

Report of the ICES2007 workshop on Education about Standardization in Delft, the Netherlands¹

Henk J. de Vries (Erasmus University Rotterdam) and Tineke M. Egyedi (Delft University of Technology), February 20, 2007

A few years ago, universities in Korea hardly spent any time on standards and standardization. Last year (2006), however, 87 standardization courses at 46 Korean universities were attended by 6681 students. Korea's stance is that standards shape the market for products and services. As they want to increase their influence in the process of developing these standards and make their companies profit from standardization, they indeed understand the need for education.

This report presents the main results of an international workshop on standardization education organized by the International Committee for Education about Standardization (ICES). ICES was established in Tokyo, February 6-8 2006 at an expert meeting on 'The Future of Global Education in Standards.' Experts from academia and industry from Asia, North America and Europe met to share ideas and learn from each other's education practices. The participants agreed that education about standardization globally is a subject worth pursuing, to meet once a year, to share knowledge and experiences, and to proceed under the name ICES.



Figure1: Presentation on education content by Danbee Kim (KSA) just prior to the Group Decision Support exercise.

The ICES workshop discussed in this report is the follow-up of the Tokyo meeting. It took place February 7-9 2007 at the Delft University of Technology in Delft, the Netherlands, and was organized by Tineke Egyedi (Delft University of Technology) and Henk de Vries (Erasmus University Rotterdam). Here, they report about what they think

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are the main findings from the workshop, grouped into the four thematic sessions of the workshop:

1. Need for standardization education
2. Audiences and learning objectives
3. Contents of a cross-academic course on standardization
4. Inventory of existing educational material.

The first two sessions addressed standardization education in the widest sense, whereas the last two sessions focused on academic teaching.

Momentum

But before discussing the workshop findings, what is the state of interest for standardization education world-wide? Korea's initiatives in standardization education spearheaded a flurry of activity internationally. Since 2003 the number of activities has increased rapidly. To name but a few,

- The first Strategic Standardization Workshop of the Korean Standards Association is held.
- Start of the Secondary School Program on Standardization Education in Thailand (2003-2006): 2354 teachers are trained and 444,600 students receive standardization education.
- Start of the Asia Link Project on Standardization Education (2004-2006): a co-operation between the universities of two European and four Asian countries.
- Publication about the need for standardization education in the Japanese journal for Science and Technology Trends "Quarterly Review" (Kurokawa, 2005).
- In the framework of the IEC Centennial two publicly available lecture series are developed, one series for engineers and one for business schools.
- The International Committee on Education about Standardization (ICES) is founded (2006) and annual meetings are announced.
- KSA organizes its 1st international Standards Education Seminar (2006).
- Hitotsubashi University Project (Japan) on 'Standardology' starts (2006-2009).
- Installment of a working group on Standardization Education within the European Academy for Standardization (2006).
- ITU organizes a consultation meeting on "Cooperation between ITU-T and Universities" in Geneva 18-19 January 2007.
- Two European projects COPRAS and INTEREST, finalized in 2007, address how to feed R&D results of universities and companies into standardization and include educational issues.
- The "International Journal of IT Standards & Standardization Research" organizes a special issue on Standards Education (2007).
- ISO organizes an award to encourage and recognize successful programs for higher education in standardization (2007).

- APEC project on standardization education starts, led by Korea, in which Indonesia, Japan, Singapore, Thailand, USA and Vietnam participate (2007-2010).

This incomplete listing suggests a surge of interest in standardization education worldwide, and a momentum for discussion and collaboration.

Needs for standardization education

The first session of the ICES workshop in Delft focused on acquiring insight in what needs or demands there are for standardization education. Such insight may help drive, focus and structure new initiatives in this area and in a practical sense ‘legitimizes’ them. The following four approaches ease identifying needs for standardization education (source: presentation by dr. Henk de Vries): (1) deducing needs from current course offerings, (2) deducing needs from standardization related tasks, (3) deducing needs from standardization-related problems, and (4) systematically studying aspects of the standards phenomenon and inferring related needs.

