Education Techniques for Lifelong Learning

Making a PowerPoint Presentation[1]

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Most radiologists are now creating their own image and text slides for oral presentations. PowerPoint software offers a tremendous number of options for personalizing slides. Having choices of font, color scheme, display options, sound, and graphics provide an opportunity to enhance a presentation in ways that were not possible with 35-mm slides and slide projectors. However, inappropriate use of PowerPoint features can substantially degrade the quality of a presentation. Many of the "rules" for creating an effective presentation given with slide projectors apply to electronic presentations, but some of the options available with only electronic presentations (eg, building, transitioning, and sound) necessitate new "rules." The article provides tips on how to develop effective text and image slides for electronic presentation by using PowerPoint, including the appropriate use of text, font, color, sound, graphics, slide display, and radiologic images.

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Introduction

Presentation of teaching or research material is an important part of the work of health professionals. Only a few years ago, when slide projectors were used at radiology meetings, many radiologists did not create their own slides. They had a secretary or a medical illustrator do this work. Specially trained persons were hired to make slides of radiologic images. The radiologist would choose images and give them to the photographer and draft text to give to his or her secretary. Secretaries began using PowerPoint software (Microsoft, Redmond, Wash) before many radiologists did. When radiologists began using computers to give presentations, they started to learn how to create text and image slides themselves. Some learned many years ago, and some only recently started to experiment with the features of PowerPoint. Anyone who gives lectures on a regular basis has surely started to learn how to use PowerPoint. Just as some slide projector presentations were better than others, there are ways to improve PowerPoint presentations. This article provides tips on how to develop effective text and image slides by using PowerPoint. After reading this article, the reader should be able to describe common mistakes made in the use of text, font, color, sound, and graphics in PowerPoint presentations; explain how to use building and transitioning; and describe common mistakes made in preparing and showing images in a PowerPoint presentation.

Text Slides

A common fault of scientific presentations is the use of slides with too many lines per slide, too many words per line, lines that extend too far inferiorly on the slide, spelling errors, distracting animation effects, too many graphs, and poor color scheme (1). A review of speaker evaluations at a national radiology meeting showed that 37 (4.3%) of 862 comments were related to poor quality of text slides, and 26 (32%) of 81 speakers received one or more negative comments related to poor quality of text slides (1).

Clear, legible text is essential for electronic presentation. Slides should be kept simple. A horizontal (landscape) layout is preferred over a vertical (portrait) layout to ensure that the top and bottom of the slide will not project off the screen. The information on the slide should convey only the main points or key words, without using complete sentences and punctuation. Nonstandard abbreviations should be avoided. The

Table 1
Examples of Serif and Sans Serif Fonts

Serif	Sans Serif
Times New Roman	Arial
Courier New	Arial Unicode MS
Letter Gothic	Comic Sans MS
Georgia	Antique Olive

choice of slide template can enhance or degrade a presentation. Logos, borders, and shading can establish continuity in a presentation, but many templates are inherently distracting and can even decrease the visibility of the text. An important step in creating a slide show is to use the *Spell Check* feature that comes with PowerPoint software. Misspelled words send a negative message to the audience that the presentation was carelessly crafted.

Font Type

Given the importance of text, the choice of font warrants some consideration (2). There are two font styles, serif and sans serif. The serif is the small tail added to the ends of letter strokes as a decoration. Examples of fonts that have these types of letters include Times New Roman, Courier New, Palatino, and Georgia. Sans serif (no tail, therefore less decorative) fonts include Arial, Arial UniCode MS, Comic Sans MS, and Century Gothic (Table 1). Fonts can vary from computer to computer, and not all fonts are available on all computers. Although serif fonts are traditionally used for the printed page (the addition of the serif helps guide the reader's eyes along the line), they do not always work well when projected on screen (3,4). The different thicknesses of the lines making up the characters can also make them difficult to read. A sans serif font with uniform line thickness is easier to read and a better choice for PowerPoint presentations.

