PowerPoint®: It's not yes or no - it's when and how

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ABSTRACT. A great deal of research has been done on the use of PowerPoint in the classroom. Most of it has used student acceptance of PowerPoint as the measure of its effectiveness, and these results have overwhelmingly shown that students like PowerPoint. However, most studies measuring PowerPoint's impact on learning have not shown any benefit from its use, and there is no shortage of articles blaming PowerPoint itself for these results. In this paper we show that the problem lies in the way in which PowerPoint is used rather than with the technology itself, and that more information is needed to fully understand how and when to use PowerPoint to enhance learning.

KEYWORDS: *Effectiveness, Impact, Learning style, Measurement, Misconceptions, PowerPoint*

Introduction

PowerPoint was introduced to the business world in 1987 and has since become the method of choice for business presentations. By 2012, PowerPoint was installed on over 1 billion computers and PowerPoint usage at that time was estimated to be 350 times per second (Parks, 2012). This level of use would imply that PowerPoint is a very powerful and effective tool for communication, but this is not always the case. The overuse and misuse of PowerPoint has led to such commonly-used slurs as "death by PowerPoint" and "PowerPointlessness" (McKenzie, 2000), and some businesses have actually banned its use. Steve Jobs, the late Apple founder, banned it from company meetings (Isaacson as cited in Phillips, 2012), asserting that "People who know what they're talking about don't need PowerPoint". And there is even a political party opposed to PowerPoint! Switzerland's Anti-PowerPoint Party (APPP) believes that "the use of presentation software costs the Swiss economy 2.1 billion Swiss francs (US$ 2.5 billion) annually, while across the whole of Europe, presentation software causes an economic loss

of €110 billion (US$ 160 billion)." (Sayer, 2011, p. 1). PowerPoint is also used today in a high percentage of academic classrooms, due largely to three issues: (1) Increased publication and administration pressures that drive many faculty to seek ways to simplify their teaching and course preparation time; (2) Publishers who recognize this market and profit opportunity and respond by providing ready-made PowerPoint slide presentations with more and more textbooks; and (3) Students who appreciate the availability of lecture notes they don't have to create themselves and who have responded favorably on course evaluations and surveys regarding the use of PowerPoint, putting more pressure on faculty to create, distribute and use PowerPoint in their classes. (Apperson, et al., 2006; Frey, Birnbaum, 2002; Gabriel, 2008; Harknett, Cobane, 1997; Nouri, Shahid, 2005). And although several recent studies on student response to PowerPoint use have shown lower levels of student satisfaction with its use than in earlier studies, it is still a very popular study tool and will likely continue to be requested by students. (Craig, Amernic, 2006; James, et al., 2006; Young, 2004). In fact, PowerPoint use is so prevalent in academic settings that the ability to refrain from using it is "sometimes seen as a mark of seniority and privilege" (Parker, 2001, p. 6, citing a conversation with Stanford University Professor Clifford Nass). Gabriel (2008) states that "Another friend of mine explained that, in his highly prestigious institution, only star performers teaching executive development programmes for which participants pay several thousand dollars each earn the right to teach without PowerPoint" (p. 262). Given the ever-expanding presence of PowerPoint in the college classroom and its benefits to instructors and publishers, it is critical that those in academics clearly understand the impact of PowerPoint use on student performance and not just base its use on student acceptance or teaching ease. Is the use of PowerPoint making us better teachers or is it instead just exposing more and more students to "death by PowerPoint"? Are we, as Parker contends, concentrating more on "formatting slides – because it's more fun to do than concentrate on what [they're] going to say" (2001, p. 5)? And if using PowerPoint does not produce the intended beneficial effects on learning, what can be done to improve its use and capitalize on the generally positive perception students have of it? The purpose of this paper is to address these very questions.

The vast majority of the studies to date show positive student responses to PowerPoint use in the classroom, with PowerPoint-based lectures commonly perceived by students to be more interesting, better organized, more efficient at emphasizing key points, easier to follow and understand, and easier to take notes from than traditional lectures (Atkins-Sayre, et al., 1998; Butler, Mautz, 1996; Frey, Birnbaum, 2002; Nowaczyk, et.al., 1998; Perry, Perry, 1998; Pippert, Moore, 1999). Many studies further show that students believe PowerPoint use helps them learn the materials more effectively (Atkins-Sayre, 1998; Bartsch, Coburn, 2003; Nowaczyk, et al., 1998; Sammons, 1995; Susskind, 2005). However, the majority of studies performed to date on the effect of PowerPoint use on student performance show no significant difference in student grades or material recall when using Powerpoint in the classroom, which seems to contradict student perceptions on its benefits to them (Bartsch, Cobern, 2003; Cassady, 1998; Craig, Amernic, 2006; Dietz, 2002; Frey, Birnbaum, 2002; Howard, 2005; Kunkel, 2004; Levasseur, Sawyer, 2006; Lowry, 1999; Rankin, Hoass, 2001; Savoy, Salendy, 2008; Simons, 2000; Susskind, 2005). To determine whether these results may have changed in recent years, in 2012 we replicated a 2001 study performed by Rankin and Hoass, using eight sections of an introductory information systems class. The same professor taught all eight classes using the same textbook, tests, and assignments, so the only difference between the classes was that PowerPoint was used in four of them and a more traditional lecture and discussion format without PowerPoint was used in the other four. The results are shown in Table 1 (Appendix). A t-test was performed on this data with the null hypothesis that the mean GPAs are the same with or without PowerPoint. The test yielded a p-value of 0.917, which indicates that there was no significant difference in overall GPAs when PowerPoint was used.

