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College-based case studies in using PowerPoint effectively

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Abstract: This study reexamined PowerPoint's potential to enhance traditional pedagogical practices in higher education. The study addressed (1) the conditions under which PowerPoint meets students' needs in typical lecture-based classrooms, (2) whether professors consider PowerPoint-based lectures more effective than lectures supported by material on chalkboards, and (3) whether PowerPoint is the best tool for what professors want to accomplish in the classroom. The study's participants were seven faculty members at a four-year US Land Grant institution in the western Pacific serving both undergraduate and graduate students. The participants represented a variety of teaching disciplines from Psychology to English and from Art to Political Science. In the study, data were obtained through non-participant observations and follow-up questions. The findings of this study suggest the ways of using PowerPoint to meet students' needs, as well as the professor's needs, by shifting from a passive, teacher-centered (thus lecture-style) classroom to an interactive, student-centered classroom.

Subjects: Development Studies; Environment; Social Work; Urban Studies; Education; Educational Technology

Keywords: teacher performance; case studies; PowerPoint presentation; classroom-based lectures; student-centered classroom; active lecturing

ABOUT THE AUTHOR

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PUBLIC INTEREST STATEMENT

The target reader of the current paper includes professors, scholars, researchers, college students, library media specialists, schoolteachers, and administrators, as well as educational technologists (who design instruction, produce instructional materials, and manage learning resources collections) from academic communities throughout the world. Thus, the reader is not limited to the educational community in the western Pacific. The outcomes from the case studies reported in this paper will have a definite practical application, and will perhaps be most useful to individuals who are interested in teaching with technology or in learning with technology. In terms of teaching styles and how they incorporate PowerPoint into their lectures, the goal of this paper is to a universal appeal to individuals with a professional interest in effective ways of teaching with technology in lecture-based college classrooms. Anyone working with college students or anyone engaged in teaching with technology will also find this paper useful.

1. Introduction

PowerPoint has greatly changed the ways that professors teach in higher education classrooms. In other words, PowerPoint has changed much of how professors engage their students and present their subject matter. However, not all of these changes are necessarily positive. PowerPoint presentations in academia have a reputation for being less than engaging in this era of learner-centered teaching (Berk, 2012, p. 1). Young (2004) observes that even though PowerPoint is the most commonly used visual presentation technology in college classrooms of today, it is also the most criticized one by students; for instance, “students say some professors simply dump their notes into PowerPoint presentations and then read them, which can make the delivery even flatter than it would be if the professor did not use slides” (para. 17).

PowerPoint—the best presentation tool for sales and other marketing presentations (Amare, 2006)—“has become the predominant technology platform for teaching in academia. However, the research on PowerPoint is not widely known and, as a consequence, is not reflected in classroom practices” (Berk, 2011, p. 24). Because of “the rapid adoption and seemingly indispensable nature of PowerPoint, the format has largely escaped criticism, with one notable exception—writings of Edward Tufte” (Kangas, 2012, p. 421). Tufte’s criticism that PowerPoint templates weaken verbal and spatial reasoning is important because both contribute to learning: the cognitive process whereby individuals acquire new knowledge and modify existing knowledge. Professors should ensure that students are given opportunities to enhance their cognitive and metacognitive abilities. “The benefit of PowerPoint is continuously debated, but both supporters and detractors have insufficient empirical evidence” (Savoy, Proctor, & Salvendy, 2009, p. 858). The debate in using computer technology in teaching for improving students’ performance remains uncertain for university instructors (Bawaneh, 2011, p. 266).

The current study sought to reexamine the potential of PowerPoint to contribute effectively to active lecturing. For the purpose of this study, “active lecturing” refers to interacting with students while lecturing, and to integrating student-centered teaching methods with lectures, allowing students to become more actively involved in constructing and using knowledge. The study is based in part on the assumption that the success of a lecture essentially depends on more than the presenter’s knowledge of the material. The methods by which students are involved in the material also help to determine the effectiveness of the class session.

Qualitative methods were chosen due to the exploratory nature of the research questions, and observations and follow-up questions were used to collect data. The aim of the data was thus to reevaluate PowerPoint’s potentially transformative influences on the typical college classroom lecture, including large class settings. The study addressed three specific research questions: (1) Under what conditions do professors believe that PowerPoint best meets students’ needs, supporting learning in lecture-based classrooms?; (2) Do professors consider PowerPoint-based lectures more effective than lectures supported by material on chalkboards?; and (3) Is PowerPoint the best tool for what professors want to accomplish in the classroom?