Another consideration is whether to change the fonts in the presentation. It has been suggested that a presentation should use a minimum of two different fonts, one for headings and one for the body of the text (4). I have found it useful to use a different font, text size, and color scheme, when I want to interject a slide that will grab the audience's attention. The average attention span during a lecture is 15–20 minutes, after which time the mind wanders involuntarily (5). For this reason, it is important to pause or vary the format every 15–20 minutes. One way of doing this is to tell a story. A carefully crafted slide can provide an effective segue to the telling of a story.

Table 2
Appropriate Font Size Based on Size of Presentation Room

No. of Seats	Heading (points)	Main Text (points)
>200	42	36
50 < Seats < 200	36	28
<50	32	24

Source.—Reference 2.

Font Size

Font size is measured in points, with one point being equal to 1/72 of an inch. Font sizes range from 8 to 72 (6). Setting a minimum font size will help prevent placing too much information on each slide. It will also allow slides to be easily read by persons who are not close to the screen, which is the typical situation in a large lecture hall. It is inappropriate, if not inexcusable, to say, "I know there is too much on this slide. . . " or "You probably cannot see this in the back of the room. . . " If the audience cannot see the slide in the back of the room, the slide shouldn't be shown. Even in small lecture rooms, where a smaller font is legible, a larger font can be more effective. Appropriate font size has been recommended based on the size of the presentation room (2) (Table 2). I recommend using a larger font size regardless of the size of the room. Using a small font size of 24 points will result in placing too much content on a slide or, if content is limited, text too small relative to the space available on the slide. The amount of text on a slide should be limited, and once the text has been determined, the font can be increased to a maximum level that will allow the text to be appropriately centered on the slide. I routinely use font sizes over 50 for headings and over 40 for main text, regardless of the size of the presentation room.

Rule of Six

To determine the appropriate amount of text for a slide, one can use the "rule of six." This rule refers to a maximum of six lines per slide and six words per line. Of course the size of words varies, so longer words will necessitate fewer words per slide to maintain the same visual effectiveness. In my experience, the fewer words per slide, the better. The more text there is on a slide, the greater risk that the audience will either become disinterested and focus their attention away from the presentation, or read the slides instead of listening to the presenter. The purpose of the text is not to provide something for the presenter to read, but

rather to emphasize a point that the presenter can expand on. This technique allows the presenter to be in control of the audience. One way to judge the readability of a slide is to walk to the other side of the room and view the computer screen from approximately 10 feet (3 m) away. Slides that are readable from this distance are generally readable by the audience when projected (7).

When it comes to the amount of text per slide, more is not better. Each slide should be limited to one idea or concept. At times, it may be most effective to have only one word on a slide, and nothing else. It can also be effective to use a blank slide. This technique clears the screen, allowing the audience to concentrate solely on the speaker. Fearing that they might leave something out, or that the audience won't "get it," presenters frequently lump too much data on a slide. It has been said that no individual, even the greatest of all multitaskers, can read and listen at the same time (8). People, tenacious as they are, will struggle to do both and ultimately achieve neither (the exception to this is when part of a PowerPoint presentation includes an audiovisual demonstration). Data show that the tendency to try and include as much content as possible in a lecture is ill advised and that students remember less when told more, a process referred to as "retroactive inhibition" (9).

Letter Case

Consideration should be given to the choice of letter case (capitals, lowercase, or a combination). Some authors have suggested that a combination is more readable than either on its own (4,10). Research supports the use of lowercase type styles for improved reader comprehension (11,12). The eye recognizes letters by the shape of the upper half. Shape recognition is easier in lowercase letters because the top half is distinctive and stands out against a white background. Conversely, when a word is in capitals, the eye is presented with a rectangular shape that is more difficult to read and less intuitive. Thus, for maximum presentation effect, one should choose predominantly lowercase letters.

