The Evolution of an Assignment: Using a Technical News Story as a Writing Prompt

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Abstract – Engineering instructors without a research background or research agenda sometimes struggle to come up with substantive new assignment material. Requiring students to provide their own subject matter, while mutually beneficial in many ways, has several limitations, all of which are exacerbated when the instructors come from different educational backgrounds than the students. Thus, instructors in this situation must be vigilant about looking for new raw material. This paper discusses how instructors in an engineering-communication course discovered a technical news story that became the basis for a new assignment and implemented the assignment for the first time (complete with samples of student responses). The paper closes with a discussion of future steps in the evolution of this topic.

Keywords: writing, communication, writing pedagogy

PROGRAM AND CLASS DESCRIPTION

The Shackouls Technical Communication Program (TCP) has been an integral part of the Bagley College of Engineering at Mississippi State University since 1999. This program exists to assist all engineering students and faculty with writing and speaking issues relevant to engineering in academic and industry contexts. Major thrusts of the program include a writing center that reviews engineering students' writing (like a discipline-specific writing center); writing- and speaking-related workshops conducted in both undergraduate and graduate engineering courses; and provision of relevant ABET data – particularly data related to ABET criteria (d), (f), (g), and (h) – to each of the college's eight engineering departments.

The Shackouls TCP's main activity, however, is coordination and administration of GE 3513 Technical Writing. This junior/senior-level course is required of all engineering undergraduates (we see approximately 350-375 students per year) and marks one of the few times in any of these students' curricula that they work interactively with students from potentially every other engineering department in the college. Thus, as described below, GE 3513 is fertile territory for interdisciplinary work on a number of levels, including the opportunity for students who are proficient in certain topics to introduce their fellow students to heretofore unfamiliar concepts.

One feature of GE 3513 especially relevant to this paper is the instructors' backgrounds: commensurate with a growing national trend, all three instructors for GE 3513 have master's degrees in English with little to no formal instruction in or sophisticated understanding of engineering. This lack of a common knowledge base with students presents a daunting challenge: how to devise meaningful, discipline-specific assignment materials for the course. Moreover, these instructors are not tenure-track faculty and, as such, have little in the way of a research agenda (and certainly no engineering research agenda) from which to draw potential subject matter for assignments. This is the problem at the root of this paper: how do trained writing instructors with no engineering background provide meaningful engineering-related writing experiences for junior/senior-level engineering students? Collaboration with specialized engineering faculty is of course one option (and one we have successfully used), but the vagaries of individual work schedules mean that this option must be supplemented with other strategies.

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THE ASSIGNMENT PROMPT: DISCOVERY AND IMPLEMENTATION

Harper's Magazine's "Weekly Review" for Tuesday, July 26, 2011 contains the following statement [1]:

> Korean scientists determined that the shaking of a Seoul skyscraper, which shut down the building for two days, was caused not by an earthquake but by a Tae Bo class in the building's gym.

Perhaps this story is intriguing even to a structural engineer, but to a layperson, it is literally difficult to fathom. How could what must be a relatively small number of people create an earthquake-like effect so distinct that it forced a building's closure for two days? This seeming disparity – a small group of people creating a seismic phenomenon – along with the opportunity for communicating the science behind the disparity is what makes this one-sentence news story an excellent candidate for a useful writing assignment.

Several weeks later, in the next semester, the GE 3513 instructors used this sentence as the basis for an in-class assignment. These in-class assignments typically involve interactive team activities that require students to read a brief prompt and share their response with the rest of the class, in writing or in a group discussion or both. These activities are designed to be open-ended vehicles for in-class participation; as such, student responses to them are not graded as rigorously as, for example, major out-of-class writing assignments and formal presentations. Thus, this paper does not discuss a grading rubric or quantitative measures of student performance on the assignment because the assignment is not graded in this manner.