In addition, the grade distributions of these eight classes were compared using a Chi-Square test, which also showed no significant change in the pattern of the grades between PowerPoint and non-PowerPoint classes at a 5% level of significance. The grade distribution data are shown in Table 2 (Appendix).

Analysis

This study confirmed previous findings that PowerPoint use does not increase student learning over lectures without PowerPoint (it also supported more recent studies reporting a decrease in student satisfaction with PowerPoint in the classroom, but we will leave that topic to another discussion). It is our contention in this paper that the problem lies not with PowerPoint itself, but with the way in which it is commonly used today, by both faculty and students. We discuss here five of the major problems with classroom PowerPoint use that we believe are barriers to enhanced student learning.

1. The limitations of bullets and lists

The first problem is the need to "bulletize" all information presented, which is at the heart of the PowerPoint template. It has been suggested that reducing information down to a list of several-word bullets neglects context, leaves critical relationships between the bullets unspecified and also inhibits the processing and storing of information (Adams, 2006; Buchko, et al., 2012; Doumont, 2005; Karreman, Strannegard, 2004; Shaw et al., 1998; Tufte, 2003; Vik, 2004). The lack of a hierarchical arrangement of the bullet points across slides can further contribute to cognitive overload because it interferes with schema construction (van Merriënboer, Ayres, 2005). Further, lists can lead students to make false assumptions about them, such as the common assumptions that the list is exhaustive, or that all items in the list are co-equivalent, or that the items are mutually exclusive (Feynmann, 2001; Gabriel, 2008). As cited in Craig, Amernic (2006), Shwom, Keller (2003) conclude that Powerpoint lists cause audiences to "often lose their way in a thicket of points and sub-points" in "lists gone amuck" (p. 157).

2. Focus solely on the presentation

Another weakness of using PowerPoint in the classroom is that it takes the focus away from the lecturer and the relevant content of the lecture as well as from the student, and places it entirely on the slides themselves (Crang, 2003; DuFrene, Lehman, 2004; Tufte, 2003). Nunberg (1999) argues that PowerPoint slides "have begun to take on a life of their own, as if they no longer needed talking heads to speak for them" (p. 330). In fact, students often comment that they can study with just the PowerPoint slides – that they don't

need to read the material or take their own notes or even hear the lecture to learn the material (Jones, 2003; Williams, 2012) – a grave misconception since research clearly shows the importance of note taking for learning and retention (Dyer, et al.,1979; Einstein, et al., 1985; Fox, Siedow, 1985). In their 2007 study on student perceptions of PowerPoint, Ahmadi and colleagues theorized that students may be relying too much on the PowerPoint presentations provided by their professor and neglecting their textbooks. A faculty source in Hill and colleagues, (2012), is quoted as saying "Because the info is already synthesized for them in PP slides, the students are less responsible for (and increasingly less capable of) picking out the crucial elements of a lecture, as they always have the slides to fall back on" (p. 251).

3. Lack of interaction and discussion

This lack of focus on the lecturer also results in a loss of "connection" between the student and teacher, with the format of the slideshow dictating the flow of the lecture and limiting discussion and interaction, both of which are known to be important to student learning (Carini, et al., 2006; Crandall, et al., 2010; Herzog, 2007). In their 2011 article, Burrell and colleagues cite the work of Felder, Brent (2007 and 2009) and state that "student-centered teaching … has been successful for the adult learner because it focuses on the student for development and retention of their learning skills and knowledge." (p. 48). Student-centered learning techniques include active learning (problem solving, debating, discussion, etc. during class), team work, and inductive teaching and learning (which allow students to use the course materials to solve problems), none of which are present in the typical PowerPoint presentation.

