books related to the STEM topics that will be discussed:

STEM—Science, Technology, Engineering and Mathematics Education for Gifted Students: Designing a Powerful Approach to Real-World Problem Solving for Gifted Students in Middle and High School Grades, *Gifted Education Press*, 2011.

Solar Power, Fuel Cells, Wind Power and Other Important Environmental Studies for Upper Elementary and Middle School Gifted Students and Their Teachers: A Technology, Problem-Solving and Invention Guide, *Gifted Education Press*, 2008.

STEM Warm-up

The young child excitedly told her father of the fun day at school, and how her teacher was happy with answers she gave in class. The father smiled, told her he was proud, and then asked with twinkling eyes....”So how many good questions did you ask today?”

Let’s start with a quick STEM warm-up to get the juices flowing!

Empower all your gifted students to think out of the box, and you do the same. Make them all junior engineers and impress upon them to think like engineers do as you make your way through the subject matter of this book.

Engineers solve problems to seek solutions to a pressing need or want, and to gain perspective on their world. Engineers excel at performing this problem solving process. It is the bedrock of their collegiate education, and they practice it all day long on the job. And here lies the Holy Grail and true power of STEM. In the industrial world, problems are not neatly packaged in a simple format where certain parameters are given and others are to be found. In the real world, one must ask many questions to determine exactly what the problem represents and what needs to be found out including searching where important information about the problem may be found.

Any problem has multiple solutions, depending upon how you perceive it and the inquiries, i.e., questions you make of it. A problem solver determines the answer, as much as the situational context of the problem itself. Humans are the active ingredient, the creative element, the question askers, the catalysts toward finding a solution. . .therefore, being able to ask good questions is very important. . .questions that cut to the heart of the matter, and yield useful and interesting data and information. This is the basement-foundation level of a STEM-based educational approach, regardless of the topic or design challenge. Advanced students are empowered to conduct their own inquiries into problems; thereby owning those problems, becoming vested in their solution. Students self-actualize. . .because you are empowering (and challenging) them to do so. This is powerful stuff when done right. It’s the kind of stuff that employers love to see in new hires—someone who knows how to think and apply knowledge for useful ends.

Note to G&T Teachers

It could not hurt to have some information at hand, perhaps a couple of pages about what engineers do , and how they are different than scientists or technicians. Better yet, let the students research this using various Internet and school media center/ library resources. This engineering mind set is important to this book and others like it in different technology areas. Thinking like an engineer is thinking like a master problem solver.

As we pursue answers to questions we must keep in mind that civilization is a tapestry woven with some thick fundamental threads like:

-Technology -Economy -Society -Safety -Regulatory -Environment -Government -Law -Politics -Global perspective

When we solve problems we should be trying to include consideration of these fundamental threads in both the question asking and solution formation. For instance, when trying to implement a new cross-cutting technology like nano-particles, it will most definitely have impacts on the fundamental threads, and hard questions need to be asked at the outset to help define a high quality solution down the road. Our problems today with the automobile and our dependence upon oil stem from our inability to get a high quality solution many years ago when the automobile was young, and question asking was in its simplistic infancy.

There are penalties involved with simplistic solutions that lack multi-dimensionality and multi-disciplinary approaches. The best solutions always seem to possess a certain high quality. They are rich in texture, solved from an inter-disciplinary and multi-dimensional viewpoint, and appear as though they will stand the test of time. High quality solutions derive from the asking of high quality questions. It will be no different when we seek solutions about how best to apply robotic technologies—the subject matter of this book.

Keep all this in mind as we move through the chapters and you come across questions, challenges and design situations. Make sure your gifted charges are thinking across the tapestry of civilization as they attempt to solve problems.looking for linkages and cross-impacts between the fundamental threads. Be the referee, the Socratic gatekeeper, who keeps their thinking knife-edge sharp and focused on STEM principles!