WEB-BASED LEARNING:
RELATIONSHIPS AMONG STUDENT MOTIVATION, ATTITUDE, LEARNING STYLES, AND ACHIEVEMENT

Ching-Chun Shih, Research Associate
Julia Gamon, Professor Emeritus
Iowa State University

Abstract

This study analyzed the relationships between student achievement and the following variables: attitude, motivation, learning styles, and selected demographics. This population study included 99 students taking two web-based courses offered by the college of agriculture at a land grant university. Seventy-four (75%) students completed a learning style test, an on-line questionnaire, and received a grade by the end of the semester. The learning style test was the Group Embedded Figures Test (GEFT), which classified students as either field-dependent or field-independent. The on-line questionnaire consisted of two scales (motivation and attitude), whose pilot-test reliabilities were .71 and .91, respectively. Over two-thirds of the students taking the web-based courses were field-independent learners; however, there were no significant differences (.05 level) in achievement between field-dependent and field-independent students. Also, students with different learning styles and backgrounds learned equally well in web-based courses. The students enjoyed the convenience and self-controlled learning pace and were motivated by competition and high expectations in web-based learning. Motivation was the only significant factor that explained more than one-fourth of student achievement measured by class grade.

Introduction and Theoretical Framework

As the population of the World Wide Web (WWW) increases, its use as a means of delivering instruction is also growing. Several researchers (Parson, 1998; Alexander, 1995; Miller, 1995a & 1995b) argued that while implementing a new technology, educators should evaluate how and why students learn via the new technology in order to help with curriculum and instructional designs. Additionally, Parson (1998) stressed the importance of understanding how the new technology can affect learning when it is used by different types of learners.

Identifying students' learning styles helps educators understand how people perceive and process information in different ways. According to Cano, Garton, and Raven (1992), one of the most widely studied learning style theories contrasts field-dependence and field-independence. Several studies (Annis, 1979; Moore & Dwyer, 1992; Ronning, McCurdy, & Ballinger, 1984) have shown that field-independent people tend to outperform field-dependent people in various settings. However, in their study related to the effects of learning styles on achievement in a WWW course, Day, Raven, and Newman (1997) found learning styles had no effect on student achievement or attitudes toward Web-based instruction, which echoes the findings of the study on learning styles in a hypermedia environment conducted by Liu and Reed (1994).

The taxonomy of learning styles developed by Curry (1990) used the concepts of learning styles, student achievement, and motivation to explain the process of learning. Learning styles consist of a combination of motivation, engagement, and cognitive processing habits, which then influence the use of metacognitve skills such as situation analysis, self-pacing, and self-evaluation to produce a learning outcome. Curry's taxonomy (1990) suggested that motivation, learning styles, and student achievement are associated.

Motivation influences how and why people learn as well as how they perform (Pintrich & Schunk, 1996). Motivation was found to be the best predictor of student achievement in the two studies that investigated factors influencing student achievement and effects of the factors on students' achievement in learning the Japanese language through the medium of satellite television (Oxford, Park-Oh, Ito, & Sumrall, 1993a; 1993b). Moreover, in the study on predicting student success with the Learning and Study Strategies Inventory (LASSI), Hendrickson (1997) found that motivation and attitude were the best predictors of student grade point average.

Based on this literature review, student learning styles, motivation, and attitude seem to be associated with achievement. Research is needed to understand the relationship between student achievement and the motivation and attitude of students who have different learning styles. Also, research is needed to obtain more understanding of the learning factors that influence student success in web-based learning. This type of research will assist educators in planning, organizing, and delivering quality web-based instruction in a manner that will improve student learning.

Purpose and Objectives

The purpose of this study was to determine how student motivation, attitude, and learning styles influenced achievement in web-based courses. The objectives of the study were to identify: (a) the demographic characteristics of the students in relation to learning styles, (b) differences in student motivation, attitude, and achievement in relation to learning styles, and (c) relationships among student achievement, motivation, attitude, learning styles, and selected variables in web-based learning.