Color

It is best to plan the color scheme for the whole presentation before choosing colors for individual elements. There is a wide choice of color combinations available with PowerPoint. Whether it's designing a home or creating presentation slides, some people are better than others in choosing colors that mix well together. Table 3 offers some

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Table 3
Color Guidelines for Presentation Slides

Limit the number of color regions on any one slide to a maximum of 4

Be consistent with color choice

Select colors for audience meaning (eg, red-and-white stop sign)

Consider the cultural significance of colors

Text color should complement, and be distinguishable from, the color background (eg, white or pale text, use dark background; black or blue text, use lighter background)

If colors are graded, moving from light to dark, the intensity should increase from the top to the bottom of the slide

Consider the psychologic effects of color. Bright colors project energy and pastels are more delicate. Blues and greens are "cool," reds and oranges, "hot." White is perceived as more cheerful than black

Avoid red and green. These colors cannot be distinguished by color-blind individuals and can be difficult to see for non–color-blind individuals

guidelines for choosing colors. The primary colors are red, yellow, and blue. Secondary colors are made by combining adjacent primary colors on the color wheel (eg, green is a combination of blue and yellow, orange is a combination of red and yellow, and violet is a combination of red and blue) (13). The greatest contrast is created from a pair of primary colors, and the least contrast is created from a pair of secondary colors.

Colors have been associated with different meanings (Table 4), and these associations can be used to emphasize a point in a presentation. Yellow with black lettering is considered the most readable (eg, school buses and traffic signs). However, on a sign, color is paint; on a screen, color is light. What may work on a sign or in print may not work well on a projector. In addition, colors displayed on a monitor may not be the same when viewed on a large projection screen. Colors are usually darker when projected in large rooms. Small rooms give the opposite effect. There can also be a difference between the range of colors available on a computer and the number of colors available on the projection system. A dark blue as the main background color works well in most situations. I use a black background for radiologic images and, for consistency, will often use the black background for text slides. Beware patterned backgrounds, which can reduce readability of text.

Color blindness, which occurs in about 8%–12% of men of European origin and about 0.5% of women, is a condition in which certain colors cannot be distinguished, and it is most commonly an inherited condition (14). Red/green color

Table 4
Color Meanings

Color	Color Meaning
Red	Vibrancy, energy
Green	Growth
Blue	Serenity
Purple	Royalty
Brown	Earthy
White	Purity

blindness is by far the most common form (about 99% of cases) and causes problems in distinguishing reds and greens. Some of life's minor frustrations (and occasional dangers) for the color blind are not being able to distinguish certain colors on weather maps, not seeing the red or green colors on traffic lights (color-blind people learn the position of the colored lights on a traffic signal), not recognizing sunburn until it becomes painful, choosing strange color combinations for clothes, inability to interpret test strips for swimming pools, or not recognizing whether a piece of meat is raw or well done. They also cannot see red or green on a projection screen, which is why these colors should be avoided.

Building and Transitioning

PowerPoint allows the option of creating layers or "slide builds" to reveal each point in a topic line by line on the slide. Builds, also called animation, can help the audience to focus on a current point while providing extra liveliness to the presentation. A *build* displays objects or lines of text on the screen, one at a time. For slides with bulleted text, the viewers see only the line of discussion rather than the entire slide. With a click of the

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mouse or by pressing an arrow key on the keyboard, the next line appears and the presentation is advanced. To create builds, the lines of text must first be created. Builds are then created by choosing *Slide Show > Custom Animation* to open the Custom Animation dialog box. The *Order & Timing* tab specifies the order that the lines will appear. When the desired line in the listing is selected or highlighted, the *Effects* tab is clicked to apply a build to that line. Animation effects can be added from the drop-down box in the *Entry Animation and Sound* section. Slide building can be an effective tool for a question-answer format. The question is presented on one side of the slide and compared with point form answers controlled by the presenter on the other side of the slide. Another feature used with builds is dimming. Previous points are dimmed so that only the current point is highlighted, a technique that allows the audience to absorb the information one step at a time. Dimming effects can be added by clicking on the *Dim Previous Points* check box. Building should be used only when necessary to make a point because it slows the presentation. At one time or another, all of us are bound to push the limits of good taste with regard to using the fun new features that come with presentation-graphics software. However, one should never confuse effect with affect.