1. Inventory of current courses

In case of supply, a demand may usually be presumed. In line, studying the supply of standardization education may well indicate which needs there are. While many Korean universities offer courses on standardization, in other countries the number of universities is very limited. In the USA, the Catholic University in Washington DC is, as far as we know, the only university in the USA with a separate standardization course. In Europe the number of universities with courses on offering is somewhere between 10 and 30 (see e.g. http://ec.europa.eu/enterprise/standards_policy/academic_network/catalogue.htm; no recent inventories are available). These courses tend to attract only a small number of students. The major share of academic education on standardization can be found in Asia: mainly in China, Japan and Korea, but also in Thailand and, thanks to the common European-Asian ‘Asia Link’ project on standardization education, in Indonesia, Sri Lanka and Vietnam as well.

Non-academic teaching is offered in many countries, mainly in the form of courses for technicians about certain standards. For some of these standards the number of students is huge, e.g. in case of standards for quality management. The national standards bodies of certain countries, e.g. Austria, Germany, USA and Vietnam, also offer some more general courses on standardization. However, compared to the number of people involved in standardization, the supply of education is very restricted. This indicates a limited manifest need for education.

2. Courses for standardization related tasks

Standardization activities are carried out by people who may need specific knowledge and/or skills to do their job. Their educational needs can be identified by determining what they must do during specific stages of the standards process. This, irrespective of

where standardization takes place, at company, national, regional or international level, in the committees of consortia or formal standards bodies.

For those who develop standards professionally the education required will usually differ from those who are merely indirectly involved. Currently, the most extensive education for standardization professionals is offered by Prof. Song and his colleagues at China Jiliang University in Hangzhou, Peoples Republic of China. Several international, regional and national standards bodies offer short courses for standards professionals and standards officers in companies (e.g. the German national standards institute DIN). However, most participants in standardization committees have had very little training, if any. As a result standardization activities in companies, consortia and standards bodies are carried out in a rather 'primitive' way (de Vries, 2005).

A similar observation can be made about people for whom standardization activities only constitute part of their job. They are usually not aware that they can profit from training and education. This applies to the management level as well as to the workers on the shop floor.

3. Education to solve problems

John Hill, Standards Manager of Sun Microsystems and initiator of ICES, argues that 'Companies as well as standards bodies need well-educated standardization experts. Standardization processes should keep up with the times. Who will progress the theory and practice of standardization? Will universities provide us with such people?'. His concern is echoed by Dr. Toshiaki Kurokawa (ICES2007 presentation). Japanese companies, too, experience difficulties in creating standards specialists for the longer term. 'On the job' training is costly and insufficient.

Doede Bakker, speaking on behalf of the Dutch trade association for the technology-industry sector (FME-CWM), notes that companies which want to achieve a leading market position have to set the relevant standards themselves. Therefore, education on all company levels is needed, in particular at the managerial level. Managers need to be convinced about the importance of standards by clearly demonstrating and quantifying the benefits of standardization.

The national, regional and international standards bodies are facing the problem that technical experts for standards development are scarce. Moreover, an important part of those who are currently active will be retiring the coming decade without there being enough successors. This demographic development partly explains the timing of present interest of standards bodies in education.

4. Academic approach to needs

De Vries also describes a more academic approach to determine standardization education needs. The approach starts out by asking the questions *what* is done in practice (in this case, by the people involved in standardization), *how* is it done, *why* is it done, and *why* is it done *in a certain way*. By means of a general model, first, processes in standardization are defined, then the people related to these processes, and, finally, the education they need to carry out their tasks. This model can be applied to different standardization settings, e.g., at company, inter-company, national and international level,

in different business sectors, in technical as well as non-technical areas, and for different kinds of standards.

Conclusions and lessons learnt

The workshop discussions highlight the enormous gap between latent and manifest needs for standardization education as a main challenge. Countries like Korea, Thailand and Turkey show that to bridge this gap a national strategy is needed, as is cooperation between a country's government, industry, national standards body, academia and educational institutions.

Another lesson learnt during the workshop is that it is easier to talk about educational content (i.e. in terms of there being a need for ...) than identifying the source of educational needs (i.e. why should one have knowledge of standardization?). Nevertheless, the latter should be the starting point of standardization education. It determines which audience should be targeted and what should be educated (learning objectives).

Audiences and learning objectives

The third session of the workshop was devoted to the questions who should be educated on standardization (which audiences are there) and why (which learning objectives match these audiences).

