A National Survey of United States Standards Education Content and Priorities Among Standards Education Groups

By

The Center for Global Standards Analysis

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Edited by

Donald E. Purcell, Chair

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Acknowledgement

In the spring of 2010, the Center for Global Standards Analysis ("Center") conducted a national survey concerning United States Standards Education Content and Priorities Among Standards Education Groups. Survey invitations were sent to private sector corporations, standards development organizations, firms and universities.[1] The Center received 17 responses to the survey. The Center is very grateful to the organizations and individuals for the time and effort used to respond to the survey.

The Center for Global Standards Analysis

The Center is a Washington, D.C. think tank dedicated to conducting research, establishing education programs in the field of global standardization, and making presentations on the strategic value of standards education programs. Since 1999, the Center has supported the graduate course *Strategic Standardization* in The Catholic University of America School of Engineering program for Engineering Management. The course on *Strategic Standardization* is one of four courses on standards offered among the Schools of Engineering in the United States. Other standards courses are offered at the University of Colorado (Boulder) Center for Advanced Engineering and Technology Education, University of Pittsburgh School of Information Sciences and Telecommunications, and Purdue University College of Technology. Seattle University School of Law and Yale University School of Law also offer a course on standards.

Members of the Center include: Jean-Paul Emard, Alliance for Telecommunications Industry Solutions; William Fox, Esq.; John Kenny, The Eluminate Group; Dr. Linda Garcia, Georgetown University; Laura Hitchcock, The Boeing Company, Barbara Kotschwar, Peterson Institute for International Economics; Stephen Lowell, U.S. Department of Defense; Amy Marasco, Microsoft Corporation; Mary McKiel, U.S. Environmental Protection Agency; Donald Purcell, The Catholic University of America; James Walters, Air-Conditioning, Heating, and Refrigeration Institute; and Erik Puskar, U.S. National Institute of Standards and Technology (Liaison).

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[1] *See* The Center's Survey Invitation, Appendix A.

Introduction

Significance of Standards and Standardization

From the Center's perspective, significant global economic, political and social circumstances are being driven by engineering, technology, science and globalization. The Center anticipates a future which is more complex, competitively intense, and in which standards and standardization systems will play an increasingly important role.

For example, since 1999, it has been generally accepted that private sector standards and government technical regulations directly affect at least 80% of world trade.[2] In 2005, Congress estimated that private sector standards and government technical regulations directly affected at least $7 trillion (US) of world trade in 2003.[3] In a world dominated by rampant globalization that will remain so for the foreseeable future, technology standards play a critical role. (*The World is Flat*, Thomas Friedman, 2005).[4] Standards influence everything we do (UK National Standards Strategy, 2003).[5] Standards control markets (German National Standards Strategy, 2005).[6] Moreover, standardization is one of the most powerful sources of competitive economic intelligence available (French Standardization Strategy, 2006; Canada National Standards Strategy, 2005).[7] Put simply, the evidence is overwhelming that standardization programs offer one of the best, most important means to evaluate current technology and provide a glimpse of where future technology innovations may occur. Standardization programs are indispensable for the strategic evaluation of technology and the analysis of competitive issues. In strategic terms, "If you control an industry's standards, you control that industry lock, stock, and ledger" (Out of the Crisis, by W. Edwards Deming, Center for Advanced Engineering Study, published by MIT Press at 302, 1986).

Survey Background

In 2008, the Center conducted a survey to determine whether interested parties considered standards education programs to have a strategic value. Interested corporations and standards development organizations from around the world responded unanimously that standards education programs do in fact have a strategic value.[8] Typical of the survey responses are the statements set forth below.

- The significant growth of standards Education programmes is symptomatic of the increasing interest in international standardization. Worldwide, ISO standards on quality and environmental management (ISO 9001, 14001) have become commonplace terms in the business sector. The Education sector in the UK is keenly interested in this topic, typified by

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[2] *See* Report on *Regulatory Reform and International Standardization* (OECD 1999).
[3] U.S. House of Representatives Congressional Hearing: China, Europe and the Use of Standards as Trade Barriers: How should the U.S. respond? (May 11, 2005)
[4] http://www.thomaslfriedman.com/worldisflat.htm
[5] http://www.nssf.info/resources/documents/Guide_to_NSSF.pdf
[6] http://www.din.de/sixcms_upload/media/2896/DNS_english%5B1%5D.pdf
[7] http://portailgroupe.afnor.fr/v3/pdf/strategystandardization_2010.pdf ; http://www.scc.ca/en/nss
[8] For a copy of the survey send an email to Donald Purcell at donpurcell@strategicstandards.com .

