Investigating Technologies in Teacher Education: Does PowerPoint Enhance Retention or Influence Attitudes?

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This study investigated the impact of presentation formats on preservice teachers' ability to retain information along with their perceptions regarding subject matter and instructor's effectiveness. Participants were 79 preservice teachers in three sections of an elementary methods course. Each section received instruction using lecture and discussion accompanied by a different presentation format: black and white overhead transparencies, color overhead transparencies, and PowerPoint slides. Following treatment, participants responded to the Course Presentation Survey (CPS), a 7-item questionnaire developed to measure perceptions of presentation effectiveness, and completed a 10-item content quiz. Quantitative data from the CPS were analyzed using an analysis of variance while quiz scores were analyzed using an analysis of covariance with overall grade point average as the covariate.

In traditional classrooms, a teacher's basic instructional tools for displaying information are chalkboards, multipurpose boards, peg-boards, bulletin boards and flip charts (Heinich, Molenda, Russell, & Smaldino, 1999). To project instructional materials, overhead transparencies displayed via an overhead projector are still a commonly used classroom presentation methods. As an advantage to using chalkboards and multi-purpose boards, overhead transparencies eliminate the necessity of manually writing, and later erasing, information every time it is required; thus, allowing for the storage of information (Yao, Ouyang, & Wang, 2000).

Pedras and Horton (1996) noted that the tools of many professions are changing at an incredible rate and that education is no exception. The impact of technology has led to the increased use of computers for presenting information in many of today's classrooms. Microsoft PowerPoint, hailed as an easy-to-use means of creating professional presentations (www.microsoft.com/office/powerpoint), has become a favorite among teachers for creating classroom presentations. Ljungdahl (2000) found PowerPoint to be one of the most widely used software programs in both an area educator preparation program and local public schools. According to Simons (2005), "more than 400 million copies of the program are currently in circulation, and somewhere between 20 and 30 million PowerPoint-based presentations are given around the globe each day" (p. 1).

PowerPoint, a standard part of the Microsoft Office software package, is used for preparing a sequence of slides that are displayed to the audience on a computer-guided monitor. Each slide typically contains information (in the form of bulleted terms, phrases or ideas) central to the presenter's theme and communicated amid a myriad of font, color and background choices often accompanied by a selected graphic (chart, clip art or photograph) (Mason & Hlynka, 1997). Presentations developed with this type of software can

be saved digitally and easily modified facilitating future use (Yao, Ouyang, & Wang, 2000).

Additionally, teaching notes (Yao, Ouyang, & Wang, 2000) and student handouts (Pedras & Horton, 1996) can be generated from completed presentations. PowerPoint projects can be printed in several formats to be used as handout sheets. Each page may contain a single slide, two, three (slides appear on the left-hand side of the page with lines for taking notes to the right of each slide) or six slides per page, while the printing options of notes view (a single slide displayed at the top of each page with space for notes underneath) or outline view (text only, presented in outline form) may also be utilized (Stafford, 1997).

Using computer presentation programs, such as Microsoft PowerPoint, allows teachers to include charts, clip art, photographs, sounds or video segments to demonstrate concepts. Likewise, stimulating graphics or animation can be incorporated to emphasize important points (Pedras & Horton, 1996; Yao, Ouyang, & Wang, 2000) and, where internet is available, embed links to related websites. Further, PowerPoint presentations can be made available to students on disk or via a listserve, which eliminates spending course time remediating students who missed a class (Stafford, 1997) and conserves paper while lowering copy costs. While transparencies once held the advantage of allowing the presenter to make marks or drawings during the display of the information (Yao, Ouyang, & Wang, 2000), the latest version of PowerPoint (2007) also allows presenters to make spontaneous additions to text by adding, highlighting, or otherwise emphasizing (e.g. underline, circle) information on slides. According to Craig and Amernic (2006), "PowerPoint should be recognized as a new communication medium that is fundamentally changing the nature and dynamic of *how* we teach" (p. 156).