4. The assumption that "one teaching style fits all"

Another problem with the use of PowerPoint in the classroom is that it tends to be used the same way across all types of students, all learning styles and all disciplines – in a "one teaching style fits all" manner. It assumes that everyone is a visual learner. However, Khurshid and Mahmood's (2012) study on graduate student learning styles found that male students more often prefer group and kinesthetic learning, where female students tend to prefer individual and auditory; social science students

most commonly prefer visual and group learning, where tactile, auditory and kinesthetic styles are commonly preferred by natural science students. Parker and colleagues (2008) also discussed the differences in PowerPoint effectiveness across disciplines, saying that "The organizing properties of PowerPoint may be particularly well suited to the linear presentation of information required by the natural sciences" (p. 290) as compared to the social sciences. Other studies have compared PowerPoint effectiveness across business disciplines, suggesting that "If PPT's feature strength is to cut through and help organize content, then disciplines rife with theory (e.g., management) benefit the most … However, for disciplines in which mathematical or quantitative application of central ideas is emphasized, instructors often need to repeatedly demonstrate step-by-step examples of how to apply models or churn through certain formulas" (Burke, James, 2009, p. 249).

Differences in learning styles across ages are also prevalent. For example, Papp and Matulich (2012) tell us that "Millenials are visual and kinesthetic learners who need interaction amongst themselves and hands-on learning to master concepts" (p. 2) and that they "prefer engagement from and with their peers … [and need] time to reflect" (p. 5). Other studies show that there are relationships between past student performance (GPA) and their preferred learning styles, with freshman and students with lower GPAs tending to benefit more from the linear and concrete nature of PowerPoint than older students or students with higher GPAs (Parker, et al., 2008).

5. The lack of understanding of how cognitive load theory and other learning principles apply to PowerPoint design and use

Although a great deal of research has been done on principles of learning and memory/recall such as Cognitive Load Theory, most people using PowerPoint do not have a full understanding of how PowerPoint use affects learning and how we need to design presentations to maximize their effectiveness. Stoner (2013) comments that "…even for the mindful author, using PowerPoint effectively is not easy or intuitive" (p. 374). In many cases, there is a fine line between presentations that enhance learning and those that inhibit it. For example, Mayer's limited channel theory tells us that people have a finite capacity for storing, organizing and retrieving

knowledge and when that capacity is exceeded, cognitive overload may occur and limit the student's ability to process information (Mayer, 2002 as cited in Cooper, 2009). Cognitive overload is common in multimedia presentations such as PowerPoint when the student receives the same information in two or more forms, such as verbal and written (Hede, 2003), yet presenters often commit the "sin of triple delivery, where precisely the same text is seen on the screen, spoken aloud, and printed on the handout in from of you" (Parker, 2001, p. 5). In addition to boring students and being one of their most common complaints with regard to PowerPoint use, this mistake dramatically decreases retention and memory transfer (Burke, James, 2009; Mayer, 2001). However, Mayer's personalization principle states that conversational words encourage learning, where expository words do not (Mayer, 2002 as cited in Cooper, 2009), so when presenters discuss the content of the slides rather than reading it, learning is enhanced.

Another subtle difference is found with Mayer's modality principle, which states that animation with narration enhances learning, but animation with narration and written text overloads the visual processing channels (Mayer, 2002 as cited in Cooper, 2009).

In another example, Mayer's coherence principle states that students learn more from interesting multimedia presentations than from less entertaining ones. Berk agrees with Meyer, stating that the combination of movement, music and videos (also known as "rich media"), has been known to "create an emotional connection, engagement, and excitement unlike any other elements in your slides" (2012, p. 144). However, it is also known that these benefits do not occur when there are excessive or irrelevant sounds, images, movement, etc., so there is clearly a limit to what should be included in a presentation (Cooper, 2009; Mayer, 2002), something many PowerPoint presentation designers fail to consider. One student's response to the question of "What's not so good about the use of PowerPoint in the classroom?" in Burke and James' 2009 study confirms this: "Some teachers get carried away with animation and pictures and it takes my attention away from the main content topic" (2009, p. 251).

Finally, even if we did fully appreciate the subtleties of learning theory and understand how to apply them to PowerPoint presentations, two problems would still remain. First, many presenters are limited in their ability to use this technology to its

fullest capabilities (Abernathy, 1999; Craig, Amernic, 2006; Griffin, 2003; Parker, et al., 2008). And while this problem can easily be resolved with training and practice, few institutions have the resources needed to provide this level of training, few teachers have the time needed to learn it, and even fewer have the time and resources needed to master multimedia presentation techniques. Keep in mind that the transition to PowerPoint in the classroom was due, in large part, to our desire to save time in the first place! In fact, a large percentage of faculty who use PowerPoint use the presentations provided by their textbook publishers, a major selling point for textbooks today. And while we sometimes "enhance" or "correct" these presentations, they are created by employees of the publishers or authors who typically lack the subject knowledge, teaching experience, learning theory knowledge, and PowerPoint skills needed to create presentations that enhance learning.