For this assignment's initial use, students were given the *Harper's* sentence above along with the following instructions:

> *Assignment*: Verify the accuracy of this story, and then write a detailed description of the science behind it, suitable for a non-expert audience. This description should primarily be in your own words; if you use references, use them sparingly.

These instructions showcase three critical skills central to GE 3513: (1) verifying the accuracy/credibility of sources; (2) writing descriptions of technical concepts, especially for non-technical audiences; and (3) using source material appropriately/sparingly. Incidentally, the issue of verifying source accuracy is particularly important in this situation because the style of the *Harper's* "Weekly Review" can lend itself to distortion: put another way, the "Weekly Review" is designed to be a summary of global news events for the preceding week, typically devoting no more than two sentences (and often only one) to any given story, and this stylized brevity can obviously leave out details that significantly affect the way a reader perceives that story. Hence, an important part of the assignment would be determining that this one-sentence treatment is, in fact, accurate.

Examining the use of this news story as the basis for an assignment requires answering five questions:

1. How would the students verify the story's accuracy? Would any of them be *unable* to verify the story's accuracy?
2. What sort of techniques would students use to describe the science underlying the phenomenon?
3. Would the students' descriptions differ from one another, and, if so, how much?
4. How would non-technical instructors know whether the students' scientific descriptions were accurate?
5. How much would the students from "non-structural" majors – biological, chemical, computer science, and so on – be able to contribute to their teams' solutions? Would they learn anything from their more structurally inclined peers?

