Using Visuals Effectively in the
Distance Education Classroom

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Abstract

The purpose of this study was to evaluate the effectiveness of visuals and their components presented through a television monitor in the distance education classroom. As a means of accomplishing the purpose of the study, answers to the following questions were sought: (a) What are the demographic variables of the participants in the study? (b) What are the most appropriate color combinations for effective presentations for graphics utilizing distance education equipment? (c) What are the most appropriate types of fonts for effective presentations for graphics utilizing distance education equipment? (d) What are the most appropriate font sizes for effective presentations for graphics utilizing distance education equipment? (e) What are the most appropriate styles of emphasis for effective presentations for graphics utilizing distance education equipment? (f) Are there differences in preferences of color combinations, fonts and font sizes according to selected demographic variables?

The design for this study was survey research. Participants were asked to rate different color combinations, font types, font sizes and styles of emphasis according to their personal preference.

This study found that contrasting color combinations are essential to presentation formatting. The most preferred color combination was violet background/white text. The color preferred most for text was white. Sans-serif fonts are more desirable than serif fonts. The most preferred font size was 54. Distance or visual impairments had no significant relationship with color combination preferences, preferences for font style or styles of emphasis.

Introduction/Theoretical Framework

Americans have come to rely on technology for entertainment, communications, and to accomplish other daily tasks (Coldeway, 1988). Technology in telecommunications has been embedded into the routines of our lives at home and work over the last several years. Most recently, the use and application of telecommunication technology has found its way to our educational system (Valore & Diehl, 1987). Traditional education has become infused with technology and therefore, methods of education have greatly changed. Common words such as pencil, blackboard, and textbook are being replaced with words such as satellite uplink and downlink, laser disk, electronic library, Internet, telecourses and interactive video (Slama, 1995). This relatively new phenomenon, referred to as distance education, has greatly increased the possibilities for providing and accessing instruction (Wolcott, 1995).

Distance education takes place when the instructor and student are separated and the instructional gap is bridged by technology (i.e., voice, video, satellite, and print) (Willis, 1993). The gap that separates the instructor and the students at the remote site poses special challenges and responsibilities to the instructor. The instructor must develop an understanding for: (1) the needs of distant learners with limited or no face-to-face contact; (2) the delivery system technology; (3) how to function as a facilitator; and (4) course content material (Gottschalk, 1996).

The aim of distance education is to deliver instruction in places and times convenient to the learners instead of the instructor or the teaching institution (Moore & Kearsley, 1996). Through offering distance education courses, colleges and universities are given the opportunity to extend the institution's educational offerings, add consistency to curriculums by allowing students from many campuses to take courses from the best teachers, and reduce time and expenses in student and instructor transportation (LeBaron & Bragg, 1994). With all the opportunities to be gained, Wolcott (1995) claimed that, "it is increasingly likely that a college professor will be responsible for teaching in a distance education program" (p. 39).

Bischoff et. al (1996) stated the delivery method used for distance education is increasingly the use of interactive television technology. The technology used in distance education serves to enhance courses and their educational value (The Center for Distance Learning Research-Texas A&M, 1996). The Center for Distance Learning Research at Texas A&M (1996) suggested instructors should understand the capabilities and limitations of the technology. The center also commented that instructors' abilities to teach may be more valued through distance education classes since a broader audience is reached from a variety of places. Therefore it is important that graphics be modified or redesigned for maximum effectiveness over television monitors. Cyrs and Conway (1997) stated that existing lecture-based courses

which are taught over television without the teaching methods being modified or adjusted result in a "talking head" telecourse.

There has been limited research devoted to determine what makes effective visuals in the distance education classroom. The increase in technology changes the problem from being able to find a way to deliver necessary materials, to finding good quality materials to deliver (Moore & Kearsley, 1996). If educators can communicate concepts in a variety of delivery methods, instead of predominately text, chances will increase that a greater number of students will be able to comprehend and retain information (Sethi, 1998).

Statement of the Problem

Despite widespread agreement about the need to incorporate visuals into the distance education classroom, there is controversy concerning the most effective color combinations, font type and size, and styles for emphasis. Experts have suggested the best color combinations, fonts, type size and styles to use for effective visuals in the classroom. However, the suggestions have contradictory information.