Before widening up to other target groups, Korean education started off by targeting students of engineering. The reason for starting with future engineers was that a main significance of standards stems from the fact that they are embedded in products. The courses focus e.g. on creating awareness about the significance of standards, on what standards are and on how they influence the world market. Furthermore, Danbee Kim of KSA argues that a main lesson learnt by the Koreans is that teachers of standardization education are an important category of people for standardization education ("teach the teachers").

In a brainstorm session, the workshop came up with a list of audiences who would benefit from standardization education. Those listed varied, i.e.:

- from audiences in the regular educational system (e.g. primary school, secondary school, vocational training, university students including e.g. MBA students, PhD students and post-docs, teachers and university professors) to job training (e.g. for standards developers, implementers, corporate managers, managers of functional units (e.g. purchasing department), researchers, policy makers (see Figure2), public administration, lobbyists e.g. for an industry sector, and media people), and education for the wider public. For instance, in Thailand, Turkey and Korea children of primary and secondary school age receive standards education. In Korea, for example, summer camps are organized;
- within regular education, from general (e.g. cross-academic courses) to specific education;

- from those who will make a full-time career out of standardization, which applies to a group of standardization experts in China), and those who end up in this area at a later stage of their career, as is mostly the case.

An example of education for full-time standards professionals is the set of courses offered at the China Jiliang University (ICES2007 presentation by Prof. Mingshun Song). The types of students are:

- postgraduate students from mechanical and electronic engineering disciplines;
- postgraduate students from testing technology and measuring meters disciplines;
- undergraduate students from standardization and quality management.

The learning objectives for the bachelor level are:

- to work in company standardization jobs;
- to serve the standardization management sectors of the government at different levels;
- to serve the medium servicing organization for standardization.

The objectives for master level are:

- to draft professional, local or national standards;
- to participate in regional or international standardization activities as a representative of the organization;
- to engage in standardization management affairs in government and big companies.

The curriculum may lead to a qualification in standardization (i.e. a license for ISO 9000 auditor). More than 70% of the students get a standardization-related job after their bachelors.

People usually come into contact with standards via their profession (e.g. in a specific technical area). They may sometimes already be acquainted with specific standards such as standards for technical drawing or standards for safety of low voltage installations through regular education at the lower, intermediate or higher vocational level. However, in the long run this knowledge will not suffice as new standards emerge and existing standards are changed or withdrawn. So, once people really get involved in developing or applying standards in their professional life they will need continuous education, e.g. by means of a course offered by a national standards body.

‘Ministers recognized the importance of standards education and encouraged members to develop reference curricula and materials to address the significance of standards and conformance to trade facilitation in the region’.

Box 1: Joint statement issued at the *Eighteenth APEC Ministerial Meeting, Ha Noi, Vietnam, 15-16 November 2006*, page 8/29 (Source: ICES2007 presentation Donggeun Choi, KSA).

The regional and national policies on standardization education (see Box 1) and the educational settings differ widely, and, as a consequence, so does education content. The policies and settings range from becoming a strong player on the international market (Korea), to preparing the country for EU membership (e.g. Turkey), and improving student chances for employment abroad (Sri Lanka, “exporting people, not products”). That is, each country may have a different focus, and therefore a different view on what students need to prepare them for work.