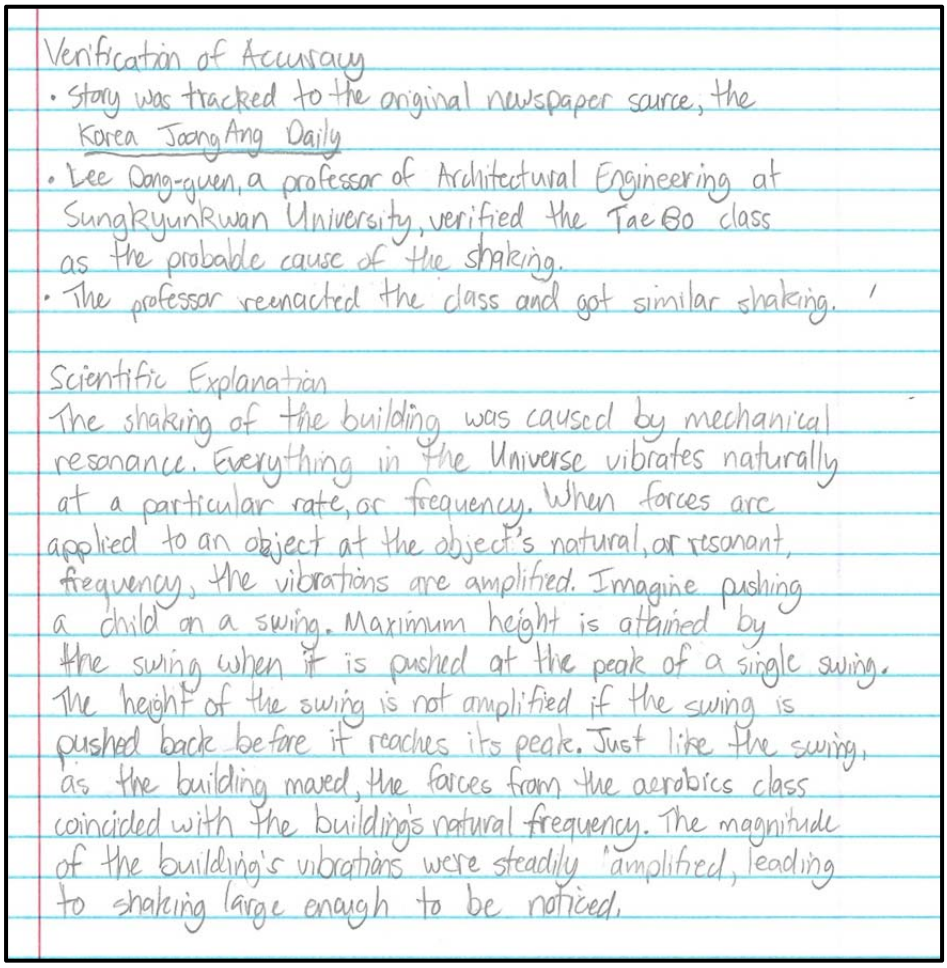
STUDENT RESPONSES AND DISCUSSION

Below are answers to the five questions posed above along with samples of relevant student responses; all errors have remained intact and, where possible, marked with the editorial mark [sic]. The formatting of some responses differs because students can choose whether they type their responses or write them by hand.

How would the students verify the story's accuracy? Would any of them be *unable* to verify the story's accuracy?

In general, few teams specifically sought to verify the accuracy of the news story as it was presented to them; that is, how did they know the brief statement in *Harper's Weekly* was accurate? In fact, over two semesters using this assignment, out of 32 teams, only two teams specifically verified the accuracy of the *Harper's* sentence. These are shown in Responses A and B below.

Response A – Description Verifying the Story and Using the Swing Analogy



Verification of Accuracy
- Story was tracked to the original newspaper source, the Korea JoongAng Daily
- Lee Dong-guen, a professor of Architectural Engineering at SungkyunKwan University, verified the Tae Bo class as the probable cause of the shaking.
- The professor reenacted the class and got similar shaking.

Scientific Explanation
The shaking of the building was caused by mechanical resonance. Everything in the Universe vibrates naturally at a particular rate, or frequency. When forces are applied to an object at the object's natural, or resonant, frequency, the vibrations are amplified. Imagine pushing a child on a swing. Maximum height is attained by the swing when it is pushed at the peak of a single swing. The height of the swing is not amplified if the swing is pushed back before it reaches its peak. Just like the swing, as the building moved, the forces from the aerobics class coincided with the building's natural frequency. The magnitude of the building's vibrations were steadily amplified, leading to shaking large enough to be noticed.

Response B – Excerpt Showing Verification by Multiple Sources

> The accuracy of this story is verified by several of the nation's leading news providers, including Harper's Magazine, CNN, and the San Francisco Chronicle, all reporting the same result.

Some students said they assumed the story to be true not because they themselves were familiar with *Harper's* but simply because their instructor had provided it to them. Others did not interpret the assignment directions to mean that they should verify the accuracy of the *Harper's* statement, only that they needed to verify the event, which they did via reports from Korean scientists (specifically Professor Lee Dong-guen of Sungkyunkwan University) and architects who had recreated the shaking. This latter development clearly shows the need to clarify the assignment directions, since most students interpreted the directions differently than the instructors intended.

Is there, though, a difference in looking for reports from scientists/architects that verify the science and looking more generally for additional news reports that confirm the *Harper's* story? Even though most students did attempt to verify the science involved in this incident, it seems important to emphasize to students that they should also focus on verifying the incident as a news story, since a news-based forum is likely how most readers would encounter the incident (rather than from, say, from a structural-mechanics journal). As one instructor told students during discussions…

> What if I had given you this assignment and you could find no mention of the story anywhere except in *Harper's Weekly*? What if you found several mentions of the story, but they were all divergent?

Students quickly answered that the story would then seem suspicious to them, which opened a discussion on the general principle of *repeatability*: just as scientific researchers hope to repeat the same experimental results to prove a hypothesis, researchers sifting through print materials should attempt to verify a news story's accuracy by finding that same story reported in the same fashion in at least three different, reputable publications. The extremely broad term "reputable publications" then led to a discussion of the most effective way to determine a source's reputability, perhaps using, for example, a logical set of criteria modified from Markel [2]:

1. *Accuracy* – Is the information correct?
2. *Repeatability* – Can you find the same information in more than one reputable place?
3. *Bias* – What are the chances that the source has a financial interest in the topic/project?
4. *Reputation* – What are the author's /organization's background and credentials?
5. *Comprehensiveness* – How diverse or selective is the information?
6. *Appropriate complexity* – How detailed is the information?
7. *Currency* – How old / new is the information?
8. *Clarity* – Is the information easy to understand?