The literature also emphasized the importance of using effective visual components to enhance learning in distance education. The problem of this study was dissenting guidance in the designing of visual components to enhance the dissemination of information in the distance education classroom. The purpose of this study was to evaluate the effectiveness of visuals and their components presented through a television monitor in the distance education classroom.

Questions To Be Answered

In order to accomplish the purpose of this study, the following questions were formulated:

1. What are the demographic variables of the participants in the study in regard to the following variables: (a) distance seated from the television monitors; (b) gender; (c) size of hometown; (d) level of computer literacy; (e) access and utilization of the Internet and/or World Wide Web; (f) amount of television watched daily; and (g) visual impairments?

2. What are the most appropriate color combinations for effective presentations for graphics utilizing distance education equipment?

3. What are the most appropriate types of fonts for effective presentations for graphics utilizing distance education equipment?

4. What are the most appropriate font sizes for effective presentations for graphics utilizing distance education equipment?

5. What are the most appropriate styles of emphasis for effective presentations for graphics utilizing distance education equipment?

6. Are there differences in preferences of color combinations, fonts and font sizes according to selected demographic variables?

Significance

There is an ever-increasing likeliness that more colleges and universities will be adopting distance education programs and more college professors and students will be directly involved in distance learning. Therefore, it is important to research the effectiveness of visuals in these courses, since there has been little research done to identify the needs of visuals to enhance presentations.

Limitations

There were limitations of this study, which should be considered in the interpretation of the findings. First, the sample of this study was limited to the population of graduate and undergraduate students at a selected university, cooperating high school agricultural science teachers and participants of orientation activities who were present at the selected university during the 1998 summer sessions. Second, the study was further limited to those graduate and undergraduate students at the selected university, cooperating agriscience teachers and participants of orientation activities who voluntarily participated in the focus group activity.

Another limitation of the study was the variance in color adjustment levels and size of the television monitors. This must be taken into account when interpreting the data on color combinations. The monitors used in the study were 32" Sony televisions. Also, the statements used on the slides were kept short and this could be a limitation in making determinations of the best font sizes to use.

Methodology

Design

The design for this study was survey research, which was used to determine preferences of participants. Demographic information was collected from each participant concerning the distance seated from the television monitors, gender, size of hometown, level of computer literacy, access and utilization of the Internet and/or World Wide Web, amount of television watched daily, and visual impairments. In addition to the demographic information, participants were asked to rate different color combinations, font types, font sizes and styles of emphasis according to their personal preference.

Procedure

        The distance from the television monitors to each chair was measured and recorded. The distance was measured from an estimated eye level, for each person seated in each chair, to the middle of the screen on the monitors. The chairs were labeled with numbers so each participant could be tracked for distance from the monitors. The participants were asked to put their chair number on the demographic information of the survey.

        A series of two-color color combinations were shown to the participants, and they were asked to place a value from one to ten (one = no appeal, ten = high appeal) for each combination. The color combinations were chosen from previous research conducted by Pettersson (1989). The researcher's study listed colors in rank order of preference for both the background and text, and combinations were derived from those results. The colors used were the default colors on the Microsoft Power Point program. Participants were also asked to choose which font types (serif or sans serif) were most readable to them. Types of font selected came from research by Johnson (1996), The Center for Distance Learning Research (1996), and Bankerd (1997). In this study, seven slides were presented with two statements in different font types. Participants chose which font type was most readable. They were also asked to place values on font sizes. There is some conflicting previous research on the size of font that is acceptable. Gibson and Mata (1992) stated point size should be no smaller than 26, while Bankerd (1997) suggested size could go as low as 24 point. For the purpose of this study, font sizes went as low as 18 point and as high as 66 point. Participants also chose the type style, which was most effective for showing emphasis. The styles of emphasis used were italics, underline, shadow, bold, and combinations of these styles.

Population

        The population consisted of volunteers and included high school agricultural science teachers, current students of the selected university (both undergraduate and graduate), incoming freshman students and their parents. This sample of participants was used to enhance the range of the demographic variables, since the distance education classroom will be used by traditional and non-traditional audiences. The sample consisted of one hundred participants.