2. Review of the literature

Recent PowerPoint studies have mainly examined the linkage between PowerPoint and students’ levels of engagement or explored the efficacy of this widely used presentation software (Brock & Joglekar, 2011). Swati, Suresh, and Sachin (2014) found that when students in a microbiology course were learning simple material, chalkboard-based lectures had no significant advantage over PowerPoint. However, students learning complex material via chalkboard-based lectures reliably outperformed students learning the same material in PowerPoint-based lectures. In spite of that, students preferred PowerPoint to the chalkboard.

O’Dwyer (2008) found that in engineering courses, students valued PowerPoint both as a means of better understanding the material, and for the medium’s structural and organizational advantages. Students recognized that PowerPoint conveyed substantially less of the lecture material, in

comparison with lectures using the chalkboard. But students favored PowerPoint slides and expressed a preference for their being available online; also requesting that paper copies of PowerPoint presentations be distributed at each of the classroom lectures.

Savoy et al. (2009) sought to determine how to present information effectively for maximum retention, which is assessed in terms of accuracy of recall, or recognition of the material on tests. They compared traditional lectures (chalk-and-talk), lectures using overhead projectors, and online lectures using PowerPoint. Data collected from 62 students revealed that students retained 15 percent less of the information delivered verbally by PowerPoint lecturers, but students preferred PowerPoint over chalkboard. Savoy et al. emphasize the “intelligent use” of technology, which considers cognitive processes within members of the audience, as well as technology itself; with the goal of identifying when to use a given technology, and when not to. The authors’ opinion, below, is intriguing as well as practical.

If students are expected to retain complex graphics, animations, and figures, PowerPoint presentations may have an advantage. If students are expected to retain alphanumeric information, the lecturer could use either of the presentation styles. If students are expected to retain information and/or concepts that are best conveyed through dialogue or verbal explanation, traditional presentations appear to be best. ... People tend to pay attention to what is presented on the slides as opposed to what is verbalized. ... Personal preference of delivery style, alone, does not resolve selection of presentation choice for optimal information retention. (p. 866)

Kumar’s (2013) study supports the position described above, indicating that students preferred PowerPoint over blackboard-based lectures, because the “inherent deficiency of each method is compensated by the other. While blackboard teaching is deficient in showing three dimensional diagrams, animated videos, and sounds; the same can be demonstrated using a PowerPoint presentation” (p. 240). Kumar points out that contemporary college students are interested in learning through live demonstrations and active interactions rather than simple lectures; therefore, instructional technologies confer an advantage when used properly.

Signor (2009) surveyed online students’ opinions on PowerPoint lectures and webpage lectures, collecting data from students enrolled through Open University Australia. The results indicated that online students prefer webpage to PowerPoint for text-based online lectures because of the added features of the webpage format. As noted by the author, “Every aspect of online learning involves technology, and with the advent of new technology and new versions of existing technology, the importance of learning has often been overtaken by the aspects of technology” (p. 967). Signor’s viewpoints, as summarized below, express important insights about the relationships among cognition, instruction, and technology.

With the Internet now providing tools such as Blogging, Wiki spaces, Virtual Worlds, Audio and Video Presentation, it may seem strange to revisit this simple issue of text-based online lectures. However, learning material is still presented in the majority by the written word. This foundation needs to be done correctly, only then can the learning materials be expanded through the use of these new tools. (p. 966)

Nouri and Shahid (2005), using PowerPoint slides that came with the textbook in an accounting course, found that PowerPoint may improve student attitudes toward the professor and the lecture, but the results did not provide conclusive evidence that PowerPoint improves either students’ short-term or long-term memories of the material. Selimoglu and Arsoy (2009) also examined the potential of students’ preferences for PowerPoint in financial accounting courses, to predict their final scores. The researchers found no main effect of a student’s relative level of preference for PowerPoint as a predictor of the student’s final score. However, when a preference for PowerPoint is combined with an appropriate study environment, use of PowerPoint positively increases the final scores.

Every lecture topic has some specific facts that students should retain in their memories, helping them later to apply the new knowledge. For this reason, it is the duty of the professor to emphasize important facts during the lecture. Using instructional technologies such as PowerPoint can contribute to this emphasis (DeSa & Keny, 2014). Considering the impact that slide designs and layouts can have on student learning, Clay (2014) cites the following:

In one study, Benassi proved to professors that PowerPoint presentations with animation, colorful backgrounds and unrelated photographs can direct students' attention away from the lesson content. ... Benassi conducted a study in which he asked volunteers to submit their slides to him. He then redesigned half the slides in professors' presentations to conform to good multimedia design principles by deleting anything extraneous, breaking material into smaller segments and adding graphic elements to illustrate text. The result? The percentage of correct responses on quizzes at the end of each class was 14 percent higher for questions about material presented in the redesigned slides compared with those about material presented in unmodified slides. (p. 39)

Like any other visual presentation technology, PowerPoint can have both positive and negative effects on teaching and learning. In Xingeng and Jianxiang's (2012) list, its advantages include: producing better visual effects and deeper impressions; speeding up the information transfer (delivering more information than chalkboard lectures); and greater precision and more systematicity. PowerPoint's disadvantages include: greater tendencies to include irrelevant information that may actually detract from core concepts; neglect of interaction with students, making a lecture a monolog; the high speed reducing participation by students; and the fact that professors' adhering strictly to the order of concepts in slides can limit potentially fruitful elaborations of the content and explanations.

