THE EFFECTS OF WORLD WIDE WEB INSTRUCTION AND TRADITIONAL INSTRUCTION AND LEARNING STYLES ON ACHIEVEMENT AND CHANGES IN STUDENT ATTITUDES IN A TECHNICAL WRITING IN AN AGRICOMMUNICATION COURSE

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Abstract

The *purpose of this experimental study was to determine the effects of types of instruction and learning styles in a three-credit hour, technical writing in an agricommunication course on their achievement and attitudes towards writing, learning about writing, computers and the Internet. The two methods of instruction were traditional instruction without a laboratory and World Wide Web instruction with a laboratory. Two applications questions on the midterm examination and the major class project were used to measure students' achievement. To measure the attitudes of the students, a semantic differenctial instrument was developed. The Group Embedded Figures Test (GEFT) was used to determine preferred learning styles. Significant differences were found to exist between type of instruction for both achievement and attitudes. WWW-dependent instruction was significantly higher for group means on achievement. The WWW-dependent class also had a higher mean gain for attitude toward writing. No significant difference was found between learning style groups on achievement and attitudes. There was no significant interaction effect between type of instruction and learning style on achievement or attitudes.*

Introduction

The use of educational technologies such as computers and telecommunications offers great potential for improving the delivery of already high quality instructional programs (McCaslin & Torres, 1992). "The Internet and in particular the World Wide Web (WWW) promise to be some of the most powerful classroom tools available," (NVATA, 1995). A multimedia/ hypermedia part of the Internet, the WWW brings a graphical user interface to world wide networking by allowing full integration of color graphics, text of varying typefaces, animation, video, and sound (Seguin & Seguin, 1995). The WWW can be viewed with browser programs such as Netscape Navigator (NVATA, 1995). The main feature these browsers provide is a user-friendly approach to using the WWW with a simple point and click of the mouse.

According to Marrison and Frick (1994), "Multimedia is a multi-faceted approach to computer-based education that brings together text, animation, graphics, video, and audio" (p. 26). Hypermedia is the next generation of multimedia. Liu and Reed (1994) identified four advantages of hypermedia: non-linearness, associatively, flexibility, and efficiency. Hypermedia-based instruction differs from traditional instruction, because there is no specific sequence for proceeding from one point to another (Liu & Reed, 1994). Because of this capacity and the ability to present information through text, graphics, audio, and video, hypermedia holds much potential for optimizing learning (Liu & Reed, 1994).

Numerous universities throughout the country have on-line classes, with the number of hypermedia-based course materials and lessons being placed on home pages increasing (Raven & Settle, 1995). These classes provide students with a supplement to the classroom experience in the form of a class Web site. Students are able to access assignments, reading materials, quizzes, videos, graphics, audio, slide presentations, and other useful information.

Mississippi State University's Department of Agricultural Education and Experimental Statistics currently has nine classes with on-line resources. Each course uses the WWW differently for instruction. Of the nine courses on-line, only one is classified as "Web-dependent", AEE 3203 - Technical Writing in Agricommunication (Oregon State University, 1996). This technical writing course is similar in content to the writing courses taught by agricultural education departments at other universities (e.g., University of Florida, Oklahoma State University).

Numerous agricultural disciplines currently offer courses via the WWW. However, because the WWW is such a new medium, little information exists on the effectiveness of courses taught using the Web. Some possible benefits include improving students' computer abilities and information processing abilities, providing students with teachers' lecture materials, and providing students with links to related information so they can study the subject matter in more depth (Newman, Raven, & Day, 1995).

Student Achievement and Attitudes

In a study of computer-aided learning using the WWW, Goldberg (1996) found that students who were taught using traditional lecture and the WWW performed better than two other groups who were taught with either traditional lecture or the WWW. In an experimental study of computer-assisted instruction in mathematics, Ganguli (1992) found that the CAI instruction group experienced higher enjoyment, more motivation, and better understanding of the concepts in the course. In a college chemistry course, subjects taught using a computer simulation scored better than students taught using the traditional lecture method and the learning cycle method (Jackman, Moellenberg, & Brabson, 1987).

Researchers have differed in their findings, however, when studying student attitudes toward the computer as an instructional tool. Some researchers have found that giving students the opportunity to use computers in instruction increases their attitudes toward using the computer (Kinzie, Delcourt, & Powers, 1994; Busch, 1995). Other researchers have concluded that students' attitudes may either increase or decrease with more experience (Weil, Rosen, & Wugalter, 1990; Campbell & Williams, 1990).