While Pedras and Horton (1996) suggested that computer-generated presentations could enhance the teaching process by increasing student interest and improving retention of material, this claim has not yet been established. Alternately, in a study conducted among 143 pre-service teachers, Ahmed (1998) found "very little difference in test scores when comparing using traditional overheads and PowerPoint technology" (p. 4). In research by Szabo and Hastings (2000), findings in two of three studies indicated that PowerPoint lectures might have more entertainment than instructional value. In a study of high school math students, Petersen (2005) did not find conclusive evidence that the use of PowerPoint had a direct impact on student achievement in a secondary classroom. Amare (2006), who analyzed the performance and attitudes of undergraduate technical writing students in PowerPoint-enhanced and in non-PowerPoint enhanced lectures, found higher performance scores for students in sections using traditional lecture format (teacher at podium, chalkboard, and handouts) as opposed to those receiving PowerPoint presentations. Similarly, undergraduate psychology students in a study conducted by Bartsch and Cobern (2003) performed worse on quizzes when PowerPoint presentations included non-text items such as pictures and sound effects. One possible explanation for this perplexing lack of difference is that added visual images may have no apparent benefit for non-visual learners while actually creating a distraction for some students. Bartsch and Cobern (2003), who also studied students' performance on recall and recognition tasks having been exposed to PowerPoint with non-relevant pictures, concluded that including material on PowerPoint slides that is not pertinent to the presentation can actually be harmful to learning.

Despite the increased use of digital media and technology in the classroom, traditional methods of presenting information remain in use (Yao, Ouyang, & Wang, 2000); thus, raising questions related to the effectiveness of various presentation formats. This study investigated the impact of three presentation formats (black and white overhead transparencies, color overhead transparencies, and PowerPoint slides) and the effects of these formats on preservice teachers' ability to retain information. Preservice teachers' perceptions regarding subject matter and instructor's effectiveness related to these formats was also explored.

Method

Participants

Participants were 79 undergraduate seniors majoring in elementary education and enrolled in three sections of a required language arts methodology course. Four participants were African-American; one was Asian American, and the remaining 74 were Caucasian. One participant was male.

Participants' placement in each section was predetermined by course registration; however, they were randomly assigned to the three experimental conditions, with 28 participants receiving lecture with black and white overhead transparencies, 24 participants receiving lecture with color overhead transparencies, and 27 receiving lecture with PowerPoint slides.

Materials

The Course Presentation Survey (CPS) is a 7-item questionnaire developed by the researchers for the purpose of obtaining students' perceptions of various aspects pertaining to the different presentation formats. A four-point, fully anchored, rating scale, ranging from 1 (Excellent) to 4 (Poor), was used for responding to CPS items with additional space provided for comments related to each item. A high score (indicated by a lower numerical value) on an individual item implies that the respondent has a positive view of the presentation aspect addressed by that particular item. Individual items are displayed in Table 1.

A 10-item multiple-choice/true-false quiz was used to determine participants' retention of information presented in the two class sessions.

Design and Procedure

Participants received instruction during two 50-minute class sessions relating to Chapter 7 Listening to Learn, pages 228-337, of the course text *Language Arts: Content and Teaching Strategies* (6th ed., Merrill Prentice-Hall, 2005) by Gail E. Tompkins. Although the content and instructor remained constant for all three sections, the method of presentation varied. While all three sections received instruction using lecture and discussion, each section received a different presentation format: black and white overhead transparencies, color overhead transparencies, and PowerPoint slides. Following the two class sessions, participants responded to the Course Presentation Survey. In addition, participants completed a 10-item, objective, select-response, quiz pertaining to the content of the class sessions.

Scoring

Quantitative data obtained from Course Presentation Surveys was analyzed using an analysis of variance with post hoc, follow-up tests run to indicate specific areas of differences. Quiz scores were analyzed using an analysis of covariance with self-reported overall grade point average serving as the covariate.

The researchers, for the purpose of detecting patterns or themes in responses, independently analyzed qualitative data in the form of comments obtained from the CPS. Following a collaborative

analysis of the researchers' notes, findings were formulated and discussed.

Results

A one-way analysis of variance was conducted for each of the seven Course Presentation Survey (CPS) items to evaluate the relationship between the students' perceptions of effectiveness specified in each item at the three levels (black and white transparencies, color transparencies, and PowerPoint) of the presentation format.

