

This is a continuing series of quarterly articles on lessons learned and best practices in civil engineering education. The intent of the series is to reinforce good practices, describe new or developing practices, and provide a forum for what works well and what does not. It is hoped that this series will be an important quarterly read for all civil engineering educators and all those interested in what's going on in civil engineering education today. Authors and topics will vary from issue to issue. Contact the associate editor, Mark Evans, at mark.evans@usma.edu if you wish to contribute to an upcoming issue.

Avoiding Death by PowerPoint

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Introduction

Slides prepared using Microsoft PowerPoint (PowerPoint 2002) are commonly used to convey information to groups in corporate settings, the military, and increasingly in the classroom. There are obvious practical advantages to using PowerPoint for undergraduate teaching. Thoughtfully prepared slides, shown in a meaningful sequence, reduce reliance upon teaching notes and raise the instructor's confidence level, especially when teaching new material. Slides also keep the instructor organized and, at least initially, help foster a more positive perception of the presenter. Ian Parker (2001) notes that PowerPoint "helps you make a case, but it also makes it own case: about how to organize information, how much information to organize, how to look at the world."

PowerPoint is ubiquitous in many undergraduate classrooms. Classrooms on many campuses are equipped with state-of-the-art networked computers and ceiling mounted digital projectors, or other technology. Many instructors use PowerPoint, at least to some degree, for almost every class or lecture. New instructors in particular arrive on campus already conversant with the technology and software advances from graduate school and feel comfortable and inclined to use it in the undergraduate classrooms. Unfortunately, it is not uncommon to hear students describe slide-intensive classes or lectures as "Death by PowerPoint."

Being a technophobe myself with only rudimentary computer skills, I arrived at West Point (my first undergraduate teaching assignment) with minimal prior exposure to PowerPoint. In hindsight, however, my lack of expertise was not a disadvantage. As I taught myself PowerPoint, I must have subconsciously approached PowerPoint in the aesthetic sense. I saw PowerPoint as a virtual art form, not simply as a means to transfer substantive information from my own notes into text-based slides for student note taking.

Looking for guidance on how best to use PowerPoint from experienced faculty and from Internet sources proved frustrating. Everyone seemed to focus on how to design slides, repeating the same advice about simple fonts, maintaining unity of design,

avoiding special effects, and mantras about not exceeding six points per slide. While these tips were useful, at least to some degree, they perpetuated a teaching mindset oriented on text. Ignored were important research findings that "the one medium of information transmission that is not clear is written prose" (Felder and Henriques 1995). In other words, PowerPoint for many is no more than a convenient way to temporarily "publish" embellished teaching notes.

I wanted PowerPoint to help me become a better teacher—to entertain, to bridge the gap between students who respond to concrete experience and those that respond better to the abstract (Kolb 1984). I knew if my teaching approach included a thoughtful visual dimension it would appeal to and engage all students, whatever their learning styles. While mastering the basic mechanics of the PowerPoint software was remarkably easy, it was not so easy at first making slides that were visually interesting. Slides should facilitate cooperative learning by providing shared information between students. They foster thoughtful classroom discussion, and draw student focus away from me as the instructor (Felder and Brent 2001). Properly used PowerPoint slides should help keep students awake, alert, interested, and engaged.

Furthermore, with a curriculum weighted heavily towards math, science, and engineering, the challenge in teaching constitutional law at West Point was not in presenting complex engineering or technical information. The challenge was impressing upon engineering and science majors that there is an intrinsic utility (if not beauty) to be found within our nation's laws. I wanted to create a "whole picture communication" (Vogel et al. 1986) of the rule of law and the role cadets will play in our government as commissioned officers. Interestingly enough, after guest lecturing in a computer-systems engineering elective, I came to realize that the advantages and benefits of creative visual imagery in my law classroom would work equally well in the engineering classroom.

