

PowerPoint Presentation Handouts and College Student Learning Outcomes

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Abstract

This investigation sought to determine if supplementing lectures using Microsoft PowerPoint slides with handouts of the slides enhanced test-taking performance in an undergraduate Human Development course. In the first study, one section of the course ($N=50$) was given handouts for one exam and a final; the other ($N=50$) received handouts only for the final. No significant differences in test performance occurred across sections. The second study, conducted the following semester for two sections of the same course, assessed whether the receipt of PowerPoint handouts was moderated by learning styles. Learning styles were not predictive of improved test performance as a function of receipt of handouts. These results question the efficacy of presentation software handouts for student learning outcomes.

Introduction

Note taking is a time-honored learning tool in the college classroom. Great variety exists in the ways in which notes are taken, and the efficacy of one style over another for learning is an important question for research. For example, Kiewra (1985) found that note taking in college students may often be ineffective due to poorly organized note taking styles, and Boyd (2004) found that students who take notes perform better on exams than students who simply highlight text.

Instructors also are confronted with making the decision of whether to make their notes available as handouts to students for use during the lecture period. In a survey conducted by Isaacs (1994), 43% of the academic staff indicated that they often or always use handouts in the classroom and feel that handouts direct the students' note taking and allow them to listen and participate more in lecture. Professors who did not use handouts cited fears of students missing class, falling asleep or losing attention (Isaacs, 1994). Despite these fears, Kiewra (1985) found that taking notes from an instructor-provided skeletal outline helps college students' learning, since the main points of the lecture are highlighted and an organized format is provided for them

This issue of note taking in the college class room has taken an interesting technological slant as the use of presentation software such as Microsoft PowerPoint and its associated handouts has gained in popularity on college campuses (Adams, 2006). Many college professors present lectures using such software and often print their presentations into

handouts. Professors have several options for providing these handouts to their students. For example, many instructors e-mail or post their handouts on the Internet for students to

view and print if they wish. Others distribute the notes after class to provide students with an outline after they have already taken their own notes on the lecture. Another option that has been used is to create skeletal notes with blank spaces so students are still required to pay attention in class and fill in the missing information.

In the face of Microsoft PowerPoint's increasing popularity in college campuses, its use recently has come under scrutiny. For example, Tufte (2003), Cyphert (2004) and McDaniel & McDaniel (2005) argue that PowerPoint and other presentation software have reduced the quality of presentations and represent poor pedagogy. Empirical assessment of the use of PowerPoint in the classroom has typically compared two sections of the same course with and without the slide presentation. This research indicates that students actually prefer lectures presented with PowerPoint (Frey & Birnbaum, 2002; Susskind, 2005). However, both Susskind (2005) and Kunkel (2004) found no significant difference in student performance between classes taught with and without slideshow software. Although material on the use (and misuse) of PowerPoint in the classroom exists with respect to student learning outcomes, few studies currently are available that assess the effectiveness of providing accompanying printouts of the slides for use during the presentation. In one rare examination of the practice, McDaniel, Allen, and Barlett (2006) found no differences in exam scores between undergraduates who randomly received the handouts and those who did not. Furthermore, providing handouts may even be more controversial than the actual use of the presentation software in the classroom. Whereas some instructors claim that providing handouts of the slides allows students to pay attention in class without worrying about copying verbatim what is on the screen, others are concerned that providing the notes offers further disincentive to attend or participate in class and may actually divert students' attention away from the class discussion or lecture (Young, 2004).

Thus, this quantitative and qualitative research, conducted in two studies, was designed to determine if supplementing Microsoft PowerPoint lectures with handouts of the slides enhanced test-taking performance in an undergraduate human development course. Arguments in favor of the use of such handouts are rooted in what we have learned from cognitive psychology. For example, information processing theory suggests that memory is enhanced when operating efficiency through the use of memory strategies is increased (Case, 1998). Furthermore, recent research suggests that the ability to sustain focused attention by resisting interference during encoding leads to enhanced memory and learning (Kane, Bleckley, Conway, & Engle, 2001). Providing handouts may function to support both of these dimensions of information processing. Presenting key words, terms, and ideas from the class presentation enables students' memory space to be allocated to activities leading to deeper processing (such as thinking about the significance of the points presented). The handouts may also enable students to focus on the significant dimensions of the material and inhibit attention to extraneous material. In a survey of students' attitudes about the use of PowerPoint in the college classroom (Frey & Birnbaum, 2002), most agreed that PowerPoint handouts helped them to take notes and organize their studying. Thus, in the first study, it was expected that students who received the handouts would perform significantly better on exams than students who did not. To add further insight as to how the handouts either helped or hindered student learning, students were surveyed about their use of the PowerPoint handouts and perceptions of the degree to which the notes helped with exam performance.