the high volume of enquiries BSI British Standards (BSI) receives from students and teachers. (BSI British Standards)

- According to our case study and field practice, the Standards Education Programs (SEPs) are of great significance for standardization academic institutions. For the progress of a developing country, the answer for this issue is essential. Making knowledge of standardization widely available provides the fundamental knowledge and the driving force for the rapid development of the economy and society in China. (China National Institute of Standardization)
- The standards world has radically changed over the past two decades especially in international standardization, with an increased impact on business and society. Rapid globalization of markets and accelerating technological innovation has brought a new need for multidisciplinary education in standards and standardization not only in the developed countries but also in the developing countries in order to improve international competitiveness of their industries and to solve various socioeconomic and environmental issues facing them. Academic sectors need to meet the challenge of newly emerging educational needs for the future generations and prepare a comprehensive interdisciplinary curriculum with support from industry, government and international organizations. (Hitosubashi University)
- Heightened national awareness of the importance of standards activities has been reflected by U.S. enactment of the National Technology Transfer and Advancement Act (NTTA) of 1995 which directs Federal agencies to use voluntary consensus standards to carry out policy objectives or activities determined by the agencies and departments, except where impracticable, and by recommendations presented in the National Research Council's report "Standards, Conformity Assessment, and Trade into the 21st Century." This body of evidence has convinced industry, academia and governments of the strategic importance of standards - hence the development of many comprehensive standards education programs in the United States and around the world. (U.S. National Institute of Standards and Technology)

In 2009 the Center conducted a follow up survey and posed the question – should the United States increase its support and resources for standards education programs.[9] Survey respondents unanimously agreed the United States should increase its support and resources for standards education programs. Typical of the survey responses are the statements set forth below.

- ASME believes there should be a renewed focus on standards education. With Globalization and rapidly developing technologies, engineering and technical education should include a standards component that may include education about the standards development process (including WTO/TBT principles), the role of standards in regulation and application of specific standards related technical content as may be appropriate based on a student's field of study. . . . Promotion of standards education can result in a larger pool of talent from which participants may be drawn to engage in future standards writing activities. This can help ensure the longevity of the private voluntary technical consensus standards development process. . . . The U.S. government can increase its support of standards education and may wish to consider grants to standards development organizations to create specific course

[9] *Ibid.*

content for universities and colleges. Schools may also be given incentives to introduce standards related courses into their curricula. (American Society of Mechanical Engineers)

- The United States should increase its support for U.S. standards education programs at the University level. Globalization in the marketplace and rapid changes in technology in the 21st century demand that engineers acquire the skills necessary to be immediately effective upon graduation. In addition to the math and science skills important in engineering curriculum, today's engineers must acquire knowledge of standards and their role in defining specific procedures, rules and guidelines. Two other key components for students to understand are the processes by which standards are developed and the regulatory policies and agreements that have been written surrounding standards. (ASTM International)
- Standards education programs are essential for the U.S. to maintain – even enhance – its competitive position in the global marketplace. ITI's recommendations for increased standards education focus on both national and international fora. Additionally, standards education should be not be limited solely to technical fields, but rather, should occur in all sectors – private, public and academic – and across multiple academic disciplines. . . . In our view, standards education is an opportunity for increased partnership among industry, academia and government, and should help build awareness of the role and importance of standards, including how the U.S. standards system facilitates trade and innovation in a timely manner. Clearly, standards benefit all sectors of the economy. Accordingly, standards education needs to be viewed holistically. (Information Industry Technology Council)

In the Spring of 2010, the Center determined a follow up survey to the 2008 and 2009 surveys was necessary in order to identify content for standards education programs and priorities among potential standards education groups. Survey results set forth below address these issues.

Highlights

To evaluate the significance of standards education content and priorities among potential standards education groups, the survey established four categories: *Essential, Necessary, Optional and Not relevant.* The 17 respondents reported a consensus on the following categories. To determine whether a consensus existed for a particular category, the *Essential* and *Necessary* categories were combined to determine whether a combined category had a value of at least 10.