Methods and Procedures

The population for this study included 99 students taking two non-major biology introductory courses, Zoology 155 and Biology 109, offered by the College of Agriculture at a land grant university. These two web-based courses were stand-alone courses in which most course materials and resources were accessed and delivered by the Internet. More than 60% (60) of the population were on-campus students, and almost 40% (39) were off-campus students. Thirty-two of the 39 off-campus students were high school students. Before the study was conducted, a letter was sent to the high school teachers to seek permission for their students to participate in this study.

The Group Embedded Figures Test (GEFT) was used to determine preferred learning styles, either as field-dependent (FD) or field-independent (FI). Individuals scoring higher than the national mean (11.4) were classified as field-independent learners, whereas those scoring lower than the national mean were considered to prefer a field-dependent style. The total possible raw score on the GEFT was 18. The reliability coefficient for the GEFT was .82 (Witkin, Oltman, Raskin, & Karp, 1971).

An on-line questionnaire was designed by the researchers and included two scales plus demographic questions. The questionnaire, written in the HTML (HyperText Markup Language) format, was posted on the web. Nine statements representing the motivational scale were selected from the Motivation Strategies for Learning Questionnaire (MSLQ) developed by Pintrich and his colleagues at University of Michigan (Pintrich, Smith, Garcia, & McKeachie, 1991). The students were asked to rate themselves according to how well the statements described them while they were taking the web-based course by using a five-point scale with response options ranging from (1) Not at all typical of me to (5) Very much typical of me. The researchers modified the attitude scale that was used in Miller's (1995b) study on assessing professional agricultural degree program graduates' attitudes toward videotaped instruction. As a result, 11 statements were developed. The five point Likert-type scale had response options ranging from (1) Strong Disagree to (5) Strong Agree. Demographic variables included web-based courses students were taking (Zoology 105 or Biology 109), types of students as off-campus or on-campus students, whether or not they were university students, number of previous

courses taken in the subject area, limited or unlimited computer access, study and work hours per week, and gender.

Content and face validity for the questionnaire were established by a panel of three faculty members associated with the college of agriculture and three graduate students in agricultural education. The scales were pilot-tested for reliability with 38 students taking a different undergraduate web-based course, Biology 201. Cronbach's alpha coefficients were .71 and .91 for the motivation and attitude scales, respectively.

The researchers administered the learning style test (GEFT) to on-campus students, and proctors administered it to off-campus students. A total of 78 (79%) students completed the GEFT. An on-line questionnaire was posted on the web three weeks before the final exams. A follow-up electronic letter to nonrespondents of the on-line questionnaire yielded a total of 94 responses for a 95% return rate. Instructors provided grades for all students at the end of the semester, and these were used as a measure of achievement.

For purposes of analysis, the learning style scores, questionnaire responses, and students' grades were matched. This yielded a final response rate of 74 (75%), which was considered to be an acceptable representation of the population. Data were analyzed using the Statistical Package for Social Science, Personal Computer Version (SPSSx/PC). Analyses of data included frequencies, means, standard deviations, t-tests, Pearson correlations, and regressions. The alpha level was established *a priori* at the .05 level.

Results

Objective 1: Demographics of the students in relation to learning styles

Table 1 displays demographic data of the respondents by learning style type. The usable responses included 29 (39%) in the Zoology class and 45 (61%) in the Biology class. Less than half (29; 39%) of the usable respondents were males. Twenty-eight (38%) were high school students and forty-six (62%) were university students. Forty-five (61%) students had unlimited access to a computer; whereas twenty-nine students could only access a computer at a set time. More than two thirds (51; 69%) of the respondents were field-independent learners.

On average, the students had previously taken 1.45 courses in the subject area of Zoology or Biology (Table 2). The students spent an average of 4.55 hours per week studying, ranging from 1 to 20 hours and worked an average of 16.97 hours per week, ranging from 0 to 80 hours. No significant differences by learning styles were found in the number of courses taken previously, study hours per week, or work hours per week.

