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To See the World Anew: Learning Engineering through a Humanistic Lens

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Imagine a first-year college course where students play engineers, industrialists, laborers, lawmakers, scientists, journalists, and others from the nineteenth-century industrial city of Worcester, Massachusetts. The game opens with a mass meeting called by a progressive Catholic priest from the Water Street neighborhood, characterized by its working-class immigrants, low elevation, and foul Blackstone Canal. The canal and the Blackstone River into which it empties serve as an open sewer, carrying Worcester's household and industrial waste through this neighborhood and downstream to the mill town of Millbury.

Inspired by the successful *Reacting to the Past* role-playing games for humanities courses, this game gives students historical identities, objectives, contemporaneous primary and secondary sources, and research questions motivated by their roles and answerable using those nineteenth-century sources. Alternately on their own and in teams, they explore the symptoms and etiology of water-borne illnesses, learn about germ and filth theories of disease, test water for bacteria and chemical pollutants, map pollutant and sewage overflow data from nineteenth-century health department reports, and compare them to other geospatial data (population, occupation, elevation, proximity to factories, etc.). In all their activities —mass meeting, data collection, research, analysis, arguments from data, and cross-cultural communication— they learn to scope the problem that first

emerges in the personal experiences of people living and working along the Blackstone waters. They will later form teams to design an engineering solution.

Whatever position they take and whatever resources they use, players always make their arguments to diverse stakeholders with their own interests to uphold. A writing instructor would call this the *counter-argument*, a rhetorical move to anticipate doubts and preempt opposition to the argument. Young people often have a hard time with this step, reducing imagined conflicts to straw-men arguments. In our game, each student is motivated to play her role earnestly and carefully, to represent her character's beliefs and perspectives, and to use legitimate and historically appropriate quantitative *and* qualitative data. By enacting a particular perspective and mastering the information behind it, students learn their subject matter deeply, practice articulating it to others, are challenged by their classmates, and experience the world as ambiguous and complex, not clear-cut like an abstract problem in a textbook. The game takes students through the early stages of the engineering process: determining the scope of the problem, designing and communicating solutions, and submitting their solution for review. For each phase, the contextual issues (economic, ethical, social, legal, cultural, political, geographical) matter as much as the technical considerations. This game, carrying credit for both humanities and engineering, addresses the concerns on both sides of the Liberal Studies and Engineering divide: that content will fall short of standards in engineering education ("engineering light") and that content and methods from the liberal arts will serve a merely instrumental role ("communication skills" for engineering).

We must and need not settle for either outcome. Even if many engineering jobs still remain unrewardingly narrow, humanists and engineers have good reasons to want to

collaborate. Amid the hand-wringing about the decline of the humanities, many liberal arts are (re)discovering the value of applied humanities.[1] Meanwhile, ABET encourages engineering faculty to prepare students for more expansive roles. A colleague who spent many years in an electrical engineering department after a brief career in industry admits he worries that "we engineering faculty are preparing our students for jobs that many of us have decided we don't prefer." A thoughtful man with wide interests, I think he voices the aspirations of many faculty to represent the world to our students in all its messy and fascinating complexity.

How do we do this? The success of the course depends on the involvement of faculty from both engineering and the humanities who will vigorously defend their own disciplinary content: engineers working toward rigorous ABET standards and humanists protecting their disciplines from becoming mere instruments to advance engineering agendas. They must be equal partners in course development and instruction as they educate engineers who might in turn transform their profession into an enterprise worthy of them. At WPI, we've taken the time for meaningful collaboration. My undergraduates designed our game with steady supervision from me and significant instruction and experience in research at the American Antiquarian Society, one of the world's great archives, the Worcester Historical Museum, and our own college library under the guidance of a gifted instructional research librarian. I spent two years working with successive teams of students and my library colleague to ensure that the game's structure

[1] While the performing arts have always had to consider and appeal to real audiences, other humanities disciplines are also turning in this direction rather than simply assuming their own inherent value. Examples include the sub-disciplines of applied philosophy and public history as well as the Modern Language Association's 2016 Presidential Theme, "Literature and its Publics."

and episodes were historically responsible, with rich sources to inform game play.[2] I then talked to civil and mechanical engineers to determine what engineering content would be most appropriate. In other words, I made sure the humanistic content was in place before the technical content was imported. The engineers, for their part, added engineering content to an already-existing context, *just as practicing engineers do in the real world*. This summer, two humanists will work with two engineers to refine the course with specific content tailored toward particular roles for particular student majors: lessons and exercises on fluid flow, for example, will be assigned along with roles to chemical, civil, or mechanical engineering majors; power transmission to electrical and computer engineering majors; and chemical precipitation to chemical engineering majors. All students will learn about opportunity recognition or sustainability in lectures delivered by engineering or environmental science faculty representing actual nineteenth-century experts.

My engineering colleagues are as excited as I am to collaborate on game development, assessment instruments, and course instruction for this co-taught course. It offers us the chance to learn from each other and do something creative, not narrow like the engineering jobs of old. Many of us who value our faculty positions because of the freedom they offer us to shape our own work want our students to experience this same openness to possibility, to receive what Mark Edmundson calls "real learning —learning

[2] The following WPI students were involved in game development: Sarah Abell, Benjamin Anderson, Timothy Beane, Ryan Bussett, Nicholas Campbell, Anthony Fisher, Nathan Ford, Rachel Harrison, Meghan Hennessey, Chad LaBove, Christopher Martineau, Tyler Mathews, Edward Mercer, Elias Miner, Khoa Nguyen, Devin Roberts, Vincent Tavernelli, Derek Tsaknopoulos, Nathanael Vander Els, and Brendan Walsh. WPI faculty and staff collaborators include Laura Hanlan, John Bergendahl, Rob Krueger, Glenn Gaudette, and Kathi Fisler.

that will help [them] see the world anew and show [them] that there could be more to [their] lives than [they] had thought" (xii).

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