

## **Ethical Aerobics: Preparing Engineers for the Global Workplace**

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### **Abstract**

Inadequate ethical conditioning can undermine the credibility of individuals and institutions. Fortunately, the professional staff of the Hanson Center for Technical Communication have devised a series of innovative workouts for the ethically winded. These workouts, consisting of writing-intensive exercises integrated into department-level and core curriculum courses at The University of Iowa's College of Engineering, challenge students to revitalize lazy arguments, pursue accuracy to the point of exhaustion, and recognize that there are few (if any) merely technical decisions. In addition, we encourage students to visit the Hanson Center for one-on-one sessions with our peer consultants: fellow students who serve as role models for tackling the rhetorical challenges of engineering. Although the regimen of activities at the Hanson Center defies simple categorization, the Center's ethic of "no pain, no gain" means simply that there are no short cuts to good writing or public speaking, and that the process of drafting, obtaining feedback, and revising is part of an overall exercise in ethical behavior that enables engineers to balance their responsibility to themselves, their profession, and the world.

### **Background**

#### Mission

Now in its 14th year of service, the Hanson Center is an endowed writing program within the College of Engineering. Centrally located in the College's Student Commons, the Center is the scene for hundreds of one-on-one and team tutorial sessions each year (1201 in AY 2013-14). This level of traffic suggests that the Center is an ideal forum for modeling the practice of technical communication—particularly when students and tutors share the same discipline-specific interests and aspirations.

The Hanson Center supports, creates, and delivers writing-intensive assignments across the engineering curriculum. Working closely with faculty, the Center provides verbal feedback and written evaluations to hundreds of engineering students each semester. Our goal as a writing center is to train students to not only purge their writing of vagueness and hyperbole but to consider "the global" import of their communications. Have they addressed the key questions they were tasked to answer? Have they considered the needs and expectations of their audience? And above all, have they behaved ethically as writers? In the quest for good grades, it is easy for students to forget that the field of engineering holds its members to the highest standards of excellence. Given this reality, the Hanson Center devotes the majority of its time training students to display and interpret data, to view problems from multiple perspectives, to make clear and unbiased recommendations, and to give credit where credit is due.

## Professional Staff

Recruited from Iowa's graduate and doctoral community, a team of graders assist the Director in evaluating hundreds of technical reports and proposals each year. The Director and Assistant Director provide grading rubrics for writing-intensive assignments, and in this manner standardize criteria for evaluating student writing across the engineering curriculum. The Center also delivers revenue-bearing writing seminars for the College's external partners, and represents the College at conferences, professional societies, symposiums, and workshops.

## Student Staff

The Center (or CTC, as our students invariably call it), recruits engineering undergraduates who have shown exceptional promise as technical communicators to serve as its peer consultants. Peer consultants neither grade nor pass judgments on grades. Instead, by addressing global concerns (organization, clarity, and relevant analysis), they help fellow students turn rough drafts into professional reports and proposals.

## **Working the Core (Curriculum)**

For the sake of brevity, this paper will focus on the Hanson Center's most rigorous initiative to improve the ethical fitness of its student body. For the past 13 years, The Center's "flagship" assignment has been a three-stage proposal project tethered to Engineering Fundamentals I: Statics, a core curriculum course for all second-year students, thus providing a unique cohort study of their writing abilities and deficits. Obliging them to write as a team, we asked students to explain how common structures are built and stay upright—in terms that a general audience can understand. The premise of the assignment was that a fictitious foundation called the GFE (Grants for Furthering Education) offered funding to visit structures anywhere in the world on the following condition: "applicants must demonstrate that their trip enhances their knowledge of statics and contributes to their growth as engineers."

Following a formal letter of intent, the students (in randomly chosen teams of two) wrote a first and final draft of their proposal, receiving at each stage extensive commentary and suggestions for improvement—a significant exertion for the Center's staff, given that the course enrollment each fall semester averaged between 275 to 290 students. It was our hope that the assignment's open-endedness would inspire students to resist the most obvious and iconic structures (though to be fair we did read many excellent proposals on the Golden Gate Bridge) and reach instead for more intrepid choices: in this hope we were not disappointed. Over the years our engineers-in-training have written concise and persuasive proposals to visit an ice hotel in Scandinavia, to watch spinal fusion surgery-in-progress at the Mayo Clinic, or, right here in Iowa, to tease out the statics principles upholding an octagonal barn in West Liberty or a set of monkey bars at an Iowa City playground, or to explain why the Delhi dam collapsed without warning.

