

# The Effect of Agricultural Students' Learning Styles on Academic Achievement and Their Perceptions of Two Methods of Instruction

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A wealth of research has been undertaken to attempt to define and demonstrate the effects of a student's learning style on academic performance in the classroom. Cognitive style is not a single entity. Researchers examining learning styles have varied views on the exact components and characteristics of learning styles. Keefe (1982) stated,

Learning styles are cognitive, affective, and physiological traits that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment. (p. 32)

The most accepted learning styles range from the Conceptual Tempo (Kagan et al., 1964) and Hemisphericity (Bjorklund, 1989) approaches to the Convergent/Divergent thinking (Guilford, 1959) and Independent/Dependent (Witkin, Moores, Goodenough, & Cox, 1977) techniques.

According to Rasinski (1983), field independence/dependence is "by far" the most researched of all cognitive styles. This learning approach measures how much students are able to overcome the effects of distracting background elements when they attempt to differentiate relevant aspects of a particular situation (Dembo, 1991). Witkin et al. (1977) stated that field independent students show greater interest in more impersonal, abstract aspects of various stimuli. In contrast, field dependent students, prefer a higher level of social sensitivity and prefer structured activities that require involvement with others.

Dembo (1991) stated the following about field dependent versus field independent students and how they interact differently with their environment:

Field dependent persons are drawn to people, favor occupations, such as teaching, that require involvement with others, and prefer academic areas, such

as the social sciences, that are more people oriented. Field independent persons favor school subjects such as mathematics and the physical sciences, that stress the impersonal and abstract. Field dependent persons are better at learning and remembering social material, and field independent persons are better at learning and remembering impersonal material. (p. 83)

Independent and dependent learning style has an impact with respect to academic achievement in classrooms that use computer aided instruction. Cheney (1980) suggested that computer aided instruction can be made more effective if it is adapted to an individual's cognitive style. Post (1987) found similar results in his computer based research. MacGregor, Shapiro, and Niemiec (1988) in researching the effect of computer aided mathematical instruction, found that although field independent students outperformed field dependent students in all teaching methods, field dependent students particularly benefited from computer aided instruction as it provided the needed cognitive structure and consistency they lack.

A continual dilemma experienced by agricultural educators is how to respond to the changing face of society and stay abreast of the possible impacts that technology could have in the teaching-learning context. A relatively new dimension of microcomputer technology entitled, "multimedia" possesses the potential to influence student learning and knowledge acquisition. Multimedia is a multi-faceted approach to computer-based education that brings together text, graphics, animation, video, still images, audio, and motion video.

Sensing the vast capabilities of multimedia in the educational realm, computer companies have developed multimedia software packages that can be used as teaching tools by instructors. Multimedia can possibly serve as a trenchant

teaching tool since it uses several student senses in the learning process. Multimedia instructional material allows the learner to actually see, hear, and use the content learned (Roden, 1991). Because multimedia software and hardware furnish students with these experiences, it has the potential to be applied in a variety of educational settings.

While other studies have addressed the impact of computer multimedia on student achievement, none have been undertaken to determine the effect that learning style has on student performance when utilizing multimedia instruction. In this study, the researcher sought to identify the effects of students' learning styles on academic achievement and perceptions of two distinctly different methods of instruction. If agricultural educators can adapt and utilize multimedia technology as a new teaching tool capable of improving every students' ability to learn, then certainly all individuals involved in agricultural education will benefit,

### **Purpose and Objectives**

The major purpose of this research study was to compare the extent to which academic achievement and students' perceptions of traditional lecture and computer multimedia instruction are influenced by learning style. Specific objectives for this study were to determine:

The extent to which academic achievement is effected by learning style

The effect of learning style on student perceptions of the computer multimedia module

The effect of learning style on students' perceptions of lecture instruction.

### **Procedures**

#### Methodology, Population, and Sample

This study was planned and conducted in conjunction with a larger study on the effects of computer multimedia education. The researchers utilized a pretest-posttest control group experimental design. The population of this study was undergraduate students (N=75) in the School of Agriculture at a major land-grant university

enrolled in Agricultural Economics 100 during the spring semester, 1992. Agricultural Economics 100 is the introductory agricultural economics course. The population and subsequent sample was purposefully selected for the conduct of this study. The course was selected as all freshmen in all majors in the School of Agriculture have the opportunity to enroll in this course. This population provided the researchers with a wide breadth and diversity of students from the School of Agriculture to be represented in the sample group. Students were randomly assigned to one of three experimental groups: multimedia instruction only, lecture instruction with multimedia as a supplemental learning tool, and lecture only. Students in these groups were then classified as either field dependent or field independent using the Group Embedded Figures Test (G.E.F.T.). This test gauges the students' learning styles by having them locate a previously seen simple figure within a larger complex figure which is organized such that the simple figure is embedded.