Respondents' learning style scores were compared by gender (Table 3). It was found that the male learning style mean score (mean = 14.07) was significantly higher than the female mean score (mean = 11.76). The learning style mean score of all respondents was 12.66. This was consistent with the preliminary norm data on GEFT, in which college men (mean = 12.00) performed slightly but significantly higher than college women (mean = 10.8) (Witkin, Oltman, Raskin, & Karp, 1971). However, in this study, the GEFT mean scores of both males and females were higher than those of the norm data (mean = 11.4).

Table 1

Description of Field-Dependent (FD) and Field-Independent (FI) Respondents by Class, Student Type, Class level, Access to Computer, and Gender (n = 74)

Variable	Description	Total		Learning Styles			
				FD		FI	
		n	%	n	%	n	%
Class	Zoology	29	39%	11	38%	18	62%
	Biology	45	61%	12	27%	33	73%

Table 1 (Continued)

| | | Total | | Learning Styles | | | |
| | | | | FD | | FI | |
Variable	Description	n	%	n	%	n	%
Student type	On-campus	41	55%	13	32%	28	68%
	Off-campus	33	45%	10	30%	23	70%
Class level	High School	28	38%	8	29%	20	71%
	University	46	62%	15	33%	31	67%
Access to computers	Limited	29	39%	9	31%	20	69%
	Unlimited	45	61%	14	31%	31	69%
Gender	Male	29	39%	4	14%	25	86%
	Female	45	61%	19	42%	26	58%
Total		74	100%	23	31%	51	69%

Table 2
Description of Field-Dependent (FD) and Field-Independent (FI) Respondents by Selected Demographic Variables (n = 74)

| | Total | | Learning Style Type | | | | |
| | | | FD | | FI | | |
Variable	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	t-value
Number of previous courses taken in the same subject area	74	1.45 (1.53)	23	1.22 (1.41)	51	1.55 (1.58)	-.90
Study hours/week for this course	74	4.55 (16.97)	23	5.28 (4.25)	51	4.24 (2.73)	1.25
Work hours/week for pay	74	16.97 (15.96)	23	21.11 (21.52)	51	15.10 (12.52)	1.25

Table 3
Means, Standard Deviations, and t-test of Respondents' Learning Style Scores By Gender (n = 74)

| | Total | | Gender | | | | |
| | | | Male | | Female | | |
Variable	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	t-value
Learning style scores	74	12.66 (4.52)	29	14.07 (4.57)	45	11.76 (4.46)	2.16*

*$p < .05$

Objective 2: Differences in student motivation, attitude, and achievement in relation to learning styles

Although field-independent students had a mean of 3.51 and field-dependent students had a mean of 3.42, no significant difference was found on student motivation by learning style (Table 4). The mean scores on the nine items ranged from 2.81 to 4.21. Four statements were rated above 3.50. The highest rated motivation was that the

students wanted to get better grades than most other students (mean = 4.21). The second most highly rated item was that they expected to do well in the class (mean = 3.77). Students also believed that they could do better if they studied in appropriate ways (mean = 3.70), and they preferred course material that aroused their curiosity (mean = 3.66). Only one statement, *I think of how poorly I am doing*, was rated below 3.00. The overall mean for student motivation in Web-based learning was 3.48 with a standard deviation of .52.

Table 5 presents the means and standard deviations for individual statements by learning style for student attitudes toward web-based instruction. Results showed that students provided positive responses for statements related to the convenience of web- based instruction (mean = 4.03), the ability to control the pace of learning (mean = 4.00), delivery of more web-based instruction (mean = 3.69), recommendations of web-based courses to friends (mean = 3.62), and opportunities for learning provided by web-based courses (mean = 3.57). The mean score of students' attitudes toward web-based instruction was 3.49 (SD = .64). Moreover, no significant difference was found between field-dependent students and field-independent students in their attitudes toward web-based instruction.

