The Interactive Effects of PowerPoint and Note-taking as a Function of Lecture Pace Among UW-Eau Claire Students

Ashley S. Zellhoefer¹, Nathaniel B. Murken¹, Benjamin D. Hustedt¹, Andrew P. Clemens², Daniel P. Walenski², Kathryn L. Hamilton², and Allen H. Keniston¹

¹Department of Psychology, University of Wisconsin-Eau-Claire, ²Department of Psychology of University of Wisconsin Stout

Introduction

PowerPoint is a widely-used but little researched lecture aid. A few previous studies have suggested that PowerPoint may facilitate comprehension of lecture material because of its abilities to free cognitive load. However, some studies have argued that PowerPoint will interfere with a lecture because it will overload cognitive space with its redundancy. We have previously manipulated variables such as lecture pace, level of detail, and the amount of accompanying PowerPoint slides and the use of systematic breaks within the lecture. However, none of our previous studies have yielded clear effects or supplied a clear picture of PowerPoint's effectiveness. Still, theory suggests that pace mediates multimedia effects. To date pace has not been a topic of research.

Research has found that a lecture at a fast pace can hinder note-taking. When PowerPoint may interfere with a students' comprehension of lecture material at a fast pace.

Hypotheses

- We expected PowerPoint use, a normal lecture pace and student's note-taking to enhance retention and comprehension of a short lecture.
- We also hypothesized that note-taking benefits would be augmented by PowerPoint when students heard a normally paced lecture, but PowerPoint would interfere with note-taking benefits at a fast pace.

Methods

Participants: 86 Students from UWEC invited to participate via a research signup board; 80% of sample were freshmen, 27% were sophomores, 11% were juniors, and 13% were seniors. (Total is larger than 100% due to rounding error.)

Materials
- Informed consent form
- University PC computers using Qualtrics software and headphones
- Test of previous knowledge of neuron communication
- 28-item multiple-choice retention test
- Debriefing form
- Evidence of participation form

Procedure
- Participants read and completed the informed consent form.
- Students were asked to log onto their University computer and then into the Qualtrics program.
- Students first completed the test of previous knowledge.
- After completing the test, students were randomly assigned to one of the 8 conditions.
- Participants viewed either the normal fast paced lecture, or with or without the accompanying PowerPoint slides.
- Depending on the condition participants were randomly assigned were encouraged to take notes.
- After the lecture students completed the retention and comprehension tests. When finished the participants then received an evidence of participation and debriefing form.

Results

Effects of PowerPoint, lecture speed, and note-taking on retention

Neither PowerPoint nor lecture speed influenced retention test scores (p>.05 for both main effects in the ANOVA). Note-taking exerted only a marginal effect on retention, F(1, 78) = 5.77, p = .03. Participants who took notes had an average test score of 17.74 (SE = .85) compared to the average score of 19.65 (SE = .85) for those who did not.

Possible suppression of effects by previous knowledge of the lecture topic

The correlation of retention with previous knowledge was significant (r = .23, p < .04). An ANCOVA using previous knowledge as a covariate to control for the possibility that previous knowledge suppressed the impacts of the manipulated variables simply has not been an artifact of previous knowledge. In other words, the marginal note-taking effect appears to have been an artifact of previous knowledge.

Correlation of retention and comprehension

The zero-order correlation of retention and comprehension was .53 (p<.001)

Effects of PowerPoint, lecture speed, and note-taking on comprehension

- Figure 1 displays the breakdown of comprehension scores by lecture pace, PowerPoint, and note-taking conditions.
- The ANOVA for comprehension revealed only a marginal 3-way interaction among the independent variables, F(1, 78) = 2.93, p = .09. The interaction appears in Figure 1.
- Because the zero-order correlation between comprehension and retention is .53 (p<.001), and we conducted an ANOVAC using retention as a covariate to test for the possibility that retention acts as a suppressor of the manipulated variables effects. In this analysis, there was a significant interaction of lecture speed with note-taking, F(1, 77) = 6.42, p = .01. The three-way interaction depicted in Figure 1 is also significant, F(1, 77) = 7.32, p < .01.
- The three-way interaction qualifies the interpretation of the two-way interaction. Thus, when the lecture ran at a normal pace, note-taking produced higher comprehension scores when there were no PowerPoint slides, but reduced the comprehension scores when there were PowerPoint slides. However, during a fast-paced lecture, note-taking produces lower comprehension scores in both PowerPoint conditions, although the reduction appears to be smaller when the lecture is accompanied by PowerPoint than when it is not.

Discussion

Our data supported none of our hypotheses.
- Finding that note-taking marginally impaired retention is unusual. Typically the reverse occurs. However, that the effect was marginal and eliminated under control for previous knowledge leads us to discount the finding.
- The marginal three-way interaction of lecture pace, use of PowerPoint, note-taking and comprehension becomes significant under control for control for lecture pace. Note-taking had different effects in combination with PowerPoint use depending on lecture speed. In general, note-taking reduced comprehension with or without PowerPoint slides when the lecture was fast. But when the lecture pace was normal, note-taking enhanced comprehension when there were no accompanying PowerPoint slides, but reduced comprehension scores when there were accompanying PowerPoint slides.
- Given that the effect size for the three-way interaction was small (η² = 0.10), and the fragility of three-way interactions, we are cautious about interpreting our main finding about the effects of our variables on lecture comprehension. Nevertheless, we suggest that PowerPoint's effects are complex. In the present case they are a function of two aspects of the presentation, one participant variable, and one person variable. We suspect that there are many other variables that may be influential, including the conceptual organization of the material. Its representation in the organization of PowerPoint slides.
- Our research will continue to explore modifications in the organization of PowerPoint slides. The combined impact of our studies is that simply using PowerPoint slides as a lecture outline produces no beneficial effects in terms of students' memory or understanding of lectures. However, developments in research on other forms of multimedia indicate promise for PowerPoint applications.

References