In a follow-up study, we decided to assess the learning styles of students in order to determine if the learning styles may moderate the effect that PowerPoint presentation handouts may have on student learning outcomes. Although the consideration of learning styles and student outcomes has a long history in educational psychology (Dunn, Beaudry,

& Klavas, 1989), the publication of Gardner's (1983) theory of multiple intelligences (MI) inspired a renewed interest and concern about how individual differences in cognitive processing affect the learning process. Thus, pedagogical implications have been observed in Kolb's work, which divides learning into seven different styles (Loo, 2004), as well as the writing of Lazear (1991) who directly applies MI theory to the learning process. Students, for example, can be categorized as preferring material that is presented either in visual, auditory, kinesthetic, or spatial modalities. Furthermore, research on the relationship between learning styles and learning outcomes has found a correlation between learning styles and the success of students (Farkas, 2003; Dunn et al., 1989) and that students prefer learning in a way that is compatible with their self-identified style of learning (Rinaldi & Gurung, 2005). However, this construct is not without controversy, and concerns have been voiced (Vasquez & Smith, 2006) regarding the potential problems that ensue when a particular learning style is misused to label or overgeneralize its effects on student classroom performance.

Three of the learning styles described by Gardner (1983) and Lazear (1991) that have face validity in terms of classroom performance are those that are linguistic, visual-spatial, and bodily kinesthetic. Linguistic learning occurs through verbal interaction with concepts and words; visual-spatial learning involves the visual aspects involved with learning; and bodily-kinesthetic refers to manipulating the material, such as taking notes or creating learning tools that involve use of the body. Students who learn mostly by linguistic style will need more auditory exposure to class material; they will benefit mostly by reading material aloud and hearing lectures. Visual-spatial learners may benefit from seeing PowerPoint slides and printed notes. Writing notes and performing class projects may enhance the learning outcomes of the bodily-kinesthetic learner. If hearing a lecture, especially without the "burden" of taking notes represents a compatibility between the auditory style and learning, taking notes involves bodily-kinesthetic learning, and seeing slides of lecture material engages the visual-spatial learning style, handouts of PowerPoint slides may be a particularly beneficial match between the auditory and visual-spatial learning styles and learning outcomes. On the other hand, the handouts may reduce the need for note taking for bodily-kinesthetic learners, and thus their learning may actually be impeded by receiving such handouts: "To observe a classroom with PowerPoint at its centre is often to watch a group of students with idle hands" (Adams, 2006, p. 401).

This second study, therefore, looked at the three learning styles of linguistic, visual-spatial, and bodily-kinesthetic as possible moderators of the efficacy of handouts of PowerPoint slides in promoting student learning outcomes.

Method

For the first study in the fall semester, students in two sections of an upper level Human Development course at a small Midwestern university participated in the current study. Each section had 50 students who were demographically similar across sections. The combined sections' mean age of the students was 22.51 years ($R = 19-45$ years) and 78% were female. The following semester, a second study was conducted with the same two

class section format of the same course; the first section was 83% female ($N = 42$) with a mean age of 22.90 years ($R = 19 - 41$ years) and the second section was 90% female ($N =$

40), with the mean age of students 22.18 years ($R = 20 - 39$ years). All classes were predominately Caucasian, with approximately fewer than 10% of an ethnic minority or race.

