AC 2011-260: INFORMED INFLUENCE: PREPARING GRADUATE ENGINEERS TO PRESENT WITH POWER INSTEAD OF JUST POWERPOINT

Christine G. Nicometo, University of Wisconsin - Madison

Christine G. Nicometo is an associate faculty associate in the Engineering Professional Development (EPD) Department at the University of Wisconsin-Madison. Within EPD, she teaches technical communication courses in three programs: Technical Communication Certificate (TCC); Masters of Engineering Professional Practice (MEPP); and Masters of Engineering Engine Systems(MEES). Through the College of Engineering, she also directs the New Educators Orientation Program. She has been an active member of ASEE since 2006.

Traci M Nathans-Kelly, University of Wisconsin–Madison

Traci Nathans-Kelly earned her PhD in 1997. At that time, she was also the Program Director for the Scientific and Technical Communication BS degree at the University of Minnesota, Crookston. She came to the University of Wisconsin-Madison to teach in the College of Engineering's Technical Communication program, the Masters of Engineering inProfessional Practice program, and the Masters of Engineering in Engine Systems program. She instructs a variety of topics, including technical communication (graduate and undergraduate), technical presentations (graduate and undergraduate), technical editing, writing user manuals, and other courses. She is active in the Society for Technical Communication (STC) as Senior Member, where she is the Manager for International Technical Communication Special Interest Group, she is a member of the Committee on Global Strategies, and she judges at the international level for the STC Publications contests for scholarly journals, scholarly articles, and information materials. As a member of IEEE's Professional Communication Society, she serves as a book series editor for "Professional Engineering Communication." For the University of Wisconsin-Madison, she regularly holds workshops (both online and face-to-face) for practicing engineers all over the globe on how to improve their technical presentations.

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Informed Influence: Preparing Graduate Engineering Students to Present with Power and Not Just PowerPoint

Of late, it is difficult to browse a blog, attend a conference, or read a professional publication and find no mention of how to improve presentation skills and PowerPoint mastery. The creators of the software package themselves have commented on the rampant misuse of their creation by otherwise well-intentioned professionals[1], top military commanders have called it "the enemy,"[2] and Edward Tufte has compared it to Stalin's regime[3].

And while all of these critiques have well-documented merit across a number of fields, changing the practice of working engineers involves much more than presenting the facts. The traditional slide design of fragmented text-heavy information is ubiquitous in industry; busy technical professionals looking for better communication modes not only have to first learn new methods, but also battle existing expectations and extremely tight time constraints to begin to incorporate better practices into their presentations. However, for professionals who are able to overcome these barriers and use improved slide design in their presentation techniques, the payoff can be great.

With an eye specifically towards slide design as an integral part of the communication strategies that engineers use to push information within their organizations, this paper first reports on the broad call for the need to improve engineers' communication skills as the most recognizable skill that contributes to professional effectiveness; second, we cover our approach when teaching new methods of slide design to practicing engineers enrolled in an online masters engineering program; and third, we provide some examples of outcomes from that sample group measured across the past four years. The need for teaching these presentation methods becomes clear and more pressing when we hear from the practicing engineers themselves.

The Need: The Studies and The Studied All Agree--Communication Must Improve

The Studies Call for Better Engineering Communication

The call for better communication skills in the engineering profession has been well documented in recent years. Using industry and academic input, ABET, Inc. first published the "a-k" list of skills a decade ago, outlining the skills that undergraduates should attain in order to become effective engineers.[4] In similar gestures, other organizations and publications emphasized communication, business acumen, interdisciplinary teamwork, creativity, life-long learning, and technical problem solving, and other non-technical skills as keys to career success. The National Academy of Engineering, in *The Engineer of 2020*, described just such skills that education should emphasize, with a focus on the changing nature of engineering work.[5] At the professional society level, The American Society for Engineering Education (ASEE) Corporate Membership Council also listed these same skills as critical for the future of engineering, noting attributes that a "global engineer" should possess.[6] Similarly, the American Society of Civil Engineers posited the *Civil Engineering Body of Knowledge*

for the 21st Century [7] that echoed these sentiments and demands from undergraduate engineering programs.

Other studies that focused on engineering skills highlight attributes that might not be typically considered in a description of general engineering work or in a plan for education. For example, Trevelyan observed a key attribute of effective engineers as being the ability to work with and influence "other people so they conscientiously perform necessary work." [8] His emphasis on the skill of technical coordination, noted earlier, is repeated in other work finding effective communication as the one skill viewed as most essential by engineers.[9] [10]

As part of a three-year NSF study [11] that ended in 2010, we were part of a University of Wisconsin-Madison team that, in part, studied the working practices of six engineering firms. The aim was to put forth a situated description of engineering work, constraints, skills, and values. To effectively compare and contrast what Knorr Cetina [12] describes as "knowledge cultures" within organizations and professions, we developed our understanding of the epistemic frame/culture of engineers by situating ourselves inside the six companies, sometimes at different sites therein, observing engineers at work while also having them describe what their work involves.