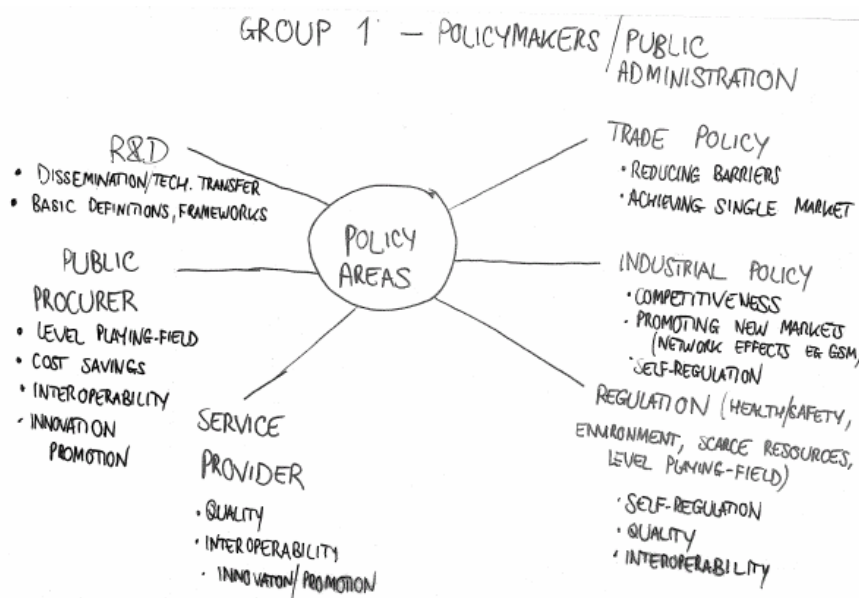


Figure 2: In small groups a select number of audiences were discussed and reported back to the plenary. One of the groups focused on the audience of “policy makers / public administration” and identified educational needs in the areas of trade policy, industrial policy, regulation, R&D, public procurement, and service provision.

Three types of interrelated learning objectives were discussed: attitude-, skill- and knowledge-related objectives. In the wording of Françoise Bousquet (ZFIB Conseil), there is a need both for knowledge (understanding the importance of standardization, knowing and understanding the process and the standards procedures) and know how (how to behave, lobbying, representation, reporting, collection of information). The workshop participants further emphasized the need to know how to work in a team, how to arrive at consensus, how to negotiate (give and take) and debate, and how to deal with cultural differences.

As for knowledge-related learning objectives, the importance was noted of recognizing, on the one hand, the strategic value of standards for industry (“competitive intelligence”), countries, and regions (“trade facilitation”) and, on the other, the standardization strategies of countries and standards bodies (e.g. France, Japan, Korea, Sri Lanka). For example, one of the learning objectives of an MBA course in Sri Lanka is “to present the importance of standardization as a strategic tool and provide an understanding of different standardization strategies” (Prof. Niranjana Gunawardena, University of Moratuwa).

Contents of an academic curriculum

Standardization courses differ in the topics they address. Most curricula seem to be composed in a rather pragmatic way, strongly depending on the specific knowledge of the designer.



Figure 3: A selection of the teaching modules supported by the Asia Link e-learning platform. The Asia Link project 'Standardisation in Companies and Markets' is one of the bigger projects on standardization education (source: ICES2007 presentation by Prof. Wilfried Hesser and Wenke Siedersleben).

In the third workshop session we focused on determining the content of an academic cross-disciplinary course. This was done with help of 'group decision support software' and 30 interconnected computers (see Figure 1). This interactive approach permitted us to achieve rough consensus on the ingredients of a curriculum with the active involvement of all participants and in one morning. We first identified important topics. Next, we defined general themes, and grouped the topics under the theme headings. In the last phase, missing topics were added to the themes.

Theme	Curriculum			
	Korea	Asia Link	Washington	ICES Workshop
Importance and effects of standards	X	X	X	X
Definitions	X	X	X	X
Classification of standards	X	X	X	X
Functions of standards	X	X		X
History of standardization	X	X		X
Importance of international standards	X		X	
Organizations for international standardization	X	X	X	X
Processes of international standardization	X		X	X
Industrial standardization in Korea	X			
Measurement standards	X	X		
Company standardization and quality management	X	X		X
Application of company standards	X	X		X
Conformity assessment	X	X	X	X
Standards & IPR	X	X	X	X
Economic aspects of standardization		X		
Development of standards		X		
Standardization in product development and design		X		
Standardization within a company – a strategic perspective		X		X
External standardization as a company strategy		X	X	X
Standardization and innovation		X		X
Standardization and international law		X		X
The European standardization regulatory framework		X		
Standardization policy of the European Union		X		
Standardization and law in the Federal Republic of Germany		X		
The European Union and its New Approach		X		
Quality management and ISO 9001		X		
Implementation of the ISO 14000 environmental management system		X		
Agricultural standardization		X		
National standards policies			X	X
United States standardization system			X	
Consortia		X	X	
Regulatory perspectives (USA)			X	
International trade and standardization		X	X	X
International competition			X	
Health, safety and the environment			X	
Antitrust, competition and trade regulation			X	
Value of standardization for different actors				X
Lifecycle of standards and technologies				X
Structure of standards documents				X
Standards and cultural diversity				X
Skills in standard setting				X

In the table above we compare the themes identified in the workshop session with those of the curricula in Korea, the Catholic University of Washington, and the Asia Link project ‘Standardization in Companies and Markets’ as indicated by chapter headings. This is no more than a tentative comparison, for a theme in one course may encompass three themes in another course. So, having fewer themes mentioned does not mean that a course is less complete. Moreover, because circumstances differ per country, the contents need not be the same in each country.