In a remarkable coincidence, a real-life example of the need for source verification (and especially electronic source verification) occurred during the most recent use of the Korean skyscraper assignment and helped to edify the notion that source material of all types must be properly vetted before use and distribution. On the night of January 21, 2012, the website Onward State, an online news organization covering the Pennsylvania State University community, reported that former Penn State football coach Joe Paterno had passed away, a report that soon turned out to be false (via direct statements from the Paterno family). The story quickly appeared on the websites of CBS Sports, the Huffington Post, and Deadspin, perhaps sped up by its simultaneous presence on the social media site Twitter, where national journalists – including Anderson Cooper of CNN and Howard Kurtz, formerly a *Washington Post* media columnist and now a CNN host – also reported incorrectly that Paterno had died. Within 45 minutes, the story had largely been corrected/retracted in national outlets, though the managing editor of Onward State was forced to resign as a result of the error [3].

What sort of techniques would students use to describe the science behind the phenomenon?

Some teams described the science behind this event using mainly technical terms: mechanical resonance, vertical vibration cycle, elasticity, natural frequency, constructive interference, and so on. Responses C and D below show descriptions using primarily technical language, one with a suitable amount of detail and one without.

Response C – Description Using Primarily Technical Language

According to the Korean Times, a Seoul skyscraper was shut down for two days because of vibrations [1]. Rather than an earthquake, the shaking was actually caused by a Tae Bo class in the gym [1]. The rhythm of the choreographed movements happened to coeincide [sic] with the resonance frequency of the building and caused the upper floors to shake. Resonance frequency is a reoccuring [sic] beat specific to an individual object that causes exponential growth of vibrations as the beat continues. The motion of the twenty-three class attendees moving in

synchronization with the resonance frequency on the twelfth floor of the building sent shock waves upwards that increased as the rigidity of the building decreased with every floor. This lack of rigidity in the upper floors is designed into every building to counteract strong wind gusts and allow the building to flex without structural damage. As a result, the top floor violently shook as if from an earthquake while the twelfth floor and down felt no movement.

Response D – Description Using Primarily Technical Language and Lacking Adequate Specifics

On July 5, 2011, 17 individuals doing a tai [sic] bo workout caused the Seoul Building in Korea to be evacuated because employees believed an unknown shaking was an earthquake. Scientist investigated the incident and concluded the excessive shaking was due to mechanical resonance. The investigation concluded the building's structure is sound. There have been numerous instances where human activity gas induced resonance to occur. A study on building resonance in 1987 stated the increased heights and floor spans increases the chances of building resonance due to human activity. [1]

[1] National Research Canada – "Building Vibrations Due to Human Activities" By DE Allen, JH Rainer, GaPernica

While the technical terms were usually correct, even in a relatively small class of engineering students not everyone clearly understood the descriptions that used these terms. In fact, after a question-laden discussion of his team's written response, one particular student neatly crystallized the technical-communication conundrum:

> Wow. You know, we thought we did a pretty good job explaining this [the skyscraper's shaking], but after what everyone said…well, I think we have some things to fix.

Most teams, however, resorted to analogies in addition to relevant technical terms, perhaps in keeping with the assignment's charge that they write a description suitable for a non-technical audience. Below are the most common analogies and their associated examples.