Gathering rich observations and interviews from our on-site work, we employed a grounded theory approach to make sense of our data. As we gathered data, we further categorized it into narrower themes that began to stand out on their own. We coded specific data and organized it all within the software, NVivo. Our review of the initial findings, categorized in a variety of ways, enabled us to validate or revise our initial theories about the epistemic frame of the engineering profession—thus grounding them within a range of qualitative data.

From this body of research, we found a clear call for advanced communication skills and prowess from engineering practitioners we observed on-site. Confirming this finding, a survey deployed simultaneously, polling a different set of alumni engineering graduates (N=162)[13], confirmed our on-site findings. Communication skills are the top demand and most prized skill in engineering.

The Studied Engineers Also Call for Better Engineering Communication

As instructors, we are in the unique position to be teaching graduate students who are also practicing professionals in various engineering enterprises. For admission to the UW-Madison engineering graduate programs that employ us, students must be at least four years into their career paths. They work for organizations big and small, private and public, including automotive manufacturers, software developers, government agencies, private firms, design-to-build companies, pharmaceutical and medical device manufacturers, industrial plants, nuclear facilities, the military, road construction firms, packaged food manufacturers, defense contractors, and even themselves.

These practicing engineers in our graduate courses know firsthand how bad presentations can be, and they often see slides contributing to inadequate or substandard on-site

communication. Time and again, these professionals write about how poor slide design exacerbates good information dispersal of complex material or how bad slides and worse delivery by the speakers infuriate the audience. They complain repeatedly of presenters wasting their time, of expert speakers not heeding audience need, and presenters not using the tool (slide software) to its best potential.

How bad does it get? Some presentation events are so harrowing for participants that it can greatly affect morale. While a bit tongue-in-cheek, this complaint was posted in the class forum by a product development engineer; the disdain is palpable:

> I attended a week-long training seminar this past October that included daily presentations by the "experts" of various processes. The bullet points below are a summary of one of the presentations as well as some of the things that were going through my head.
>
> - Presentation length was approximately 15 slides, duration was approximately 2.5 hours.
> - Approximately 500 words per slide, font size = 14, single spaced
> - Zero graphics
> - Thoughts: "Is this a joke? Are we secretly being tested for our patience?"
> - Presenter read the slides to the audience, which consisted of [the] "Top Engineering Team" verbatim while following along the words with a laser pointer.
> - Monotone voice, zero interaction with the audience, no eye contact or pauses for discussion.
> - Thoughts: "If my boss's boss wasn't sponsoring this training, I would walk out." "I seriously am going to fall asleep." "Why didn't this guy just hand everyone a print out and tell us to read it quietly to ourselves?" "Does this guy really think that we cannot read?"
>
> As you can see from my summary above, the presentation was horrible. I hope to never give a presentation to an audience who is wondering if the whole thing is secretly a joke.

Packed slides, too few or too many slides, poor speaker use of the slideware, and scant audience analysis all come together in an organizational communication effort that has utterly failed to gain the desired outcome for this training session. We all know that a bad talk can damage a speaker's ethos, but perhaps we underestimate the extent of this damage all too often.

Another trait that engineers often struggle with is the appropriate amount of detail to present at a given event. One of the visible traits of good engineers is that they can amass and vet details. However, the small details that engineers are so good at working with are rarely needed in a progress briefing, a team meeting, or most other venues. For example, we heard this senior development engineer at a major vehicle manufacturer describe a coworker's approach to a talk:

> [A] form of bad presentation is too much detail. I have a co-worker that is so

> fascinated with his work that he is sure you are too. He will be given an hour to present his topic and when his hour is up, he will have 32 of the 56 slides remaining. (I'm not kidding!) He will then ask if he can get some time at the next meeting to finish. Also, most of the 56 slides will be bullet point paragraph form text that he reads verbatim. By the end you are looking for a sword to fall on.

Based on numerous examples of similar complaints from the engineers in both our NSF study as well as our graduate programs, it is clear that change is needed. In an economic climate that requires intense focus on productivity, the presentation practice of many professionals is an area of severe liability. The studies and the engineers themselves concur; something needs to be done about these "decks of drudgery," as one of our engineers labeled them. And in our own academic interface with industry, we have found a way to encourage more thoughtful slide design, and thus better organizational communication, within the engineering and technical fields.

The Design: Crafted from Research in Engineering Education and Cognitive Science

Beginning in 2006, using the emerging research from engineering education and drawing upon the established research on multimedia learning from Richard E. Mayer and John Sweller, we designed a technical presentation component into our online graduate course enrolled with practicing engineers. This new component of the course curriculum challenged the slide design methods widely in use in industry. In order to present such a bold challenge to students' deeply entrenched slide design practices, we took a careful rhetorical approach.

Given the audience of practicing engineers from across all industry and government sectors, including several students who live and work internationally, the research from the cognitive science realm was a key component to our argument for change. As the leading voice in multimedia learning in the U.S., Richard E. Mayer's[14] work describing the limited capacity in cognitive channels for visual and verbal information helped us lay the foundation for specific changes that we taught students to make in their presentation visuals.