Available material for academic teaching

The aims of the fourth and last workshop session were to get an idea about what educational material is used by ICES participants, and to provide opportunity to show, discuss and exchange material, explore collaboration, and identify which material is still lacking and needs to be developed.

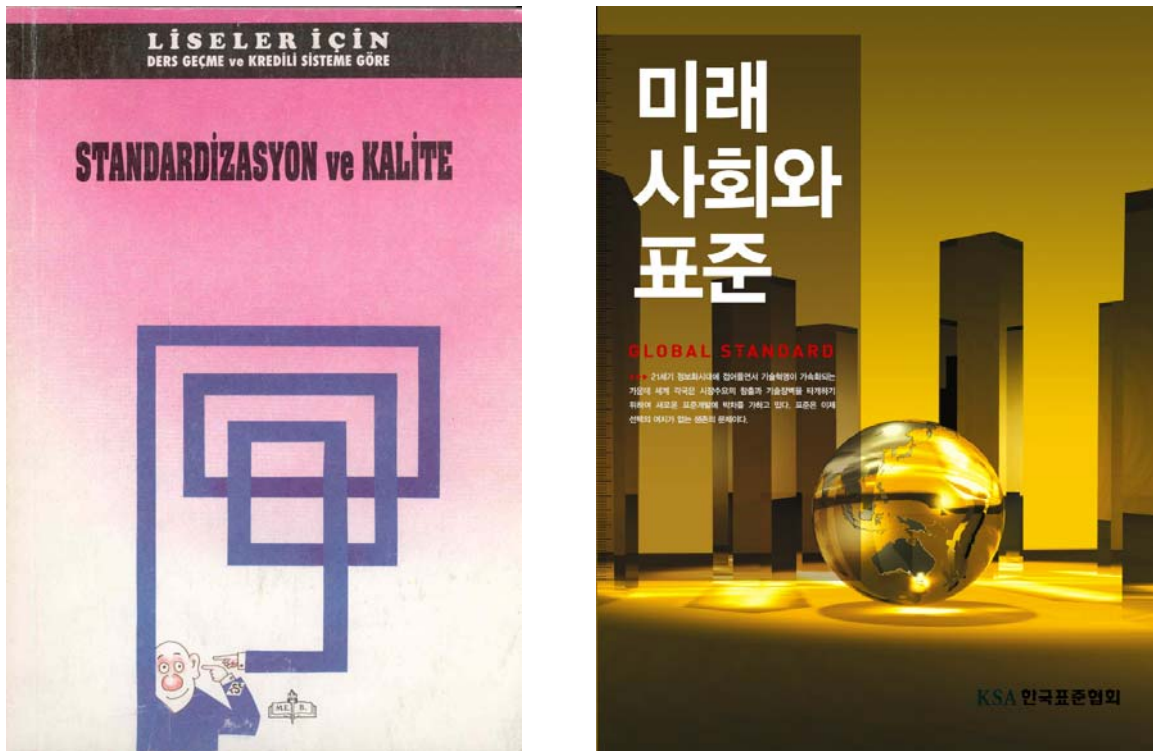


Figure 4: Covers of two books on standards education (Icin, 1994; KSA, 2004).

A fair amount of books (e.g. Icin, 1994; Simons & de Vries, 2002), e-learning environments, digitally available lectures and internet courses (e.g. Korean e-learning environment, Hesser et al., 2006; Purcell, 2005; Egyedi, 2007), bibliographies (e.g. for Greek SMEs and for US engineering students), teaching cases (de Vries, 2006) and other educational material exist. However, the vast majority is written in Chinese, Dutch, Japanese, Korean, Turkish, etc. (see figure 4) and is as such not easily accessible. Only a small proportion used by the workshop participants is available in English, the language

spoken at the workshop. One such exception is the Asia Link course book (Hesser et al. 2006) and the corresponding e-learning curriculum (see figure 3). The internet curriculum, to which one can subscribe, consists of 22 learning modules. Like the Korean courses, internet is not only used to offer course material. It is also a means to do exercises, exchange information within groups and between teachers and students, and to store and retrieve documents. The e-learning curriculum includes a 'Frequently Asked Questions' section, a glossary and examination questions (Siedersleben, 2006).