Both PowerPoint and the chalkboard have strengths and limitations, and both have pedagogical value in teaching and learning. Therefore, methods of teaching that integrate the two are more effective (Meo et al., 2013). Given that PowerPoint has become an almost indispensable part of teaching in college classrooms, now is the time to rethink the ways in which professors design their slides; as well as the ways in which PowerPoint-based presentations are delivered in actual classroom presentations. The research can help people to learn *how* and *when* professors use PowerPoint slides to complement other instructional methods in promoting effective classroom-based presentations.

3. Method

This study drew on case studies of professors' classroom lectures at an American Pacific university in which both faculty and students are culturally, ethnically, and linguistically diverse. The study was approved by the university's committee on human research subjects. Based on a network sampling procedure, seven full-time faculty members, who were teaching in a variety of disciplines, were selected as participants. During the 2015 spring semester, with their consent, the participants were observed during their regular 80-min lectures. The participants provided their course syllabi as well as their written responses to the follow-up questions.

The researcher is the instrument in qualitative research, and the author of this paper, as an observer, tried to be as unobtrusive as possible while visiting the classroom. The present author sat in the back quietly and observed using an observation form the author developed (Appendix A). Part One of the form focused on three things: (1) observe classroom environments (e.g. what kind of rapport exists between professor and student or between students); (2) observe professors' techniques (e.g. what skills of presentations, discussions, or other activities seem to be most effective?); and (3) observe students (e.g. how active or passive are the students?; how engaged are students?).

Part Two of the observation form listed 15 PowerPoint design concepts derived from the present author's previous study (Inoue-Smith, 2015), in which data were collected from 120 college students. A summary of their beliefs concerning the most and least important five concepts appears in Table 1. The results largely conform to Blokzijl's (2004) results, in that students identified the

Table 1. College students' opinions about the PowerPoint design concepts

Most important concepts	Less important concepts
Text contrasts with background color	Not to include no more than 6 words a line
Include only the necessary information	Use the sound
Avoid long sentences	Not to include no more than 6 lines a slide
Not use all capital letters in text	Use animations
Include images, pictures, and graphics	Limit punctuation marks

following concepts as less important when professors use PowerPoint: use of sound; use of animations; using a large variety of colors; using a busy background; reading text from the slides; and being a stagehand, that is, the professor making PowerPoint the center of attention and placing himself or herself in the position of a commentator.

The primary goal of this study was to compare PowerPoint slides in actual use in college professors' presentations with students' perceptions of PowerPoint (as expressed in the previous study). The study is exploratory in nature. One advantage of qualitative research methods is that open-ended questions and probes give participants the opportunity to respond in their own words, rather than forcing them to choose from fixed responses, as quantitative methods do. Follow-up questions were equivalent to open-ended questions. These questions addressed the secondary goal of the study: to examine how effectively PowerPoint can meet the goals of typical college lectures. Each case is comprised of observations of a different professor. Course syllabi and responses to the follow-up questions provided by these professors were diverse, and provided meaningful information as well.

4. Findings and discussion

Case 1—Professor of psychology: visual enrichment of key concepts

The course, General Psychology, is taught in the lecture hall because of its large enrollment (more than 100 students). The course requires students to be active participants, involving exercises and discussions. The professor emphasized that students' notes should provide a complete summary of the lesson, not just a record of what was written in the slides. PowerPoint was set up before the class; a big slide screen was showing the day's topic. Many students were eagerly taking notes, though some were texting with cell phones which is a habit of the tech-addicted generation. In this type of large classes, the professor needs speaking skills (to make the lecture interesting for large audience) and writing skills (to describe the content in a slide with limited words), whereas students need listening skills (listening carefully while taking notes) and reading comprehension skills (to read the text chapter and understand the topic before the class).