Conclusion

PowerPoint has been criticized as an ineffective tool for communication and learning. However, in this paper we demonstrated that the problem is not with PowerPoint, but with our use of it. We agree with Gabriel (2008) that PowerPoint "can become a platform for passionate, discovery learning, a medium that, far from closing discursive adventures, enables individuals and groups to discover a voice and develop their learning and communication potential" (p. 256). But not the way it's commonly used today! This paper discussed several of the common mistakes made with PowerPoint so that presenters might give more consideration to these issues before using PowerPoint. For example, PowerPoint can easily be used in an interactive manner that encourages note taking to exercise the connection between writing and understanding (El Khoury, Mattar, 2012; Harlin, Brown, 2007; Luse, 2010). We can pose discussion questions or introduce short quizzes or group application exercises into presentations to allow time for interaction, discussion and reflection.
We also believe that a great deal more research is needed to understand why PowerPoint use does not appear to enhance learning – a topic that should be as important to educators as student acceptance and the time-saving benefits of PowerPoint –

and when PowerPoint is appropriate in the classroom, since we have seen that not all students and disciplines are equally served by it; it is clear that the "one presentation style fits all" approach is not working. PowerPoint has the potential to enhance learning, but only if we first learn how to use it effectively.

APPENDIX

Table 1. GPA for classes taught with and without PowerPoint

GPA for classes taught with PowerPoint	GPA for classes taught without PowerPoint
3.11	3.54
3.27	2.60
3.12	2.75
2.64	3.14

Table 2. Grade distribution for classes taught with or without PowerPoint

Grades	Number in classes taught with PowerPoint	Number in classes taught without PowerPoint
A	48	36
B	43	19
C	5	8
D/F	1	3

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Sintesi

Power point è un prodotto molto noto agli utenti, utilizzato dai tardi anni Ottanta nel settore delle presentazioni professionali, ma anche per fini didattici nelle classi universitarie. La grande diffusione di questo strumento è conseguenza di fattori diversi, quali la necessità di ridurre i tempi di studio; la disponibilità di presentazioni già pronte fornite insieme ai libri di testo e l'apprezzamento degli studenti per le presentazioni in Power point, testimoniato ampiamente nei sondaggi e negli studi somministrati dalle istituzioni accademiche ai propri iscritti. Secondo gli studenti, infatti, le lezioni organizzate con i Power point sono più interessanti, più semplici da seguire, meglio organizzate ed efficaci nell'indicazione dei punti chiave, e permettono di prendere appunti con maggiore facilità rispetto alle lezioni tradizionali.
Esiste una letteratura molto ampia che documenta gli usi e le potenzialità di questo strumento, e tuttavia non vi sono evidenze chiare sull'utilità didattica delle presentazioni

in Power point e, anzi, secondo alcuni studi l'uso di tale strumento non ha alcun impatto positivo sulle performance didattiche e sull'apprendimento. Tuttavia, non è lo strumento in se stesso ad avere dei limiti che ne impediscano l'impiego efficace in didattica, quanto piuttosto l'uso che se ne fa a non essere sempre adeguato. In questo senso, si rileva l'opportunità di una migliore ricerca e di informazioni e indicazioni aggiornate su come e quando applicare questo genere di strumenti all'ambito educativo. In particolare, la necessità di trasformare le informazioni in elenchi puntati ha notevoli limiti didattici in quanto tralascia l'aspetto narrativo e l'evoluzione dei termini nonché la loro relazione definita e induce lo studente a inferire tali elementi al di fuori del controllo dei docenti. Inoltre, la relativa semplicità di lettura del Power point distoglie l'attenzione degli studenti dall'istruttore e dal contesto, limita l'interazione, focalizzando la lezione solamente sulla presentazione. Sarebbe opportuno, infatti, che il docente discutesse con la classe i contenuti delle slide, mentre la mera lettura delle stesse crea un overload di informazioni che inibisce piuttosto che favorire la memorizzazione. Lo stesso ovrload si verifica quando si sovrappongono narrazione, animazione e testo scritto, mentre l'interazione di narrazione e animazione facilita l'apprendimento. Infatti, è la combinazione di movimento, musica e video – purché non siano eccessivi - a creare un prodotto didattico "ricco" ("rich media") che riesce ad attrarre e potenziare l'interesse degli studenti, creando una partecipazione emozionale favorevole all'apprendimento.
Un ulteriore problema nell'uso dei Power point, che va in direzione contraria rispetto alle correnti tendenze della didattica, sta nell'univocità dell'approccio educativo, che non tiene conto della molteplicità degli stili di apprendimento e delle caratteristiche degli studenti stessi.