Learning Styles

Numerous studies in agricultural education have used the Group Embedded Figures Test (GEFT) to measure learning styles. However, except for a few, most of the learning styles research conducted in agricultural education has been explorative and has not considered the impact of students' learning styles on teaching and learning. Marrison and Frick (1994) determined that learning styles had no significant effect on students' overall achievement or students' perceptions of lecture versus multimedia instruction. Cano, Garton, and Raven (1992) determined that a positive, statistically significant relationship existed between learning styles and performance in a Methods of Teaching Agriculture course. Cano and Garton (1994) found that learning styles had an effect on microteaching scores and final grades in a methods course.

Studying learning styles is not a new concept

to agricultural education; however, the use of the WWW is a new concept in the discipline. Studies in Australia and British Columbia have looked at the WWW as an instructional tool. However, the researchers found no WWW research in agricultural education.

Statement of the Problem

The purpose of this study was to determine the effects of Web-dependent instruction on student achievement and attitudes in technical writing in agricommunication course, while also considering the effects of learning style and the interaction of learning style and method of instruction. The following null hypotheses were tested at the two-tailed ***a priori*** level of. 05 :

H_O^1: For students in AEE 3203 - Technical Writing in Agricommunication there will be no difference in group means between students taught using Web-dependent instruction with a laboratory and those taught using traditional instruction on selected assignments.

H_O^2: For students in AEE 3203 - Technical Writing in Agricommunication there will be no difference in group means between students who are field-independent according to the Group Embedded Figures Test and those who are field-dependent on selected assignments.

H_O^3: There will be no interaction observed between learning style and method of instruction when means for subject subgroups are compared on selected assignments.

H_O^4: For students in AEE 3203 - Technical Writing in Agricommunication there will be no difference in group mean increases on selected attitude scales between students taught using Web-dependent instruction with a laboratory and those taught using traditional instruction.

H_O^5: For Students in AEE 3203 - Technical Writing in Agricommunication there will be no difference in group mean increases on selected attitude scales between students who are field-independent according to the Group Embedded Figures Test and those who are field-dependent.

H_O^6: There will be no interaction observed between learning style and method of instruction when mean increases on selected attitude scales for subject subgroups are compared.

Methodology

Research Design. To determine the effects of method of instruction on students' achievement, a posttest-only experimental design was used. To determine the change in student attitudes, a pretest-posttest experimental design was used.

Population & Samolinq. The population of the study consisted of 58 undergraduate students at Mississippi State University enrolled in AEE 3203, Technical Writing in Agricommunication during Fall semester, 1995. AEE 3203 is a technical writing course for juniors and seniors in the College of Agriculture and Life Sciences. Although class size is typically limited to 28

students, 58 students were allowed to register for Section 2 of the class. Prior to the first day of class, students were randomly assigned to one of two groups, A or B. The treatment level was then randomly assigned to the groups. Group A was assigned to the traditional course. Group B was the WWW course. Each group had 29 students. One student from Group B withdrew from the university during the semester.

Description of Treatments. Students in Group A received a traditional, 3-credit-hour course. Students attended class three times per week for 50 minutes each class session. Students purchased a textbook and a course packet of handout materials. The chalkboard and overhead transparencies were primarily used in instruction. Each student completed seven major assignments for the class: a review of a journal article, a memorandum, a business letter, a letter of application, a press release, a technical report, and an oral presentation about the technical report. Midterm and final examinations also were given.

Students in Group B participated in a "Web-dependent class" (Oregon State University, 1996). Students in this class attended two 50-minute class sessions each week (on Monday and Wednesday) and one 50-minute laboratory each week (on Friday). Computer-generated slides using a computer, overhead projector, and LCD display panel were the primary media used for instruction. The laboratory activities consisted of assignments based on each week's class sessions that the students completed in a computer laboratory under the supervision of the course instructor. Students could turn in these assignments using electronic mail. Students were required to purchase the course textbook but not the handout materials, which were located on the WWW. All supplemental course materials, including regular and laboratory assignments, were provided on the AEE 3203 Web site. In addition, all of the computer-generated slides used in the class sessions were available to students via the AEE 3203 Web site. Students were required to complete the same seven major assignments as Group A. They also took the same midterm and final examination.