Designing Meaningful Digital Imagery

In designing and creating graphic slides, my assessment for whether a classroom slide works is based upon three criteria. First, is the image relevant to what is being taught? Second, is the slide interesting and/or entertaining? Finally, does the slide stimulate internal or external dialogue? Does it make students think? Does the image encourage engagement or debate? Distilling these criteria further to their practical ends yielded five relatively hard and fast rules to prevent "death by PowerPoint."

Rule No. 1

Avoid text based "bullet" slides. Students inevitably copy every word on a slide. Instructors who rely upon a text-heavy format (Fig. 1), essentially delegate the teaching role to slides. In the event that a text heavy slide is absolutely unavoidable, direct students to copy the slide and wait in silence until they are done. Virtually anything said while students are copying text from slides is wasted effort. Few of us are capable of writing text while simultaneously absorbing substantive content from a speaker. A real and practical benefit associated with imagery is the resulting loss of available space for text. Imagery forces you to synthesize the textual component of your presentation.

Fourier's Law

- Heat in a solid
- C = the coefficient of thermal conductivity.
- In a pure fluid under certain conditions, the coefficient C may vary with the temperature T .
- Varies from one substance to another.
- Always a positive constant.
- Heat (kinetic energy) flows from regions of high concentration of internal energy to regions of low internal energy,
- Heat directed in direction of the gradient of the temperature.

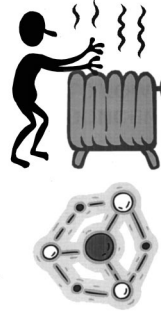
Fig. 1. Text-heavy slides should be avoided as students will inevitably copy every word off the slides and not hear a word the instructor says

As teachers we tend to present information in as comprehensive a manner as possible. This is perhaps most apparent when we show what students perceive is “testable” material. If not used sparingly, text-based slides have an unwelcome side effect. Students may assume (often quite correctly) that by copying slides they can forego assigned readings and still successfully pass the course. If students have an expectation of being spoon-fed content, there is little reason for them to read assigned texts. In the worst case, they fail to develop independent thoughts, opinions, and ideas about the subject. As a general rule, if your students routinely ask for your teaching slides in order to prepare for exams, then you are guilty of inflicting “death by PowerPoint.”

Rule No. 2

Slides should facilitate discussion. They highlight your primary teaching points. They should not *be* the teaching point. For example, when discussing one’s right to burn our flag under the

FOURIER'S LAW



- HEAT IN A SOLID
- FLOWS FROM HIGH TO LOW CONCENTRATIONS
- DIRECTED IN DIRECTION OF GRADIENT OF TEMPERATURE

Fig. 2. Don’t mistake nonphotographic clip art as “meaningful” imagery

First Amendment, news images of groups and individuals burning American flags encourage thoughtful and meaningful class discussion. On the other hand, bullet-text slides detailing the “three components of protected speech” or complicated flowcharts do not facilitate discussion.

In a business law class on corporate ethics, I present a slide with pictures of a large-scale commercial logging operation in East Africa. It also contains a picture of the severed head of a mountain gorilla resting on a tabletop. The point being made is that there is a cause-and-effect relationship between constructing logging roads to harvest jungle trees and providing poachers with easier access to endangered species. The graphic visual images will help students to retain this causal relationship. Similarly, in a structural design class, images of the tragic 1981 Hyatt-Regency walkway collapse might graphically illustrate to future architects the critical importance of proper load design, as well as the need for strict engineering oversight at the construction site itself.

