STEM Initiatives and Explorations

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What is STEM?

There is no universal definition of STEM, however experts generally agree that STEM workers use their knowledge of science, technology, engineering, or math to try to understand how the world works and to solve problems.”

Occupational Outlook Quarterly • Spring 2014

Why STEM?

“The future of the economy is in STEM…”

“That’s where the jobs of tomorrow will be.”

James Brown, USA Executive Director of STEM Education Coalition

Why STEM?

The global economy is changing which means new industries are emerging and new skills are required for workers at all levels.

Applying STEM knowledge and skills leads to:

- new products and technologies
- more efficient services and systems
- higher quality health care
- enhanced natural resource management
- new ways to respond to environmental change
- progress on tackling national and global challenges
- better decision-making in governments and industry

STEM Occupations of Today and Tomorrow

Table 1: STEM occupations, by occupational group

Management		
Architectural and engineering managers	technicians	Forest and conservation technicians
Computer and information systems managers	Electrical engineers	Foresters
	Electro-mechanical technicians	Geological and petroleum technicians
Computer and mathematics	Electronics engineers, except computer	
	Environmental engineers	Hydrologists
Computer and information research scientists	Health and safety engineers, except mining safety engineers and inspectors	Life, physical, and social science technicians, all other
Computer network architects	Industrial engineering technicians	Materials scientists
Computer network support specialists	Industrial engineers	Medical scientists, except epidemiologists
Computer programmers	Marine engineers and naval architects	Microbiologists
Computer systems analysts	Materials engineers	Nuclear technicians
Computer user support specialists	Mechanical drafters	Physicists
Database administrators	Mechanical engineering technicians	Soil and plant scientists
Information security analysts	Mechanical engineers	Zoologists and wildlife biologists
Mathematical technicians	Mining and geological engineers, including mining safety engineers	Biological scientists, all other
Mathematicians	Nuclear engineers	Life scientists, all other
Network and computer systems administrators	Petroleum engineers	**Education, training, and library**
Operations research analysts	Surveying and mapping technicians	postsecondary
Software developers, applications	Drafters, all other	Architecture teachers, postsecondary
Software developers, systems software	Engineering technicians, except drafters, all other	Atmospheric, earth, marine, and space sciences teachers, postsecondary
Statisticians		
Web developers	**Life, physical, and social sciences**	
Computer occupations, all other		Chemistry teachers, postsecondary
Mathematical science occupations,	Animal scientists	Computer science teachers, postsecondary
Architecture and engineering		
technicians	Atmospheric and space scientists	Environmental science teachers, postsecondary
Aerospace engineers	Biochemists and biophysicists	
Agricultural engineers	Biological technicians	Forestry and conservation science teachers, postsecondary
Architectural and civil drafters	Chemical technicians	Mathematical science teachers, postsecondary
Biomedical engineers	Chemists	
Chemical engineers	Conservation scientists	
Civil engineering technicians	Environmental science and protection technicians, including health	**Sales and related**
Civil engineers	Environmental scientists and specialists, including health	Sales representatives, wholesale and manufacturing, technical and scientific products
Computer hardware engineers	Epidemiologists	
Electrical and electronics drafters	Food scientists and technologists	

Management

Computer and Mathematics

Education, Training, and Library

Life, Physical, and Social Sciences

Architecture and Engineering

Sales and Related

Source: 2018 Standard Occupational Classification (SOC) System (USA)

Local AOC Chapters Government STEM Initiatives

- Singapore
- Taiwan
- South Korea
- Japan
- New Zealand
- Australia

Lets look at Australia

STEM in Australia

- In 2015, all Australian education ministers agreed to the National STEM School Education Strategy 2016-2026 which focuses on developing mathematical, scientific and digital literacy; and promoting problem-solving, critical analysis and creative thinking skills.

- The strategy has two main goals:
  - *Ensure all students finish school with strong foundational knowledge in STEM and related skills*
  - *Ensure that students are inspired to take on more challenging STEM subjects*

STEM in Australia

- The Australian government also funds several early learning and school-based initiatives.
  - This includes a $AUD 6 million investment in the ‘Early Learning STEM Education’ scheme (ELSA, a play-based digital STEM learning platform for preschool children).
  - $AUD 4 million in the ‘Little Scientists‘ STEM professional development programme for early childhood educators and teachers.
  - The ‘STEM professionals in schools‘ programme facilitates partnerships between schools and industry to bring real-world STEM into the classroom.

Source: *STEM Education Around the World*, www.howtostem.co.uk

Lets look at New Zealand

STEM in New Zealand

- The New Zealand government has recently been encouraging schools to promote STEM education in the hope that this will ease the STEM skills shortage.
- The Ministry of Education supports teacher training programs such as Teach First and Manaiakalani Digital Teachers Academy programme which help to place high performing STEM graduates and digitally confident teachers in education.
- A national strategic plan, A Nation of Curious Minds, is a government initiative with a ten-year goal to promote the importance of science and technology in New Zealand.
- Since 2015 it has funded more than 175 projects in excess of $NZD 6 million.