Table 4
Means, Standard Deviations, and t-test for Respondents' Motivation by Field-Dependent (FD) or Field-Independent (FI) Learning Style (n = 74)

| | | Learning Style | | |
| | Total | FD | FI | |
Statement	Mean (SD)	Mean (SD)	Mean (SD)	t-value
1. I want to get better grades than other students	4.21 (1.01)	4.26 (.96)	4.18 (1.04)	
2. I expect to do well in this class	3.77 (.84)	3.78 (1.00)	3.76 (.76)	
3. Studying appropriately, I can learn the material	3.70 (.89)	3.43 (.84)	3.82 (.89)	
4. I prefer course material that arouses my curiosity	3.66 (.80)	3.48 (.67)	3.75 (.84)	
5. I am satisfied with trying to understand content	3.49 (.80)	3.48 (.67)	3.49 (.86)	
6. Course material is useful to learn	3.49 (.83)	3.52 (.85)	3.47 (.83)	
7. I think of the questions I cannot answer[a]	3.30 (1.08)	3.30 (1.15)	3.29 (1.01)	
8. I am interested in the content area of this course	3.14 (.93)	3.00 (.95)	3.20 (.92)	
9. I think of how poorly I am doing[a]	2.81 (1.51)	2.83 (1.67)	2.78 (1.35)	
Total	**3.48 (.52)**	**3.43 (.57)**	**3.51 (.50)**	**-.64**

Note: Scale 1=Not at all typical of me, 2=Not very typical of me, 3=Somewhat typical of me, 4=Quite typical of me, and 5=Very much typical of me.
[a]Negatively stated items. Means of these statements were reversed in the total mean.

Table 5
Means, Standard Deviations, and t-test for Respondents' Attitude by Field-Dependent (FD) or Field-Independent (FI) Learning Style (n = 74)

		Learning Style		
	Total	FD	FI	
Statement	Mean (SD)	Mean (SD)	Mean (SD)	t-value
1. Learning through Web-based instruction is convenient	4.03 (1.11)	4.04 (.82)	3.98 (.97)	
2. Web-based courses allow me to control the pace of my learning	4.00 (.92)	4.13 (1.25)	3.98 (1.05)	
3. Web-based courses should be utilized more often to deliver instruction	3.69 (.89)	3.91 (.60)	3.59 (.98)	
4. I will recommend Web-based courses to my friends	3.62 (1.00)	3.78 (.95)	3.55 (1.03)	
5. Web-based courses provide me with learning opportunities that I otherwise would not have had	3.57 (1.11)	3.61 (1.16)	3.55 (1.10)	
6. I enjoy learning from the Web-based lessons	3.49 (1.06)	3.83 (.83)	3.33 (1.13)	
7. I will enroll in another Web-based course	3.27 (1.01)	3.30 (.88)	3.25 (1.07)	
8. I feel isolated as a student when I take courses via the web[a]	3.01 (1.20)	2.91 (1.20)	3.06 (1.21)	
9. I would not have taken Web-based courses if I had some other means of acquiring course credits[a]	2.80 (.99)	2.61 (.89)	2.88 (1.03)	
10. I prefer Web-based courses to traditional classroom instruction	2.65 (1.05)	2.87 (.87)	2.55 (1.12)	
11. Learning through Web-based courses is boring[a]	2.62 (1.02)	2.35 (1.07)	2.75 (1.00)	
Total	**3.49 (.64)**	**3.60 (.60)**	**3.37 (.68)**	**1.38**

<u>Note</u>: Scale 1=Strongly disagree, 2=Disagree, 3=Undecided, 4=Agree, and 5=Strongly Agree.
[a]Negatively stated items. Means of these statements were reversed in the total mean.

Objective 3: Relationships among student achievement, motivation, attitude, learning styles, and selected variables

Pearson correlations and point biserial correlations were used to describe associations between student standardized achievement scores and selected variables. Ten relationships were examined that ranged in magnitude from substantial to none (Table 6). The relationship between student achievement and overall motivation mean scores (r =.53) was significant.   No significant relationships were found between student achievement and the following variables: overall attitude mean scores, learning style scores, and selected demographics.

