Policy Interests Driving Promotion of STEM Programs at Higher-Education Institutions

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According to Statement 16 of the 2009 World Conference on Higher Education in Paris, "greater emphasis on the areas of science, technology, engineering and math (STEM), as well as social and human sciences, is vital for all our societies."[1] Access to programs of study in these areas is considered important for enhancing the quality-of-life experience for individuals by providing skills that translate to technological-capacity nation building, one of the keys to success in a global economy secured by knowledge-based industries.

The driving premise—as mentioned in the 1998 "World Declaration on Higher Education for the 21st Century"—is the need to advance knowledge through research.[2] Specifically:

- The intellectual and cultural rights on the results of research should be used to the benefit of humanity and should be protected so that they cannot be abused (Art. 5(b)).
- Of special importance is the enhancement of research capacities in higher education research institutions, as mutual enhancement of quality takes place when higher education and research are conducted at a high level within the same institution (Art. 5(c)).

The STEM fields have been put on the front burner by nations throughout the world because these subjects are inextricably tied to economic development and success, and many existing and new products require greater technological knowledge. When looking at the process of job churning—the evolutionary process of creation and loss of jobs—you can see how the newer jobs require additional education and training of a more technical and technological nature.

Another way of saying this is to update Schumpeter's 1934 view[3] that old employment needs to clear the way for new developments—"the adoption of new technologies may require the destruction of outdated relatively obsolete productive units."[4]

In 1963, Schultz observed that the acquisition and dissemination of knowledge is an investment in future economic development.[5] More to the point, "The ability of a society to produce, select, adapt, commercialize and use knowledge is critical for sustained economic growth and improved living standards."[6] These are reasons why the current knowledge industry is characterized as employing high proportions of educated people as measured by standard levels of individual qualification.[7]

This can be seen in the difference in employment and wages between those who have not graduated from high school or have graduated just from high school and those with college experience and degrees. Data demonstrates that the more education a person has, the higher the wages and job security that person gets. Although, current experience in the financial sector demonstrates what happens when an industry implodes and no new opportunities are immediately apparent, which echoes back to Schumpeter's views regarding the impact of new technologies and thinking on jobs.

Globalization and higher education

Globalization threatens and provides opportunities for higher education.[8] The threat is what the World Declaration on Higher Education is trying to overcome by providing students who demonstrate merit access to quality programs, particularly in scientific and technical fields where new developments are being spurred. The world economic system is being restructured as a result of the network society and the formation of a knowledge economy. The core of the new, evolving system creates new dependencies as a result of outsourcing practices by

developed countries that provide opportunities to developing countries to build their economic capacity by creating and enhancing their stocks of technological knowledge.

In the United States, citing projected job shortages in what it defines as key fields in the health professions and sciences, the high-profile Spellings Commission Report from 2006 provides a specific example of how STEM fields are being encouraged as part of meeting national policy. It calls for colleges and universities to improve curricula and instruction in science and math as a means "keeping the nation at the forefront of the knowledge revolution."[9]

It also calls for federal investment in areas critical to global competitiveness and economic prosperity. The report's concern is that fewer American students are earning degrees in the STEM fields, medicine and other disciplines requiring a math or science background. Foreign-born students represent about half of the computer science graduates, more than half of the doctorate degrees awarded in engineering and about 30% of science and engineering doctorate holders employed in the country.

Reading Veenstra's 2008 study on engineering student retention supports the need to look at STEM programs from a systems-based perspective.[10] One of the finding of the Spellings Commission Report was an insufficient alignment between K-12 and higher education due to a disconnect between perceptions and understanding of each other's criteria. Veenstra's discussion of models used to describe the challenges found in engineering education provides background and recommendations for the issues related to attracting more students to STEM programs.

One of the recommendations is that attention needs to be given to student recruitment in engineering programs based on an assessment of each student's math and science preparation. This suggests the need to bridge the disconnect discussed in the Spellings Commission Report. Colleges must help shape K-12 standards, and university faculty should be involved in shaping K-12 curriculum.[11]

Observations

The increased interest and support of STEM programs is not without its detractors.[12] There are concerns the economic capacity-building aspect of the support may engender the process and quality of the educational experience for individual learners, and it may over emphasize standardization at the expense of the creativity process that disinterested and multi-disciplinary research provides. Nonetheless, there is also a strong argument that the creation of a global economy, based and shaped on a knowledge industry, provides new opportunities for personal and national development.

Although implicit rather than explicit, there is a connection between enhancing personal and national stocks of technical knowledge and improved quality of life. To again quote from the 2009 World Declaration, "The past decade provides evidence that higher education and research contribute to the eradication of poverty, to sustainable development and to progress toward reaching the internationally agreed upon development goals …"[13] It is also worth noting that, at least at the international level, agencies such as the United Nations Educational, Scientific and Cultural Organization (UNESCO) link quality assurance with the need to improve higher-education delivery of instruction, instructional techniques and research. Notions of quality, as alluded to by Van Damme[14] and others through the years, provide the public and governments with means of protecting and shaping their interests.[15]

Interestingly enough, there is controversy in the role quality assurance will play in the United States because of the changes the use of standards via an external review process would mean to accreditation organizations.[16] Article 9 of the 2009 World Declaration maintains that the expansion of access to higher education requires the simultaneous pursuit of equity,

relevance and higher education. Article 18 says the "training offered by institutions of higher education should both respond to and anticipate societal needs" and this "includes promoting research for the development and use of new technologies and ensuring the provision of technical and vocational training, entrepreneurship education and [programs] for lifelong learning."[17]

Therefore, quality:

- Requires establishing quality assurance systems and patterns of evaluation, as well as promoting a quality culture within institutions (Article 19).
- Includes regulatory and quality assurance mechanisms that promote access and create conditions for the completion of studies. These mechanisms should be put in place for the entire higher education sector (Article 20).
- Criteria must reflect the overall objectives of higher education, notably the aim of cultivating students critical and independent thought, and the capacity to learn throughout life (Article 21).

Colleges and universities are expected to meet national and state policy requirements as part of the quid pro quo of receiving public funds to support the existence of higher-education institutions and the instructional and research tasks they perform.

STEM has been an identified as a key policy-steering mechanism the educational system must pursue. It meets significant economic development and maintenance capacity and, by extension, critical social needs leading toward the expansion of democratic ideals. This is why concepts of access and equity are central to policy efforts. It is also why quality is identified as making sure the interests of stakeholders are taken into consideration.

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