Enhancing American K-12 Technology Education to a Global Standard

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Abstract

The focus of this paper is to address the issues and concerns facing K-12 American Technology Education, which is lacking in meeting current standards. A global competitive workforce along with decreasing student performance has led to a new emphasis on enhancing current policies, curriculum standards, and teaching as well as student performance. In order for American K-12 Technology Education to remain competitive, it is necessary to research and identify successful programs in other parts of the world and to utilize existing programs to better promote and enhance current programs.

Keywords: K-12 Technology Education, United States, Globalization, America Competes Act, United Nations, UNESCO, technology education curriculum, technology standards, technology policies, globalized curriculum, math, science, technology.

1. INTRODUCTION AND PURPOSE:

Globalization and the aging population of U.S. workers in the fields of science, math, and technology have led federal and state governments to refocus attention on educating a new generation of IT workers. The public school system provides the United States a platform to launch our future in the field of information systems. The American educational system's focus must be reshaped to give students more opportunities in math, science, and technology fields to reflect a new global balance. Currently, American K-12 education centers offer many very attractive options, but they may not involve business, math, science, and technology courses. The United States needs to return to the field of science and engineering and give students a broader perspective of how new systems are utilized and managed by industry. Our future systems will be designed by future generations somewhere. In order for American school children to remain competitive, we must give students the tools and the inspiration needed to succeed in a flat world. American students can either be users of global information systems or can create new technologies such as their predecessors.

Since 1983, the National Commission of Excellence in Education has been very concerned with pushing for major K-12 education reform. The many initiatives, mandates, and programs launched by both federal and state governments have not met the US pledge made in 1989 to have US students lead in math and science achievement by 2000. In fact, the Programme for International Student Assessment, PISA, and the Organization of Economic Co-operation and Development recently announced that the US "remains a long distance from the target" (Hanushek, Jamison, Jamison, Woessmann 2008). Both federal and state governments must invest

research in the area of science, math, and technology learning systems and approaches in leading countries so that the United States will not continue to face a worsening economic crisis and loose its competitive edge.

Some researchers and leaders have compared this crisis to the crisis that our government faced in the 1950's, with the passing of the National Defense Education Act. While there are some similarities with the need for big educational reforms, the general public in large has yet to recognize the economic peril we may face in the future if we do not aggressively address this issue.

CIOs are worried too, and research conducted by the Computer Science Teachers' Association exposes critical problems in the computer science K-12 education. Only 25% of the US high schools even offer computer science as a requirement. Females and minority groups in the US are underrepresented in computer science courses. Even worse, 89% of computer science teachers feel that they lack administrative support. CSTA has estimated that there will be a critical shortage of IT professionals starting in 2012 (Overby 2006).

The purpose of this paper is to begin to address the following questions. What are the global standards for K-12 Technology Education? In addition, how can US K-12 technology education programs become enhanced to meet global standards? Technology education in the United States is deeply rooted in standards with a very long history that includes the Standards for Technology Programs, the Technology for All Americans Project, and the most recent passing of the America Competes Act (Drugger 2002).

There are many factors that researchers will need to consider when addressing educational approaches across the globe. In addition, it is important for the United States and the western world to understand the importance of addressing problems with existing educational systems. The global economy is producing a pool of new educated students in many developing countries who are motivated and eager to learn. The international community has a rare chance, perhaps the first ever, to drastically change the world and provide educational resources to developing countries. This opportunity can give future generations the chance to develop new technologies and allow for global problems and concerns to be better addressed.

2. A FRAMEWORK FOR GLOBAL STANDARDS IN IS EDUCATION

Emerging technologies, innovations, and globalization is providing a framework for the international community to give students across the planet educational opportunities that did not exist prior to the "Global Era". Currently, a global race exits to acquire the next generation of top scientists, engineers, and computer software engineers. In addition, K-12 education systems and approaches vary drastically. However, there is now an international effort to provide a global commitment to improve K-12 education by allowing professionals from different areas to collaborate and exchange ideas so that economies can embrace and revamp existing K-12 education systems. In fact, standards already exist in the area of technology education in many areas in the world including United Kingdom, Australia, New Zealand, and Taiwan for example. Standards vary but usually consist of competencies in two areas, primary and secondary levels (Lin 2007). In order to achieve international pre-eminence in the field of information systems, America must foster creativity within our public schools.