For both semesters, during most class periods in which a lecture was delivered, projections of Microsoft PowerPoint slides were presented to both sections of the course as the instructor spoke. In the fall semester, the course was divided into thirds, with an exam (multiple choice and two essays) given at the end of each third. Students were required to take one of the first two noncumulative exams comprised of multiple choice and essay questions. Students were encouraged to take both of these exams, as the lower grade of the two was not computed into the final grade. The final cumulative exam was required of all students. At the beginning of class, Section 1 students were given hard-copy handouts to accompany the Power Point lectures for the second exam and the final; they were instructed not to show these handouts to students from Section 2. Section 2 students were given the handouts for the final third of the semester only (see Table 1). Thus, both classes did not receive the handouts prior to the first exam, and did receive the handouts prior to the final exam, with the middle third of the course being the time in which different procedures across the two classes were followed. The handouts were two-columned, with three slides on the left column and blank lines for note taking on the right column. The slides on the handouts were duplicates of the slides projected during the in-class lectures. The number of slides covered during each class session varied, but on the average they were comprised of seven to ten slides, varying in content, inclusion of graphics, and sentence length. The slides presented a general outline of the lecture, definitions of key terms and brief descriptions of empirical studies. Lecture and discussions in class supplemented the material in greater depth than was presented on the slides which may account for the relatively few number of slides shown per 50 minute class session. A survey (available from the first author) was given to all students at the end of the final containing both open-ended and Likert scale questions (11 total questions) about their note taking behavior during class, perceived helpfulness of the handouts, attention to the projected slides, format of the handouts and study techniques.

During the spring semester, the classes experienced three exams plus a cumulative exam during finals week. The lowest test score of the first three exams was dropped in the calculation of course grades. The procedure for the spring semester study was similar to the fall semester, with the exception that after the first exam students in both sections were informed of the study and then administered the Multiple Intelligences (MI) Inventory for Adults (Harper, 2005; Lazear, 1991), a checklist consisting of ten items in each of the categories of Linguistic Intelligence, Logical-Mathematical Intelligence, Spatial Intelligence, Bodily-Kinesthetic Intelligence, Musical Intelligence, Interpersonal Intelligence, and Intrapersonal Intelligence. Students were allowed to check as many items as they believed characterized the ways in which they learn material. The MI Inventory took about 10 minutes for the class to complete. For the remainder of the semester, students in the second, later session of the course were given handouts of the PowerPoint slides at the beginning of each topic and instructed not to share these handouts with members of the earlier class.

Results

For both studies, the effectiveness of receiving PowerPoint handouts was tested both within and across sections of the course. There were no significant differences on test scores due to age or gender, which is not surprising given the limited age range and

predominance of females in the class. All subsequent analyses combined data from males and females. For all *t*-tests, alpha levels of .05 were used.

Table 1 presents the fall semester means and standard deviations for the test scores for each section of the course as well as whether or not students received handouts of the PowerPoint slides.

Table 1: Mean Exam Scores for Two Sections of Human Development Course (Fall Semester)

	Section 1			Section 2		
	Exam 1	Exam 2	Exam 3	Exam 1	Exam 2	Exam 3
Handouts given to class		<i>M</i> =79.32 <i>SD</i> =8.69 <i>n</i> =27	<i>M</i> =81.00 <i>SD</i> =9.03 <i>n</i> =50			<i>M</i> =77.79 <i>SD</i> =8.90 <i>n</i> =50
Handouts not give to class	<i>M</i> =83.42 <i>SD</i> =10.89 <i>n</i> =50			<i>M</i> =80.62 <i>SD</i> =10.99 <i>n</i> =50	<i>M</i> =80.87 <i>SD</i> =9.10 <i>n</i> =32	

For the first test, where both class sections did not receive notes, the differences in test mean scores, as assessed by a *t*-test for independent samples was not significant (see Table 1). The effectiveness of receiving handouts during class time was determined by *t*-tests for independent samples conducted across both sections comparing each exam (including the first exam where neither section received handouts) and the final. No significant differences were found. In order to determine if receiving handouts of the presentation slides were effective in enhancing test performance within classes, *t*-tests for paired samples were also conducted within classes for the first and final exam scores. The findings were not significant.

Because students had the option of taking only one of the first two exams (all students did take the first exam), *t*-tests for independent samples were also computed comparing Exam 1 performance for Section 1 and Section 2 for those students who took both first and second exams, and comparing Exam 1 performance for Section 1 and Section 2 for those students who took the first exam but not the second. The differences across sections were nonsignificant.