Standards Education Content

Value of standards	16
Standards Development Bodies	15
Process & Procedures	14
U.S. Standards System	14
International Standards System	14
Technical Barriers to Trade	14
U.S. Public Policy on Standards	16
Standards Legal Issues	13
Standards and Regulations	16
Standards Research	11

Priorities Among Potential Standards Education Groups

Standards Professionals	15
Practicing Engineers	16
Technology Professionals	14
Executives (private sector)	11
Attorneys (private sector)	10
Attorneys (public sector)	11
University Students	14

About the Editor

Donald E. Purcell is Chair of the Center. He is a member of the adjunct faculty at the Catholic University of America School of Engineering where he teaches a graduate course, *Strategic Standardization*, and the School of Law where he teaches *Cyber Law*. In 2008, the Standards Engineering Society conferred the Fellow Award upon him in recognition of his dedication, leadership and valuable contributions to the principles and practices of standardization. Since 1999, he has been teaching, giving lectures and presentations on the strategic significance of education programs for global standards and standardization systems in North America, Europe and Asia. *See* www.strategicstandards.com for further background information; email: donpurcell@strategicstandards.com .

Respondents

The Organizations and individuals that responded to the survey include the following:

- Adobe
- Air-conditioning, Heating and Refrigeration Institute
- Andrew Updegrove, Esq.
- American Society of Mechanical Engineers
- ASTM International
- BICSI
- Boston University
- Caterpillar
- Georgetown University
- Institute of Electrical and Electronics Engineers
- National Electrical Manufacturers Association
- National Fire Protection Association
- Society of Fire Protection Engineers
- Society for Human Resource Management
- Toy Association
- Underwriters Laboratories
- University of Colorado (Boulder)

Respondent Comments

Adobe

Standardization, not standards, is an essential discipline. Standards themselves are reasonably trite. However, the use of both de facto and de jure standards in products makes the discipline interesting and non-trivial. You don't draw this distinction – and it is very important. I've never met a senior executive who cared about standards – they care about the benefits of standardization. They don't much care how it gets done – all they care about (justifiably) is the result of the activity, which should be a positive change in the bottom line, either through cost containment or opportunity creation, done legally.

While it would be nice to have some education about standardization, my assumption is that the focus would probably be on the formal or documented standards process. The problem with this approach, at least in high technology, is that it is most honored in the breech than in the observance. High tech (specifically the ICT arena) is responsible for most of the changes in standardization over the past 15 years – we made consortia real, we've validated the open source model, we've moved away from using formal standards in many of the things we actually create. The interest in standardization is high – the interest in "Standards" is low in the high technology arena. The exception to this rule is when standards are the basis of national economic or industrial policy, as happens in South America, China, Europe, Asia, and most everywhere in the world except the U.S.

The same applies to "standards systems". A good knowledge of the system usually is gained from cumulative learning experience, and is not something that can be taught in the class. The most effective lesson for young standards players would be a good grounding in a multiple iteration "Prisoners Dilemma" activity, where they learn cooperation is much more successful than competition.

It might be helpful to explain the basis of standards as a government grant, as well. Similar to the patent system, standards are a public good that permits the use of a limited monopoly for social good (at least, that's how most nations see them.)

Finally, in a global economy, there is the question of whether national standards have any role, except as instruments of the government. In nations where export (rather than import) is an economic driver, national standards fade in significance as compared to regional (trading partner) or international standards (export market). And, as country governments seize control of their standards bodies to push national agendas, the international standards arena (and the WTO and WIPO) become the new ground in which standardization will be practiced.

BICSI

1. While there are content categories that are applicable to everyone, the weighting of non-essential content will vary. For instance, pre-law/law studies would need a much more content on standards case history/case law and intellectual property issues than those within engineering. This weighting would also apply to courses on international business and political science, as each of these have differing needs in levels of content.

The same applies to the education groups. Additionally, segments of some groups would not have need of much, if any, standards education, as their job duties would have little, if any interaction of standards on the levels of education indicated. Conversely, for some segments, in-depth standards education would be required, such as the intellectual property attorneys, managers/executive staff at NIST, educators of standards content, etc.

2. Depending on the definition of technology professional, a potential missing category are those professionals, such as architects, telecommunication and IT designers, etc., who may not be formal PEs, but whose work is subject to codes and standards. While a PE is required at some point within the approval process for a fair amount of this work, improvements/corrections can be made to the work at an earlier stage if the applicable standards knowledge is present, which can reduce the potential of larger issues/failures.

In a similar vein, the standards knowledge of inspectors, certifiers, evaluators, etc. within both public and private entities is extremely varied and leads to all manner of issues, delays, unnecessary expense and inefficiencies. While their required knowledge may only be a small subset of the categories listed above, the lack of consistency and depth of certifier's essential knowledge even within the same jurisdiction is becoming a large concern.