There is, of course, also teaching material with a more narrow focus (e.g. an internet module about two standards in the batch processing industry; www.batchcentre.tudelft.nl), and there are books and internet sites, which do not specifically target education but may provide useful input for education. Examples are the books from Spivak & Brenner (2001), Blind (2005), and Jakobs (2001, 2006), and the COPRAS website www.copras.org (i.e. guidelines to facilitate interfacing between research projects and ICT standards organizations).

In many western countries it turns out to be difficult to attract students. This problem may be related to the educational material used. Workshop participants concluded that, to reach students, the way of presenting content should be "fun" and "sexy" at all levels of education. Although e.g. case studies are very useful and essential to illustrate standardization issues, and invited speakers, in particular, from industry liven up courses (e.g. Korea and USA), overall teaching cases are lacking which involve role playing and help students 'experience' standardization. A notable example is the one developed by the ISO. ISO has developed an e-learning course which uses a teaching case, a simulation, for educating standardizers. The course takes as a starting point the interests of a company from the imaginary country "Southistan" and simulates learning by doing. Courses like these, which aim at standardizers, would also seem useful for academic teaching (ICES2007 presentation by Daniele Gerundino). (Vice versa, the teaching material developed for academic teaching may well be applicable in other educational settings.)

The manner in which standardization education is offered (pedagogical means) is one thing. The context in which it is presented is another. Françoise Bousquet's positioning of standardization as an industry tool for 'Competitive Intelligence' is a good example. This makes explicit that standardization is a means and not an end. Moreover, possibly the need for standardization can be more compellingly demonstrated if expressed as a derivative of and tool for a higher, strategic goal such as it being a tool for competitive intelligence, safe working conditions, effective production process, reduced health risks, etc.

By whatever pedagogical means standardization education is offered, and in whatever context it is cast, the experience of the workshop participants is that the availability of teaching material determines what is used for courses ("The more material the better").

Reviewing the material discussed at the ICES2007 workshop, is certain content lacking? Even given our bias towards material provided in English, the content of (Internet) courses and books showed much overlap. Only a limited number of subjects were not or not equally covered, such as

- different national and regional standardization education strategies (which is e.g. included in a USA course);
- the history of standardization;
- the impact of cultural diversity on standardization (which is addressed by a CEN focus group).

Regarding these issues more research is needed as an input for education. The need for more research also applies to ‘the impact of standards’, a subject which despite recurrent efforts remains difficult to argue and quantify. Better insight on this matter would very much ease getting standardization education on the political agenda of more countries.

Conclusion and future developments

The ICES workshop findings indicate that an enormous gap exists between manifest and latent needs for standardization education. Few policy makers notice the contribution of standards to industry and society. Company managers lack awareness of the strategic importance of standards for their company in terms of market share and effectiveness of the organization. People who do the standards work, e.g. experts who participate in standards committees, mostly do so without any education or training. They are not aware that findings in standardization research and training in professional skills could enhance their effectiveness considerably. The lesson to be learnt from some of the Asian countries is that the gap can be bridged. First, by a strong national policy which may be part of a regional policy. Secondly, by cooperation between government, industry, national standards body, academia and other educational institutions.

The workshop identified a diversity of target groups, each with different educational needs. However, catering to the needs of these target groups need not start from scratch, as the experience gained in different countries and the educational material already developed show

The increasing number of initiatives and activities of the last three years indicates that there is a momentum for education on standardization. In the period leading up to and at the next ICES meeting, which will take place in 2008 at the National Institute of Standards and Technology (NIST, USA), we will try to seize this momentum. The above stated lack of awareness suggests itself as a possible theme. That is, how can we make governments, industry and universities aware of the strategic importance of standards and standards education? Or, focusing on educator problems,

- How can students be drawn to courses about standardization?
- What pedagogical means can best be used to trigger their interest?
- In what manner can teachers secure institutional support for such courses?

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