Between section and/or between exam differences were examined by use of a repeated measures ANCOVA with class section as the main effect, scores on Exam 2 and the Final (or Exam 3) as the dependent variables, and Exam 1 test scores as the covariate. We decided to use the covariate because there were significant differences on Exam 1 scores for Section 1 students who did and did not opt to take Exam 2, $t(41) = 4.34, p = .001$ (two-tailed). Only the scores for those students who took all three tests were used (Section 1 $N = 27$; Section 2 $N = 32$). No significant differences were found between exams or sections. Partialling out Exam 1 test scores, there was a significant exam by section interaction

($F=5.85$, $p = .019$, $N=59$) with Section 1, the notes group, performing significantly worse on the final than on Exam 2 (Exam 2 $M=80.67$; $SD=9.10$, $N=32$; Final $M=75.59$, $SD=7.80$, $N=32$). Section 2 students performed similarly on both exams (Exam 2 $M=79.32$, $SD=8.69$, $N=27$; Final $M=79.51$, $SD=8.52$, $N=27$).

A repeated measures ANOVA was performed for both sections with Exam 1 and Exam 2 as the repeated measures. Test scores for only those students who took both tests were used in the analysis. The only significant difference was across exams. For both sections, students performed significantly better ($F=5.16$, $p=.027$, $N=59$) on Exam 2 than Exam 1 (Section 1 Exam 1 $M=78.11$, Exam 2 $M=79.32$, $n=27$; Section 2 Exam 1 $M=72.22$, Exam 2 $M=80.87$, $n=32$).

As in first study of the fall semester, the second study tested the effectiveness of receiving handouts during class time was determined by using *t*-tests for independent samples conducted across both sections comparing each exam and the final. With an alpha level set at .05, no significant differences were found for any of these tests. Scores were computed for each of the seven intelligences by adding up the number of items checked in each category. Analyses were conducted to test the moderating effect of visual-spatial ($M=4.66$, $SD=1.88$, $N=90$), linguistic ($M=3.72$, $SD=1.87$, $N=90$), and kinesthetic ($M=6.04$, $SD=1.71$, $N=90$) learning styles on the effectiveness of receiving PowerPoint handouts on exam performance. Three multiple regressions were performed using class section and the three learning styles scores as the predictor variables, each exam score as the dependent variables, and first exam performance as the covariate. None of the predictor variables explained a significant proportion of the variance for any of the exam scores.

Follow-up analyses examined the relationship between the perception that receipt of the handouts enhanced students' learning experience or were compatible with their learning styles (e.g., the handouts enhanced students' ability to focus on the lecture, visual image recall and were generally helpful). Again, none of the correlations were significant. Interestingly, the visual-spatial learners who were in the class section that did not receive handouts believed that had they received the handouts, they would have had better visual recall of the material ($r = .37$, $p = .02$, $N = 38$) and their classmates in this same section who were designated as linguistic learners thought that receiving the handouts would have enhanced their ability to take more notes ($r = .38$, $p = .02$, $N = 38$).

Survey Results and Qualitative Analyses

Responses to the survey (N Section 1 = 50; N Section 2 = 49) were first analyzed with respect to how students used the presentation software handouts. Most students (79%) used the notes for studying for the final, 21% were very attentive to the PowerPoint projections along with the notes, 25% indicated that they had paid a lot of attention to the lecture along with the handouts, and 39% frequently wrote additional notes on the handouts.

Open-ended questions were analyzed using a content analysis procedure. Three researchers independently derived themes that emerged from the responses of the students. As described below, the researchers found that the main themes from the survey responses concerned level of satisfaction with the quality of the learning experience and the formatting of the handouts:

The first theme indicated that providing notes along with the PowerPoint slides diminished the learning experience for students because they were less engaged:

"The handouts did not help me. It allowed me to daydream during class instead of take notes. I think they hurt rather than helped me."

"Because I wasn't writing the notes, my attention seemed to drift, and I didn't catch as much of the material."

The second theme referred to the need to improve the formatting of the notes:

"I would have liked them more in outline form and not so small so it would be easier to write notes next to the type instead of drawing arrows."

"If the handouts had a larger sized font, I would have just used them. But it was too hard to concentrate on such a small font."

Responses to the open-ended questions suggested that lectures went too fast when notes were provided:

"I don't like having handouts. It makes the lecture go too quickly and we didn't spend as much time explaining and learning the slides."

