Avoiding Death by PowerPoint: Can We Improve Our Use of this Now Ubiquitous Teaching Tool?

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It's no wonder our students often compare optometry school to a marathon rather than a sprint. The countless hours they spend in teaching labs, studying and practicing their clinical skills are rivaled by the thousands of hours they attend lectures. At the Pacific University College of Optometry (PUCO), where I teach, lecture time approaches 2,000 hours for the three didactic years of our curriculum. The vast majority of this time is spent learning from lectures in PowerPoint, a term used generically here to refer to the popular Microsoft software as well as similar platforms like Google, Keynote or Prezi. It is not unusual for the electronic "slide count" to exceed 10,000 for the first three years of optometry school. Our PUCO class of 2014 actually counted and came up with that number.

These sobering facts take on a different quality from the perspective of optometric educators. While we are passionate about and skilled at what we do, most of us have not had formal training in teaching, much less in making and delivering effective PowerPoint presentations. We all know good ones (and bad ones) when we see them, but many of us were trained on the job and may have started teaching in the days of analog slides and overhead projectors. Younger optometrists may not remember that photographic slide trays were still the norm at professional meetings into the mid-'90s, when laptop computers became ubiquitous and PowerPoint became, arguably, the prima lingua of scientific communication.[1]

Since PowerPoint software was originally developed for business presentations 30 years ago, it has swept both higher and continuing education, especially for large audiences. Microsoft calculated in 2001 that 30 million PowerPoint presentations were produced daily. This was about one for every eight computers, and there is every indication that both statistics have increased exponentially.[1] As with many technological advances, this is in part due to practical reasons, including the lower cost, higher resolution and ease of file sharing of digital presentations. There are also sound educational reasons involving the superiority of visual over auditory memory for most in the audience. Last, but far from least, our students who are signing up for those 2,000 hours of optometric education might argue that a well-constructed PowerPoint lecture is more memorable because it is more engaging than other methods, including whiteboard use or chalk and talk.[2]

PowerPoint is here to stay, so it behooves the optometric educator to know what the evidence shows about optimizing its use. Only in the past decade has the literature even begun to address the subject of best practices in the use of PowerPoint in education. What follows is a summary of several representative Medline articles on the subject that have explored what is most and least effective in PowerPoint lecture design, preparation and delivery.

Potential PowerPoint Presentation Flaws and Failures

Expert in the study of memory, the field of psychology has a unique perspective on the use of PowerPoint in higher education. Kosslyn and colleagues, in a collaborative study between Stanford, the University of Amsterdam and Harvard, found that the average PowerPoint presentation violates eight psychological principles, and audiences notice this, though they are not as accurate in identifying which slides in a particular presentation do so.[3]

The authors group these eight principles into the filters of memory encoding, working memory and long-term memory processes as follows:

1. Discriminability
2. Perceptual organization
3. Salience
4. Limited capacity
5. Informative change
6. Appropriate knowledge
7. Compatibility
8. Relevance.

The idea is a student will not know how to encode to memory a PowerPoint slide that is not visible (discriminable), organized and relevant (salient). The authors include many detailed facts involving visual perception, including contrast, spatial frequency, orientation channels and chromatic aberration. In

short, the layout of a slide should be clean and pleasing to the eye.

If the slide succeeds in being encodable, the working memory filters must be overcome next. However, it is well known that working memory has a very limited capacity of about four chunks of separate information. These chunks need time to sink in, and information that does not convey an informative change will be ignored. Fortunately, this amount of information can be held neatly on a single PowerPoint slide. When it cannot, up to four subcategories can be chunked on the next slide.

Lastly, the authors point out, a successful PowerPoint slide needs to pass the long-term memory filters. The knowledge it attempts to convey must be appropriate and relevant to the audience, compatible with them. This means the students need to be familiar enough with the material presented to make sense of it, and images on the slide have to match the text and verbal presentation. Finally, the information has to be compatible, or clinically relevant in the case of our students.

In a very readable manuscript, Southwick discusses a problem with medical students forgetting their second-year microbiology by their fourth graduate year.[4] This was attributed to the standard teaching techniques involving PowerPoint lectures and multiple-choice exams that created a reduced reliance on the use of medical textbooks. In fact, fewer than 25 textbooks were purchased for a class of more than 100 students, with less than 2% reporting they actually used it on a regular basis.

To address this problem, the authors replaced the passive approach with active learning techniques, including Just-in-Time Teaching (JiTT), whereby current student questions helped to shape the format of daily lectures. Peer instruction was also used, whereby students who had better comprehension would explain unclear concepts to their classmates. In addition, "essays and short-answer questions were combined with multiple-choice questions to improve understanding and recall." These measures served to increase the use of the textbook to almost 80%. More importantly, scores in microbiology on the national board exam increased from the 59th percentile over three previous years to the 83rd percentile in the subsequent year.

Tips for Effective PowerPoint Use: All Learning is Limbic

Those of us who constantly make (and remake) PowerPoint presentations have undoubtedly given a lot of thought to ideal design. Speaking styles differ, but some PowerPoint formats are definitely more effective than others. Personally, I have changed from alternating entirely illustrated and entirely text slides to single-illustration slides with greater use of the presenter notes, which are visible to my students but not on the big screen. Perhaps the hardest thing for me to do is temper my teaching about interesting topics in vision science that are not relevant to the primary-care clinician. Other times, I must find their relevance.