1. *Child on a swing*: Response A above shows this analogy as does the following excerpt: "A simpler example of mechanical resonance could be explained using a child's swing. As the child's swing moves from a starting position through a complete cycle back to its original position, the skyscraper completes similar vibration cycles on an unnoticeable scale. Resonant frequency is similar to a child swinging on their own power but when that frequency is matched by an outside force such as a parent pushing the swing, the swing moves at a greater rate. Similarly, when the Tae Bo class moved in unison at the resonant frequency of the building, the vibrations felt in the upper levels were much greater than normal."

2. *Guitar string*: Response E below shows an example of this analogy.

Response E – Description Using Technical Language and the Guitar String Analogy

In the July issue of *Harper's Weekly*, they reported that scientists claimed a Tae Bo class, not an earthquake, was the reason for evacuation of a Seoul skyscraper. While this would seem unrealistic, the claim has some solid scientific relevance. According to the *Korean Times*, mechanical resonance of the skyscraper was amplified by the Tae Bo class on the 12th floor. Mechanical resonance is the natural tendency of a body that can vibrate to oscillate. When a rod is supported at one end and is struck, it will amplify the oscillation. [1] The skyscraper, like the rod, is a free-ended body. Since the class took place on the 12th floor which is closer to the center, it was able to amplify the mechanical resonance of the structure. It is significant that the Tae Bo class was near the middle because it would cause the most movement. An example of this is plucking a guitar string in the middle rather than the end will cause the maximum amount of noise because it has the most movement. Since the building is supported at the base, most of the displacement was experienced on higher floors.

[1] "Mechanical Resonance." Rutgers University, Jan. 2002. Web. Jan. 2012. <http://www.physics.rutgers.edu/~jackph/2005s/PS02.pdf>.

3. *Wine glass and opera singer*: Response F below shows an example of this analogy.

Response F – Excerpt from a Description Showing Both the Swing and Wine Glass Analogies

> This phenomenon is one that structural engineers have to grapple with constantly. A resonant frequency is one at which a structure or object (like a bell) naturally vibrates when perturbed. Even small excitations at these frequencies can result in very large amplitude vibrations. A common example of this kind of excitation is a child on a swing. The small force imbalance caused by the shifting of the child's weight eventually results in a large amplitude swinging motion at the natural frequency of the pendulum.
>
> The principle is the same for structures. If even a small force is applied to the structure at the same frequency it naturally vibrates, the amplitudes of the perturbations are amplified. If the excitation continues long enough, resonance can result in catastrophic failure of the structure. A relatively small example of this is the shattering of a wine class due to sonic excitation. When a vocalist sings the proper note that coincides with the frequency of the wine glass, the extremely small exciting force from the sound waves eventually results in larger amplitude vibrations thus shattering the glass.

Interestingly enough, the wine glass analogy prompted several students to mention that they had seen this particular phenomenon disproved on the television show *Mythbusters*, which further led to a discussion of whether *Mythbusters*, as a television show (and all that that entails), should be considered a reliable source (no consensus was reached on this point, though).

4. *Tacoma Narrows*: Response G below shows an example of this analogy.

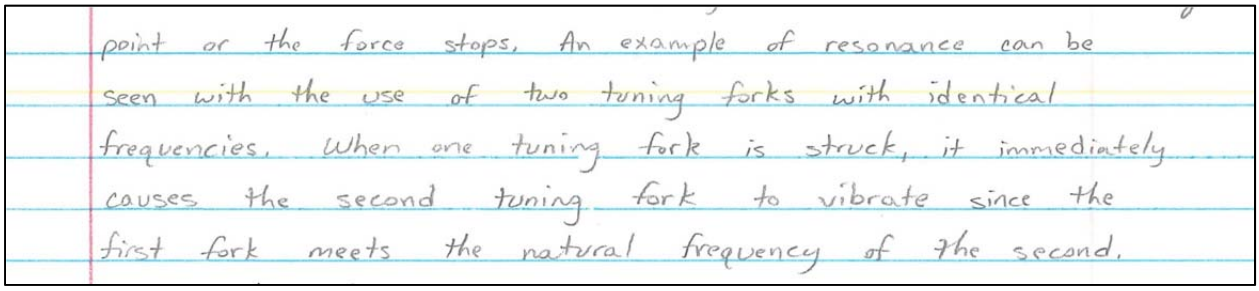
Response G – Excerpt from a Description Using the Tacoma Narrows Analogy