Instrumentation. Two application questions on the midterm examination were used as one measure of students' achievement. Six instructors who teach different sections of the course developed the questions. One question involved writing a memorandum. The other involved editing a business letter. Content validity of the measurement is assumed because the two questions reflected the overall objectives of the course. The midterm examinations were pooled and graded by a graduate assistant to control for inter-rater reliability and experimenter effect. The researchers provided a scoring key to the graduate assistant.

The other measure of student achievement was the major class project, a technical report. Three evaluators, using a standardized rating scale that incorporated the criteria presented in class and in the text, graded each technical report. The graduate assistant graded 10 technical reports from each class to determine inter-rater reliability. For Group B, the Web-dependent course, the graduate assistant and instructor had an inter-rater reliability above 95% (within plus/minus 5%). Therefore, the instructor's grades were used. For Group A, the traditional class, the graduate assistant and instructor had a low inter-rater reliability of below 70%. Therefore, the researcher re-graded all of the technical reports for Group A.

To measure the attitudes of the students toward computers, writing, the Internet, and learning about writing, semantic differential instruments were developed. Each instrument contained 10 sets of bipolar adjectives with a seven-space scale in between for students to indicate where their feelings existed. All four instruments contained the same 10 sets of adjectives. Reliability estimates for the semantic

differential instruments were obtained through the use of a pilot test during a Summer 1995 session of AEE 3203. Obtained reliability estimates were as follows: computers-.96, writing-.8 1, the Internet-.84, and learning about writing-.87. Although the groups were assigned randomly, group sizes was a concern (N = 57). Therefore, student attitudes were measured on the first day of class and the last day of class, with gain scores used as the dependent variables for hypotheses 4, 5 and 6.

The Group Embedded Figures Test (GEFT) was used to determine preferred learning styles, either as field-dependent or field-independent. Individuals scoring greater than the national mean (11.4) were classified as field-independent learners, while those scoring less than the national mean were considered to a prefer field-dependent learning style (Witkin et al., 1971). Internal consistency was measured by treating each scored section (sections two and three) as spilt halves. Witkin et al. (1971) reported a Spearman-Brown reliability coefficient of .82 on the GEFT.

Statistical Analysis.. For the purpose of statistical analysis, the researchers treated the students in the study as a sample of possible students who might enroll in the course (Allen, Abaye, McKenna, & Camp, 1995). Based on this approach, inferential statistics were used in the analysis. To reduce the family-wise error rate for the null hypotheses, a multivariate analysis of variance was used to determine if the students were different based on teaching method and learning style (Hair, Anderson, & Tatham, 1987).

Findings

Effects of Method of Instruction and Learning Style on Achievement

To avoid having a large family-wise error rate, null hypotheses 1, 2, and 3 were tested using a factorial MANOVA. Table 1 contains a summary of the MANOVA. Follow-up analyses were conducted where a significance was found.

Test of Null Hvoothesis 1. The first null hypothesis, that of no significant difference between type of instruction on students' achievement, was tested using multivariate analysis of variance (MANOVA). The MANOVA yielded a Wilks' lambda of .73 1 for an F(1,50) = 8.841 which was significant at the two-tailed *apriori* alpha level of .05 ($p \leq ,001$). The results from the MANOVA are given in Table 1. Table 2 contains the mean for each class on the midterm examination and technical report. Group A, the traditional group, had a mean of 27.54 out of a possible 50.00 on the two questions of the midterm. Group B, the WWW group, had a mean of 30.81. On the technical report, Group A had a mean of 184.79 out of a possible 250.00. Group B had a mean of 212.08.

Univariate F-tests revealed differences between the two groups on the two dependent variables. The results of the tests are given in Table 3. Means for the groups on the two dependent variables given in Table 2 show that the Group B, the WWW group, scored higher on both dependent variables. The null hypothesis

Table 1. Summary of MANOVA Analysis for Achievement (n=53)

Variable	df	Wilks' Lambda	F	E!
Type-of Instruction	1	.73 1	8.841	,001
Learning Style	1	.951	1.237	.299
Interaction	1	.998	0.005	.995

Table 2.. Group Means of Midterm Examination and Technical Report by Tvpe of Instruction

Group	Mean Midterm	n	SD	Mean Technical Report	n	SD
A - Traditional	27.54	28	5.29	184.79	28	21.40
B - World Wide Web	30.81	27	6.72	212.08	26	26.85
Total	**29.15**	**55**	**6.20**	**197.93**	**54**	**27.62**

Table 3. Summary of Univariate F Tests from the MANOVA Analvsis for Section

	Hypothesis MS	Error MS	F	p
Midterm Exam	266.13	25.21	10.56	.002
Technical Report	9446.72	602.76	15.67	<.001

was rejected and the research hypothesis was retained.