CONDUCTION

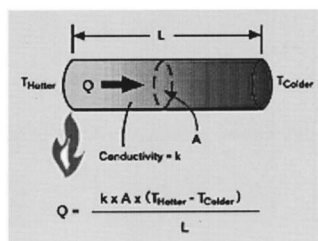
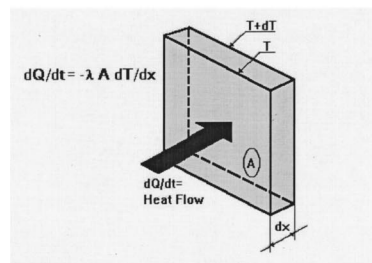
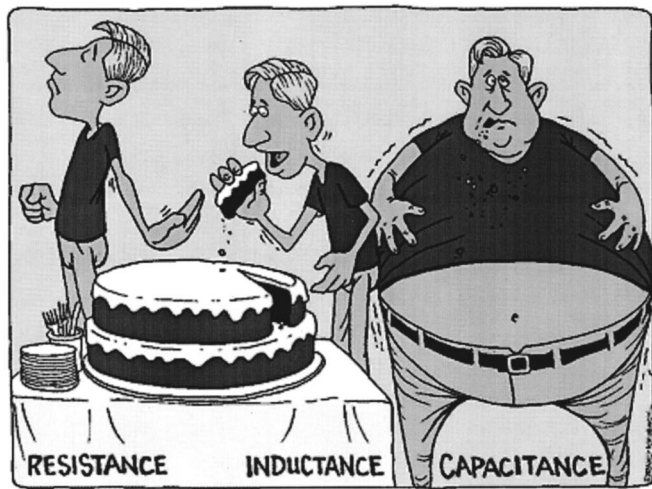


Fig. 3. The Internet is a viable way to find meaningful photo images on just about every topic



(a)



(b)

Fig. 4. Sometimes corporate Web sites contain images that are perfect for slides [(a) and (b) copyright 2002, Agilent Technologies, Inc., reproduced with permission]

Another slide from the constitutional law class is a full-screen news photo of a young Army lieutenant escorting the “Little Rock Nine” into Central High School in 1957. As we discuss the Equal Protection Clause of the 14th Amendment, I point to the officer and ask the class, “What is the lieutenant doing here in the picture?” After several technically correct answers along the lines of “Sir, he is leading his platoon;” or, “Sir, he is making sure the minority students are safe” a better answer always emerges. “Sir, he is fulfilling his oath to protect and defend the Constitution of the United States.” Bingo, that is why they call it PowerPoint.

Rule No. 3

Slides should entertain and be entertaining whenever possible. The primary function of classroom slides is keeping and maintaining the attention level of students. As aptly noted by the English historian, Richard Starkey, “the techniques of entertainment, the techniques of giving pleasure, are also integral to the techniques of teaching” (Starkey 2002). If the topic being taught is not inherently fascinating to begin with, then a picture (any picture)

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“We have to make a management decision.”

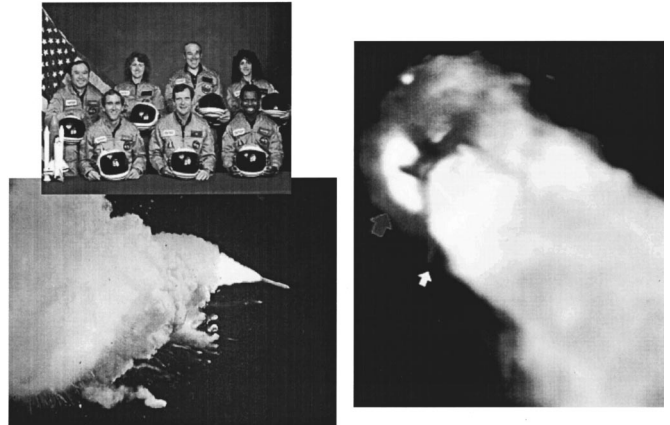


Fig. 5. Example of an effective classroom slide

always beats text alone. For example, if we are to review a specific legal case in an upcoming class, I start with just a basic case name and citation at the top of the slide and then scour the Internet for relevant images. For well-known cases such as *Roe v. Wade* or *Miranda v. Arizona*, finding thought-provoking images is easy. If the case or issue is more obscure and I can find nothing directly on point, I usually fall back on whatever is “close enough.”

