

## Does PowerPoint enhance learning?

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### ABSTRACT

The ubiquitous nature of *PowerPoint* begs the question, does *PowerPoint* enhance learning? This narrative explores the evidence for the effectiveness of *PowerPoint* and multimedia presentations in learning and information processing. Practical recommendations are provided for presentations.

### RÉSUMÉ

L'utilisation généralisée de *PowerPoint* soulève la question suivante: *PowerPoint* facilite-t-il l'apprentissage? Le présent article fait état des données probantes sur l'efficacité de *PowerPoint* et des présentations multimédias dans l'apprentissage et le traitement de l'information. Il contient également des recommandations pratiques sur les présentations.

**Keywords:** effectiveness, learning, multimedia, *PowerPoint*

### EDUCATION SCENARIO

You are asked by your chief to present emergency medicine grand rounds next month. You are quite excited at the opportunity as you have just attended a faculty development session on effective use of *PowerPoint*. You are looking forward to trying some of the new techniques that you learned in the workshop, but you ask yourself the question, "Does *PowerPoint* really enhance learning?"

### BACKGROUND

*PowerPoint* (Microsoft Corporation) has been used everywhere, from grade school classrooms to boardrooms and lecture halls. *PowerPoint* and its cousin *Keynote* (Apple Inc.) have become the predominant technology used with all presentations. There are also

many newer forms of presentation software, which collectively can be referred to as slideware. For the purposes of this review, *PowerPoint* and slideware are interchangeable. The ubiquitous nature of *PowerPoint* begs the question, does *PowerPoint* enhance learning? This narrative, nonsystematic review provides an overview of the literature on the effects of *PowerPoint* and multimedia presentations on learning and information processing.

### THE PROBLEM WITH POWERPOINT

There are many books, articles, websites, and blogs on how to use *PowerPoint* effectively; however, there is not very much scientific evidence on the effectiveness of *PowerPoint*. This "how to" advice, although profuse, tends to vary greatly and even to be contradictory. In a study on *PowerPoint* use textbooks, the author demonstrated that only 35% of the recommendations were referenced and only 33% of these were based on research, most of which was quasiexperimental.<sup>1</sup>

Much has been written about *PowerPoint* and its limitations. Edward Tufte, an information design expert, believes that "PowerPoint is evil" and that it is "making us stupid."<sup>2</sup> He contends in his e-book, *The Cognitive Style of PowerPoint*, that *PowerPoint* has many inherent limitations that reduce learning when it is used. He contends that the average audience is finished reading the slide even before the speaker begins his talk. The use of bullets prevents the audience from creating "schema" or connections from the information presented. Eliot Masie, an e-learning authority, called *PowerPoint* "the single most dangerous tool invented on the planet."<sup>3</sup> In essence, *PowerPoint* replaces effective communication with presentation.

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### **DOES POWERPOINT ENHANCE LEARNING?**

There has been a moderate amount of research on the effectiveness of *PowerPoint* in the classroom. Levasseur and Sawyer, in an extensive review of the literature, concluded that most studies demonstrate that students prefer *PowerPoint* to traditional lectures.<sup>4</sup> Traditional lecture-format *PowerPoint*, however, does not produce significant difference in learning (typically demonstrated as performance on examinations) compared to several alternatives. Some studies have shown that students performed worst on test scores with *PowerPoint* lectures compared to traditional formats.<sup>5,6</sup>

### **DOES THE POWERPOINT STYLE IMPACT LEARNING?**

One explanation for the lack of evidence of *PowerPoint* enhancing learning may be the style and formats of *PowerPoint* used in previous studies, such as traditional text-based slides with bullets. Bullet points have become the single most controversial aspect of *PowerPoint*.<sup>3</sup> Concerns with bullet points are that they lead to an oversimplification of concepts, lack aesthetic appeal, and are hierarchical in design, lacking relational impact. Recently, Johnson and Christensen studied the formats of *PowerPoint* in higher education.<sup>7</sup> They compared traditional format with bullets and text to a format referred to as the “simply-visually rich approach,” which uses frequent visuals and minimizes on-screen text. They demonstrated that undergraduate psychology students had a significantly higher satisfaction with the “simply-visually rich approach” but no differences in learning outcomes. Similarly, Tangen and colleagues demonstrated that students preferred image-rich slides and that performance (although not interest) depended on whether or not the images were relevant to the content of the lecture.<sup>8</sup>

### **WHAT ARE THE EFFECTS OF MULTIMEDIA PRESENTATIONS ON INFORMATION PROCESSING?**

Multimedia refers to presentations involving words (such as spoken or printed text) and pictures (such as animation, video, illustrations, and photographs). Multimedia learning promotes acquisition, retention, and transfer of information.<sup>9</sup> Richard Mayer, an educational psychologist, has conducted considerable research on the effects of multimedia learning on students’ retention of a topic. His theory of multimedia learning states that “meaningful learning occurs when

learning engages in appropriate verbal and visuospatial thinking.”<sup>9</sup> The theory is based on three theories of cognitive learning: 1) dual channel or dual coding theory, which states that working memory processes visual and auditory stimuli separately, and simultaneous intake of multiple sources of stimuli may result in overload of the brain; 2) limited channel assumption, which states that we have limited capacity within each channel for storing, organizing, and retrieving knowledge; and 3) active processing assumption, which states that meaningful learning occurs when humans actively process and organize audio and visual information.<sup>9</sup>