Clearly the professor estimated the time required for each portion of the lecture, including transition slides for each change of topic and the projected ending point. He used animation-free copies of key slides from preceding lectures, to provide a brief review to open the class. His slides exemplified four things: (1) highlighting key concepts and brief points (with the bulk of verbal communication being oral, not based on excessive lines of slide-based text); (2) color schemes appropriate to the subject matter, for example, using fonts in bright colors against a black background for the topic of sleep, dreams, and other altered states of consciousness; (3) differences in relative emphasis given to various points and exercises, with consequent choices of the number of slides for each point; and (4) using images (photos and occasional cartoons) designed to provide visual enrichment to key concepts, making them more memorable.

The slides also contained some images that were surprising, humorous or striking, to keep students' attention. The professor mentioned that he challenges himself to make his slides almost as

attention-getting and memorable as a good movie, and that he has to do so if he is to compete with smartphones and the Internet. In terms of an understanding of knowledge acquisition, his practice might be an application described by Gardner and Aleksejuniene (2011): “PowerPoint can be an artistic canvas on which the educator creates his/her multimedia learning experience, but if it contains only text, working memory will be overloaded resulting in less effective communication slower processing, and slower learning” (pp. 3–4).

Case 2—Professor of art: applying dual coding theory

The course (about 50 students enrolled), Introduction to Art, focusing on art trends and their place in history, satisfies a general education requirement, and is primarily intended for students not majoring in art. In the lecture hall, on the day of the observation, the professor lectured on Western art history from the 14th through the 16th centuries, showing famous paintings on a big screen using PowerPoint.

In spite of technological advances, the lecture is still widely used in college classrooms; and student engagement and responsibility shared with students remain essential ingredients for effective class sessions. The traditional lecture often falls short of creating such learning environments: but an art history course provides a perfect opportunity to combine lectures with PowerPoint. As Spiller (2014) states, “The challenge is to find ways of designing, implementing, and enhancing large group learning so as to maximize student engagement and promote higher order learning” (p. 1). One feature of this course is that every week there are dialog questions posted in the assignment section in the course’s Moodle site, and students’ participation in the dialog addressing each topic is mandatory and essential for completing the course.

Nouri and Shahid (2005) stated that theories about how imagery and verbal systems interact to impact human information processing can be applied to PowerPoint: “According to dual coding theory, the imagery system processes information about nonverbal objects, including images for shapes, pictures, models, animation, color, and sound” (p. 55); “The graphical nature of the PowerPoint presentation arouses students’ imagery systems, which become more activated when information (e.g. instructional material) is presented in non-verbal forms” (p. 56).

Case 3—Professor of business administration: interactive lectures

The course, International Tourism, examining the dynamics of international tourism from various management perspectives, focuses on distribution channels of inbound–outbound tourism affecting the Pacific Rim and Western Pacific. This was a standard-sized class (25 students), and the professor used the chalkboard as well as PowerPoint during the lecture. Teaching with the chalkboard engages learners actively, and learners tend to attend more closely to what the teacher is discussing, writing, and illustrating on the board (Prabhu, 2014, p. 72).

The course has no required textbook. Given that the purpose of a textbook is to enhance the effectiveness of the teacher, and the textbook provides a “safety net” of sorts—addressing important topics for which full coverage in class was not possible—teaching without the textbook is a challenge. However, the professor had turned the situation to his advantage. At the beginning, the professor asked students to summarize an article assigned for reading before the class. Then, he explained the key terms and concepts using a white board, and followed up by using PowerPoint to summarize key points and to enrich them visually with appropriate photos and images. The professor teaches interactively, encouraging all students to contribute. This promotes both learning of the content presented during lecture, and student retention.

The professor tried to maintain eye contact with students throughout the room, which is essential for engaging students. Most classrooms are now equipped with wireless Internet access, and the professor can direct online searches for the definitions of concepts in tourism, for example, using

Google. This is one way to redirect students' prevalent tendencies to use Wi-Fi during class to learning and class participation. In terms of technology, the professor emphasized that: "Anything that incorporates as many of the five senses as possible, I believe, will be effective. I also use videos in my courses to incorporate enhanced sound with the visuals."

Case 4—Professor of sociology: short documentary films

The course, Introduction to Sociology, is taught in the Lecture Hall because of its large enrollment (about 100 students). Topics for the course include: foundations of culture, social interaction, social controls, social changes, and cross-cultural relations. The professor used a short documentary film to complement the PowerPoint slides. Such films are useful to discuss sociology within the Pacific and Asian region, as well as within other countries.