#### Instrumentation

Instruments were developed to measure the dependent variables and to record perception, personal, and situational data. Data were collected using a demographic questionnaire, agricultural economics demand knowledge test, Multimedia Perception Questionnaire, Lecture Perception Questionnaire, and the G.E.F.T. test. Reliability coefficients were calculated for the three achievement tests, the G.E.F.T. and the perception questionnaires. Coefficient alpha of .93 and .49 were computed for the multimedia and lecture perception questionnaires, respectively. Reliability for the G.E.F.T. has been determined to be .82. The achievement test instruments produced reliability coefficients of .63 for the pretest, .66 for the short-term posttest, and .68 for the delayed posttest. As noted, the demand test was administered on three occasions during this study. Demand test results tended to indicate that students' results were consistent on all three administrations.

The computer multimedia module on demand concepts was developed by the researcher. This module was composed using text, still pictures, and graphics. However, the module lacked a sound component cited by Roden (1991). Instructional content included in this module was as follows: definition of demand, marginal utility, factors that shift demand, and factors that change

quantity demanded. Content validity of the program was evaluated by experts in the field of agricultural economics and agricultural education. The multimedia package was pilot tested on selected School of Agriculture students who had previously completed the Agricultural Economics 100 course.

### Administration

Prior to the pretest, the students were randomly assigned to a multimedia only group (Group I), a lecture group with multimedia supplementation (Group II), or the lecture control group (Group III) using the students' identification numbers and a table of random numbers. All students took the agricultural economics demand knowledge pretest and completed the demographic questionnaire during the class period preceding the first treatment.

All students then received instruction on the selected topic, "Demand Principles." The experimental group (Group I) did not attend the traditional class on this topic; rather they were asked to work with the computer multimedia instructional packet. The students had up to 50 minutes to work with the multimedia program. Instructional time spent on the demand module for each student was kept both manually and through tracking procedures within the multimedia module. Upon completion of the computer multimedia instructional module, the students filled out a questionnaire to determine their perceptions of the computer multimedia module. The students in Group II attended the traditional lecture with the control group (Group III). The lecture teaching demand concepts were 50 minutes long and was taught in the regular classroom by the agricultural economics professor.

One week after the completion of the instructional unit, all students were given the agricultural economics short-term demand knowledge posttest. The students in Group II and III also completed the Lecture Perception Questionnaire at this time. Group II, the traditional group that used multimedia as a supplement learning tool, was then given a set of written instructions and had one week to work with the multimedia module in the computer center and complete the Multimedia Perception Questionnaire. The delayed demand knowledge posttest was given

to all students three weeks following the instructional unit.

All students were given the G.E.F.T. instrument 30 days following the delayed posttest. Since this is a psychological test that can be given at any time, the researchers gave the test during a time that was convenient to the schedule of the Agricultural Economics 100 class. The length of this study was 23 days from the initial pretest to the delayed posttest and 53 days from pretest to the G.E.F.T.

### Analysis of Data

The data collected from this experiment were checked, coded, and entered into data files on the main frame computer and were analyzed using the Statistical Package for the Social Sciences (SPSSx). Only completed data from students taking the pretest, short-term posttest, long-term posttest, perception questionnaires, and the G.E.F.T. were used in the analyses.

Dependent variable gathering instruments including the pretest, posttests, and perception questionnaires were analyzed for reliability. Cronbach's Coefficient Alpha was used to estimate the reliability for this analysis. Descriptive statistics, analysis of variance, multifactor analysis of variance, and inferential statistics were used to determine differences between treatment groups and pretest and posttest scores. A .05 significance level was set by the researchers. Questions on the perception questionnaires designed to elicit negative responses were recorded for data analysis purposes to provide uniform responses for calculation of individual and group means. Descriptive statistics and analysis of variance were used to analyze data on the perception questionnaires and to gauge differences between learning styles.

## **Results**

### Description of Sample

Only completed data from students taking the pretest, short-term posttest, long-term posttest, perception questionnaires, and the G.E.F.T. were used in the analyses. The sample size decreased to 53 students. Available SAT, pretest, posttest and G.E.F.T. scores of the students dropped from the study were analyzed and were determined not to be significantly different from those included in the

sample group. For this study, a majority of the student population (62.3%) was white male. No members of the sample group or population were minority students.

All students were enrolled in the School of Agriculture. Agricultural Economics and Agricultural Education majors, respectively, made up 42 and 21 percent of this group. Using the G.E.F.T. instrument, 23 (43.4%) students were classified as field dependent learners and 30 (56.6%) were classified as field independent learners. The breakdown of learning style by treatment group can be viewed in Table 1.

Table 1. Distribution of Students by Learning Style

Group	Independent	Dependent
Group I (n=15)	9	6
Group II (n=22)	13	9
Group III (n=16)	8	8

#### Learning Style Effects on Academic Achievement

Students in the three groups were subdivided by learning style to allow for this analysis. Utilizing a 3 treatment by 2 learning style by 3 times of measurement MANOVA, test scores were analyzed for all main effects and interaction effects. Results from this analysis indicated that the groups did change over time as a time main effect did occur. However a group by learning style by time interaction effect was not found. Treatment and/or learning style did not have a greater significant effect on the demand knowledge test. These results can be viewed in Table 2.

