What Is the Impact of PowerPoint Lectures on Learning? A Brief Review of Research

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Since PowerPoint was developed thirty years ago, the Microsoft slide presentation program has become ubiquitous in meetings and college lectures. PowerPoint has fans and detractors. A well-done PowerPoint presentation or lecture has the power to reveal a talk's organization, to illuminate a speaker's points, to illustrate patterns and numbers, and to capture and hold an audience's attention. However, many presentations do not use PowerPoint's potential. A columnist in Forbes describes "death by PowerPoint" as being so common in corporate meetings that the person who can present engagingly "has a fantastic career advantage" (Gallo 2013). A traditional presentation or lecture can be interesting or boring, too. Does lecturing with PowerPoint affect college students' learning outcomes? The research indicates that PowerPoint has no impact on learning – but students like it, and the way it is used affects learning.

Traditional lecture or PowerPoint lecture? For learning, there is no difference

While some studies have found that students learn more in traditional non-PowerPoint lectures (e.g., Amare 2006), most studies have found that PowerPoint has "no measurable influence on course performance and minimal effect on grades" (Hill, et al. 2012: 243), on short-term or long-term memory of lecture content (Nouri 2005), or on recall of sermon content (Buchoko, et al. 2012). The most common way of studying the question has been to compare learning outcomes of students across an entire course (El Khoury and Mattar 2012). Studies finding a favorable impact of PowerPoint have used other methodologies.

Students prefer PowerPoint

Students prefer PowerPoint lectures. They rated lectures with PowerPoint slides more highly than those without slides (Drouin, et al. 2013), also giving higher ratings to their course and self-efficacy (Suskind 2005) and to their instructor (Nouri 2005) when their lectures used PowerPoint. The instructor rating bonus was about 6 percent in a study of courses across several disciplines (Apperson, et al. 2006).

To anyone who has endured a boring, dense slide presentation, a PowerPoint lecture's main weakness might be its potential for monotony. Of course, traditional lecture can be boring, and either style of lecture can be interesting. El Khoury and Mattar (2012) found no statistically significant differences in students' rating of either format as "entertaining" or "boring." Their study found that PowerPoint use decreased students' learning, and students

preferred traditional lecture. The latter finding is unusual in the research, however, and may be related to students' tendency to prefer technology uses with which they are most familiar (Drouin, et al. 2013). Students typically prefer lectures with PowerPoint and believe they learn more with PowerPoint – a pattern that points to the gap between students' learning and their perceptions of their learning.

Best practices for using PowerPoint to teach

If PowerPoint is used in lectures, the best practice is to limit the amount of information contained on each slide, and to consider developing slides that use the assertion-evidence (A-E) approach to the presentation of information.   Presentation expert Guy Kawasaki popularized the "10/20/30 rule" of PowerPoint: no more than 10 slides, no more than 20 minutes, no less than 30-point font. For educational purposes, the number of slides does not seem to matter, but amount of content per slide does matter.   A study conducted by Brock, et al. (2011) found that the number of slides used in college lectures did not affect teaching effectiveness. However, slides containing no more than three bullet points and 20 or fewer words were more effective than slides with higher density.

The assertion-evidence (A-E) approach to slide design (e.g., Marshall 2012) promotes understanding better than does the current common-practice PowerPoint approach.   Typically, presenters organize slide content as a topic phrase followed by a set of bulleted points, or bulleted points combined with a figure. The A-E approach uses a claim supported by visual evidence such as a figure, diagram, or photograph.   Text is used sparingly, only to convey the assertion and label essential parts of the visual content. An assertion-evidence audience remembered and understood content from a scientific presentation better than did the common-practice audience (Alley, et al. 2013). Student presenters using the two methods recalled the components of their presentations about equally, but students using the AE approach understood the content better (Aippersbach, et al. 2013). Self-selected groups of advanced veterinary students who attended traditional and A-E PowerPoint lectures showed no differences in their multiple choice test scores on lecture content (Root Kustritz 2014). However, the traditional group showed significant decline in content retention after one month; the A-E group did not.

Research on the effect of sharing slides with students is inconclusive. Bowman (2009) found that posting PowerPoint lecture notes to a course site had no effect on attendance or grades. However, Raver and Maydosz (2010) found that students who were provided with their instructors' lecture notes or PowerPoint slides before or after the lecture performed better in a pre-test/post-test comparison than students who were not provided with these aids.

With or without PowerPoint, lecture is less effective than active learning

While PowerPoint lectures are neither more nor less effective than traditional lectures, lecture in general is less effective than active learning.   The lecture class assumes that students have prepared for the lecture by reading.   However, only about 1 in 3 students have completed the assigned reading for any given class day, a ratio consistent since the 1970s (Hobson 2004). Instead of using lecture to advance their understanding of material they have begun to learn,

students commonly use lecture to begin to learn. If they do not read or do not understand the assigned reading after the lecture, then the lecture serves as their only source of information for the material – a role it cannot well fulfill.

Active learning changes the function of class time. Students in an active learning classroom engage directly with the material, and often with each other, during all or part of the class meeting. Active learning in class can be combined with before-class homework, reading, or other preparation assignments.

Most of the research on active learning has focused on science classes because of nationwide interest in encouraging more students into science majors and helping them succeed in those programs. A meta-analysis of 225 studies of student exam and failure rates in science, technology, engineering, and mathematics (STEM) classes shows that compared to lectures, active learning is associated with a small increase in average exam scores and a big increase in pass rates (Freeman et al. 2014). Undergraduate science classes that used lecture had withdraw/D/F rates of 55 percent higher than classes that spent at least 10 percent of class time on problem solving, personal response systems (clickers or polling), or worksheets. Active learning was especially effective for teaching concepts, and most effective in small classes of 50 or fewer students. When specific student populations are studied, the active-learning advantage is even more dramatic. An intervention increasing the amount of structure in biology classes with a combination of reading questions, homework, and in-class activities halved the black-white achievement gap and eliminated the gap between first-generation and continuing-generation students (Eddy and Hogan 2014).

Summary

Given the research evidence, how should college instructors approach PowerPoint?

- For learning outcomes such as exam scores, understanding, and memory, lectures using PowerPoint are neither better nor worse than lectures without it.

- To increase students' satisfaction with lecture, instructor, and course, PowerPoint may be helpful.

- PowerPoint's potential to increase students' understanding is best exploited with slides that illustrate or explain a point visually.

- "PowerPoint or non-PowerPoint?" is a less important question than "How can I adapt my lecture course for active learning?"

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