Images that are not pertinent to the topic can be harmful to students' learning (Bartsch & Cobern, 2003). In this regard, the professor uses lots of images that students can relate to and use to understand the concept that he is trying to cover in the lecture itself. Although students need to be actively watching, listening, and thinking during the class, the PowerPoint slides and other materials for this course, including handouts, are accessible to students prior to class on Moodle. This opens up more opportunities for discussion, as the students do not have to devote their notes to material on the slides. Instead, the professor encourages students to remain actively engaged with the oral material, and to use their note taking to explore ideas, stories, examples that the professor may talk about in class that are not covered in the slides. One weakness of PowerPoint, according to the professor, is that students are facing the front when the professor uses PowerPoint and not facing each other. PowerPoint creates an environment in the classroom that can be at odds with the pedagogic approach that puts the student at the center. Instead, the PowerPoint screen now becomes the center of the space physically and figuratively.

Still, short documentaries and TED (Technology, Entertainment, and Design) Talks [usually in the form of short, powerful talks] facilitate class discussions. The professor continues as follows: "If we are talking about human rights and then to have a TED talk on the issue from a leader in the field and then at times possibly having that same individual Skype into the classroom and further explore with the students the issue of human rights, it can be very powerful. Networking with leading scholars can be very helpful as I often have them Skype into the classroom. Skype, as a technology, has definitely changed my classroom teaching."

Case 5—Professor of education: substantial white space

The course, Secondary Methods, is designed to provide students with many strategies and techniques for achieving effectiveness as teachers in secondary classroom settings. This class is small (about 10 students), affording the professor lots of one-on-one interaction with students during each session. Generally, teacher education courses have more female students than male students, and this course was no exception. PowerPoint provided an important means for the professor to show ways of teaching secondary education courses. To take a specific example, short videos provided demonstrations of how to teach Math and English; and such videos are useful for visual, auditory, and kinesthetic learners.

One characteristic of the professor's PowerPoint is that each slide makes use of substantial white space, without background colors. Slides are mostly used for photos of the theorists, and for relevant pictures, maps, charts, and illustrations that aid understanding. In one example, the professor showed a slide full of words telling a short story, then she asked students to close their eyes and develop the image of the story while she read it from the slide. The slide had become a story board; suggesting one novel way of using PowerPoint slides effectively.

The use of PowerPoint slides in classroom lectures can promote students' active engagement with the material because the professor includes activity prompts embedded in the slides. This illustrates the fact that while PowerPoint itself can be a passive to the professor's presentation, built-in prompts, pauses and games can transform it into an active medium. Even so, the professor emphasized that it was up to the individual professor to consider the level of engagement desired, prior to the presentation. The professor wanted to make sure there were enough visuals, and that there were opportunities for the students to engage in the content, supporting the following points: "An important aspect is the 'visual uniformity' of PowerPoint" (Craig & Amernic, 2006; p. 155), and "teachers reported that they use PowerPoint presentations in their courses because they regarded them as effective tools in terms of providing visual aids, which is helpful to draw students' attention" (Ozaslan & Maden, 2013, p. 39).

Case 6—Professor of political science: blended learning, a balanced approach

The course, International Relations, presents a general framework for the study of international politics, and examines the forces that motivate policy, the tools to promote foreign policy objectives, international cooperation, and conflict resolution. This blended course requires that all students enrolled maintain and use a Moodle account for the purpose of receiving readings, PowerPoint slides, and participating in online discussions. Blended learning is a balanced approach as described by Moskal, Dziuban, and Hartman (2013): "Blended learning can increase access within the scope of existing resources while maintaining or enhancing quality ... This approach has potential for fostering a much more reflective student population and extends learning far beyond the boundaries of traditional classrooms" (p. 16).

On the observation day, the professor talked about the history and structure of the United Nations. Before the class, students were supposed to look at the lecture outline on PowerPoint via the Moodle site. In this way, students have the opportunity to prepare themselves for full engagement with the presentation. Students' appreciation for the use of PowerPoint slides is evidenced by their participation in class discussions. As the professor mentioned in answers to the follow-up questions, however, students supplied in advance with the slides tend to take fewer notes, so the professor has to explain that the slides do not contain all the information, and that they still have to take notes.

This is a small (about ten students), seminar type of class, emphasizing student-teacher interactions: including discussions that promote critical thinking skills. This course provides a good example of how facilitating class discussions by asking stimulus questions is sometimes better than providing a well-structured lecture, on its own.

Case 7—Professor of English: PowerPoint as a storyboard for ESL students

The course, Fundamentals of English, is an integrated course designed to enhance the overall competence in English among the students enrolled: based on a blend of assignments in reading, writing, speaking, and listening. This small class (less than ten students), is offered for students who are English as a second language (ESL) learners, so that they can take regular college courses eventually.

On the observation day, the professor used PowerPoint as a storyboard. Students read a short story from the big screen, and then answer the questions. The professor used answers to questions in the whole class forum to assess the students' comprehension. After the slides, students were given an assignment designed to give the professor a better sense of whether or not they understand the content. The slides clearly helped students to focus on the lesson. Finally, besides PowerPoint slides, the professor used a document camera and YouTube videos to augment instruction, providing a mix of things to keep things fresh.