Source: *STEM Education Around the World*, www.howtostem.co.uk

Lets look at Japan

STEM in Japan

- There is no explicit, national STEM policy in Japan.
- Rather, the strategies, policies and programs that affect various aspects of STEM and STEM education are implicitly present in more comprehensive measures that concern broader aspects of education and the training of human resources.
- Through its remarkable technological development following World War II, robust scientific output generated by research activities at world-class universities and institutions and distinguished achievements in basic science, Japan has been conferred the status of ‘a nation of scientific and commercial innovation’.

Source: *STEM Country Comparisons: Japan,* www.acola.org.au

STEM in Japan

- Four major strategies that enhance STEM in four key areas of Japanese education are:
  - Science advocacy programs to generate interest and enthusiasm among the general population, especially among young children;
  - ‘Elite' science programs to nurture and encourage the brightest talent from high school (upper secondary) to post graduate levels;
  - Programs to ensure successful career linkage from university to labour markets; and
  - Programs to rectify the under-representation of women in STEM subjects and research as well as workplaces.

Lets look at South Korea

STEM in South Korea

- Accomplishments made by Korea in science and technology are considered to have played a key role in the rapid economic development of Korea over the past 60 years.
- However, recent perceptions regarding science and technology in Korean society have brought about concerns regarding a crisis in science and engineering.
- For example the Korean Job Preferences below:

	Government officials	Teachers	Doctors	Science and technology	Business	Law	Journalism
Adults	25.6%	19.8%	17.4%	11.7%	9.6%	7.3%	4.2%
Adolescents	17%	16.4%	23.2%	11.8%	9.8%	7.4%	9.0%

Source: *STEM Country Comparisons: Republic of Korea,* www.acola.org.au

STEM in South Korea

- As such, the Korean government has initiated policies and strategies to:
  - Elevate students' interest in science and math so that they will choose to study and work in science and engineering; and
  - Educate talented human resources in science and technology so that national competitiveness and development can be advanced.

Source: *STEM Country Comparisons: Republic of Korea,* www.acola.org.au

Lets look at Taiwan

STEM in Taiwan

- The sci-tech policies have evolved in accordance with the different demands of economic development in Taiwan, which could be divided into three major stages.
  - First, from 1950 to 1960, the focus of sci-tech policies was the importation of advanced techniques and the transformation of traditional techniques.
  - Second, from 1970 to 1980, the focus of Taiwan's science policies moved to a combination of technique importation and indigenous R&D for the purpose of technology upgrade.

Source: *Report of Taiwan: STEM,* www.acola.org.au

STEM in Taiwan

- Since the 1990s, against the context of increasing globalization, the competition in the sci-tech innovation has become extremely fierce worldwide.
- The Taiwan authorities actively responded to the new demand of development and put the high-tech industry at the centre of sci-tech development with the vision of making Taiwan as the Green Silicon Island.
- Ten new-emerging industries have been regarded as strategic priorities and science parks have also been established for boosting the cooperation between universities, research institutions (RIs) and industries.

Source: *The Evolution of Science Policies in Taiwan and the Inspirations for the Development Western Strait Economic-Zone.* S. Chen & M.H. Zhang, 2007;

Lets look at Singapore

STEM in Singapore

- Singapore was one of the top-performing countries in the 2009 Programme for International Student Assessment (PISA) survey.
- In addition, according to the Trends in International Mathematics and Science Study (TIMSS) in 1995, 1999, 2003, 2007 and 2011, Singapore is among the top-scoring nations in the world in both Mathematics and Science.
- These achievements reflect the country's STEM based education system.

Source: *Country Report Singapore STEM,* www.acola.org.au

STEM in Singapore

- Singapore's policy to have a strong focus on mathematics, science and technical skills has been put in place especially in education since 1968 and in 1991 through the formation of the Agency of Science, Technology and Research.
- Since 1991 this effort has been further enhanced in postsecondary and tertiary education to develop human resources in high technology and the knowledge economy.
- With that in mind, the government made a paradigm shift in the education system by focusing on innovation, creativity and research.
- Usage of ICT in enhancing the teaching and learning environments was introduced in 2000 by the Ministry of Education.

Source: *Country Report Singapore STEM,* www.acola.org.au

STEM in Singapore

- Singapore drive is for science learning to be student-centred and value-driven.
- It is hoped that through science students are able to develop critical thinking and make important decisions based on the knowledge and skills gained for the better of Singapore.

Explorations and Discussion

Your discussion on STEM and what role it plays in your field of expertise, what developments are you seeing in STEM, and what initiatives are you undertaking to further develop STEM.

Thank You