

# Contents

Introduction.....	1
The Importance of STEM.....	3
The Global Economy and STEM Careers.....	4
The New Classroom.....	5
<b>Chapter 1</b>	
<b>The New Classroom.....</b>	<b>7</b>
A Classroom of the Future.....	8
Emerging Innovative Classrooms.....	10
Interview with Kathy Schrock.....	14
<b>Chapter 2</b>	
<b>What Is Career Awareness?.....</b>	<b>17</b>
Interview with Mowgli Holmes.....	20
Career Awareness at All Year Levels.....	23
Career Awareness Resources.....	24
<b>Chapter 3</b>	
<b>Interviews with STEM Professionals.....</b>	<b>29</b>
Interview with Patricia Galloway.....	30
Interview with Laurence Peters.....	33
Interview with Lynne Schrum.....	37
Interview with Michael Clark.....	40
<b>Chapter 4</b>	
<b>It Takes a Village: Partnerships for Learning.....</b>	<b>45</b>
Partnership-Building Strategies: Getting Started.....	47
STEM Partnerships Up Close.....	48
Keys to Successful Partnerships.....	53
<b>Chapter 5</b>	
<b>CASE STUDY: Extending Career Options for Rural Students.....</b>	<b>55</b>
The Grant.....	57
Project Goals.....	57
About CILC.....	58

## Contents

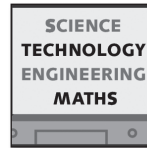
Building a Community of Learning.....	59
CyberFair.....	59
The Equipment.....	60
Digital Tools.....	60
Teacher Training.....	62
The Project.....	63
Guide One.....	64
Guide Two.....	66
Results.....	66
Interview with Jay Matheson.....	69
<b>Chapter 6</b>	
<b>Tools, Tactics, Take Off! Web 2.0 Resources.....</b>	<b>75</b>
The Tools.....	76
Tactics.....	82
Science Centres and Online Science Learning Sites.....	85
Information Repositories.....	88
Take Off!.....	90
<b>Conclusion.....</b>	<b>99</b>
<b>Appendix</b>	
<b>National Educational Technology Standards.....</b>	<b>101</b>
NETS•S.....	101
NETS•T.....	104
NETS•A.....	107
<b>References.....</b>	<b>111</b>

# Introduction

*This is the digital generation – a generation of kids raised in a media-rich, networked world of infinite possibilities. ... They are learning, communicating and socialising in new and exciting ways. ... For them, technology is more than just a tool, it's an essential component of everyday life that frames their world view.*

*But there's more to their world than just playing with gadgets. It's about engagement, self-directed learning, creativity and empowerment. They are hyperconnected to their friends and family, mastering new tools and techniques with ease. Behind every successful kid are adults and peers who guide, motivate, and support them.*

– EDUTOPIA, THE DIGITAL GENERATION PROJECT



## STEM = Science, Technology, Engineering and Maths

When the Soviets launched Sputnik in 1957, school kids waited in their backyards at night to get a glimpse of the first satellite as it blinked across a star-filled sky. The advent of the space age brought about a short-term boost in the awareness and popularity of STEM curriculum and careers. American newspaper headlines warned about the “science gap” between the US and the USSR. STEM professionals such as Wernher von Braun, Chuck Yeager, John Glenn and even NASA staffers became pop culture icons. STEM’s place in education and culture seemed to be assured.

Unfortunately, as with most things, the media attention eventually died down. Ironically, in today’s world, although there are more possibilities for STEM careers, more need for them and more choices in them than ever before, the percentage of students pursuing STEM-related degrees has declined.

Increasing student interest in STEM is a high priority for schools. It has been identified as a focus by most prominent educational systems worldwide. Although making STEM a priority is a strong first step, without strategies for making these curriculum areas interesting and attractive to students, STEM initiatives are doomed to fail.

In this book I offer educational leaders a vision for educational reform – with ideas that won't break your budget. By using the latest technologies, including Web 2.0 tools, to expose students to, and build their interest in, STEM curriculum areas and careers, educators can increase the popularity of STEM studies even among the youngest students.

We cannot afford to wait around for the next big breakthrough or the next perceived crisis to bring attention back to this area. Students need to be exposed to more than vague media stereotypes that STEM curriculum areas are only for nerds. Students need authentic engagement with professionals working in these fields. Many students have no real connection to an adult in a STEM career. It can be almost impossible for such a student to imagine herself as a scientist, engineer, technician or mathematician when she has never met anyone who works in those fields.

Used effectively, career awareness can lead to highly successful strategies for engaging students in the STEM areas. This book offers a glimpse into some of today's successful classrooms, describing innovative projects in which students are connected to real-world professionals. These examples and the related lists of resources and tools can be powerful aids in helping kids discover and pursue their STEM talents, passions and careers.

Unfortunately, we all know that there is often little money for visits to museums, to meet role models, to spend time with peers in other cultures or to take excursions to regional science centres. Even when grants or other funding is available, access to public and private labs and the professionals who work in them is often limited or impractical.

Web 2.0 technologies offer solutions to both budget-challenged and physically isolated schools. With the advent of these new digital communication and collaboration technologies and the proliferation of broadband networks in schools, students now can have access to meaningful hands-on experiences around the globe with professionals of every stripe. They can build relationships, discover new career opportunities and have experiences that inform them about a world

far beyond their borders. We no longer have to exist in isolated communities or allow a lack of funding to hold our students back. Many educators are discovering all kinds of ways to connect to the outside world without leaving the classroom. In this book, we look at the possibilities, the successes and the challenges.

Young people are passionate. They want to participate, and they want to make the world a better place – but it can be difficult for them to envision possibilities without role models and real-life examples. We have a landmark opportunity to help make connections between students and the STEM community. When students can meet and develop relationships with role models and career coaches in fields they have never envisioned, their potential and motivation expands exponentially.

