On the Pursuit of Relevance in Standards-based Curriculum Development: The CCNY Approach

Angelo Lampousis
CUNY City College

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Introduction
The Society for Standards Professionals (SES) has a significant history of documenting the use of standards in research and academia. For instance, during the 62nd Annual SES Conference in 2013 in Savannah, Georgia, the author participated in such a session highlighting examples of relationships between academic institutions, government, and standards developing organizations. In this article, we attempt to capture the current advances made from similar relationships specific to our home institution, the City College of New York (CCNY) of the City University of New York (CUNY). These advances have become possible through a grant issued under the Standards Services Curricula Development Cooperative Agreement Program of the National Institute of Standards and Technology (NIST).

CCNY was one of five institutions receiving funding in 2016 from NIST out of forty-nine applicants. The purpose has been to develop teaching materials for integration into four courses encompassing topics such as environmental management standards, mold standards following hurricanes, environmental site assessments, the effects of international trade agreements on safety standards, building standards for mitigating the effects of earthquakes, mining standards, geographic information metadata standards, and standards for first responders regarding chemical and biological substances.

Of these four courses, two are offered in sequence on the topics of Phase I and Phase II environmental site assessments. The CCNY bulletin description on these two courses reads almost verbatim from ASTM E1527-13, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process, and ASTM E1903-11, Standard Practice for Environmental Site Assessments: Phase II Environmental Site Assessment Process, respectively. For instance, the Phase I course description starts as “The purpose of this course is to introduce students to good commercial and customary practices in the United States of America for conducting environmental site assessments of commercial or residential properties with respect to hazardous substances and petroleum products…” The Phase I course has been offered every fall semester since 2010, and the Phase II course has been offered every spring semester since 2011, both at the undergraduate and graduate levels. A third course entitled Global Environmental Hazards focuses on the study of important, naturally occurring, destructive phenomena, such as earthquakes, volcanic eruptions, landslides, and coastal flooding. Related topics include long-term causes and remediation of these problems, as well as a focus on consequences to urban environments. Finally, the fourth course is specific to CUNY’s Macaulay Honors College students, who come together for a seminar course that they take over the course of their second year. This seminar course is called Science and Technology in New York City.
It is worth noting that the above-mentioned courses do not represent the only intended audience of the proposed nine modules funded by NIST. They represent more of an ecosystem of standards-related learning opportunities. In this context, the modules will be piloted and improved through multiple iterations. Ultimately, the plan is to communicate and share the results with the community of interested educators.

The CCNY approach

We consider the notion of relevance to be by far the most significant challenge in curriculum development efforts to date. In addition to a number of success stories, a quick review of curriculum development efforts in the STEM disciplines also reveals the level in which the literature is littered with unsuccessful or partially successful attempts to increase the students’ understanding and appreciation of science, technology, engineering, and math. There is good reason for the great number of frequently unfulfilled curriculum development efforts in the STEM disciplines.

First, curriculum development is a painstakingly slow process. By the time the effort is complete market trends may have already shifted, effectively decreasing the relevance of the original idea. This is especially true for educational efforts that include elements of standards and standardization, which can have a particularly narrow focus in terms of the number of standards and associated industries that are being evaluated. Second, inevitably, a great number of proposed efforts, including those that may have been locally successful, rely heavily on the unique expertise of the principal investigators involved, making it almost impossible for other educational programs to readily replicate their model. Finally, the increased reliance of curriculum development efforts on web-based applications, although it ensures in the short term the widest possible visibility of the proposed models, makes the approach unsustainable in the long term. This is due to the high maintenance cost of the continuous optimization that is required for most, if not all, web-based applications in the ever changing environment of online platforms and personal devices.

In sharp contrast with the above, our approach has the following characteristics:

1. It takes into serious consideration the major challenge of the elusive relevance quality, as outlined above.
2. It strikes a balance between the ephemeral aspects of the proposed project and its long-term objectives, ensuring sustainability of the application of our model within our academic institution and beyond.
3. It shifts focus from a narrow number of standards to a wider collection, multiplying the relevance effect to larger communities. It is a conscious decision to step outside the “comfort” zone of our own expertise and assume more of a facilitator role, as opposed to dwelling on the singular role of an educator.
4. It invests significantly in achieving a finished product, in a way that will maximize the potential for replication of the model by other educational institutions. This finished product is described below in all its components for each proposed topic in the following section.

Methodology

The academic semester at CCNY follows the universal academic calendar that is shared among the twenty-four campuses of CUNY. Teaching time for a three-credit course is typically distributed over fourteen weekly meetings of 2.5 hours each, or twenty-eight meetings of 1.25 hours (i.e., two meetings per week.) Overall, the academic semester consists of fourteen weeks, excluding the final exams week and reading periods. NIST funds facilitated the development of teaching materials sufficient for nine weeks of teaching. Certain elements of these materials were already underway prior to the NIST grant, while others are now underway. Of the nine course topics outlined below, interested educators may adopt stand-alone topics or expand on a short sequence of topics as it best fits their needs. All of these resources will become available on line at no cost at the conclusion of the project through a dedicated website. The only area of the website that will be restricted through password protection will be the solution key to the test bank, since it should be accessible to educators only.