Instrumentation

        The instrument used to measure the viewers' appeal to color combinations and type styles was a researcher-designed survey consisting of five sections. Participants were asked to watch a series of Power Point slides and answer questions regarding the slides.

        The first section of the questionnaire was used to obtain information regarding demographics. The second part of the questionnaire was fifteen sets consisting of four two-color combinations. Participants were asked to assign values to each combination, using a Likert-type rating scale from one to ten according to the level of appeal, (one = no appeal, ten = most appealing). There were a total of 60 color combination slides to be evaluated, however there were only 34 different color combinations. Combinations were repeated as a means of enhancing reliability. The third section of the questionnaire was designed to determine the viewers' preferences between serif and sans serif fonts.   Participants were shown seven slides, each

having the same statement in two font types. Participants were asked to select the most appealing type of print.

The fourth section measured the size of print on a Likert-type scale, (1 = not readable, 10 = very easy to read). The section consisted of twelve questions. The size of the print ranged from 18 point to 66 point. The fifth section was designed to determine preferences of type styles for emphasis on important phrases or key words. Participants simply placed an "X" in the appropriate space for the emphasis style they preferred. There were four sets of three styles.

Setting
The classroom used for the survey was the distance education classroom at a selected college of agricultural sciences. The classroom seats 39 students. The individual seats were numbered to measure the distance from the center of the two 32" Sony television monitors at the front of the classroom. The lighting in the room remained at the same setting for every group so lighting would be consistent. The dimmable fluorescent overhead lights were at one hundred percent intensity. The overhead track lights were turned off, and the wall sconces were turned 20 percent intensity. There are no outside windows in the classroom to affect the lighting.

Collection of Data
Data collection began June 15, 1998, using the researcher-designed questionnaire. To increase participation in the study, willing participants received pencils as suggested by Dillman's Total Design Method (1978). Participants were given a survey with a cover which thanked them for participating, briefly described the intentions of the study, and asked them to answer spontaneously, keeping their answers to themselves. Data collection was completed on August 12, 1998.

Data Analysis
Survey instrument responses were coded and entered into a computer file for analysis. Statistical analyses of the data files were completed using SPSS. Descriptive statistics were used to summarize the data pertaining to demographic variables and preferences to color combinations, font style and size, and styles of emphasis.

In order to determine if there was a relationship between the participants' demographic variables and their preferences to color combinations, font types and sizes, and styles of emphasis, an analysis of variance test was performed using the .01 level of significance for variables to enter the equation. Although the a priori level of significance for the study was .05, it was reduced to .01 in order to control for the experimental-wise Type I error which might occur as the result of conducting repeated tests of significance. Post hoc analysis was conducted using the Duncan multiple range test. Pearson's product moment coefficients and their resulting probability levels were calculated to determine if significant differences occurred between the variables of age and distance from the monitors and preference for color, font type, font size, and

style of emphasis. As a means of measuring reliability, color combinations were repeated in sets. Pearson's product moment coefficients and their resulting probability levels were calculated to determine if significant differences occurred between repeating sets of color combinations. Significant correlations were found between the duplicated sets except for one color combination violet background/white text).

Results/Conclusions

The following results and conclusions are based on data collected through the focus group sessions.

Characteristics of Participants

The majority of participants were seated 20' or closer to the monitors at the front of the room. The most common seating range was 18'1" to 20' where 17% of participants chose to sit, 40% of the participants chose to sit 20'1" to 30' away from the monitors, 33% sat from the less than 10' range to 18' from the monitors and 10% of participants sat over 30' from the monitors.

The majority of participants (67%) were male. The age of the participants ranged from under 20 years to 50 and over. The majority (33%) were ages 20-24. The next largest age group was 45-49. Most of the participants (47%) came from a small town with a population of 500 to 4,999 people.

The majority of participants (48.4%) perceived themselves as somewhat computer literate and 84.7% reported having access to the Internet or World Wide Web. Thirty-two percent of participants utilized the Internet or World Wide Web weekly. Participants were also asked to indicate the amount of television they watched daily. The majority of participants (64.3%) watched one to two hours daily.

Fifty-seven percent of the participants possessed a visual impairment of some kind. The most common type of impairment among those participants was near-sightedness (39%), followed by far-sightedness (10%). Forty-three percent of the participants did not possess a visual impairment of any kind.