As shown in Table 1, three of the seven areas on the CPS indicated statistically significant differences in the perceptions of effectiveness for

Table 1
Means, Standard Deviations, p-values, and Effect Sizes for Course Presentation Survey Responses

Category	*M*	*SD*	*p*	*η2*
1. Instructor's Knowledge of Subject Matter			.006*	0.13
Black and White Transparencies	1.04	0.189		
Color Transparencies	1.04	0.204		
PowerPoint	1.11	0.577		
2. Instructor's Knowledge of Technology			0.388	0.025
Black and White Transparencies	1.37	0.492		
Color Transparencies	1.91	0.75		
PowerPoint	1.37	0.688		
3. Clarity of Information Presented			0.185	0.044
Black and White Transparencies	1.04	0.189		
Color Transparencies	1.17	0.381		
PowerPoint	1.19	0.622		
4. Organization of Information Presented			.031*	0.088
Black and White Transparencies	1.04	0.192		
Color Transparencies	1.08	0.282		
PowerPoint	1.26	0.712		
5. Personal Interest in Information Presented			.001*	.161
Black and White Transparencies	1.07	0.262		
Color Transparencies	1.17	0.381		
PowerPoint	1.59	0.797		
6. Aesthetic Appeal of Presentation Format			.031*	.088
Black and White Transparencies	1.18	0.39		
Color Transparencies	1.6	0.675		
PowerPoint	1.59	0.844		
7. Overall Effectiveness of presentation			.126	.053
Black and White Transparencies	1.04	0.189		
Color Transparencies	1.29	0.464		
PowerPoint	1.3	0.775		

* Statistically significant at the .05 alpha level

the various modes of presentation. In regard to *Instructor's Knowledge of Technology*, students' responses indicated a statistical significantly higher perception of instructor's knowledge when black and white transparencies or PowerPoint was used (with equal mean values) than when color transparencies were used, F (2,73) = 5.44, p = .006. Student perceptions related to *Personal Interest in Information Presented*, F (2,76) = 7.29, p =. 001, and *Aesthetic Appeal of Presentation Format*, F (2,76) = 3.65, p = .031, were reportedly highest with the use of black and white transparencies and lowest with the use of PowerPoint.

Analysis of covariance, with self-reported GPA as the covariate, was used to analyze the participants' retention of subject matter, represented by quiz scores. These scores indicated a statistically significant difference between the presentation formats, F (2,71) = 5.816, p = .005, with the highest mean obtained by students receiving the color transparency presentation format and the lowest mean obtained by the group receiving the PowerPoint format of instruction (as shown in Table 2).

Findings from researchers' inductive analysis of participants' written comments regarding each item on the CPS are addressed below:

Participants who commented on *(1) Instructor's Knowledge of Subject Matter*, unanimously, and across all presentation format styles, perceived the instructor as "very informed" and possessing "appropriate" and "lots" of knowledge. A student in the PowerPoint presentation format group responded with a plea for more time to write down "examples and ideas that are verbally presented."

The *(2) Instructor's Knowledge of Technology* was met with responses addressing the preference for or against a presentation format more often than the intended response related to the knowledge of the instructor. Those who commented on instructor's "knowledge of technology" were in the black and white transparency group and stated that the instructor "uses the overhead projector very effectively." Comments relating to preference for a presentation format were mixed for the black and white and color transparency groups. One student in the black and white transparency group preferred the black and white transparencies because the color used in PowerPoint presentations hurt her eyes. Another student in this group commented that she was tired of PowerPoint because "most of the professors are using it" and the transparencies were a "change." The group receiving the PowerPoint format expressed no preference in the form of comments for this category.

The group receiving the black and white transparency presentation style commented on *(3) Clarity of Information Presented* more often than the other presentation format groups. "Very clear" and "easily understood" emerged as recurrent responses to this item by the group receiving the black and white transparency presentation style. In contrast, one student in the PowerPoint presentation format group suggested that "highlighting key words or concepts would help."

(4) Organization of Information Presented was met in all three presentation format groups

Table 2
Means and Standard Deviations for Quiz Scores

Presentation Format	*M*	*SD*
Black and White Transparencies	17.93	2.39
Color Transparencies	18.61	1.27
PowerPoint	16.4	2.94

with a few general and positive responses emphasizing instructor's preparedness. Typical responses included statements such as: "You are always very organized," and "Great."