From his studies, Mayer developed the following principles for meaningful learning in multimedia presentations. The multimedia principle states that students learn more effectively from multimedia presentations than from verbal presentations alone. In these multimedia presentations, students learn more when there are words and relevant pictures rather than just words alone. The contiguity principle states that students learn more when narration and pictures are presented simultaneously rather than consecutively. This allows the brain to create connections between the two items. The coherence principle states that students learn more effectively when the multimedia presentation is interesting than when it is basic. However, this expanded presentation should not be excessive and needs to be relevant. The modality principle states that students learn more effectively when the presentation includes images and narration rather than images and text. The personalization principle states that students learn more effectively when the presentation is conversational rather than expository. Finally, the signaling principle states that students learn more effectively when presenters direct the learner to the important passages or events in the presentation.<sup>9</sup>

Multimedia presentations used ineffectively can decrease learning. Reading text verbatim off an on-screen slide decreases learning and retention.<sup>10</sup> Irrelevant pictures accompanying text and sound effects have also been shown to decrease learning.<sup>6</sup>

### **DO YOU NEED POWERPOINT?**

It is probably most valuable to begin the discussion of *PowerPoint* effectiveness by first determining whether *PowerPoint* is needed. Consider some of the greatest orators of the twentieth century. Winston Churchill,

John F. Kennedy, and Martin Luther King Jr. were all able to deliver impactful and memorable speeches without the aid of *PowerPoint* and other visuals. We have come to rely on *PowerPoint* use in situations that are merely conversations or discussions. Not all presentations require visual support. Do we need *PowerPoint* for a small-group session or workshop that is highly interactive?

In general, there are many reasons people use *PowerPoint* for their presentations. *PowerPoint* provides a framework and structure for developing a presentation. Using *PowerPoint* during a presentation provides the speaker with an outline and is often used as speaker notes. *PowerPoint* allows for the simple creation of handouts for participants. There is often an expectation by participants and organizers that *PowerPoint* will be used for presentations. Speakers are often requested to send their slides in advance of the presentation, and when this is not done, it is often perceived as laziness and noncompliance with the usual routine. Use of *PowerPoint* might help the presenter look smart or, more frequently, hide the presenter's inadequacies on the topic. Many organizations also use *PowerPoint* as a means of document creation, communication, and archival. Presenters who use *PowerPoint* for any of the preceding reasons are setting themselves up for an ineffective presentation.

There are only three reasons to consider when deciding whether the use of *PowerPoint* (or other slideware) would be appropriate for your next presentation:

1. *Emphasis*. By using a single word or phrase on a slide, *PowerPoint* can be used to emphasize a concept.
2. *Augmentation*. By using a well-designed graph or table or a relevant picture, a presenter can use *PowerPoint* to augment a presentation visually in a manner that narration cannot.
3. *Multimedia learning*. By employing the multimedia principles discussed, a presenter can effectively use *PowerPoint* to engage learners. Overall, most of the investigations support the dual coding theory that more is better: multimedia auditory-verbal and visual-pictorial stimuli increase comprehension, understanding, memory, and deeper learning more than any single stimulus by itself.<sup>11</sup> The picture-superiority effect demonstrates that people recall pictures and narration better than they recall either narration or pictures alone.<sup>12</sup>

### HOW DO I APPLY THIS EVIDENCE TO MY NEXT PRESENTATION?

Consider not using *PowerPoint* for your next presentation or teaching activity. *PowerPoint* may not be necessary if the planned teaching methods rely on discussion and interactivity. Participants are there to hear and see you speak, not watch slides. If you do decide to use *PowerPoint*, consider the following:

#### **Preparation**

1. Prepare three documents. *PowerPoint* was never designed for written documents. Prepare speaker notes, a two- to three-page high-level handout, and your *PowerPoint* slides. This will avoid the deadly mistakes of reading your slides and putting too much content on one slide.

#### **Content**

2. Use narration and relevant images.
3. Narration and images are better than narration and text.
4. Consider not using bullets.
5. Limit the amount of information on one slide.

#### **Presentation Style**

6. Use interesting multimedia presentations but avoid excess.
7. Speak in a conversational manner.
8. Do not read slides.
9. Direct learners to important passages and events in your presentation.

### EDUCATION SCENARIO FOLLOW-UP

You start preparing for your emergency medicine grand rounds and focus initially on the key messages that you want the audience to take home. You research the topic thoroughly and then start preparing your speaker notes. You decide that you will use *PowerPoint*, but in moderation. You prepare a handful of visually rich slides with simple tables, graphs, and pictures and very limited text that support your key messages. You recognize that effective communication is not about the *PowerPoint*.

**SUMMARY**

Ultimately, there is nothing evil about *PowerPoint*, just about the way *PowerPoint* is used. *PowerPoint* is a tool; it is not pedagogy. With careful consideration, effective use of *PowerPoint* and other slideware can at least result in increased learner satisfaction. Challenging the traditional paradigm of *PowerPoint* use and employing more relevant images with narration and less text may result in enhanced learning.

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*This article provides an interesting and thoughtful discussion on the debate of PowerPoint and its place in our society.*

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*This article is a comprehensive review of the effects of computer-generated slides in the classroom. The evidence of PowerPoint on student reactions, learning outcomes, learning styles, and slide variation effects is reviewed.*

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