Boston University

Standards are unlikely to emerge as a stand-alone topic in a business school curriculum, unless there are individual faculty who have a special interest in teaching such a course. However, it would be great to see more standards-related content (in the form of case studies or teaching modules) spread across various classes. For instance, many schools offer course in technology management, and these should all have one or two sessions devoted to the role of compatibility standards in governing shared technology platforms. There is increased interest in electives related to corporate governance and environmental sustainability. These courses need teaching materials that explain the important role of the national and international standards system as a vehicle for industry-wide consensus-driven initiatives that either preempt or complement government regulation.

Georgetown University

I BELIEVE THAT STANDARDS SHOULD BE LOOKED AT IN THE LARGER SOCIETAL CONTEXT: FOR EXAMPLE, standards are a key topic in courses and technology and society, etc. They also should be looked at from a political point of view (the role of standards in determining political outcomes, standards and global international relations, etc.) We shouldn't think of them just in the context of business and technology—that is why we don't have a critical mass for standards education. We also need to look at them contextually. Why do other countries look at them differently. Does one size/approach fit all, as we seem to think.

IEEE

Education Content Categories: All of the listed content categories are important. What may be missing is education in how to use standards, especially because the category "Standards Usage" is defined as "referencing Standards in contracts and other documents").

Many practicing engineers express frustration in their attempts to understand how to use the technical information given in standards. They look for handbooks, courses, and the like to guide them. Professors and students, too, are looking for hands-on technical training in the use of specific standards.

Case Histories: Our response that these are "Essential" is based on the understanding that "Case Histories" refers to what are more commonly called case studies, i.e., analyses of real-world instances where standards or the lack of them have made an important difference to business and/or society.

University of Colorado (Boulder)

The difference between the study of standards (concepts) and standardization (implementation) is not addressed. Without an understanding of the fundamental nature of standards (concept), education in standardization is without substance. In such a case standardization appears as another political process, of importance, but indeterminate in outcome. This keeps executives and managers from investing as they see no logical means to impact outcomes. Studies of where standardization has made significant impact are certainly desirable, will not change the management view of standards until there is more information available about cause and effect.

When our field does not have a common and rigorous definition of what a standard is, teaching what standardization does may be desirable but is also premature.

Content for Standards Education Programs

Potential Content	Essential	Necessary	Optional	Not Relevant
Value of standards	15	1	1	0
Standards Development Bodies (e.g., accredited, consortia, regional)	6	9	2	0
Process & procedures	4	10	3	0
US Standards System	9	5	2	1
Intl Standards System	6	8	2	1
EU Standards System	2	6	7	2
China's Standards System	2	4	9	2
Technical Barriers to Trade	5	9	2	1
US Public Policy on Standards	8	8	1	0
EU Public Policy on Standards	3	6	7	1
China's Public Policy on Standards	3	6	7	1
Standards Legal Issues (e.g., patents)	4	9	4	0
Conformity Assessment	7	5	4	1
Standards and Regulations	8	8	0	1
Standards Case Histories	5	4	8	0
Standards Research (locating and obtaining Standards)	4	7	4	2
Standards Usage (referencing Standards in contracts and Other documents)	3	5	7	2

Priorities Among Potential Standards Education Groups

Group	Essential	Necessary	Optional	Not Relevant
Standards Professionals	12	3	1	1
Practicing Engineers	10	6	0	1
Technology Professionals	3	11	2	1
Executives (private sector)	5	6	6	0
Executives (public sector)	4	8	5	0
Managers (private sector)	3	6	7	1
Managers (government sector)	2	7	7	1
Attorneys (private sector)	1	9	6	1
Attorneys (government sector)	1	10	6	0
University faculty	5	4	8	0
University students (engineering, technology, science, business, public policy, law)	8	6	3	0

Appendix A

2010 Survey on Priorities for Standards Education Programs and Education Groups

Purposes of 2010 Survey

This survey is a follow up to surveys conducted by the Center for Global Standards Analysis ("Center") in 2008 and 2009. The 2010 survey has two purposes: (1) identify priority content for standards education programs; (2) identify priorities among education groups.