The work of this professor brings to mind the following. In the ESL classroom, “It is very difficult to attract and sustain the attention of the learners due to the foreign language status of English ... Various graphic, visual and audio-visual features embedded in the use of PowerPoint presentations help attract and sustain the much required learners’ attention” (Alkash & AI-Dersi, 2013, p. 6). Furthermore, “language instructors can utilize PowerPoint in language classrooms as an effective complement to or as a substitute for traditional textbook teaching” (Apple & Kikuchi, 2007, p. 104).

This course also brings to mind that for ESL students, every subject in a US classroom is like studying English. In skilled reading, much information is processed automatically, which is very important because of the limitations of working memory (also called short-term memory). Students are not automatically equipped to assess their own levels of skills in reading, so teachers have to help students develop their metacognitive abilities, in addition to their language skills per se. The approaches used by experts to develop such metacognitive abilities may be useful for professors to consider for their classrooms.

4.1. Delivering PowerPoint presentations

Three out of seven cases were taught in the Lecture Hall, which accommodates up to 260 students. Large classes make it difficult to provide students with effective lectures and at the same time to entertain them, if PowerPoint is not involved. Even in small classes, students now desire to be taught with technology. One thing in common among these seven cases is that the professors create PowerPoint presentations with video clips built in. Given such changes in the classroom, as created by PowerPoint, some of these professors have found that using a message board on the course web-site is a way to encourage students to participate in discussions.

The participants use PowerPoint, probably because of many of the same overall qualities noted by Simpson et al. (2003). Specifically, visual elements (color, graphics, and layout), along with elements concerning the text (e.g. the size and the length of the text) can be tailored to the needs of the presentation. Other items that contribute to the effectiveness of PowerPoint presentations include the actual content of the talk; the presenter’s understanding of the subject matter; the reliability of the technology; and the lighting in the room. It is important not to turn off all the lights in the classroom, to maintain eye contact with students, and to remove the slides from the screen when they are not needed (Polyakova-Norwood, 2009).

These case studies remind people that one of the central metaphors of the information age is a comparison of the human mind with a computer. Just as a computer receives data, stores them in memory, and displays data command, so does the human mind accept data, process data, and retrieve them as needed. Human information processing theory (including dual coding theory) can be applied to teaching with technology: identifying ways in which instructional technology can expand human capacities for learning and enhance human reasoning abilities.

4.2. Preparing PowerPoint presentations

Table 2 indicates how the participating professors prepared their PowerPoint slides before the class. Concepts in shaded boxes are those that students in the previous study identified as important concepts. Although the study examines only seven cases (that is, seven courses or seven professors), students’ preferences and the professors’ slides were relatively matched in terms of five most important concepts: (1) choosing a solid color background; (2) limiting content; (3) avoiding long sentences; (4) not using all capital letters; and (5) including images and graphics. Most of the professors in this study chose to use a background color, supporting a study by Apperson, Laws, and Scepanky (2006) that students prefer the use of color backgrounds to white. People read text on a computer screen about 28 percent slower than printed text (DeWet, 2006) and most of the participating professors are careful not to overload slides with text. They also avoid using underlines for emphasis, which signifies hypertext in digital media.

Only some of the participating professors chose to use animations and sound in their presentations. Others basically used appropriate images and graphics to support content. In particular, photos were used effectively, to make concepts and explanations more memorable. As the saying goes,

Table 2. Observed professors' PowerPoint presentation slides (N = 7)

PowerPoint design concepts	Yes	No	Unsure
Used design templates for slides	6	1	
Text in slides contrasts with background	5	2	
Avoid abbreviations and acronyms	5		2
Included only the necessary information in the slide	6		1
Did not include no more than 6 words a line		7	
Included images, pictures, and graphics	6	1	
Did not include no more than 6 lines a slide		7	
Avoided long sentences	5	2	
Used animations	1	6	
Used the sound		7	
Used colors in text	6	1	
Did not use fancy fonts in text	7		
Did not use all capital letters in text	7		
Limited punctuation marks	6	1	
Did not to use too many slides per session	5	2	

“A picture can say a thousand words,” and in the same way, one picture can stimulate class discussions and class interactions. Moreover, “graphics are not necessary for simple declarative information, but may help with more difficult, complex, or abstract concepts presented through lecture” (Bartsch & Cobern, 2003, p. 85).