Table 6
Relationships between Standardized Achievement Scores and Selected Variables (n = 74)

Variable	Association	Magnitude
Class (Zoology 155 or Biology 109)	.00[a]	none
Class level (high school or university student)	-.00[a]	none
Number of previous courses taken in the subject areas	.11[b]	low
Computer access (limited or unlimited)	.12[a]	low
Gender	-.06[a]	negligible
Study hours per week	.12[b]	low
Work hours per week	-.07[b]	negligible
Overall motivation mean scores	.53[b]*	substantial
Overall attitude mean scores	.21[b]	low
Learning style scores	.09[b]	negligible

Note: The magnitude was based on Davis (1971).
[a]Point biserial correlation   [b]Pearson correlation
*$p < .05$

A hierarchical regression analysis was conducted to ascertain the amount of variance in students' standardized achievement scores explained by the variable of interest (Table 7). The regression model was loaded first with the overall motivation mean scores, which explained 28% of the variance in achievement. The overall attitude mean scores were entered next into the regression model. This variable explained an additional 1% of the variance in student achievement. Then the learning style variable was entered into the regression, and it did not explain any additional variance in student achievement. Motivation (t = 4.77) was the only significant variable for the explanation of variance in achievement scores.

Table 7
Hierarchical Entry Regression of Selected Variables on Standardized Achievement (n =74)

Variables	R^2	R^2 Change	b	t-value
Overall motivation mean scores	.28	.28	.94	4.77*
Overall attitude mean scores	.29	.01	.17	1.09
Learning style scores	.29	.00	0.01	.63
(Constant)			-4.06	-4.88*

Standard Error = .85, Adjusted R^2 = .26
F for the Model = 9.69 $p < .05$ (df 3, 70)
*$p < .05$

Conclusions and Recommendations

More field-independent students took the web-based Zoology and Biology courses than did field-dependent students. Males were more likely to be field-independent students, although the female scores on the GEFT also fell into the field-independent range. This was similar to Miller's finding (1997) that the distant learners in agriculture were relatively more field-independent than the norm groups.

Student learning styles, attitude toward web-based instruction, and student characteristics --web-based courses students were taking (Zoology 105 or Biology 109), types of students as off-campus or on-campus students, whether or not they were university students, number of previous courses taken in the subject area, limited or unlimited computer access, study and work hours per week, and gender—were not associated with their web-based learning achievement. Moreover, field-independent

students did not differ from field-dependent students in motivation and attitude toward web-based learning. The researchers concluded that students with different types of learning styles, motivation, attitudes, and backgrounds learned equally well in Web-based courses.

This study found that students held a neutral attitude about web-based instruction. Students were most positive about the convenience of web-based instruction and the ability to control their pace of learning, which mirrors Miller's (1995b) results in his study of the Professional Agricultural Degree Program via videotaped instruction. Getting better grades than other students and expecting to do well were the two most highly rated motivators for web-based learning. Students enjoyed the convenience and self-controlled learning pace and were motivated by competition and high expectations in web-based learning.

Recommendations are that educators should provide students with information and opportunities to maintain healthy student competition and high expectations in web-based learning, such as announcing mean scores of class tests for comparison and setting clear expectations for assignments and tests. Likewise, educators should understand student motivational factors and attitudes toward web-based learning so that they can stimulate student motivation and get students actively involved in the learning process.

Student motivation seemed to play a very important role in web-based learning. In this study, motivation was the only significant factor in web-based learning that accounted for more than one fourth of student achievement. Both students and instructors should understand the importance of motivation in web-based learning so as to enhance student achievement. Several researchers (Pintrich, 1995; Pintrich & Schunk, 1996; Garcia, 1995; Bandura, 1986; Zimmerman, 1989) believed that students should monitor their learning motivation, regulate emotions, and use motivational strategies for active involvement in learning. Motivational strategies are those strategies students use to cope with the stress and emotions that are generated when they try to overcome

failures and become good learners (Garcia, 1995). It was recommended that students should examine their motivations, and use motivational strategies to be successful in web-based courses. In essence, instructors should encourage students to become active learners by providing opportunities for students to reflect on their motivation and use of motivational strategies in learning. This will help assure student success in web-based instruction.

References

Annis, L. F. (1979). Effect of cognitive style and learning passage organization on study technique effectiveness. *Journal of Educational Psychology, 71*, 620-626.