Background

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- According to our case study and field practice, the Standards Education Programs (SEPs) are of great significance for standardization academic institutions. For the progress of a developing country, the answer for this issue is essential. Making knowledge of standardization widely available provides the fundamental knowledge and the driving force for the rapid development of the economy and society in China. (China National Institute of Standardization)
- The standards world has radically changed over the past two decades especially in international standardization, with an increased impact on business and society. Rapid globalization of markets and accelerating technological innovation has brought a new need for multidisciplinary education in standards and standardization not only in the developed countries but also in the developing countries in order to improve international competitiveness of their industries and to solve various socioeconomic and environmental issues facing them. Academic sectors need to meet the challenge of newly emerging educational needs for the future generations and prepare a comprehensive interdisciplinary curriculum with support from industry, government and international organizations. (Hitosubashi University)
- Heightened national awareness of the importance of standards activities has been reflected by U.S. enactment of the National Technology Transfer and Advancement Act (NTTA) of 1995 which directs Federal agencies to use voluntary consensus standards to carry out policy

[10] For a copy of the survey send an email to Donald Purcell at donpurcell@strategicstandards.com .

objectives or activities determined by the agencies and departments, except where impracticable, and by recommendations presented in the National Research Council's report "Standards, Conformity Assessment, and Trade into the 21st Century." This body of evidence has convinced industry, academia and governments of the strategic importance of standards - hence the development of many comprehensive standards education programs in the United States and around the world. (U.S. National Institute of Standards and Technology)

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- The United States should increase its support for U.S. standards education programs at the University level. Globalization in the marketplace and rapid changes in technology in the 21st century demand that engineers acquire the skills necessary to be immediately effective upon graduation. In addition to the math and science skills important in engineering curriculum, today's engineers must acquire knowledge of standards and their role in defining specific procedures, rules and guidelines. Two other key components for students to understand are the processes by which standards are developed and the regulatory policies and agreements that have been written surrounding standards. (ASTM International)
- Standards education programs are essential for the U.S. to maintain – even enhance – its competitive position in the global marketplace. ITI's recommendations for increased standards education focus on both national and international fora. Additionally, standards education should be not be limited solely to technical fields, but rather, should occur in all sectors – private, public and academic – and across multiple academic disciplines. . . . In our view, standards education is an opportunity for increased partnership among industry, academia and government, and should help build awareness of the role and importance of standards, including how the U.S. standards system facilitates trade and innovation in a timely manner. Clearly, standards benefit all sectors of the economy. Accordingly,

[11] *Ibid.*

standards education needs to be viewed holistically. (Information Industry Technology Council)

Set forth below is the 2010 survey form. Please complete and return the survey form by email to Donald Purcell at donpurcell@strategicstandards.com by June 30, 2010. If you have any questions, please send an email to Donald Purcell.

2010 Survey on Priorities for Standards Education Programs and Education Groups

Please evaluate each potential education category according to the criteria set forth.

Potential Content	**Essential**	**Necessary**	**Optional**	**Not Relevant**
Value of standards	_____	_____	_____	_____
Standards Development Bodies (e.g.,accredited, consortia, regional)	_____	_____	_____	_____
Process & procedures	_____	_____	_____	_____
US Standards System	_____	_____	_____	_____
Intl Standards System	_____	_____	_____	_____
EU Standards System	_____	_____	_____	_____
China's Standards System	_____	_____	_____	_____
Technical Barriers to Trade	_____	_____	_____	_____
US Public Policy on Standards	_____	_____	_____	_____
EU Public Policy on Standards	_____	_____	_____	_____
China's Public Policy on Standards	_____	_____	_____	_____
Standards Legal Issues (e.g., patents)	_____	_____	_____	_____
Conformity Assessment	_____	_____	_____	_____
Standards and Regulations	_____	_____	_____	_____
Standards Case Histories	_____	_____	_____	_____
Standards Research (locating				

and obtaining Standards)	_____	_____	_____	_____
Standards Usage (referencing Standards in contracts and Other documents)	_____	_____	_____	_____

Please evaluate each potential education group below according to the criteria set forth.

Group	**Essential**	**Necessary**	**Optional**	**Not Relevant**
Standards Professionals	_____	_____	_____	_____
Practicing Engineers	_____	_____	_____	_____
Technology Professionals	_____	_____	_____	_____
Executives (private sector)	_____	_____	_____	_____
Executives (public sector)	_____	_____	_____	_____
Managers (private sector)	_____	_____	_____	_____
Managers (government sector)	_____	_____	_____	_____
Attorneys (private sector)	_____	_____	_____	_____
Attorneys (government sector)	_____	_____	_____	_____
University faculty	_____	_____	_____	_____
University students (engineering, technology, science, business, public policy, law)	_____	_____	_____	_____

Please feel free to submit additional comments on education content categories and potential education groups.