As Mayer's work on cognitive load theory points out, the use of text-heavy multimedia (in other words, the dominant current practice of slide design) is not in line with how our brains take in, process, and retain information. Specifically, when learners must take in information through pictures, text, and auditory stimuli simultaneously, they are limited by their cognitive capacity to do so effectively. However, as both Mayer[15] and Sweller's[16] research work has shown, when learners must take in information through pictures and auditory stimuli, they do so more effectively due to the lesser cognitive load on the visual channel.

Thus, cognitive load theory – specifically the modality principle that notes that people learn more deeply from pictures and spoken words than from pictures and printed words– informed our instruction on the design of technical presentation slides to our specific student set. Figure 1a shows a typical example of the "traditional" slide design that

results in cognitive overload slides; this is the slide design that most of our students use on a regular basis. Figure 1b shows the topic once transformed by the slide design techniques we model and teach.

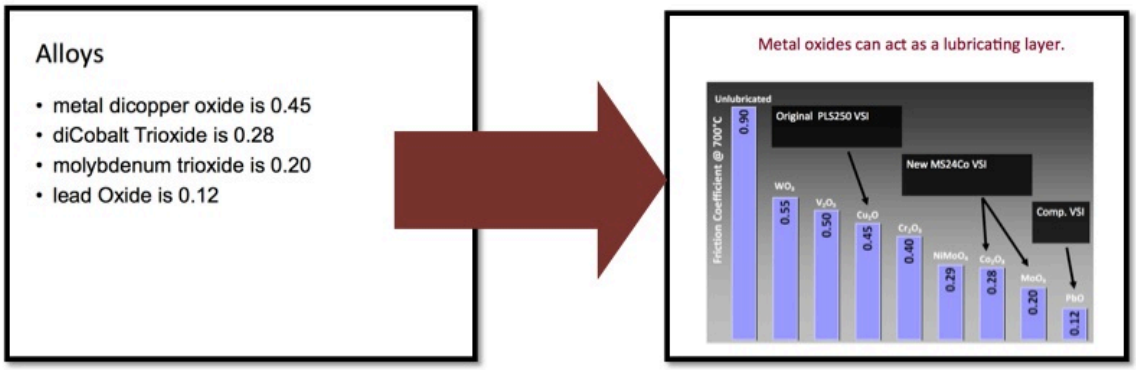

Figure 1 (1a on right, 1b on left): Cognitive overload transformed into content-appropriate slide design. We teach students to move away from fragmented, textually focused slide design, as shown in (a). Instead, we encourage them to think more completely about crafting the message using sentence headers, visual evidence, and notes to align their slide design with their audience's cognitive needs.

In teaching this design shift, we begin with the cognitive science underpinnings (including readings that are drawn upon for this research), then model examples, and finally ask students to create some before/after examples of their own.

Specifically, we begin with reminding students of the purpose of drawing people together for a live presentation to begin with (whether it is live in-person, or live online). Coordinating a live audience demands an effort that is ideally rewarded through the benefit of real-time discussion and idea sharing. However, in order for ideas to be discussed and sparked, first, real engagement with the content of the presentation must take place. And while this notion is nothing new, the reminder is always an important step.

As previously cited, given that cognitive science has challenged the traditional fragment header + bullet-heavy norm, this design practice must be changed. Our students are typically extremely accepting of this thread of logic and are ready to try a new practice.

Part of the new practice we encourage is to first, frame the presentation in a series of storyboarded assertions for the audience [17]. We build on the assertions of others that brainstorming and idea development was never the intended purpose for slideware [18]. We challenge them to step away from the computer screen and work in "analog mode," scratching and sketching out ideas on paper, crossing out words, drawing arrows, revising, and otherwise engaging with their topics. Once the basic content begins to develop, then presenters can move to using slideware to construct the visual companion to the content.

Once the analog step is well underway, presenters move to using slideware. The first change we ask them to make to their old practices is to employ the use of elegant,

efficient, and concise sentence headers in place of the typical fragment header (see Figure 2).