Using PowerPoint, in large-enrollment courses, professors can make lecturing more active, more dynamic (with visual and auditory resources combined). In small classes, professors can create an intimate learning environment, for example, with educational videos using PowerPoint. In any case, regardless of the size of a class, best practices listed by Berk (2012) might be the solution of preparing PowerPoint: slide background (choose a simple template theme); font (use a minimum of 30PT for text and larger for heads); color (high-contrast colors with a cool background (blues or greens); titles and headings (short full-sentence heading); text or bullet points (apply “less is best” rule with minimal amount of text and number of bullet points); engagement (virtually every active, cooperative, and collaborative learning activity or exercise); images (add bold, colorful, 2D, not 3D), high-impact, high-quality, dynamic graphics (photos, charts, graphs, tables, diagrams) that make a specific point with no detail; movement (use slide transitions systematically throughout the presentation); music (synchronize music with which students are familiar to animated heads, text, lists, images; and videos (embed video clips from YouTube, TV, movies, or student projects into the slide).

Additionally, a checklist for designing and using visuals in the classroom developed by the British Columbia Institute of Technology (2003) is quite useful and is recommended.

4.3. Follow-up questions

All the participants provided their responses to the follow-up questions, and the typical responses are summarized as follows:

Before the lecture: *How do you prepare before each session for PowerPoint lectures?*

- Build the slides, review the content, and ensure that I am on target with the chapters, the syllabus, and the needs of the students.

- Using subject headings which appear in the upper left corner of individual slides, I prepare slides with minimum written material per slide, and then augment with appropriate photos, illustrations, or images.
- Relative emphasis to give the points and exercises, with consequent choices of the number of slides for each point or exercise.
- Make a list of key points structuring the lecture, and make particular note of concepts for which I want photos, for example, to strengthen students' attention to and memory of these concepts.

During the lecture: *How has your lecturing changed over time by using PowerPoint?*

- It is convenient to change the presentation in the moment if needed. I can easily engage other media like YouTube and the Internet from my PowerPoint presentation.
- Lecturing alone leaves the student continually guessing at what the teacher thinks is important and what may be on the test. I can visually present the key points and expand on those points in discussion and through examples.
- As compared with trying to keep students focused on my voice, gestures, and handouts, there is no question that PowerPoint keeps their attention for more of the lecture.

After the lecture: *How often do you update PowerPoint slides for your lectures?*

- Monitor how the students responded to the slides—at least once before every lecture.
- Add new material, especially current research-relevant content, to my slides each new semester that I offer the course.
- Each time, to ensure that the data presented is not outdated.
- Whenever I feel the need to update them. I often find a better image and insert it into the lecture. I also take pictures of my own to insert into my lectures.
- Change or modify my slides as I learn more about the subject and the learning styles and capacity (attention span) of my students.
- Give the students an assessment vehicle every semester to fill out. One question specifically asks about their impressions of the PowerPoint lectures. I try to respond to any negative and constructive criticism where warranted.
- Students tend to think that if they write down what is on the slides, they do not need anything more in their notes (even though I tell them otherwise).
- It is important not to focus too much on being entertaining, at the expense of carefully structured explanation and choice of topics that support and illuminate each other.
- PowerPoint slides can be a crutch and some may overuse them. The files of slides that come with books are generally not very good. I create my own.
- Drawbacks include over-dependence on slides for the content. I sometimes find myself turning my back to the students as I read the content.

The professors in this study recognize that PowerPoint may not be the best practice, but provides a means of staying organized, of presenting material efficiently as well as effectively, and of encouraging student learning. Some professors post their slides before the class session, and this may be one way to facilitate class discussions. PowerPoint has helped the professors to refine their material, highlighting salient points and content. PowerPoint is also easy to update, saving professors' time and energy.

5. Summary and conclusion

Skills in the use of PowerPoint presentations can be broadly divided into two stages: skills in preparation and in delivery. This study focused on both stages, evaluating ways of designing and delivering

effective PowerPoint presentations, with particular attention to three research questions. The first question was, *what conditions must be met for PowerPoint to provide the best medium for promoting learning in lecture-based classrooms?* Large-enrollment courses pose many challenges, including the difficulty of creating a sense of community in the classroom: mainly because such courses promote student disengagement and feelings of alienation. Teaching with PowerPoint, at its best, can get students' attention, creating a connection between the professor and students, increasing spontaneity and interactivity. In addition to improving audience focus, PowerPoint's potential strengths include well-structured communication of knowledge; highlights for particularly important points; and presentations those simultaneously engage students with different learning styles. However, PowerPoint is not a panacea. For example, teacher-centered presentations based on slides do little to model how students should interact with the material on their own.