Alexander, S. (1995). *Teaching and learning on the World Wide Web.* Available: http://www.scu.edu.au/ausweb95/papers/education2/alexander/

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice Hall.

Cano, J., Garton, B. L., & Raven, M. R. (1992). The relationship between learning and teaching styles of student performance in a method of teaching agriculture course. *Journal of Agricultural Education, 33*(3), 8-15.

Curry, L. (1990). *Learning styles in secondary schools: A review of instruments and implications for their use.* (ERIC Document Reproduction Service No. D 317 283)

Davis, J. A. (1971). *Elementary survey analysis.* Englewood Cliffs, NJ: Prentice-Hall.

Day, T. M., Raven, M., & Newman, M. E. (1997). The effects of World Wide Web instruction and traditional instruction and learning styles on achievement and changes in student attitude in a technical writing in an agricommunication course. *Proceedings of National Agricultural Education*

Research Meeting (pp. 167-175). Las Vegas, NV.

Garcia, T. (1995). The role of motivational strategies in self-regulated learning. In R. J. Menges & M. D. Svinicki (Eds.) *Understanding self-regulated learning, New directions for teaching and learning* (No. 63, pp. 29-42). San Francisco, CA: Jossey-Bass Publishers.

Hendrickson, A. B. (1997). *Predicting student success with the Learning And Study Strategies Inventory (LASSI).* Unpublished master's thesis. Iowa State University, Ames, IA.

Liu, M. & Reed, W. M. (1994). The relationship between the learning strategies and learning styles in a hypermedia environment. *Computers in Human Behavior, 10*(4), 419-434.

Miller, G. (1995a). Off-campus study in agriculture: Challenges and opportunities. *Journal of Agricultural Education, 36*(2), 1-7.

Miller, G. (1995b). Iowa data: Professional agricultural degree program graduates assess their videotaped instruction experience as distant learners. *NACTA Journal, 34*(4*),* 26-29.

Miller, G. (1997). *Are distance education programs more acceptable to field-independent learners?* (ERIC Document Reproduction Service No. 409854).

Moore, D. M. & Dwyer, F. M. (1992). Effects of color coding on cognitive styles. *Proceedings of the Annual Meeting of the Eastern Education Research Meeting*, Hilton Head, SC.

Oxford, R., Park-Oh, Y., Ito, S., & Sumrall, M. (1993a). Japanese by satellite: Effects of motivation, language learning styles and strategies, gender, course level, and previous language learning experience on Japanese language achievement*. Foreign Language Annals, 26*(3), 358-371.

Oxford, R., Park-Oh, Y., Ito, S., & Sumrall, M. (1993b). Learning a language by satellite television: What influences student achievement? *System, 21*(1), 31-48.

Parson, R. (1998*). An investigation into instruction available on the World Wide Web.* Available: http:// www.oise.utoronto .ca/~rparson/abstract.html

Pintrich, R., Smith, D. A. F., Garcia, T., & McKeachie, W. J. (1991). Reliability and predictive validity of the motivated strategies for learning questionnaire (MSLQ). *Educational and Psychological Measurement, 53*, 801-813.

Pintrich, P.R. (1995). Understanding self-regulated learning. . In R. J. Menges & M. D. Svinicki (Eds.) *Understanding self-regulated learning, New directions for teaching and learning* (No. 63, pp. 3-12). San Francisco, CA: Jossey-Bass Publishers.

Pintrich, P. R. & Schunk, D. H. (1996). *Motivation in education: Theory, research, and application.* Englewood Cliffs, NJ: Prentice-Hall Inc.

Ronning, R. R., McCurdy, D., & Ballinger, R. (1984). Individual differences: A third component in problem-solving instruction*. Journal of Research in Science Teaching, 21*(1), 71-82.

Witkin, H.A., Oltman, P.K., Raskin, E., & Karp, S.A. (1971). *Group Embedded Figures Test manual.* Consulting Psychologists Press: Palo Alto, CA.

Zimmerman, B.J. (1989). A social cognitive view of self-regulated academic learning. *Journal of Educational Psychology, 81*(3), 329-339.