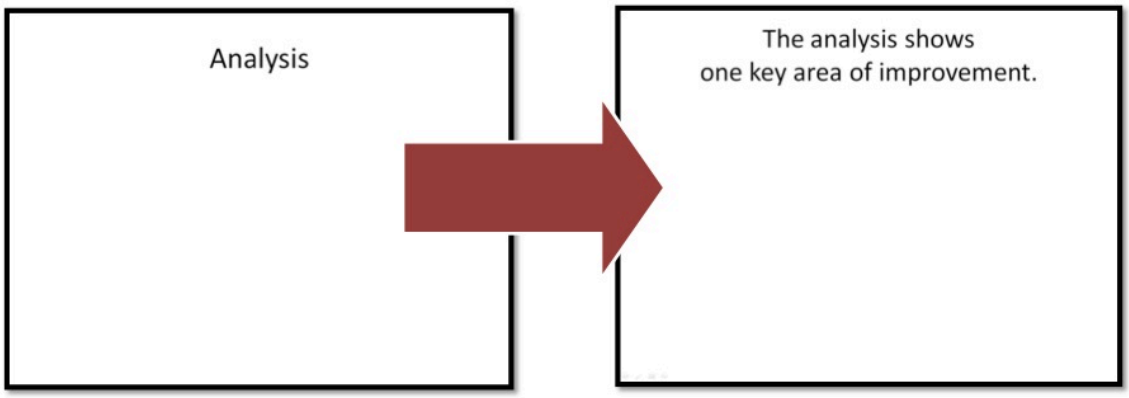

Figure 2 (2a on right, 2b on left): Fragment headers vs. sentence headers. Following the work spearheaded by Michael Alley and colleagues, we teach students to abandon fragmented headers (as shown in 2a, on the right) that tend to confuse and obfuscate. Instead, we teach them -- where appropriate -- to use complete assertive headers (as shown in 2b, on the left). The sentence headers clarify the presenter's position and cognitively engage the audience in a more substantive manner.

Some students initially raise concern that the sentence headers could add to the cognitive overload of the audience. However, as previous work has shown[19 20 21 22], sentence assertions can provide a means of framing the presentation, much like an executive summary in its directness. These short header assertions can be quickly comprehended by the audience, anchoring comprehension of the presenter's main points without the cognitive burden of having to complete a fragmented phrase with practically innumerable options.

To support and further elaborate upon the sentence assertions/main points, we encourage students to show visual support for their claims in the body of the slide. This visual evidence can take on almost endless forms, depending upon the main point of the slide, the audience, and overall purpose of the presentation. The practicing engineers in our courses have found incredibly creative means of visually displaying both quantitative and qualitative assertions through the use of this design practice.

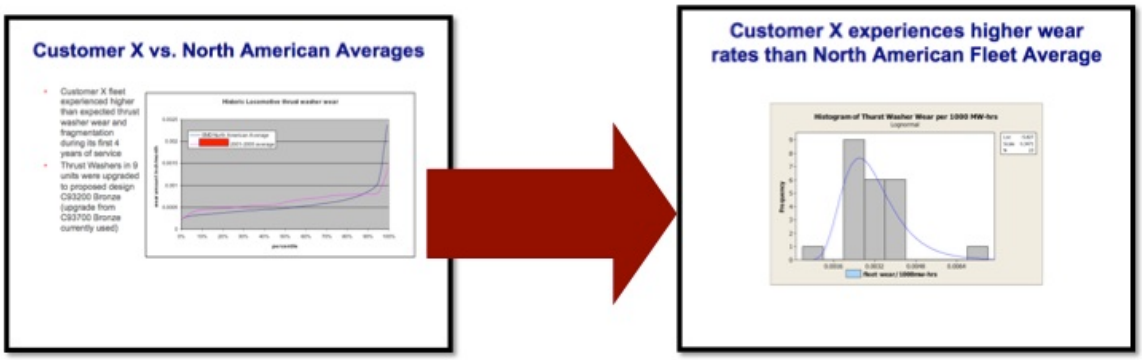

Figure 3 (3a on right, 3b on left): Transformed industry visual. Starting with an oft-seen fragmented header, text heavy bullet set, and indecipherable graph, this engineer was able to drastically improve his overall approach to slide design.

Of course, not all visuals are created equal, and we go to great lengths in the course to emphasize the visual practices that are better aligned with the cognitive load theory than others. We encourage students to follow the practice of emphasizing specific points with either a circle or arrow to identify a noteworthy aspect of the visual. Busy animations, overly detailed tables, skewed graphs, poor photographs, and the like are challenges that these engineers must overcome [23]. There is no advantage in trading one cognitive overload structure (heavy text) for another (overwhelming visuals).

The next major new piece we bring to student's slide design practice is the judicious use of sequenced visuals, wherein a complex topic is "unpacked" before the audience's eyes. Instead of bringing in all elements of a bar graph, for example, we encourage them to release each element of the graph as it will be spoken to during the talk. The controlled release of information is a powerful tool for several reasons: it allows the subject matter expert to reveal the complex technical information in a logical order both orally and visually; it prevents others from reading ahead; it prevents audience members from tuning out the speaker in order to untangle a topic yet to be addressed by the speaker.

Finally, in teaching these alternative designs, we address the need for slide decks to fully function within their organizations as reference pieces and legacy items. Many of our students' presentation slide decks are used by other colleagues and superiors as they present upward and outward in their organizations, and there is an initial fear that without a bulleted script in place on the slides, no future presenter using the slide deck will be able to make use of the slides. This fear is typically alleviated when we teach students to use the "notes" pane in slide software suites to create a detailed summary of the discussion points both prior to the initial presentation as well as following it (see Figure 4 for an industry example).