> The most famous example of a resonant frequency disaster was the 1940 Tacoma Narrows Bridge collapse. Scientists determined that strong, consistent cross winds passing around the Tacoma Narrows Bridge caused the structure to oscillate at resonant frequency. Over time, the amplitude of the oscillations increased to the point of structural failure, and the bridge collapsed into the river below. This disaster is one example of how destructive resonant oscillations can be and explains how a workout group of 17 can shake an entire building.

Following discussions of documents that incorporated Tacoma Narrows as an analogy, students were shown brief video clips of the Tacoma Narrows incident on YouTube. Some students had never seen or heard of this event and stated that seeing the video truly helped them understand the phenomenon.

5. *Tuning forks*: Response H below shows an example of this analogy.

Response H – Excerpt Using the Tuning Forks Analogy


point or the force stops. An example of resonance can be seen with the use of two tuning forks with identical frequencies. When one tuning fork is struck, it immediately causes the second tuning fork to vibrate since the first fork meets the natural frequency of the second.

Would the students' descriptions differ from one another, and, if so, how much?

Other than the obvious differences in the samples provided here – response length, amount of detail, straightforward technical language versus analogies, and so on – student responses did not generally differ in significant ways. Rarely, students added contextual information, often technical in nature as in Responses I and J below, but most maintained a narrow focus like the examples shown in this paper.

Response I – Excerpt Showing a Description at Molecular Level

> This phenomenon can be explained by the fact that all molecules vibrate if they are above zero degrees Kelvin, just not [at] a level detectable by humans.

Response J – Excerpt Putting Resonance Frequency in a Design Context

> Resonance frequency is an important design criterion in bridges and tall buildings. Preventative measures have been developed over time to prevent resonance disasters. These methods include designing shock absorbing mechanisms into the foundation, and some buildings even have huge pendulums that help to dampen vibration. Buildings today are also designed to have uncommon natural resonance frequencies.

How would non-technical instructors know whether the students' scientific descriptions were accurate?

On the surface, verifying the students' work turned out to be a simple matter of following the practices discussed in class: compare the students' work with known and reputable sources. However, given the instructors' lack of expertise in physics and structural mechanics, it would be more convincing in future uses to solicit the input of experts in these fields for verifying the accuracy of student work.

How much would the students from "non-structural" majors – biological, chemical, computer science, et al. – be able to contribute to their teams' solutions? Would they learn anything from their more structurally inclined peers?

This question is the main area for future work. Simple observation of student interactions indicated that members of all teams contributed more or less equally while they were working in their teams. However, when it came time for each team to discuss their responses, the most verbal/outspoken students seemed to be the ones from fields with more of a structural component, especially civil, mechanical, and aerospace. Intriguing though these observations are, they are currently too vague to be of much use. Future work on this topic will involve a more specific investigation of students' potential field-based differences.

NEXT STEPS

While the Korean skyscraper assignment has proven to be a useful tool in the classroom and appears to be a fertile area for study, more work is needed to verify its overall efficacy. As mentioned above, input from experts in physics and structural mechanics will be solicited to make sure that student descriptions of mechanical resonance are substantially correct. Also, in future uses of this assignment, GE 3513 instructors intend to focus more specifically on the extent to which students' majors affect their willingness to discuss the assignment content in class. Two additional possibilities for this work are higher-stakes assignments, such as larger research papers and presentations, and physical modeling, where students might team with physics, architecture, or art majors to design some sort of tactile, three-dimensional model to help show mechanical resonance in action.

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