Moving from one slide frame to the next is termed *transition*. PowerPoint offers an array of special effects (eg, wipes, blinds, dissolve, checkerboard, fades to black). The speed at which a slide appears and disappears can also be modified. Many presenters get carried away with the novelty of these features, using them to an extreme such that it interferes with the effectiveness of the presentation. The purpose of any of these features is to help the audience maintain interest in the presentation and understand the points the presenter is making. Overuse or inappropriate use of PowerPoint features can have the opposite effect. Constantly changing the transition effect should be avoided as it may be distracting to the audience to view material from different sides of the screen and in differing manners. It has been reported that PowerPoint presentations have become 18% less effective because all the fancy graphics distract the listener from the real message being delivered by the presenter (7).

Sound

PowerPoint allows the user to incorporate sound effects into a presentation. Sound, such as break-

ing glass, chime, or applause, can be combined with transition. A variety of sounds can be imported from the Web through the PowerPoint software (eg, crowds cheering, cell phones ringing, whistling), and original sounds can be recorded and incorporated into a presentation. One should be careful when using sound, as it can distract the audience rather than reinforce a message. The majority of computer sound cards do not produce sound of a sufficient amplification or clarity to be audible at the rear of a large lecture theater (3). Sound should be used only if it is directly related to the content of the presentation. For example, a presentation on cardiac disorders might be enhanced by incorporating normal and abnormal heart sounds. One can be creative and include a patient describing symptoms, a patient's spoken testimonial, or a VIP addressing the audience.

Tables and Graphs

Tables are especially effective if they include percentages used for comparison (eg, 60% vs 29% response). If percentages are used, the total number of subjects in the comparison should be shown. The percentages should total 100%. In general, too many data are presented in the average table slide. Many of these may be unnecessary. A two-column table should generally have four or fewer rows (15). For a three-column table, the maximum number of rows should be three.

Bar graphs can be used to compare the responses of different groups to different treatments. No more than eight, and ideally only six or fewer, bars should appear on a single slide (15). The bars should be arranged in a logical order, such as highest to lowest percentage response or vice versa.

Line graphs are used to show a relationship between continuous variables. There is usually a zero origin for each axis. If data between each of the data points fall on a line between the points, then the data points should be connected with a line. On the slide, the data points should, if possible, be marked by different shapes as well as densities. For example, a solid line should connect solid circles, but if there is another line on the same slide, it should be a dotted line connecting open circles.

Pie graphs are used to indicate how an entire population is distributed. Because data displayed in this type of graph denote a percentage of the

whole, it is helpful to print the numeric percentages on the corresponding parts of the pie. When percentages are used, the absolute number should be included on the slide.

A pie chart can be used to pace a presentation. Audiences tend to be impatient, especially if they don't know how much longer the presentation is going to last. An *advancing pie chart*—that is, a pie chart that simulates a moving clock—can be used to keep the audience informed of how time is progressing and how much more needs to be covered (16). An advancing pie chart can be created by dividing 360 by the number of slides to be included in the presentation program's datasheet or worksheet. The pie is then copied into one of the slides and sized to fit. Many copies of the small pie are needed, as ultimately, the color of one slice in each pie will be distinct from the others. Looking at the first pie as a clock, the color of the slice in the first time slot (eg, 12:00 to 1:00) will be changed to match the background. All other slices will be the same color as the text. In Windows presentation graphics products, the Clipboard can be used to cut and paste the pie chart into each slide.

