Standardization, the Humanities, and Design: Strategies for Student Engagement
by Andrew L. Russell, Ph.D. and Lee Jared Vinsel, Ph.D.

Readers of Standards Engineering understand our starting point very well: we think standards and standardization is fascinating, but our students (like many of our colleagues, friends, and family) think it is boring. We usually respond by explaining that standards play vital roles in the global economy, and that standardization is an enabler of innovation. And while these arguments are true, in our experience they don’t keep our students’ eyes from glazing over.

Our work conducted under NIST’s Curriculum Development program begins with a different premise, and a different strategy for student engagement: when we think about standards, we are really thinking about the human condition.

This core belief—and the belief that we could do more to orient standards education around its humanistic aspects—motivated our 2013 proposal “Design for Standardization: Standards Education from the Classroom to Everyday Practice.” Through this project, we have developed curricular materials and used them in a variety of undergraduate courses at Stevens Institute of Technology in Hoboken, New Jersey. Stevens is an ideal place for this pedagogical experiment, given its rich traditions in standardization (the first meeting of the American Society for Mechanical Engineers was held on our campus on April 7, 1880) and its “liberal technical” approach to engineering education that combines technical instruction with deep engagement in the arts and humanities.

Typically, if students learn about standards at all they encounter the subject as part of an engineering or science curriculum. Framed in these terms, students may miss some of the most fascinating aspects of standards, such as their deep significance for economics, history, philosophy, and the very definition of human identity. This recognition informs the first part of our paper, which describes a new course called “Standards and Society” that was offered for upper-level Humanities credit at Stevens in the fall 2014 semester.

With these humanistic dimensions of standardization in clearer view, the second phase of our project brings the social considerations of standardization into conversation with technical practice though the process of design. Design is an invaluable aspect of engineering education: engineering students are keen to understand how things are made, and, ultimately, they want to make new things. The second part of our paper describes instructional modules that teach standardization and innovation in a course sequence for engineering majors known as the “Design Spine.” Through these modules, engineering students learn how they can learn and apply information about the world of standards to their own work. In other words, they enhance their conceptual toolkits and prepare to deploy these tools—both as working professionals and as engaged citizens of the 21st century.

Standards and Society

In the fall 2014 semester, the authors (Russell and Vinsel) team-taught an undergraduate seminar, Standardization and Society (HST 380), offered through the Program in Science and Technology Studies (STS) in the College of Arts & Letters at Stevens. Like most STS programs, the Stevens STS program offers courses that examine science and technology from the vantage points of the humanities and social sciences. HST 380 is an advanced (junior/senior) course that is open to students of any major and counts toward the advanced Humanities requirements for all majors at Stevens. The course met in 2.5-hour sessions, once a week. Most of the nineteen students enrolled in the class were engineering majors, with a minority who major in STS, the arts, or business. The course description reads as follows: “HST 380 provides an interdisciplinary overview of the place of standardization in modern societies. Students will explore how standards play important roles in shaping our lives as consumers and citizens, as well as how they might participate in the development and use of standards in technical and social fields.”

In the first session of the semester, students were thrust immediately into a standards simulation game, where they adopted the roles of different stakeholders in a standards-setting process. The game sparked their thinking about some fundamental questions, such as: Who decides to make something standard? How are standards enforced? What can I do if I don’t like a standard? Through their participation in the game, students immediately understood that standards are not lifeless abstractions; they are conventions and agreements that are made, revised, and sometimes abandoned. In addition to the strategic intrigue that simulations provide, they also help to advance some primary goals of humanities education: for students to hone interpersonal skills of speaking, listening, reasoning, and thinking critically; and for students to develop their capacity for empathy and appreciation for a diversity of perspectives and interests.

In subsequent class sessions, students in HST 380 explored the past, present, and future of standards-setting regimes in industrial, governmental, and international arenas. To reach students with a variety of learning styles, course assignments and activities also featured guest lectures, academic books and articles, videos, student blogs on standardization in everyday life, and further simulation games. Students dove into subjects such as automobile safety standards and regulations; computer “standards wars”; and other standards that they discovered and investigated through group assignments and presentations. By learning about standards for health, aging, and life insurance, they were able to reflect on the human aspects—and human costs—of regimes of standardization that facilitate human differentiation and discrimination.

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The course concluded with a twist on those familiar end-of-semester rituals: course evaluations and student grades. Everyone in education has experienced how deeply the logic of standardization pervades it—from grades and curriculum requirements to ABET accreditation and US News and Report rankings. Our institutional mandate to conform to a system of evaluation as part of a broader regime of accreditation provides compelling material for revisiting the questions from the first class of the semester: Who decides to make something standard? How are standards enforced? What can I do if I don’t like a standard?

HST 380 thus was an interactive and exciting course, deeply engaged with matters of science and technology, and completely uninterested in any alleged divide (or border) between the “two cultures” of the sciences and the humanities. As we left behind this old boundary between the sciences and the humanities, we began to wonder about additional borders that students in our course could breach. We plan to offer the course again in Fall 2015, and are keen to explore opportunities to bring our students into collaboration with peers from other universities and with standards professionals working in government, industry, and NGOs. Located in Hoboken, New Jersey, we are fortunate to be in close proximity to a rich supply of potential guest speakers, both from the Stevens faculty as well as professionals who work in the New York City area. A guest lecture from ANSI’s Lisa Rajchel was a highlight for many students.