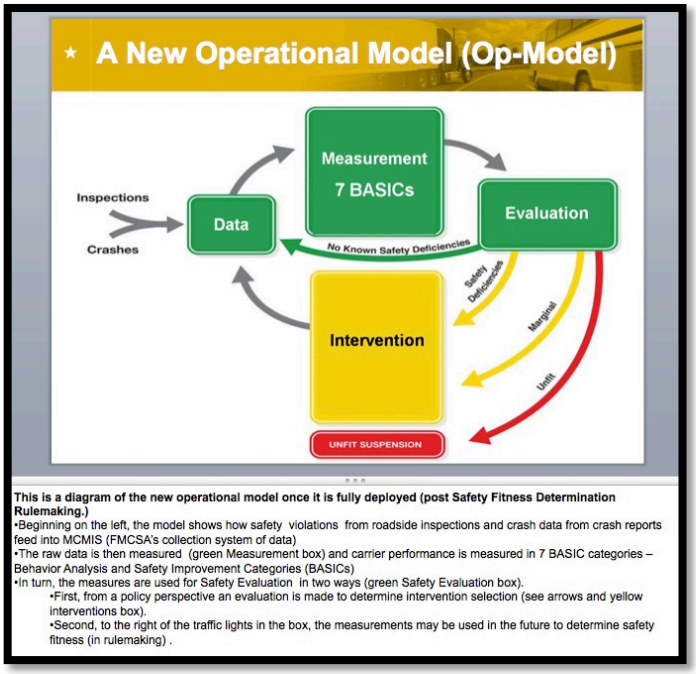

Figure 4: Use the Notes pane to act as an archive of the discussion. In this industry example, the slide used during the live talk is visual heavy, which works well for information retention. Talking points and outside references are embedded into the slide deck via the Notes feature. [24]

By capturing the main points of the live discussion in the notes pane, the slide deck can actually become even more valuable to an organization as it moves through various working groups. As well as providing a living script, of sorts, for other presenters to follow, the notes can also become a rich repository of online links, bibliographic references, and follow-up questions to be dealt with in future presentations. This archival practice often quashes remaining critiques of the design model, though by no means completely eliminates them at an organizational level.

These pedagogical pieces come together for a major paradigm shift for these practitioners. As part of the class, they are required to experiment with these methods, as appropriate for their organization. Along the way, they have ample opportunity to communicate their successes, their musings, their initial attempts, and their reviews of application as per these new methods. After teaching these new slide design techniques for five years, we have come to see a predictable pattern of adoption from cohort members.

The Practice: A Staged Process of Interest, Doubt, Experimentation and Deployment, and Conversion

We work with engineers who know a change is needed in presentation practice. They experience frustration, impatience, fatigue, resentment, and boredom with the status quo for talks within their organizations. Thus, we try to provide them with reasonable techniques, backed by research, that may improve their talks and influence others.

After being introduced to the techniques outlined in the previous section, our students tend to exhibit some noted patterns of response to the new material. Listed in order:

> Phase 1: Interest--I like these ideas; I can see how they could work very well.
> Phase 2: Doubt--These methods will never work at my organization.
> Phase 3: Experimentation and Deployment--I tried one or two of these ideas in a talk at work; I had some interesting results.
> Phase 4: Conversion--I am a changed presenter!

Phase 1: Interest -- I like these ideas; I can see how they could work very well.
Once we have introduced the new slide design methods and ask them to experiment, the engineers begin to understand that we are asking for a change in a communication practice that affects the very core of their organizational communication strategies. Again and again we hear that this is completely different than what they usually do at work, as the typical slide practice is to have a fragmented header and a slide full of heavy text and bullets that the speaker reads.

They are excited about the possibilities that the new slide design presents; engineers often think in spatial and/or pictorial terms, and our slide methodology gives them permission to bring complex methods of problem solving to their communication strategies at work.

The struggle to reconcile these new methods and techniques was articulated well by a vehicle calibration engineer for a large equipment manufacturer. He posted this in the course asynchronous forum where we were discussing slide design strategies:

> Trust me; I am one of those people who stubbornly holds onto ideas and ways that I am more familiar and comfortable with. I personally am very hesitant to try new tactics. But one thing that fights this personality trait of mine is the desire to be different from the rest by having a unique approach in solving problems and presenting my ideas.

An engineering colleague from another automotive manufacturer responded about an hour later:

> One drawback of sticking to one presentation style is, I think, that the presentation style limits your consideration process, thus your imagination. If this is true, then it is very bad.

It is typical that we, as instructors, see some early engagement with the new methods because the engineers see windows to opportunities. Rarely do our engineering professionals consider themselves wordsmiths or communication experts; rather, they struggle with finding the right ways to reach their various audiences and have had limited successes in the past. As both presenters and audience members who have witnessed poor presentations, they are compelled to try new methods.

Because slide use is ubiquitous in engineering, scientific, and technical industries, the tool and its abuse must be addressed. Using slide software to best purpose is not a skill that gets much training or mentoring. Some use it and get by. Others avoid it. For example, this insight came from a software security engineer at a communications company:

> I have [now] changed the way I prepare for presentations…For years, I had not used PowerPoint and instead handed out documents and displayed relevant visuals using other tools. I hated the endless lists of bulleted text that I usually see in PowerPoint, so I blamed the tool instead of the presenter.