Literature Review

According to recent research, experts agree that strong educational learning, not just attendance, fosters a country's gross domestic product, which in turn generates true economic growth (Hanushek, Jamison, Jamison, & Woessmann 2008). With globalization, the need to develop improvements in science, math, and technology K-12 education is real. Industries rely on new innovations and technologies to expand and produce jobs. Cultures, political environments, and socio-economic factors all play a role in how students are prepared to compete in the global economy. It is important for educators and governments to communicate and collaborate on how to develop a world

view for improving education globally. Many of the problems faced by the entire world, such as space exploration, food crisis, epidemics can only be resolved by applying "scientific solutions with a wide-ranging understanding of cultural values and customs" (Padilla 2006).

In order to begin developing a framework, it is important to identify what international and national standards are currently in place. Currently, there is a wide availability of resources and organizations already contributing to this effort and serve as facilitators. For example, the United Nations Educational Scientific and Cultural Organization, UNESCO, had adopted a framework, Education for All, to provide nations with a plan of action to include goals and models and to serve as a meeting point to communicate and coordinate efforts, contributing to a global model for primary and secondary technical education. According to UNESCO's website, current frameworks include international cooperation of members, training and capacity building, production of curriculum that adheres to global standards, establishment of international support networks, and promotion of STE, The Science and Technology Programme (UNESCO 2005).

Another resource available includes online learning communities, such as the program sponsored by KnowledgeWorks Foundation partnered with Curriki: The Global Education and Learning Community. The KnowledgeWorks Program allows contributing teachers to collaborate on their open-source website to develop a worldwide network and discuss research-based K-12 approaches. Curriki, sponsored by Sun Microsystems, offers free Open Source curriculums and is focused on developing quality educational materials. The hope is that such a resource will provide a beginning or foundation for a new global approach to K-12 education (KnowledgeWorks 2008). Open educational resources, like Curriki, provide free resources such as: open source software, syllabi, lectures, textbooks, lesson plans, digital libraries of images and videos, and assignments. The idea is that unlocking educational resources will produce a worldwide bank of knowledge, which is a "public good" (Geith and Vignare 2008).

It is important to sell programs such as the one mentioned above to the global community so that educators, scientists, engineers, and leaders can engage and develop an international commitment to improving K-12 education. It is important to promote global collaboration due to the fact that many economic, health, and science world issues will continue to challenge our global society, and educators will need to adapt to the "Global Age" (Padilla 2006).

Online learning, or e-learning, programs are also available free of charge to assist students. Students may be self-paced, utilize distance learning, and can provide for student interaction. Online learning improves the right to a K-12 education worldwide. Literature reviewed depicts the huge gap of supply and demand for higher education, which includes secondary education, worldwide. The number of K-12 students on the globe is huge. In fact, half of the population of the world is under twenty years old. Growing economies like India and China will continue to produce exceptional students who will want to attend a good university. Unfortunately, there are not enough schools to accommodate the increasing demand. Opportunities utilizing both online learning and educational communities could reduce costs, tackle the education gap, and create a quality learning experience for students across the globe (Geith and Vignare 2008).

3. PROPOSALS FOR ENHANCING US K-12 TECHNOLOGY EDUCATION

The shifting economy has created a new debate in the United States as to how to prepare K-12 students to adapt to "Global Era". America's top students are lagging in math, science, and technology compared to other countries. The National Academy of Science's report, "Rising Above the Gathering Storm," suggests that the United States is losing its competitive technical edge with the US now 15th in world ranking of broadband net penetration (Kurlantzick 2008). Regarding post secondary education, the college and university system is a market driven organization, which is funded by the government. The US government does foster many policies to provide countless scholarships and loans, which many argue are too easy to get

(Murray 2008). Americans do have many opportunities to overcome socio-economic status that other students in other areas do not receive. However, a large majority of Americans that enter the university system leave or drop out due to the fact that occupations in demand in the US require a technical or specialized training and not a college degree. In fact, only twenty-five percent of the jobs in the US actually require a college degree (82007). According to the Commission on Professionals in Science and Technology, wages for American scientists and engineers did not grow any faster than wages for all workers from 1995-2005 (Brainard 2007). American students lack the socio-economic motivators that many students have in other parts of the world. For example, students in the United States who focus on a specialized skill or "craft" like a CAD designer, carpenter, plumber, dental hygienist, or nurse may have more economic opportunity then a software engineer, scientist, or engineer (Murray 2008).