Our evaluators were particularly impressed with the proposal to visit the Delhi dam, for it went beyond the requirement to provide a plausible, citation-rich technical analysis to venture into the territory of ethics, speculating whether the collapse was the result of small but significant

oversights in maintenance or if the failure could be traced back to design flaws or mistakes that went unrecognized during construction. In this proposal, and in others that dwelt on structures particularly prone to failure, the writers almost always demonstrated an unusually high level of ambition, initiative, and curiosity: the ideal traits one would wish for in engineers.

Intrigued by how a focus on structural failures not only resulted in more insightfully written papers but also led to fruitful considerations of ethics, the Center has made a significant revision to the College’s Statics Writing Exercise, replacing its proposal with an assignment to help young engineers consider one often unacknowledged aspect of the career for which they are preparing: the importance of anticipating and learning from failure. In 2003, shortly after the Space Shuttle Columbia’s fatal return to Earth (the craft having sustained heat shield damage during takeoff), *The New York Times* published a short article by civil engineer Henry Petroski titled “Failure Is Always an Option,”<sup>1</sup> which has become the title (with due acknowledgement) of our new assignment.

Writing about what he calls “the art of the fail,”<sup>2</sup> Petroski argues that it is failure (not success) that drives the field of engineering forward. His goal was to explain to the general public how engineers factor into their work the reality of failure. He explained, “The design of any device, machine or system is fraught with failure. Indeed, the way engineers achieve success in their designs is by imagining how they might fail”<sup>3</sup>. In emulation of Petroski, our assignment asks each student to write their own guest article for *The New York Times* about the significance of learning the principles of statics. Writing for a general audience, they must explain how a specific structure or system failed – for instance, was it a design flaw involving insufficient consideration of moments and forces? Was it a lack of redundant safety mechanisms in the event of structural failure? Was it preventable? What steps could have been taken before it failed? Here is the remainder of the prompt:

- (1) Choose a structure (building, bridge, dam, etc.) whose failure can be used to explain basic principles of statics to a general audience. To jumpstart your paper, here is a short list of well-documented failures – you may choose one of these to write about or find one on your own:

<b>Building Failures</b>	<b>Bridge Failures</b>
The Leaning Tower of Pisa, 1173 - Present	Ashtabula Bridge, 1876
Bomber Crash into Empire State Building, 1945	Quebec Bridge, 1907
Hartford Civic Center, 1978	Falls View Bridge, 1938
Kemper Arena, 1979	Sando Arch Bridge, 1939
L’Ambiance Plaza, 1987	Peace River Bridge, 1957
Oklahoma City Murrah Federal Building, 1995	Antelope Valley Freeway, 1971 and 1994
Sampoong Superstore, 1995	Schoharie Creek Bridge, 1987
World Trade Center Attack, 2001	Oakland Bay Bridge, 1989
Charles de Gaulle Airport, 2004	Autoroute 19 de la Concorde Overpass, 2006
Rana Plaza Building, 2013	Minneapolis I-35W Bridge, 2007

- (2) Write a short article (750 to 1,000 words – roughly 3 double-spaced pages) for readers who lack your technical expertise but are curious about how engineers strive to prevent failures. You should:

- Explain for a non-engineering audience why/how your structure failed from a statics perspective.
- Discuss other considerations that contributed to the failure, including ethical shortcomings. **Hint:** many of the failures above were a direct consequence of ethical failures that led to structural collapses.
- In light of your research and your reading of the Petroski article, reflect on the challenges and responsibilities engineers face in the design and maintenance of structures.

(3) You must cite at least two credible sources and include a References page in APA format.

A successful article will provide readers with an insightful discussion about not only how engineers employ the principles of Statics but how other factors can undermine a structure's integrity.

### **Conclusion**

Embarking on this new paradigm after 13 years mirrors, in its own fashion, the art of the fail. Perhaps it is fitting that the Hanson Center, a program whose mission is to help Iowa engineers express their expertise and whose ethic reads “no pain, no gain,” also be put through its paces.

### **Bibliography**

1. Petroski, Henry. “Failure is Always an Option.” *The New York Times* 29 August 2003.
2. Ibid.
3. Ibid.