Preference of Color Combinations

Only those color combinations with ratings of 5.0 and higher were deemed acceptable. The color preferred most for text was white and yellow was the second highest preference. White text was in the top four-color combination selections preferred. The top four preferred color combinations, with ratings of 7.0 and up, were violet background/white text, green background/white text, black background/white text, and black background/yellow text. Those combinations with ratings of 6.0 to 7.0 were white background/black text, yellow background/blue text, white background/blue text, yellow background/black text, green background/yellow text, yellow background/red text, white background/green text, blue background/yellow text, black background/green text, and blue background/white text. The color combinations rated below 6.0 but still accepted at above 5.0 were white background/red

text, and orange background/black text. The color combination with the lowest rating was yellow background/white text with a rating of 1.0.

Preferences of Font Sizes

There was a negative correlation between the rating of the font size with distance seated from the monitor. In most instances, except the extremes (18 point font size and 66 point font size), the participants further from the screens rated the font sizes lower. The most preferred size of font was 54. Font sizes larger than 54 began to decrease in scores as font size increased. Only those sizes with scores of 5.0 or higher were deemed acceptable. Font size 36 was the lowest scoring size still over 5.0, with a score of 6.43.

In every instance except one, sans-serif fonts were preferred over serif fonts. The fonts compared were: (1) Helvetica (97%)/Times (3%); (2) Palatino (13%)/Arial (87%); (3) Chicago (36%)/Bookman (64%); (4) New York (46%)/Arial (54%); (5) Helvetica (71%)/Century Schoolbook (29%); (6) Times (8%)/Gills Sans Condensed Bold (92%); and (7) Avante Garde (68%)/Book Antiqua (32%). The only time a serif font was preferred over a sans-serif font was in the third group where Bookman was preferred over Chicago. This finding concurs with previous research sited (Johnson, 1996; Bankerd, 1997; and the Center for Distance Learning Research, 1996) that sans-serif fonts are easier to read and generally preferred over serif fonts.

Styles of Emphasis

A combination of styles allows for better emphasis on important phrases and key words. The majority of participants chose a combination of two styles for emphasis in every instance where they were asked to choose between two styles of emphasis and a combination of the two.

Differences in preferences of color combinations, fonts, font sizes, and styles of emphasis according to selected demographic variables

Distance had no significant relationship with color combination preferences, preferences for font style or styles of emphasis. There was a significant relationship between the distance seated from the monitors and the size of font preferred. As distance increased, the preference to font sizes decreased. There was also a significant relationship between color combinations and age. There was a negative correlation between three of the color combinations and age (as age increased, preference for these color combinations decreased). The combinations were repeated in the survey to ensure reliability and the negative correlations appeared each time. No other demographic variables were significant in other preferences. When testing for reliability between the repeated color combinations, significant correlations were found between the duplicated sets except for one color combination (violet background/white text).

Recommendations

As a result of the findings of this study, the following recommendations are made:

1. Specific color combinations recommended are the top four preferred in the study: Violet background/white text; green background/white text; black background/white text; and black background/yellow text. Dark colors are recommended for background use with contrasting light colors for text. White or yellow are recommended for text.

2. Sans-serif fonts are recommended for text over serif fonts.

3. The recommended font sizes to be used are 40-48. Font size should not exceed 54 or be less than 36.

4. When emphasizing words or key phrases in the text, it is recommended that a combination of two styles of emphasis be used.

The following is a list of recommendations for future studies related to this study:

1. Further research should be conducted with color combinations being transmitted through the interactive compressed video system to determine if preferences remain the same after being delivered to a remote site.

2. Research should be conducted to determine the amount of text acceptable for monitors.

3. Because overheads are also utilized in the distance education classroom, a similar study should be conducted for determining what is most effective when overheads are presented using a document camera. A study should also be conducted to find if there is a difference in the effectiveness of overheads as compared to graphics seen on the television monitors.

4. The level of lighting in the classroom is an issue since darkness makes the slides and overheads easier to read and see, but makes note-taking more difficult. A future study should be done to determine the best level of lighting to utilize in the classroom.

5. The test should be repeated for the violet background/white text color combination since it was rated first in preference and was the only combination that did not show a significant correlation between the duplicate set.

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