With a long history of standards and reforms, America's issues regarding enhancing K-12 programs rest with a large state bureaucratic process in implementing reforms. The system is lacking in coordination, communication, and promotion of initiatives state to state (Bybee 2003). A national clearinghouse is needed to implement a unified standard that is measured using global assessments. National standards and enhancements should be integrated with global initiatives mentioned earlier. Funds are desperately needed to ensure that even current standards are met under America Competes Act (Career & Technical Education Advisor 2008).

Examples of Creative Thinking

Students, especially in secondary schools, should be focusing on creative thinking instead of memorization so that the K-12 system can foster the "teaching of innovation", which is critical to a global economy (Elings 1995). In order to accomplish this national initiative, we should utilize existing international test scores and study document research to identify top computer science education programs. In addition, professionals should spend time observing top computer science programs conducting systematic observations and conducting interviews with curriculum directors at top performing schools. From this information, we will utilize both quantitative and qualitative data analysis techniques to hopefully identify target areas to develop a curriculum that can be implemented across all states quickly.

K – 2	Computer Safety and Responsibility, Introduction to Computer Hardware/Software, Use of Interactive Technology Devices, Keyboarding Concepts , Internet Communications Using Global E-Pals, Utilizing GIS Devices to Problem Solve and Explore, Employing Searching Techniques for Problem Solving. Introduction To Digital Photography
3 – 5	Anatomy of the Computer and a System, Introduction to Windows Office and Multimedia, Surveying and Mapping, Geographical Exercises, Weather Surveys, Basic DBMS Design and Reporting, E-Pals and Global Learning Communities
6-8	Anatomy of the Internet and Online Systems, Basic Languages, Introduction to HTML and Web Design, Advanced Database Design, Development of a Prototype, Introduction to Digital Video Production, Online Collaborative Projects, Intro. To Computer Maintenance, Basic Economics in Relation to Information Systems,
9-12	System Development Process, CAD Design, Advanced Languages, Distance Learning, Intro. To Network Design, Video Game Design, Practical Programming Solutions, Study and Forecast the Effects of Computer Information Systems on Global Markets

Table 1: Curriculum Examples

Students need to be instructed on how to solve problems and work in "real world" scenarios not textbook scenarios (Elings 1995). The new High Tech High in San Diego, a charter school open to everyone K-12, is built around the idea of global competition. Professionals are hired as teacher and are required to have a degree in

their field. Students are allowed to have fun and discover science, math, and technology through robotic competitions and entrepreneurial scenarios. Surprisingly, one hundred percent of students graduating from High Tech High met the state of California's college acceptance standard compared to only thirty eight percent of California's public school attendees (NewsHour 2008). The program offered at High Tech High gives students "real world" scenarios, is project based instead of just textbook based, and requires that students think instead of just memorizing facts or completing work sheets. Students apply how science, math, and technology apply to their lives and are given employable and technical skills along with tools to allow them to compete in the global economy.

4. FRAMEWORK FOR IMPLEMENTING GLOBAL IS STANDARDS IN PUBLIC SCHOOLS

Public education allows for students to interact with a diverse population, which fosters creativity. Since most of our students attend public schools, our focus should be on improving the public school experience. Information systems can be introduced at an early stage and at the same time incorporate real world scenarios to encourage the imagination. Table 1 provides curriculum examples addressing real world scenarios in a global context.

5. CONCLUSION

Programs that focus on preparing students K-12 to succeed in a global economy are needed. Occupations in the United States that are in demand will require everyone to have a basic level of understanding in information systems. The United States must recognize that the "Global Era" of information technology will require students to compete on a much larger scale. Educational approaches from around the world should be embraced by the United States so that educators can increase student opportunities to succeed in the global economy. Online communities and online learning should also be embraced by industry so that a pool of educated and qualified workers will allow for economies to continue growing.

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