For each one of the proposed nine topics, we are developing the following components:

• Downloadable Power Point presentation.
• Training and reference materials library.
• Short interview recorded in video-podcast format featuring high-profile members of the standards community.
• Instructor guidance document consisting of instructions for preparation, detailed lesson plan, individual slide notes for the Power Point presentations, student handouts, and a collection of suggested in-class activities and homework assignments.
• A bank of forty test questions and answers for each topic, or 360 questions in all. These questions will be in a format suitable for machine scoring in large classes. Half of the questions will be in a multiple-choice format and half in a true-false format.

Curriculum development areas

We present below titles of the nine topics under development and we provide brief descriptions for each one.

1. Large-scale adaptation of international environmental management standards

The Metropolitan Transportation Authority (MTA) of New York City Transit (NYCT) is the first public transportation company in North America certified to ISO 14001:2015, Environmental management systems – Requirements with guidance for use. In this topic, we present in detail what an environmental management system (EMS) is made up of, how to construct an EMS, and how to manage a successful EMS.
NGOs, recorded 215 disputes over the exploitation of natural resources in nineteen Latin American countries in 2014. Fourteen Latin American countries have signed the International Labour Organisation’s Convention 169 on Indigenous and Tribal Peoples (1989), which requires governments to ensure that indigenous and tribal communities are consulted about projects that affect them. As the balance of power has shifted in favor of local populations, and the international community becomes increasingly aware of these issues, we will discuss mining and quarrying standards. Subtopics include exploration, drilling, construction of mines, mining operations, and processing of minerals.

8. The use of Geographic information metadata standards in the development of resilient and sustainable growth

The Geographic Information Gateway (Gateway) is a state-of-the-art publicly available database under the Office of Planning and Development (OPD) of the New York Department of State (NYDOS). OPD is advancing progressive land use solutions, community development, and building standards and codes in support of New York communities. ISO 19115 on Geographic information metadata and Federal Geographic Data Committee (FGDC) metadata standards constitute the data acceptance standards for data included in the NYDOS OPD Gateway. We will introduce this topic with background information on Geographic Information Systems (GIS) and

5. OSH A safety standards from New York City to Bangladesh

New York City is intertwined with the history of the Occupational Safety and Health Administration (OSHA). The story of US Secretary of Labor Frances Perkins, the first woman appointed to the US Cabinet, is emblematic of this relationship. Secretary Perkins famously witnessed the Triangle Shirtwaist Factory fire in 1911 in New York City. 100 years after the Triangle fire, a similar tragedy in Bangladesh killed twenty-six workers making clothes for US companies. We will explore the effect of international trade agreements between the US and low-income countries on worker safety standards worldwide.

6. Building standards and global hazards: The case of Port-au-Prince, Haiti

On January 12, 2010, the capital of Haiti, Port-au-Prince, was struck by a 7.0 magnitude earthquake, killing as many as 250,000 people. Across Port-au-Prince there were two buildings that remained largely unscathed after the earthquake: The US embassy and the tower headquarters of Digicel Haiti, a mobile telephone operator. These two buildings were designed to modern building standards. Through this incident we introduce the importance of building standards for earthquake-prone regions and beyond.

7. Mining standards in the US and internationally: The case of Latin American mining

The Observatory of Mining Conflicts in Latin America, a coalition of

2. Post hurricane Sandy resiliency efforts: The case of mold

New York State recently joined an increasing number of states that regulate mold. In this topic we discuss the difference between the notions of “scientifically clean” and “customer clean” in the context of post hurricane Sandy resiliency efforts and as they relate to mold. (Hurricane Sandy developed in late October 2012, and impacted over sixteen states, including power outages for more than 8.5 million residences and 380,000 homes destroyed or damaged.) Figure 1 shows Dr. Angelo Lampousis (left) and Dr. Jack Caravanos inspecting a hurricane-impacted property of a CUNY colleague in Coney Island, Brooklyn, New York, on November 17, 2012, while Figure 2 shows the visible mold on the same site. New York City’s guidelines on assessment and remediation of fungi in indoor environments, OSHA’s A brief guide to mold in the workplace, EPA’s Mold remediation in schools and commercial buildings, FEMA’s Cleaning flooded buildings, as well as the IICRC/ANSI S520 Standard for professional mold remediation (third edition, 12/8/15) cite relevant standards that are candidate for inclusion in this module.