This engineer astutely identified that many blame the tool when, in truth, the unexamined methods of the practitioners need to be adjusted. When using a slideware editor, such as PowerPoint or Keynote, users often default to a toolkit that has templates, preset standards, and finite variability. It is not difficult to see why engineers (or any technical experts), who spend their days with physical manifestations of their work (buildings, pipes, engines, valves, pistons, food packaging, cans, medicines, manufacturing lines, sewers, roads, and so forth) or electronic renderings of their ideas (in CAD programs or software code, for example), would then struggle to communicate their ideas to colleagues using bulleted words and phrases alone. Tradition and company culture lead many practitioners to believe that the slide software demands such translation, and they abide. Their physical work realities painfully transmogrify into bulleted lists because the tool's default format presents to them templates full of cramped headers and bulleted lists.

Thus, when they are given permission to bring their working realities to bear on the slides that they use to help them communicate, they are very encouraged. At first.

Phase 2: Doubt--These methods will never work at my organization.
Engineers are often very astute at assessing how change will be regarded within their organizations. Because we work with innovative practicing engineers, they are almost always willing to engage in a new methodology if doing so might improve workflow.

Once they begin to engage with these new presentation methods, however, a quick realization sets in that they will be communicating against the tide, so to speak, when it comes to slide design. It is all too common for the design tradition of slides at a given organization to be rife with fragmented headers, bullets, and heavy text. This is the norm, even when the format is reviled.

These engineers soon understand that making a change in the communication structure is akin to making a change to the organization itself. On our course forums, they discuss how presentation style is linked to corporate culture; such organizational cultures have legitimized substandard slide design through unscrutinized repetition and tradition. "Although it [the new techniques] sounds like a good idea, proposing to change the presentation styles is like proposing to change the business culture," noted a regulatory affairs engineer at a medical device company. Interestingly, a peer in the course soon

revealed that his company is a contractor for her company; as a senior mechanical project engineer, he said of the presentation culture:

> I have been reviewing our internal processes and procedures since starting with the firm late last year. It is VERY difficult to present 'new' ideas on how to better merge and manage the flow of work and information because each business unit does it differently (and independently). We are small compared to [your company], but it's been ingrained in the culture [that] 'this is the way you do it.' I feel the length of time a 'standard' has been around has a significant amount of mass when you are proposing new ideas.

The original regulatory affairs engineer then commented as a follow-up:

> A couple of weeks ago, I had to put together a slide for these business reviews, and I was thumbing through *Slide:ology* for ideas. Our culture is so used to packed powerpoint [sic] slides, that most of my co-workers chuckled in seeing the concepts presented in the book. *A lot of them agreed that those may be good ideas, but just not what fits in our business. I guess if everyone at the bottom decided to change the way we created presentations, then it might have an effect.* Otherwise, it seems pretty difficult to change the status-quo at such a large business [emphasis added]."

This engineer clearly has significant doubts about her ability to make changes in her slide within her organization. While she is interested in trying the new design strategies and sees some promise in them, her concerns about misaligning her efforts with the current corporate culture cripple her enthusiasm.

Phase 3: Experimentation and Deployment--I tried one or two of these ideas in a talk at work; I had some interesting results.

Because these engineers are enrolled in a graduate course, we expect that they try to incorporate some of these methods of slide design into a talk that they give on-site. For proprietary reasons, we often do not see entire slide decks used at their place of work; instead, we rely on a meta-analysis of the event provided to us within ten days of the workplace presentation. This analysis includes the engineer's assessment of a video taken of the talk, a review of the required feedback forms gathered from attendees, and any other relevant information.

When they review the course at the end of the term, they pass on their assessment of the most compelling and helpful pieces of the course. Without fail, the presentations techniques rank at the top. Here are some representative excerpts from the collected anonymous course evaluations:

> It was obvious current standards were not effective but I didn't know how to change them or how to identify what was wrong. I am well on my way to better presentations now.

> Using tons of bullets seems to be the way it is done in industry, but this opened my eyes to why this is not a good practice.
>
> Before I did not know the importance of visuals in communication, and when I applied it to my in-house presentations, I found the [big] impact of visuals on the audience.
>
> [The presentation techniques] I found to be directly applicable to my workplace; it has helped to establish my credentials as a leader at work.
>
> My skills have improved tremendously in preparing effective visuals for presentations for all audience types.
>
> [These techniques] gave me a chance to find why I fear presentations and PPT and the ways to improve it.

Overall, the practicing engineers in our graduate program report back that their new techniques have made them better presenters. They feel more freedom to be the true subject matter expert in the room, instead of playing second fiddle to a slide.

A design engineer posted in the course forum that "I presented at work just today for my…project. I made it a goal to use as few words as possible and as many graphics as possible. I think it is probably the best power point [sic] I have every put together." Another cohort member, an electronics engineer for a United States government agency noted that using these techniques

> …has caused me to change up a little how I usually prepare for my presentations. In these past presentations, I was more reliant on the slides to tell most of the story and I think that hurt some of my flow. I found using that by using visual cues in the slides my presentation flowed very well and was felt much more like story telling rather than just going though the information line by line.