"I didn't really care for the handouts, because the material is presented way too fast. When we have to write it down, it allows for digestion of the material."

Finally, a few students indicated that they found the notes to be helpful:

"I really liked having the handouts. It let me add more of what was talked about in class in an organized way, very helpful."

"I could listen a lot more because I wasn't frantically writing."

Similar to the fall semester study, the spring semester students were for the most part quite positive about receiving the handouts, as 75% indicated that the handouts were generally helpful, 75% felt that they were useful in preparing for tests, and 50% indicated that the handouts improved their listening to the lectures.

Discussion

The present study represents one of the first empirical investigations on the efficacy of PowerPoint handouts in the classroom. The study reveals that distributing handouts that contain duplications of the projected PowerPoint slides, a common practice with PowerPoint technology (Kinchin, 2006), offers little to the learning experience of students. Although a limitation of this study is that for several statistical analyses the data sets reflected fewer than 50 students, the results were consistent across two studies in two different semesters, wherein the course content, slides, instructor presentation, and structure of the course were kept as similar as possible. These findings are important then, given the prevalence of the use of such presentation software in college and the frequent requests by students to receive handouts. Such findings also provide interesting theoretical implications in terms of

the role of handouts of presentation software in information processing in the classroom. Students and faculty alike may assume that individual preferences in learning styles could be favorably matched with handouts of slides (Dunn, Beaudry, & Klavas, 1989). Others believe that demands on cognitive processing might be alleviated with handouts of PowerPoint slides because the preciously limited capacity of working memory could be allocated to deeper learning if not diverted to note taking (Kane et al., 2001). However, the present research indicated that neither cognitive processing nor learning styles interacted with the use of these handouts in any way that led to demonstrable improvement in test performance, findings compatible with other studies that have looked, in a variety of ways, at the effects of PowerPoint (Hardin, 2005; Katayama, Shambaugh, & Doctor (2005).

Although the present findings appear to be fairly robust, there are a number of factors that should be taken into consideration as we begin to evaluate the use of this teaching technique.

One factor that may influence the learning outcomes in classes using PowerPoint is course content. Kunkel (2004) found, for example, that course content did influence how students benefit from their notes when they are taken from PowerPoint slides. In his study, two sociological courses on criminology served as the basis of comparison. One course focused on criminology theory, the other was predominantly a survey-type course that relied more on memorization than abstraction of ideas from theory. Kunkel (2004) found no significant differences on test scores for students who attended either the presentation software or more traditionally taught theory-based criminology course, although the spread of scores was greater for the presentation software group. Those students who attended the presentation software descriptive course did perform significantly better than those in the more traditional descriptive course. Although elements of both types of courses in the Kunkel (2004) study appear in the course of the present study, it seems to more closely resemble Kunkel's (2004) descriptive course than the theoretical course. However, in the present study, for those students who received the handouts for the last two thirds of the semester, final exam performance was significantly worse than for students from the other class. Although students initially were enthusiastic about receiving handouts, they became overwhelmingly negative because of their increased passivity in class. Even student discussion decreased after the initiation of the handouts condition. Comments on the survey indicated that once students received handouts of the slideshow, they did not pay much attention to the slides as they were presented overhead during the class lecture. It is possible that this is especially true for the less motivated students. Such responses suggest that providing handouts reduce students' engagement in the classroom, a perception shared by some of their professors as well (Young, 2004). Kunkel (2004) agrees as he speculates that "better" students may become bored in a class that is predominantly based on slide show presentations.

Ironically, the overall lackluster effect that handouts of PowerPoint slides has on learning outcomes is not matched by students' intuitive beliefs. In the fall semester study, despite the negative effects on student involvement in the class given the handouts, students' attitudes toward the class, as measured by an end of the semester course evaluation, were more positive than those who were in the no-handouts class. This was especially true for the few returning adults in the class. Out of a scale of 1 – 10, with 10 being the highest, students rated the section with the PowerPoint handouts an overall 8.7 ($N = 42$) as compared to an 8.0 ($N = 42$) in the section without handouts. Two other items on the course evaluation, "Learning course content" and "Course organization" also received higher ratings in the class given the presentation software handouts (8.5 compared to 7.7; 8.9 compared to 8.3 respectively). Thus, test scores may not indicate better learning outcomes