3/4. Phase I / Phase II environmental site assessments

In the next two topics we introduce students to good commercial and customary practices in the United States of America for conducting Phase I and Phase II environmental site assessments (ESA).
the methods of building geodatabases, and then we will explore the applications of the Gateway in building standards and codes that support the resilient and sustainable growth of New York communities.

9. **Chemical and biological warfare agents: The case of Syria**

In recent years there has been a significant effort invested in the development of counterterrorism standards to assist emergency first responders. One area of immediate interest is to facilitate advanced decontamination training related to chemical and biological agents. Chemical agents are chemical substances that are intended for use in terrorist activities and warfare. Biological agents likely to be used in terrorist activities include bacterial agents and viral agents. The mission of neutralizing on a US Navy vessel nearly 600 metric tons of chemical weapons originating from the Syrian regime will introduce this topic, which is related to the use of field deployable hydrolysis machines. Standards associated with the neutralization of and decontamination from chemical and biological warfare agents will be discussed in detail.

**Current status and future steps**

We are presently in the stage of field-testing the various curriculum components described above in real classroom environments. Student feedback is being actively collected. The final review of the material will be concluded at the end of the fall 2017 semester. Necessary changes and updates will be implemented during the last two months of the project.

Preliminary survey data for the first delivery of eight out of the nine proposed modules were realized during the spring 2017 academic semester. Over the course of 2.5 hours the eight modules were presented in fifteen-minute sections before a class of ninety-four undergraduate students enrolled in the Global Environmental Hazards course. Of these ninety-four students, sixty-two are majoring in civil engineering, eighteen in the environmental earth systems science program (i.e., an interdisciplinary program of the CCNY Division of Science and the CCNY Grove School of Engineering), three in geology, three in chemical engineering, one in biomedical science, one in psychology, and six have not yet declared a major. The survey was anonymous and recorded a total of eighty-four responses. Survey statistics on the question “Was any of the information presented in this module new to you?” are presented in Table 1. Overall, the survey results indicate that the majority of students had little to no prior exposure to those modules. Survey results also confirm some of the demographics described above. For instance, it comes as no surprise that a class of sixty-two civil engineering majors out of ninety-four undergraduate students has a little prior experience with building standards at 53.75 percent and a fair amount of prior experience with building standards at 32.5 percent (or a combined 86.25 percent.)

Civil engineering majors in great numbers in this particular class may also explain a solid 88.75 percent who found building standards as “very relevant” on the question “How relevant do you think this lecture is to authentic real-world activities?” (see Table 2). On the relevance question the preliminary results presented in Table 2 are very encouraging with all modules crossing the fifty percent mark and most of them actually scoring strong majorities among surveyed students for topics being “very relevant.” It is also worth noting that these modules were not delivered by professional educators, but by four students supported under the NIST grant, two graduate students and two undergraduates, respectively.

Additional surveys were conducted in three other courses during the same semester, which are not presented in this report. The main conclusion in terms of progress in our standards-based curriculum efforts to date is that the CCNY approach has a significant probability of meeting the relevance criterion as described in the beginning. Ultimately, we envision the finished product to be attractive enough not only for students, but for the actual educators of students who may decide to adopt and incorporate some of the proposed modules into their respective curricula.

In closing, one may perhaps identify a common thread in most of the proposed modules in that they relate to an element of unwanted consequences when standards are absent or not followed. A student from those surveyed made the following comment on the module on building standards and earthquake hazards: “It was straight to the point of why the [Haiti] earthquake was infamous, [due to] poor building codes and little to no consideration of natural disasters. I like learning from past events to prevent a future negative outcome and informing others as well.” This sentiment, echoed by other students as well, may be the key to unlocking the elusive relevance quality in standards-based curricula.

**About the Author**

Dr. Angelo Lampousis serves as a lecturer at the department of earth and atmospheric sciences at the City College of New York (CCNY) of the City University of New York. He specializes in curriculum development addressing the needs of diverse audiences ranging from construction and general industry entry-level workers to undergraduate and graduate students in the geosciences. He contributed to IEEE’s Practical Ideas from Professors series of resources designed to help educators across the country and around the world discover ways to include standards and standardization themes into their course curricula. Dr. Lampousis is vice chair of the E50 training committee of ASTM International. He also serves on the Committee on Education of the American National Institute on Standards (ANSI). Most recently, he was the recipient of a $70,000 grant from the National Institute of Standards and Technology (NIST) to support standards-based enhanced professional training for geoscientists. He received his BS in agriculture from Aristotle University, Greece, and his MPhil in Earth and Environmental Sciences and PhD in agricultural geophysics from CUNY’s Graduate School and University Center. He is also an OSHA-authorized trainer for both construction and general industry.
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Table 1: Was any of the information presented in this module new to you?

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Table 2: How relevant do you think this lecture is to authentic real-world activities?