## The Importance of STEM

Wait a minute. Why, you ask, are science, technology, engineering and maths so important? To answer this, all you need to do is think about how radically our world and lives have changed in the past 10 years compared to the last 200 years, and the previous millennium.

Consider this: at the beginning of the 20th century, 38% of the labour force was needed for farm work. Today, in part because of the industrialisation of farming, the farm labour force constitutes less than 3% of the population. On the 2000 US Census report's trade listing, farming (or farm labour) was not even listed as a sector of the labour force for the country. This is just one example of how the workforce has dramatically changed.

The Bureau of Labor Statistics has reported that science and engineering occupations are projected to grow by 21.4% from 2004 to 2014, compared to a growth of 13% in all occupations during the same time period. Approximately 65% of the growth in these occupations will be in computer-related occupations (Matthews, 2007).

According to the Institute for a Competitive Workforce (2008), the very nature of America's economy has changed dramatically over the past decade and will continue to do so. In a knowledge-based, innovation-driven era, different knowledge, skills and abilities will be required for workers and employers to be successful. The new workplace demands higher-order technical knowledge, as

As a child, did you ever have the chance to chat with a mechanical engineer? An astronaut? A neurologist? Students probably know in an intellectual way that these are career choices, but without role models or direct interactions, the path to these careers probably seems unclear and daunting.

For the context of this book, career awareness for primary and secondary students is an understanding of the existence of and the requirements for a wide array of professions in science, technology, engineering and mathematics. Students



#### STUDENTS' UNDERSTANDING

of the world of work can be enriched as they identify career pathways, specific occupations within those pathways, and meet and develop relationships with real-life professionals. Students might discover new passions and interests as they get an up-close look at a working scientist or engineer. In some cases, students who have given up on school begin to envision a future.

– *Center of Science and Industry (COSI, [www.cosi.org](http://www.cosi.org))*

may be passionate about social and environmental issues, but without career awareness, most likely they will remain unaware of how these interests might translate into a STEM career or job. Building relationships with professionals fosters career awareness, which in turn motivates students to work. Schoolwork is more interesting, authentic and rewarding because they know why they are doing it.

What could be more personally meaningful than building relationships with astronauts who have spent months on the space station, with a research scientist trying to find a cure for AIDS, with a deep sea explorer, or with a paleontologist who has discovered bones of a new species of dinosaur? When students make these connections, the first thing they are

interested in is the person. They begin a relationship with an adult unlike any they have met before. They want to know more about their lives. Often they want to be like them. This is the beginning of career awareness.

Once students develop an interest in a certain career path, the next step is to make a connection with their own lives. Secondary school students need access to current, comprehensive and in-depth information about careers. They need to be aware of details such as typical duties and tasks, what a day in the life of a person

in that career is like, and what kinds of employment projections for hiring and wages currently exist for that position or that career.

Students are often interested in and inspired by issues. Students might be interested in global warming or health-related issues but not know how to translate those interests into a meaningful career. How should they prepare while in secondary school, what should they study in university, and in the end, what jobs would be open to them? Without exposure to an array of professionals, science centres, museums and laboratories, how would they know?

Students who were once isolated within the four walls of the classroom can now easily use interactive digital media and distance learning tools to interview professionals and to learn from role models through firsthand experiences. As students develop relationships with a mentor or guest speaker with whom they interact through communications technologies, they are likely to develop an interest in, or at least a curiosity about, the field that adult represents. Such relationships make learning and goal setting more authentic for students. They begin to understand the education and training needed to fulfill their dreams.



**THERE'S A NATURAL** curiosity that young people have – because in their minds they're going to be doing some of those things. You never know when you're going to come across an interest in a child. Let's try and give kids as many options as we can about when that interest might get challenged – and relationships start to develop.

– Jay Matheson, director of the *Extending Career Options for Rural Students* project

When students research these careers tracks, they can find out what jobs fall under each heading. For a career-awareness activity, perhaps they could locate and interview someone whose job fits into one of these categories. The relationship between a student and a professional in a STEM field can be as simple as an email interview or a one-time videoconference or web conference, or as extensive as a year-long mentorship relationship.



## INTERVIEW

# Mowgli Holmes

Mowgli Holmes is the son of a friend of mine. He is working on his PhD at Columbia University. His research project involves HIV inoculation. His undergraduate work was at Vassar, and like most young university students he focused on liberal arts and philosophy. For a time after graduation he seemed to flounder, playing drums in a band. Then he surprised everyone by taking up graduate courses

in engineering at a state university. I decided I'd talk to him, hoping to get some insight into what interested him and motivated him to pursue this work, a path that no one, including him, thought he might explore. He was quick to respond to my request for an interview, and here is a snippet of our conversation.

**Camille:** When did you first become interested in science or engineering as a career path?

**Mowgli:** I didn't become interested in science as a career path until I had been out of school for five years. I had no background whatsoever in the sciences, but had been reading pop science books and became a little obsessed with some of the new theoretical biology work that people were doing. Plus, I needed a job.

**Camille:** Was there a pivotal experience or relationship that motivated you to pursue the research, the study, you are currently pursuing?

**Mowgli:** Yes. I suddenly realised that my undergrad degree in philosophy was never going to let me support myself. But also, I have some friends with HIV and it made sense to me to work on a problem that was not abstract. Now I work in an HIV lab.

**Camille:** Did you ever feel unprepared for the requirements of graduate education?

**Mowgli:** I was totally unprepared – I had never taken a maths or science subject in my whole undergraduate education. But I was well prepared to read, write and learn stuff quickly, so I took background courses at the local state school before applying to a graduate program, and that was enough.