Test of Null Hypothesis 2. The second null hypothesis, that of no significant difference between learning style and achievement, was tested using multivariate analysis of variance (MANOVA). The MANOVA yielded a Wilks' lambda of ,951 for an approximate F(1,50) = 1.237 which was not significant at the two-tailed *a priori* alpha level of .05 (p = .299). The results from the MANOVA are given in Table 1. Therefore, the null hypothesis was retained. Table 4 contains the means for each class on the midterm exam and technical report. Group A, field-independent, had a mean of 30.12 out of a possible 50.00 on the two questions of the midterm. Group B, field-dependent, had a mean of 29.10. On the technical report, Group A had a mean of 193.96 out of a possible 250.00. Group B had a mean of 200.43.

Test of Null Hypothesis 3. The third null hypothesis, that of no interaction between type of instruction and learning style on achievement, was tested using multivariate analysis of variance (MANOVA). The MANOVA yielded a Wilks' lambda of .998 for an approximate F(1,50) = .995 which was not significant at the two-tailed *a priori* alpha level of .05 (p = ,995). The results from the MANOVA are given in Table 1. Therefore, the null hypothesis was retained. Group means by type of instruction are given in Table 2. Table 4 supplies the group means by learning style.

Effects of Method of Instruction and Learning Style on Attitudes

To avoid a large family-wise error rate, null hypotheses 4, 5, and 6 were tested using a factorial MANOVA Table 5 contains a summary of the MANOVA. Follow up analyses were conducted where a significance was found.Test of Null Hypothesis 4. The fourth null hypothesis, that of no significant difference among type of instruction and attitudes toward computers, learning about writing, the Internet, and writing, was tested using multivariate analysis of variance (MANOVA). The MANOVA revealed a statistically significant difference between the two groups. The MANOVA yielded a Wilks' lambda of .793 for an approximate F(1,50) = 3.06 which was significant at the two-tailed ***a priori*** alpha level of .05 ($p \leq ,025$). Therefore, the null hypothesis was rejected. The results from the MANOVA are given in Table 5. For the attitude scales of learning about writing, the Internet, and writing, the WWW group had a higher mean gain than

Table 4. Group Means of Midterm Examination and Technical Report by Learning Style

Group	Mean Midterm	n	SD	Mean Technical Report	n	SD
A - Field-independent	**30.12**	**25**	**4.94**	**193.96**	**25**	**30.98**
B - Field-dependent	29.10	29	5.78	200.43	28	24.33
Total	**29.57**	**54**	**5.38**	**197.38**	**53**	**27.59**

Table 5. Summary of MANOVA Analysis for Attitudes (n=53)

Variable	df	Wilks' Lambda	F	p
Type of Instruction	1	,793	3.06	.025
Learning Style	1	.991	0.10	.981
Interaction	1	.883	1.54	.205

the traditional group. The traditional group had a higher mean gain on attitude scale of computers. Table 6 contains a summary of the mean gains. Univariate F-tests revealed that the group means for one scale, writing, were significantly different. The results of the tests are given in Table 7.

Test of Null Hypothesis 5. The fifth null hypothesis, that of no significant difference between learning style and attitudes was tested using multivariate analysis of variance (MANOVA). The MANOVA yielded a Wilk's lambda of ,991 for an approximate F(1, 50) = .102 which was not significant at the two-tailed *a priori* alpha level of .05 (p = .981). The results from the MANOVA are given in Table 5. Therefore, the null hypothesis was retained and the research hypothesis was rejected. Table 8 contains the means for learning style on each attitude scale. Group A, field-independent, had higher mean gains on the scales of computers and the Internet. Group B, field-dependent, had higher group mean gains on the scales of learning about writing and writing.

Test of Null Hypothesis 6. The sixth null hypothesis, that of no interaction between type of instruction and learning style on the attitude scales on computers, learning about writing, the Internet, and writing was tested using multivariate analysis of variance (MANOVA). The MANOVA yielded a Wilks' lambda of .883 for an approximate $F(1, 50) = 1.54$ which was not significant at the *two-tailed a priori* alpha level of .05 (p = ,205). The results from the MANOVA are given in Table 5. Therefore, the null hypothesis was retained and the research hypothesis was rejected. Group means by type of instruction are given in Table 6. Table 8 supplies the group means by learning style.