In the *American Journal of Neuroaudiology* in 2011, Castillo recognizes the objections to PowerPoint format, such as reducing complex topics to simple bullet points that are potentially "detrimental to decision-making."[5] However, noting it is here to stay, he includes the following PowerPoint tips in his editorial:

- Use a simple, solid background
- Use high-contrast, simple fonts
- Use no more than four bullet points of text
- Use graphs instead of tables
- Use high-definition images, and credit sources
- Avoid animations and long videos
- Design slides to last 45 seconds each
- Proofread for typos and continuity
- Never run over your allotted time.

Notice the trend toward simplicity in PowerPoint presentations. Many seasoned presenters have overcome the initial thrill of animations and fancy transitions in their lectures, the overuse of which has been called "PowerPointlessness."[6]

Notably, the style of delivery makes a difference in PowerPoint effectiveness as well. Castillo quotes Dr. James Smirniotopoulios, writing that "all learning is limbic." In other words, while attention can be commanded with fear (usually of exams), it is more sustainable to command it with humor.

Future Directions

In his efforts to improve board scores via his microbiology class, Southwick[4] used 10 basic principles of good teaching that had been put forth by Zemelman et al[7], which are:

1. Encourage contacts between students and faculty
2. Develop reciprocity and cooperation among students
3. Use active learning techniques
4. Provide prompt feedback
5. Emphasize time on task
6. Communicate high expectations
7. Respect diverse talents and ways of learning
8. Emphasize higher-order thinking and learning
9. Emphasize key concepts and principles
10. Study a small number of topics deeply.

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There is clearly more to be done with the scholarship of teaching and learning with regard to optimizing face-to-face course presentation. Yet one thing is clear: We owe it to our students to find a middle road between spoon-feeding and force-feeding. This involves getting students ready to learn when they arrive in class, or offering alternative methods like podcasts when that fails. If we can find that middle road, we won't cause death by PowerPoint, but instead will see our students and our profession thrive. I leave you with this quote:

> *"A great lecturer speaks to the audience and not to the slides."*
>
> Dr. Robert Quencer, Editor Emeritus of the *American Journal of Neurology*.

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Appendix A: Student Perceptions of PowerPoint vs. Other Techniques

An important aspect of exploring how best to use PowerPoint in optometric education is figuring out our students' attitudes toward it, including relative to other teaching techniques. Several studies, such as the three described here, have addressed this, producing some mixed results.

As we know, dental school has some similarities to optometric education. The admission tests in the United States are similar enough in content that the OAT and DAT used to share the same preparation books. Thus, despite cultural differences, a study done at Manipal University in Mangalore, India,[1] may have pertinence to optometric education. In the study, 2,680 undergraduate students were surveyed with 10 closed-ended questions regarding their preferences in lecture and examination format. Using e-mail and follow-up postal mail, 1,980 responses were collected, an impressive response rate of almost 74%. In response to a question about PowerPoint, 63% of the students reported they preferred it (or chalkboard lectures) over demonstrations. Clearly the PowerPoint format mattered to these students. (Other interesting findings were the overwhelming student preferences for required class attendance [75%] and for lecture handouts to be distributed afterwards [83%].)

These results were not replicated as recently as 2010 in a different dental school in India, where technology setup time, and perhaps availability of quality digital images, made overhead projector and chalkboard lecturing more popular. Forty-four dental students (31 females, 13 males) completed a survey, with more than 74% preferring non-PowerPoint methods.[2] However, a total of 62 medical students (40 males, 22 females) at the same institution had no such objections, with almost two-thirds preferring PowerPoint. While no gender breakdown was made, it is interesting to note the almost perfect correlation to it in both cases, with the percentage of male dental and medical students matching the PowerPoint preference rates.

Lecture vs. PowerPoint Podcast

PowerPoint format lends itself almost perfectly to lecture capture, that is, the recording of slides in synch with the lecturer's voice. (This is very different than a video camera on a tripod recording the speaker from the back of the room.) Many educational YouTube videos use this format, notably those from Khan Academy. Larger universities, such as Penn State, record all lectures this way. Others, including Pacific University, have made the use of software like Camtasia Relay optional, at the instructor's discretion. Lectures captured in this format are easily used as podcasts.

Concerns have been raised that podcasting will adversely affect class attendance, though I personally have not noticed an effect if classes are kept rigorous and engaging. Lecturers who do not allow podcasting for one reason or another should be aware that students are capable of making their own podcasts using the instructor's PowerPoint,

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an audio recording of the lecture, and Microsoft OneNote, which is now available for both Windows PC and Macintosh platforms. This software has the major advantage of being searchable. One way or another, video podcasts are being used. The question of whether they are as effective as face-to-face lectures for healthcare education remains.

There is at least one study that attempted to answer this question. In a randomized crossover trial at the Imperial College School of Medicine in London, Schreiber, Fukuda and Gordon studied 100 undergraduate medical students to see which format was more effective, live PowerPoint lecture or video podcast.[3] The students were randomized to one of the two formats. The live lecture used the same PowerPoint slides recorded by the same instructor using the same script as a Soundstudio video podcast (which only showed the slides with synched audio narration). The podcasts were on medical topics (arthritis and vasculitis) and available at www.podmedics.com. The groups were crossed over for a second lecture in the other format. A multiple-choice exam and qualitative survey were given to compare the formats.

Sixty-six participants, 33 in each group, completed the study. The results showed that multiple-choice exam results were the same regardless of presentation method. Students found the face-to-face lecture format more engaging, but enjoyed the convenience of the podcast because they could watch it when they were ready to learn, and at their own speed (including stopping and reviewing at will). The authors concluded that as of 2010, "video podcasts are not ready to replace traditional teaching methods."

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