Student response to the course was overwhelmingly positive. Of the thirteen students who responded to assessment questionnaires, 100 percent reported that the course increased their “awareness of the ethical responsibility and societal impact of [their] future profession,” that they learned “how standards are created, negotiated, and implemented,” that they became “conversant with the strategic and professional aspects of standardization,” and that they could “now identify the great variety of roles that standards play in cultural, political, and economic aspects of daily life.” In their anonymous comments, students wrote that the course was “eye opening” and that it was “a vital class that should be required for all engineering and science students.” One student wrote, “I really enjoyed the various in-class discussions. The course provided insight into an aspect of science and technology that I wasn’t aware of.” The student continued, “As an engineer, I feel I learned valuable knowledge about the standardization process for scientific fields.” Another student wrote, “I knew standards were important, but I had never considered how much power they actually had.”

In summary, we designed HST 380 to reach a diverse group of students who otherwise would not have encountered standards in a critical and rigorous manner. We were especially pleased to see how student work combined technical and humanistic aspects of standardization. However, as we seek to engage diverse populations of majors (in Art or STS, for example), we also suspect that these students are less likely than engineering majors to pursue careers where they will work with standards. To reach the vast majority of engineering majors who will not be able to enroll in HST 380, we are designing a second set of curricular materials to cultivate their familiarity with and interest in standardization. Our overarching goal is to provide engineers-in-training with a crisp knowledge of standards, and to introduce them to the nuanced and strategic processes of creating and implementing standards. As we describe below, we are integrating these materials into the “Design Spine” sequence that all engineering majors take throughout their course of study at Stevens.

Design for Standardization

Engineering majors at Stevens take an eight-semester sequence of courses—known as the Design Spine—to develop a set of competencies in creative thinking, problem solving, teamwork, economics of engineering, project management, communication skills, ethics, environmental awareness, and systems thinking. The faculty who oversee the Design Spine, in keeping with the strategic priorities of the university, are keen to infuse this set of competencies with an emphasis on innovation and entrepreneurship.

In collaboration with the Design Spine faculty and a team of Stevens undergraduates, we are developing instructional materials that situate standardization in a context that also emphasizes innovation. The central analytical point here is well known: standards can create stable platforms that enable subsequent dynamism and creativity. Our goal is to help students reach a personal understanding of this dynamic relationship between standardization and innovation.

Our concept of “Design for Standardization” builds on the “Values in Design” (or “Design for Values”) approach pioneered by Helen Nissenbaum and Batya Friedman, among others. This approach, developed over the past decade through research, publication, and teaching materials, provides designers and engineers with new theories and methods for expressing societal values in technological designs. Our instructional materials focus student attention on the interactions between standards, design, and social values through a progression of four sets of questions:

1. Look around: how many standards do you see? What do we know about them? These questions ask students to consider a familiar environment—the classroom—and identify what aspects of it might be standardized. Typical answers might include electrical and electronic equipment, furniture, clothing, windows, and behavior.

2. How can you learn if something is standard? Where can you find standards? The response to these questions is discipline-specific, and we are currently working with faculty in Electrical and Computer Engineering, Civil Engineering, and Engineering Management to customize tutorials and learning resources. Explicit, domain-specific guidance will help students learn to anticipate when their work might come into contact with industry, national, and international standards.

3. What values do standards embody? What are the benefits of standards, and what are the costs? Students should return to their responses to the first question (“Look around”) to consider values linked with standardization, including economic values (such as efficiency and compatibility), political values (such as the redistribution of power and the boundaries of “consensus”), and cultural values (such as the desire to minimize risk or cultivate trust).
Conclusions and Next Steps

Our goal is that the approach we have outlined above—one that conceives of standards and standardization as a broad and far-reaching set of social and technical activities—can generate answers to the devastating question that all college students ask: who cares? We might soften and reframe the question: how can we encourage students to care about standards and standardization? In forming our engagement strategies in HST 380 and “Design for Standardization” modules, we kept two principles in mind: start with familiar things that students already know something about; and emphasize that the world of standards can be fun, full of irony and absurdity, and deeply important for their own lives and for global society.

In conclusion, we view this project as a set of educational experiments. We still have much to learn from the experiences of our colleagues who are working through similar matters in standards education at different institutions. In many ways, the process of curriculum development mirrors the process of standardization: it is most effective when undertaken within a community of good will; its implementation needs to reconcile universal goals with local conditions; and its outcome is never something fixed, but rather a perpetual work in progress that rewards ongoing attention and revision.

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1 Geoffrey W. Clark, History of Stevens Institute of Technology: A Record of Broad-based Curricula and Technogenesis (Jersey City, NJ: Jensen/Daniels, 2000), 36.
2 See Jorrit de Jong, “Simulating Standardization: Experiences with Serious Games Based Curricula and Technogenesis” (Jersey City, NJ: Jensen/Daniels, 2000), 36.