Image Slides

A picture is worth a thousand words. No other statement could be more relevant to radiology. The phrase "I see what you mean" is an expression that signifies the importance of "seeing" with the mind. Radiologic images reinforce textual information. People generally remember 20% of what they hear, 30% of what they see, and 50% of what they see and hear. As a general rule, a presentation about radiologic imaging should include at least as many image slides as text slides.

A poor image can be worse than no image, and poor-quality images should not be used. Radiologic images should be properly cropped and centered. Only the relevant part of the image, with enough surrounding image to put the findings in proper context, should be retained and projected to the audience. The purpose of the image is to show an example of an important point. Any in-

formation on the image that does not serve to illustrate that point is unnecessary and uses space that could be used to make the relevant portion of the image larger. In the presentations I have attended, I have seen numerous examples of images that were too small but never images that were too large. Identifiable patient information (eg, name, medical record number, birth date) should be removed or masked from the image. If cropping would remove important parts of the image, a black text box can be inserted over the patient data. If the important imaging finding is small or subtle, it can be magnified to fill more of the screen.

Images can be embellished with text or arrows. Placing arrows on an image eliminates the need to use a laser pointer to show pertinent findings. Such tools can be helpful to presenters who have difficulty seeing the screen or holding the laser pointer steady. However, it can be instructive to show an image without identifying markers and let the audience find the abnormality on their own. The presenter can then point out the finding by using a laser pointer or mouse cursor. Alternatively, the use of transition can be effective in showing unlabeled followed by labeled images. In this case, an unlabeled image dissolves into the same image, annotated with the diagnosis or arrows.

PowerPoint comes equipped with a library of graphic images called *clip art*. Illustrations may be used to reinforce a point and add some variation and interest to a slide. Graphics should be used only when they are relevant and not just for decoration. Images can be overused just as can text. Thus, overloading a slide with text, graphics, or effects should be avoided.

A wealth of material is available on the Internet. By using a search engine, such as *google.com*, and typing in the subject of a talk, many relevant sites can usually be identified. Some of these sites will likely have images, and these images can be copied into PowerPoint presentations. One must exercise caution regarding copyright laws in the use of such images, but, in general, these laws do not restrict the use of material intended for educational purposes *as long as it is not used in a publi-*

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cation. Images are most effective when they are relevant to the topic of the presentation. Thus, images should not be overused or used simply to "wow" the audience. Superfluous images can be avoided if the objectives of the presentation are kept in mind. A good rule of thumb is to eliminate anything from the presentation that does not assist in facilitating learner attainment of the objectives.

Most images will need to be adjusted for optimal contrast. A chest radiograph that is too dark can be lightened very easily by using a variety of software programs. Of course, if one starts with a poor-quality image, there may not be a way to make the image acceptable for presentation. Unfortunately, this is the case when hard-copy film is digitized, and the hard-copy film is a copy of an original film. The copy film may have been good enough to use in a presentation conducted with films and a projector, but it doesn't transfer well to a digital presentation. Starting with a bad image will lead to a final image that is even worse ("garbage in, garbage out"). When possible, one should obtain the original films for digitization, or, better yet, transfer digitally acquired images to the computer and then to the PowerPoint presentation.

When showing cine images, it is important to slow down or pause to allow the audience to see the pertinent findings. Cine images, as with all graphics, should be large enough to be seen by everyone in the audience, even those in the back of the room.

Summary

PowerPoint slides can dramatically enhance the effectiveness of a presentation, especially when images are an important part of the educational content. When used effectively, text slides can be combined with tables, illustrations, radiologic and other images, sound, and video to enhance the learning process. If used inappropriately, PowerPoint slides can substantially detract from the quality of a presentation. Common problems to avoid include use of text and images that are too small to be easily seen by the audience, poor choices of colors that render text difficult to visualize, too much information per slide, poor-quality images, and overuse of PowerPoint features that result in distracting the audience from the focus of the presentation.

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