For example, in a business law class we study the 1949 case of *Quality Motors Inc. v. Hayes*. In *Quality Motors*, a teenage boy buys a car from a dealer and subsequently tries to rescind the contract (as a minor) when he damages the car in an accident. After finding nothing else germane to this case, I simply found and inserted a picture of a vintage 1949 Ford Coupe; the same type of car purchased (and then wrecked) by young Johnny Hayes. Nothing dramatic or profound, but the picture did add a point of interest. It helped to keep students engaged and perhaps even helped them remember what might otherwise be an esoteric teaching point.

The key is finding something visual and interesting for every slide you make. If the image you select is not exactly on all fours with your topic, it matters less than you think. An image that is “close enough” (and maybe even slightly humorous) will always be of greater teaching benefit than a text-heavy slide with no imagery at all.

Rule No. 4

Avoid “frames.” Frames are templated slides that share the same background, color scheme, graphics, and even text (e.g., Thermodynamics 302—Lesson 16, Dr. John Smith). Besides being incredibly redundant, after your second or third lesson, the possibility that a student has inadvertently wandered into your classroom by mistake, or has forgotten your name, is quite remote. Standard organizational framing and symbology may be part and parcel of military and corporate presentations, but have little value in the undergraduate classroom.

Frames contribute to an inside-the-box mind set and, frankly, they are just boring. In this regard, especially if you are new to graphics software, do not be seduced into using the Auto Content Wizard function of PowerPoint. Content Wizard is a graphics (and suggested content!) template that instantly creates a 90%

complete and very professional looking graphics presentation that will rapidly somnambulate even your most enthusiastic students. The Wizard function is anathema to creating slides that truly engage students.

Rule No. 5

Use the Internet to capture meaningful imagery. Given three minutes and a good search engine, there is almost no picture or image that can't be found on the Internet. Images of Klan rallies, entropy functions in dissolved gases, the My Lai massacre, or the car used by Steve McQueen in *Bullitt* (a Shelby Mustang GT 390 by the way) are all a left-mouse key click from your classroom. By definition, "meaningful" imagery does not normally include non-photographic "clip art" (Fig. 2). A favorite source for capturing an incredible variety of digital images is the image search function of www.google.com (Fig. 3).

Searching the term "ground stabilization" or "thermodynamics" using Google's image search function yields literally thousands of images, charts, and graphs. I even found dozens of humorous cartoon depictions of basic computer systems engineering principles (e.g., blocking capacitor, finite-element analysis, floating input, etc.) from the Web site of Agilent Technologies, Inc. (Agilent Technologies 2003). [See Figs. 4(a and b)]. Images also usually contain active links to host Web sites. "Surfing" host Web sites for additional imagery has the serendipitous advantage of being the source of fresh substantive content as well. This is one of the truly remarkable collateral synergies to be derived from this creative process.

Additional Considerations

Using PowerPoint, as opposed to the chalkboard, allows a teacher to selectively refine future lessons by simply discarding slides that don't stimulate discussion and keeping (and even improving) slides and graphics that facilitate real student interest and engagement. In this respect, if there is a single disadvantage to producing

meaningful classroom imagery, it is the time needed to create them. It may take an hour or more to create 8 or 10 thoughtful slides for a single class or lecture. Nevertheless, this is always time well spent and it is never wasted effort. Making slides is a creative, stimulating, and challenging intellectual process that you quickly come to anticipate and enjoy. An additional example of an effective PowerPoint slide is shown in Fig. 5).

Perhaps the greatest single benefit to using PowerPoint imagery in the classroom is that it requires us to thoughtfully examine and reexamine how we teach. How do I most effectively organize and present this information in a way that keeps and maintains active student involvement? It is this reflective process that helps to ensure that our substantive content does not grow stale. Not every slide will be the basis for student epiphanies, but creative slides do reward even the most seasoned classroom teachers with conspicuously enhanced student interest, engagement, and dialogue.

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