As well, a design engineer for engines systems had tried using a visual heavy approach for the first time, claiming success because "I found that my presentation went extremely well because the graphics guided the conversation."

Such examples alone embody the overall reports of success of these methods. These practicing engineers have put themselves back in control of their presentations, using visuals narrated by them, and are now reaching their audiences with success. Feeling more in control of the arc of their work, they use the slides to support their points instead of using the slides as a crutch or visual filler.

Phase 4: Conversion--I am a changed presenter.

Once these practicing engineers begin to see how empowering it is to take back their own presentations, whether they are formal or informal events, they find a host of methods that work well within their own unique organizations. They are free of the tyranny of the bullet, they know what can work within the visual acreage (often cramped by company

templates), they know that the audience may be a bit surprised at the change at first, but some become almost evangelical about the new approaches. As one engineer put it, “I'm ruined--I will now forever be a presentation snob.”

We become most encouraged by their successes when they begin to find ways to go beyond anything covered in the course and they develop appropriate in-house methods that launch information more powerfully. In refashioning his approach to his slides to support his talks, an electrical engineer describes how he adapted the methods for a training session. He used visuals in rapid succession for the presentation itself, and in between each of these visual slides, he used a hidden slide that housed the speaking points (rather than using the notes feature). He explained, “It is an adaptation of our training group's method that allows them to maintain both the presentation and the official training manual as one document. It lets the audience walk away with a full text hand out, and (I believe) keeps the audience engaged.” It is just this kind of elasticity when applying some of these techniques that makes for more powerful communication inside organizations.

Presenters come back enthusiastically with good solutions to complex slide design problems. For example, when discussing technical information, engineers often have to address both theory and the application thereof. To do so, this director of application and development of a software company designed his slides with “a relevant visual on the left and an example on the right,” balancing the multi-level needs of his audience by applying good slide design.

Some of these practitioners become a bit evangelical as they engage the possibilities. A senior research scientist reported that he shared these techniques with his father who then presented at a conference in the power generation industry; “Using the low-text/high-visual approach, he gave a presentation to some chemists on water sampling at one of these conferences. He later told me, with some measure of excitement, that he had really connected with his audience. It was one of the most effective presentations he had ever given.”

While they may be battling tradition when it comes to slide design, the engineers are encouraged by the flexibility in these techniques. They often willingly become the agents of change at work, training and mentoring others to design better slides that more closely meet audience, organizational, and archival needs.

The Results: Feedback from the Field Reinforces New Approaches

But how does the audience feel about the new techniques? Our students get responses ranging from heavily positive to highly skeptical. For many, the careful and thoughtful application of the new techniques get instant, positive reactions, such as this, from a quality engineer at a defense contractor: “Imitation is the sincerest form of flattery. In the two weeks that passed since my presentation I have seen slides from it borrowed and presented. I was also asked to provide input on a presentation to our in-house government

personnel." For this senior project engineer at an appliance firm, over a year later he continues to apply the methods to his work. He reported that his vice president said "it was the presentation of your career, to date" when praising the content and the delivery of a recent talk he gave. And this from a quality engineer: "Yesterday I gave a presentation at a supplier conference with 200 people in attendance… My slides were certainly a level far above my previous work…My presentation was very well received and my confidence level was much higher."

Furthermore, during their final presentations in the course, we ask that students share the results of their audience feedback forms (distributed to their live audiences on-the-job). While the feedback form does not specifically request audience members to comment on the slide design, it is frequently a focus for the respondents anyway. Typical comments taken verbatim from the forms that students share with us include:

"Presentation was well put together and engaging"
"Very good visual support"
"Very clear with the 4 main topics that would be covered (pictures)"
"Excellent visual aids!"

In addition, students often tally their feedback form scores more numerically, as one student did last spring, shown in Table 1.

Table 1: *As shown in this student-generated table from 2010, when students tally their audience feedback form scores, they often find their highest scores are in the category of "Presentation Design."*

Presentation Feedback Form					
	1 (lowest)	2	3	4	5 (highest)
Topic Description			1	2	5
Topic Presentation				4	4
Presentation Design				1	7
Adequate Detail			1	1	6
Overall Delivery				3	5
Conclusion			1	3	4

A colleague in his class, an engineering manager, almost lamented that his boss liked what he did so much that he was now charged with training her and the entire staff with the new approach. An early adaptor from 2007 had his entire job functionality shift when his manager saw his presentation; he was asked to take his work on a “roadshow” and present to the various company campuses around the United States.

For all the positive welcome that these new techniques garner in industry, there are also some detractors. One senior sales engineer described how he has come to adjust his methods, tailoring his approach to different audiences within his organization:

> I have tried the extreme of presenting all pictures and no text once for a presentation and found that as long as I have a good story that flowed well through the visuals, I was ok. But I have found that sometimes, the audience expects more text. They want to have a "document" of what I presented and having just visual slides were not enough for them. So in preparing for my presentations now, I must know my audience and then adjust my content visual to text ratio accordingly.