The comments made for *(5) Personal Interest in Information Presented* indicated that at least some of the students interpreted this item to mean that they were measuring the *Instructor's* personal interest in the information presented. Students in the black and white and color transparency groups expressed that the instructor's ability to relate personal teaching experiences to information presented in class as well as relaying a sense of caring about the topics taught was apparent and beneficial. The students in the PowerPoint presentation format group made no comments related to this item.

(6) Aesthetic Appeal of Presentation Format elicited the following comments from two students in the color transparency group: "Some of the overheads seem old. The overheads are a little boring." and "Sometimes it gets a little boring. It maybe could be more hands on. I don't know." The only comment made by a PowerPoint group student was that "black on white is not soothing to the eye," and no related comments were made by those in the black and white transparency group.

In addition to general and positive comments from all presentation format groups, one student in the black and white transparency group responded to item *(7) Overall Effectiveness of Presentation*, with the following: "I like how you use the overhead. It makes note taking a lot easier and at the same time we learn!"

Discussion

Of the three statistically significant differences found among presentation formats in the items on the Course Presentation Survey, none included PowerPoint as being the format, above and beyond the others, perceived as the most positive. Mason and Hlynka (1998) listed the following disadvantages of using PowerPoint: (a) decreased ability to use proximity-based management strategies because presenter is confined to area that provides access to monitor and/or podium by remote, (b) spontaneity is minimized because slides cannot be easily omitted during presentation and points not already present cannot be easily discussed, (c) audiences' attention is focused on irrelevant technical dimensions, such as splashy backgrounds or animations rather than content, and (d) presentations are simplified by pre-formatted template choices that do not best represent all presentation material. In summary, Mason and Hlynka conclude that "PowerPoint's design and expected use adds to classrooms what there is already too much of: teacher-centered, pre-planned, lockstep delivery of information, primarily through words" (p. 43).

This lack of enthusiasm for PowerPoint is further supported by the objective quiz results for the participants in this study. The group receiving the PowerPoint format of instruction scored the lowest on the quiz, significantly lower than the group instructed with color transparencies. These findings are consistent with findings in a study by Amare (2006) where students receiving PowerPoint presentations were outscored by those receiving traditional lecture formats. The procedures sometimes followed with a PowerPoint presentation, i.e., dimming the lights, may facilitate lack of attentiveness and participation, therefore, reducing retention rates. Johnson and Sharp (2005) concludes that PowerPoint "has violated the social norms of a good educational classroom" (p. 6) by encouraging passivity, inhibiting spontaneity, promoting inactivity, and removing students' responsibility for learning.

Another possible drawback cited by Servage (2008) is "bullet-it is, which is "the tendency, in seemingly all facets of life, to seek out knowledge in its most abbreviated and rapidly consumable form" (p. 12). Craig and Amernic (2006) cautions that overuse of PowerPoint slides, which

are devoid of paragraphs, pronouns, punctuation, conjunctions, auxiliary verbs, and articles, have a profound negative impact on literacy. Parker (2001) alleges that PowerPoint has turned users into "bullet-point dandies" while Tufte (2003) criticizes the software for elevating form over content. Of chief concern to Servage is the possible effect this tendency, which is perpetuated by the presentation of professional development material presented using PowerPoint, may have on teachers' attempt to implement significant and lasting change in the classroom.

Maxwell (2007) concludes that PowerPoint is at its most effective when used to provide distinctive content that compliments oral lecture rather than as a bullet-point summary of a lecture, and advocates over-stimulation as preferable to boring repetition. In light of findings from Bartsch and Cobern (2003), the key for improved student performance may lie in ascertaining that PowerPoint material is in deed supplementary and pertinent as opposed to simply being extra or decorative.

It is interesting to note that the black and white transparency group reported the highest rating for aesthetic appeal of presentation, while the most negative qualitative comments regarding aesthetic appeal were made by members of the group exposed to color transparencies. Quantitative and qualitative results yielded such a mixture of responses, as does the literature, it is apparent that there is a need for further research.

It is recommended that his research be repeated to compare the use of basic PowerPoint slides to PowerPoint slides enhanced with audio clips (WAV), video clips (AVI and WMV) and animation created in Macromedia Flash might be worthy of exploration. It is also recommended that a repeated measures, counterbalanced design be used and the study be repeated in different semesters with varying course content to control for more extraneous variables.