The second question was, *Do professors consider PowerPoint-based lectures more effective than lectures supported by material on whiteboard or chalkboards?* Teaching mathematics with PowerPoint is not common; instead, most professors still use chalkboards. Chalk allows the mathematics professor to unveil each equation or theorem step by step. As stated by Savoy et al. (2009), the relative successes of delivery by chalkboard and by PowerPoint will depend on the subjects and the learning objectives of the courses. PowerPoint helps with organization and with keeping professors on track, but the ultimately responsibility for learning still rests jointly on the professor (and his choices of how to use the medium) and the students. One professor participating in this study mentioned: "PowerPoint starts the process of learning. The responsibility of learning ultimately rests with the student and their learning skill sets." Another participant in the study addressed the effectiveness of PowerPoint as follows: "The informational content of each lecture has increased. I have become a more emotional presenter, given that the images in the slides give the audience and myself something to react to in tandem, during the flow of the presentation."

The third question was, *Is PowerPoint the best tool for what professors want to accomplish in the classroom?* PowerPoint has taken the place of projection slides and large white boards. PowerPoint has certainly transformed what the typical college lecture looks like. In most cases, PowerPoint slides are used to highlight important points in text, along with presenting graphs and other visual data representations, PowerPoint would be used for more than just creating slides. Although six out of the seven professors in this study use PowerPoint (created in 1987), there are many alternatives, such as Keynote, PowToon, Prezi, Presentit, SlideRocket, and CustomShow, which are also widely used in academia. Obviously the professor participants use PowerPoint to stimulate their lecture content, increasing lecture interactivity in the classroom. Even so, they realize that PowerPoint is an instructional tool—a tool which allows them to be completely prepared for lectures, introduce visual elements into classroom lectures, change the look of the slides easily, and access the information from nearly any computer as long as an external file drive is used to save the presentation. And before creating slides, it is very important for professors to set specific goals and objectives for students' mastery of the content.

Contemporary students' preference supports Smith's (cited in Inoue & Bell, 2006) approach to teaching with PowerPoint. Smith emphasizes that PowerPoint should be used to present images that illustrate important concepts in the lecture because PowerPoint slides can overwhelm students with information if they are used simply for rapid-fire presentation of bulleted sentences. When preparing PowerPoint slides, professors should consider how each slide relates to what they will say, and to what they intend students to learn. Professors must keep in mind that PowerPoint is good for visually enriching the content and illustrating complex concepts, but it is not good at providing large amounts of information. To avoid falling into the most common and serious traps associated with PowerPoint, professors should ask their colleagues to comment on their PowerPoint slides before using them in the classroom.

This study has limitations, including the small sample size and the exploratory nature of the study. However, the findings will be beneficial for the optimal use of PowerPoint in both large and small classes, with one advice by Xingeng and Jianxiang (2012): "The employment of PowerPoint should be

based on the hypothesis that the professor is very familiar with the lecture contents and the audience” (p. 65). The participating professors use PowerPoint to improve their teaching because they know that there is no magic formula for improving teaching.

No matter how technology is changing the teaching-learning process, professors still face daily at least four common areas of academic concern in teaching: preparing and organizing courses; teaching and providing assignments; assessing student learning; and evaluating the effectiveness of teaching. Undoubtedly PowerPoint has the potential to manage these four areas, mostly facilitating “active” lecturing for professors and “active” learning for students if it is used properly and effectively. The present author offers perspectives drawn from the work of these seven participants, as a guide to considering important issues in the use of PowerPoint, and to choosing one’s own approach, accordingly.

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Appendix A. Observation guide and checklist

Classroom observation: PowerPoint-based lectures			
Professor's name			
Course title/number of students			
Classroom location			
Observation date and time			
Course syllabus			
Part one: Observation guide			
Observe the classroom environment (e.g. what kind of rapport exists between professor and student or between students)			
Observe the professor's techniques (e.g. what skills of presentations, lectures, discussions, or other activities seem to be most effective?)			
Observe students (e.g. how active or passive are the students?; how engaged are students?)			
Part two: Concepts of PowerPoint designs and layouts			
1. Professor used design templates for slides	Yes	No	Unsure
2. Professor's text contrasts with background or background color			
3. Professor avoid abbreviations and acronyms			
4. Professor included only the necessary information in the slide			
5. Professor did not include no more than 6 words a line			
6. Professors included images, pictures, and graphics			
7. Professors did not include no more than 6 lines a slide			
8. Professors avoided long sentences			
9. Professor used animations			
10. Professor used the sound			
11. Professor used colors in text			
12. Professor did not use fancy fonts in text			
13. Professor did not use all capital letters in text			
14. Professor limited punctuation marks			
15. Professor did not to use too many slides per session			
Following analysis of the evidence, the following issues require clarification:			



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