This student was not alone in hearing some calls for a return on text-heavy slides, however it is noteworthy to recognize that he sees his approach as flexible, depending upon his audience. Another student described his experience of deploying the techniques taught in class, saying,

> I have started to use more visual less text. You know what feedback I got from a meeting ? My lead told me, "Manny, if you get hit by a bus the presentation that you gave will not be able to sit by its self.
>
> That is what I got.
>
> I then told him that “knowledge/notes” were in the notes section of PowerPoint. He stated that it was no help since it was not on the slide. So, I have tailored my presentations for him specifically. For other meetings/trainings that I do, I use highly visual, since this gives me the power of the meeting. I was afraid of this first, but now have come accustom to it.”

Again, it is encouraging that, like his fellow-cohort members, he is developing a flexible approach and is not seeing the techniques as exclusive or binary.

In addition to the resistance to change, there are also some students who work in corporate cultures that encourage the use of PowerPoint as a general documentation mechanism. As one engineer at a medical device manufacturing company describes:

> We heavily use PowerPoint at my work. There are a lot of pictures (graphs, photos, etc.) that go into it, but we also use a lot of text. PowerPoint is used as the primary tool for information capture and general documentation - there are very

> few reports written using Word. Since this is the only way this information gets captured, there are generally a number of word-only slides. Also, PowerPoint "presentations" typically provide a framework for real-time discussion (including the content that the person prepared beforehand) and are frequently updated during the meetings, essentially serving as a white board. The last slide is typically an ad-hoc "actions" slide. In this context, I don't think the notes section provides a viable alternative (graphics in the slide and text in the notes) because there is not sufficient resolution to show the notes and slide at the same time.

While the practice of using the PPT software as a word processing mechanism is somewhat isolated, in the corporate cultures that encourage this type of use, students are often reluctant to criticize it and certainly do not see themselves as able to abandon it. One student, also from a medical device manufacturing company, describes the way that slides are used as documents within her organization:

> [The company's] "four block" is a slide divided into quadrants and usually used in status updates…divided into Accomplishments, Issues, Next Steps, Schedule, Revenue, etc. Instead of sending someone a Word Doc, you'd send a Powerpoint slide. For quick reviews (that may never be actually presented), then this method can be good since all the information is on a one page view. We do use a lot of "slideuments" [slides as documents] instead of reports or documents. Most actual documents are either procedures, SOP's, or white papers.
>
> However, for my example of the business plans, these slides do actually get presented. This year is my first experience with the business plans that start with the "worker bees" putting together the slides that get presented to our GM. Then, the GM works with the group to further revise slides and cut out extras so they can be presented to the next level up. After those presentations, then the slides are cut down more and modified to fit certain templates so they can be presented to the Healthcare business CEO. At each of these steps, the amount of time to present decreases. I'm not sure how high up these are presented. I think the slides are both reviewed off-line and presented live. But, there is definitely room for improvement. It is a strange process, and it does also baffle me how an exec can make sense out of such crammed slides. It may just be that everyone is used to this process and that it hasn't been questioned before.

When questioned about what "good" she saw in this practice, the student responded:

> I must be brainwashed by the [company] culture, because I actually do see value in a "four block" slide. They're good if no one is actually presenting and you need a quick glance at different topics. This slide usually has a "take-away" box...a way of cheating to tell the reader what is your message. I don't think "four block" slides are used for the high level business presentations, but I would agree that people at work put way too much information into slides. I think this happens because you may only have a couple of minutes and 1 slide to present to someone. So, even if you don't get a chance to make all your the points during the presentation, at least they're written down on the slide and someone knows you thought about it.

Thus, while this use of PowerPoint software defies most of what cognitive science demonstrates as optimal use of multimedia support for a presentation, in certain instances, it seems that the practice holds some benefit to the organization. Given this insight, it is important to remain flexible in our approach – just as we encourage our students to do as well.

Conclusion

In sum, once we provide students with the tools and research to make more informed choices about their visual design support, we have been encouraged to see them gain influence and positive recognition of their ideas and skills. While we have much yet to learn about how to continue to teach, mentor, and guide our practicing engineer students in their development as presenters, we are confident that they are leaving our course as more informed practitioners, professionals, and presenters.

There is no doubt that slideware has been an abused form of communication media inside organizations of all kinds. Recent research and commentary has enabled users to understand that there is a more robust, flexible, and targeted set of techniques that can be applied to a seemingly endlessly plastic communications tool: slideware. Practitioners that can embrace and master new techniques of slide design will have challenges, certainly, because organizations resist change. But the strength of the results using thoughtful slide design can have powerful, positive impacts as engineers communicate between themselves and with outside firms or clients.

Of course, slide design is only one element of a presentation; all other factors must play into a good talk including organization, voice, tone, expertise, lack of anxiety, and so forth. Revamping slide design alone will not create a successful presentation overall. However, understanding how to use slideware tools to their best advantage is, in our opinion, nothing but a positive game-changer in the end.

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