for students who receive handouts of the PowerPoint slideshow, but at least in the first study they seemed to believe that they were learning more. Ironically, measures of association between students' anticipated grade for the course and their ratings of how helpful the handouts were to their course performance were nonsignificant. In the second study of the spring semester, students predicted enhanced performance between a match with the handouts and their preferred learning style. Building on the findings of Rinaldi & Gurung (2005), who did not find improved performance when students' learning styles were matched to assignments, significant differences in test scores between those who received the handouts and those who did not were not evident, even when expectations were to the contrary. Unlike the first study, however, course evaluations were identical across both sections (8.6, $N = 45$; $N = 38$). The consistent findings across both studies are potent

reminders that what is intuitively obvious might not match up with empirical assessment. Given concerns over the validity of the learning style construct and associated tools of assessment (Cassidy, 2004; Vasquez & Smith, 2006), it might be prudent to study other dimensions of information processing as they work with the use of handouts in the classroom. Assessing learning outcomes using methods other than exams would yield different results; future investigations should uncover whether or not this is the case. Additionally, the timing of the distribution of the handouts may affect learning outcomes. In the present two studies, handouts were always given at the beginning of each class. Might students remain engaged if they received the handouts at the end of class, or were able to print them off a course web site at a later date? We also relied on the honor of our students to not share their handouts with students from sections where these were not received, and our analyses were predicated on that belief. Thus, a limitation to this study is the relatively little control that we have on potential student "helping."

Finally, the handouts for the courses in both studies did not provide complete sets of notes for students. In the present research, students were expected to continue to take notes as the professor elaborated on the items listed on the PowerPoint slides. The supplementary material was also included on the exams. Yet survey comments indicated that many students did not take additional notes, as they either assumed that the PowerPoint handouts were complete enough or they found that the format of the handouts did not provide enough space to write down additional information. Critics of the extensive use of PowerPoint in higher education allude to the implicit message of the slides that what is projected is important, and what is said around the bulleted points is not (Adams, 2006). This perception may be reinforced by the handouts of the slides.

There are many good rules to follow in the construction of effective handouts (Sakraida & Draus, 2005); Kinchin (2006) points out that merely duplicating what is projected on the PowerPoint slides is not the optimal method to enhance student learning. Others have also noted that receiving notes of PowerPoint slides discourages attendance and conversely, encourages performing other activities during class, including dozing and checking one's e-mail (Felder & Brent, 2006; Young, 2004).

Tufte (2003) argues that PowerPoint may be more beneficial for the presenter than the learner. In addition, Tufte's (2003) critique of PowerPoint suggests that it overly simplifies complex ideas and promotes linear thinking. Adams (2006) also argues that PowerPoint constrains intellectual discourse so that ideas are simplified, counter to higher analytical reasoning, and artificially ordered in hierarchical, noncontextual ways. However, it is important to distinguish between depending solely on the slides as the means of instruction, or using them as a pedagogical aid that enhances the class lecture and discussion. This point leads to the third factor that needs to be further explored in the use of handouts

accompanying presentation software in the classroom: the effect on the instructor. Thus far in the literature, how the use of handouts on PowerPoint slides affects teaching styles largely is unknown. Do professors speed up their lectures, use more discussion, elaborate on the handouts, put students in a hypnotic state by reading the handouts/slides, or teach in a more relaxed fashion when students can follow the class with their handouts? A recent study by Hardin (2005), comparing PowerPoint to no PowerPoint presentations by four instructors in eight sections of introductory psychology classes found instructor effects to be much more potent than PowerPoint effects. For one instructor, use of PowerPoint facilitated teaching, for another, it served as a distraction, for two there were no differences. Future

research should examine such instructor effects in the use of PowerPoint handouts, as well as whether PowerPoint slides may be more effective for certain course content and not others.

In some respects, the use of presentation software in the college classroom is one of those old controversies encased in new technological wrapping. Yet, it forces those of us who are actively involved in improving teaching and learning in higher education to articulate our assumptions and beliefs about what happens in and out of the classroom. To that end, there definitely is something to be gained in the continued use of the software and empirical exploration of its effects.

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