While not investigated in this study, the attitude and benefit to university professors employing PowerPoint is a related topic worthy of exploration. Athanasopoulos (2004) found that the transfer of course material to PowerPoint slides increased one history professor's ability to deliver, explain, and deepen the meaning of complicated lessons. Building upon this research, it would be interesting to further examine participation in the process of creating a PowerPoint presentation on preservice teachers' retention of material, as well as their research skills and problem-solving transfer.

References

Ahmed, C. (1998). *Powerpoint versus traditional overheads: Which is more effective for learning?* Paper presented at the conference of the South Dakota Association for Health, Physical Education, and Recreation. Sioux Falls, SD (ERIC Document Reproduction Service No. ED429037)

Amare, N. (2006). To slideware or not to slideware: Students' experienced with PowerPoint vs. lecture. *Journal of Technical Writing and Communication, 36*(3), 297-308.

Athanasopoulos, E. (2004). The value of teaching history with technology: A professor's evolution. (Doctoral dissertation, Boston University, 2004). *Dissertation Abstracts International, 64*(10), 3578.

Bartsch, R. A., & Cobern, K. M. (2003). Effectiveness of PowerPoint presentations in lectures. *Computers and Education, 41*, 77-86.

Craig, R. J., & Amernic, J. H. (2006). PowerPoint presentation technology and the dynamics of teaching. *Innovations in Higher Education, 31*, 147-160.

Heinich, R., Molenda, M., Russell, J. D., & Smaldino, S. E. (1999). *Instructional media and technologies for learning* (6th ed.). NJ: Prentice-Hall.

Johnson, K., & Sharp, V. (2005, November). Is PowerPoint crippling our students? *Learning & Leading with Technology, 33*(3), 6-8.

Ljungdahl, R. T. (2000). Technology integration in the teacher preparation program and public schools in Sam Houston Center for Professional Development and Educational Partnerships at Sam Houston State University. (Doctoral dissertation, Sam Houston State University, 2000). *Dissertation Abstracst International, 61*(8), 3133.

Mason, R., & Hlynka, D. (1998). 'PowerPoint' in the classroom: Where is the power? *Educational Technology, 38*(5), 42-48.

Maxwell, A. (2007). Ban the bullet-point! Content-based PowerPoint for historians. *The History Teacher, 41*(1), 39-54.

Parker, I. (2001, May 28). Absolute PowerPoint. *The New Yorker, 77*(13), 76-87. Retrieved October 15, 2008, from http://www.physics.ohio-state.edu/~wilkins/group/powerpt.html

Pedras, M. J., & Horton, J. (1996). Using technology to enhance teacher preparation. Paper presented at the annual meeting of the Northwest Association of Teacher Educators. Coer d'Arlene, ID. (ERIC Document Reproduction / Service No. ED395929)

Peterson, E. F. (2005). Using Power Point technology to enhance learning opportunities for high school math students: A case study on the perspective and opinions of administrators, teachers, and students at a suburban high school (Masters thesis, Pacific Lutheran University, Tacoma, WA, 2005). *Masters Abstracts International, 44*(3).

Servage, L. (2008). Bullet-tis (or what's wrong with a quick fix?). *Education Canada, 48*(2), 12-14, 16.

Simons, T. (2005). Does PowerPoint make you stupid? *Presentations 18*(3), Retrieved October 15, 2008, from http://www.sociable-media.com/PDF/press_presentations_magazine_03_01_04.pdf

Stafford, D. J. (1997). Powerpointing the way. *Technology Connection, 4*(1), 16-17.

Szabo, A., & Hastings, N. (2000). Using IT in the undergraduate classroom: Should we replace the blackboard with PowerPoint? *Computers & Education, 35*, 175-187.

Thompkins, G. (2005). Language arts: Content and teaching strategies (6th ed.). Merrill Prentice - Hall.

Tufte, E. R. (2003, September).PowerPoint is evil. *Wired*. Retrieved October 15, 2008, from http://www.wired.com/wired/archive/11.09/ppt2.html

Yoa, J. E., Ouyang, J. R., & Wang, H. (2000). A farewell to the traditional instructional media and technologies in the new millennium. Paper presented at the Eleventh Annual Conference of the Society for Information Technology and Teacher Education. San Diego, CA. (ERIC Document Reproduction Service No. ED 444466)

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Color Transparencies	1.91	.750		
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*Statistically significant at the .05 alpha level