Conclusions and Recommendations

Conclusions

The following conclusions are drawn from the findings of the study:

1. Students who were taught using the WWW with a laboratory achieved at a higher level than those students who were taught using the traditional classroom approach. This corroborates findings of Liu and Reed (1994).

2. Using the combination of WWW-dependent instruction with a practical laboratory was a better method of teaching students technical writing than

Table 6. Means of Attitudes for Computers, Learning about Writing, Internet, and Writing by Type of Instruction (n=52)

	Pretest	Posttest	Gain
Computer			
A - Traditional	48.33	48.92	.59
B - World Wide Web	**50.40**	**49.80**	**-.60**
Learning about Writing			
A - Traditional	47.67	46.67	-1.00
B - World Wide Web	46.16	47.04	.88
The Internet			
A - Traditional	43.41	46.67	3.26
B - World Wide Web	41.44	53.08	11.64
Writing			
A - Traditional	46.70	45.81	-.89
B - World Wide Web	41.40	46.56	5.16

Table 7. Summary of Univariate F Tests from the MANOVA Analysis

	Hypothesis MS	Error MS	F	p
Computers	**14.69**	**120.30**	**.12**	**,728**
Learning about Writing	**38.00**	**79.14**	**.48**	**,492**
The Internet	**776.82**	**209.04**	**3.72**	**,060**
Writing	**460.60**	**67.79**	**6.79**	**.012**

Table 8. Means of Attitudes for Computers. Learning about Writing, Internet, and Writing by Learning Style (n=52)

	Pretest	Posttest	Gain
Computer			
A - Field-independent	51.48	51.52	.04
B - Field-dependent	47.33	47.33	.oo
Learning about Writing			
A - Field-independent	48.36	47.92	-.44
B - Field-dependent	45.63	45.85	.22
The Internet			
A - Field-independent	44.64	53.12	8.48
B - Field-dependent	40.44	46.63	6.19
Writing			
A - Field-independent	46.24	48.16	1.92
B - Field-dependent	42.22	44.33	2.11

a traditional classroom approach. When the WWW is used in combination with classroom/laboratory strategies, it can be an especially effective teaching medium, as posited by Goldberg (1996).

3. Teaching using the WWW with a laboratory improved students' attitudes toward writing and did not harm their attitudes toward computers, the Internet, and learning about writing. This supports findings of Kinzie, et al (1994) and Busch (1995)

4. Learning styles had no effect on student achievement or attitudes in Web-dependent instruction or in traditional instruction of AEE 3203. This result is likely due to the benefits of hypermedia as an instructional tool, as suggested by Liu and Reed (1994). This result lends credence to findings of Marrison and Frick (1994) but differs from findings of Cano et al (1992) and Cano and Garton (1994).

5. Interaction effects did not occur between learning style and type of instruction (Web-dependent or traditional) on students achievement and attitudes.

Recommendations and Implications

The researcher recommends that the future sections of AEE 3203 - Technical Writing in Agricommunication at Mississippi State University be taught using the WWW with laboratory technique. This recommendation was implemented Fall semester, 1996.

More research is needed to further explain the effectiveness of the WWW as an instructional technique. The WWW is a fast-growing medium, but this is one of the first experimental studies that have focused on using the WWW for college-level instruction in agricultural education. The results of this study cannot be generalized to other populations or subject matter. The results of this study, however, indicate that the WWW is potentially an effective medium for instruction, supporting the assertions of Liu and Reed (1994).

Changes in instructional materials and methods should be evaluated in terms of achievement, study time, and attitude toward material. This study focused only on achievement and attitudes. Further research should also include the amount of time students spend studying outside of class when the different teaching methods are used (Chinien & Boutin, 1994).

Teaching with the WWW was effective for this technical writing course. Studies need to be conducted in other disciplines with other student populations. Further studies should be conducted to determine the effectiveness of the WWW as a teaching tool. As more agricultural education departments implement the use of the WWW in their instructional programs, this study can be used to support their decisions to use the WWW in instruction. An important role of the agricultural education department of the future will be to model the use of new instructional technology and support the efforts of other departments in their colleges as they strive to improve instruction and better meet the needs of students.

Finally, studies should compare WWW instruction, lecture, and a combination of the two with learning styles. Goldberg (1996) found that students who had access to a lecture and WWW performed better than the two other groups who were given either lectures or WWW.

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