Table 2. Pretest, Short-term Posttest, and Delayed Posttest Mean Score Comparison by Learning Style

Group and Learning Style	Pretest Score	Posttest Score	Delayed Posttest Score
<b>Group I</b>			
Field-dependent (n=6)	38.00	60.00	59.33
Field-independent (n=9)	44.22	60.22	67.56
<b>Group II</b>			
Field-dependent (n=9)	52.00	66.89	70.89
Field-independent (n=13)	40.46	52.92	65.69
<b>Group III</b>			
Field-dependent (n=8)	39.00	52.25	57.25
Field-independent (n=8)	48.00	64.00	66.50

#### Learning Style and Students' Perceptions

Analysis showed that independent and dependent learners, as determined by G.E.F.T. results, did not differ significantly with respect to their perceptions of the lecture on demand. Their perceptions also did not differ significantly for the multimedia module on demand. However, item analysis revealed that the field dependent and field independent learners did differ significantly in three areas: (1) ease of computer use, (2) the effect of sound, and (3) the belief that computer multimedia modules are more exciting than lecture presentations. Field dependent learners indicated that they believed that sound would have enhanced the multimedia program. Field independent learners, mean while felt the computer multimedia was easy to use and more exciting than lecture presentations.

#### **Conclusions**

Based on the findings of this study, the following conclusions concerning the effects of learning style on academic achievement and perceptions of computer multimedia versus lecture instruction on demand concepts for the experimental groups were drawn. Analysis showed that learning style (field dependent/independent) coupled with treatment had no significant effect with respect to achievement on the agricultural economics demand knowledge test. Furthermore, it was found that learning style had no significant effect on the students' overall perceptions of lecture and multimedia instruction. However, dependent learners did express the need for sound in the multimedia module. Independent learners also indicated that they found the multimedia module easy to use and that they found it more exciting than traditional lecture.

It should be noted that one limitation of the study was that academic achievement may have been influenced by the novelty of the computer multimedia software (Gay, 1987). However, randomization should have accounted for this limitation.

#### **Recommendations**

Based on these conclusions, the following recommendations were made. Other topics should be selected when replicating the methodology of

this study since topics lend themselves to different techniques of instruction and a variety of learning modes.

Since this was a base line study, further studies need to be undertaken to see if these findings are consistent. Studies similar to this one should be conducted using a larger population. Future studies of a similar nature should identify other valid and reliable tests that can be used to determine the effects of multimedia on other aspects of learning styles such as the effect that computer multimedia has on critical thinking skills. Data from future studies should be collected over a shorter and more consistent time frame.

The perceived impact that sound could have enhanced the program for dependent learners should be further studied to determine if this perceived need would improve academic achievement. Future studies should look at the impact a more sophisticated (i.e., animation and video) computer multimedia module has on academic performance and perceptions of the independent and dependent learners. Teachers who utilize this technology should strive to identify learning contexts in which computer multimedia applications produce superior academic achievement and positive perceptions for both types of learners.

## References

- Bjorklund, D.F. (1989). Children's thinking: Developmental function and individual differences. Pacific Grove, CA: Brooks/Cole.
- Cheney, P. (1980). Cognitive style and student programming ability: An investigation. Association for Educational Data Systems Journal, 513(4), 9-11.
- Dembo, M.H. (1991). Applying educational psychology in the classroom. -White Plains, NY: Longman Publishing Group.
- Gay, L.R. (1987). Educational research: Compete c'es for analysis and application. New York, NY: Macmillan Publishing Company.
- Guilford, J.P. (1959). Three faces of intellect. American Psychologist, 14: 469-479.
- Johnson, R.T., Johnson, D.W., & Stanne, M.B. (1985). Effects of cooperative, competitive, and individualistic goal structures on computer-assisted instruction. Journal of Educational Psychology, 77(6): 668-677.
- Kagan, J., Rosman, B.L., Day, D., Albert, J., & Phillips, W. (1964). Information processing in the child: Significance's of analytical and reflective attitudes. Psycholoecial Monographs, 78(1).
- Keefe, J.W. (1982). Assessing student learning styles: An overview. Student learning styles and brain behavior. Reston, VA: National Association of Secondary School Principals.
- Kulik, J.A., Kulik, C.C., & Bangert-Drowns, R.L. (1985). Effectiveness of computer-based education in elementary schools. Proceed' gs of the annual meeting: of the American Educational Research Association. Chicago, Illinois.
- Kulik, J.A. & Kulik, C.C. (1987). Review of recent research literature on computer based instruction. Contemporary Educational Psychology, 12: 22-230.
- MacGregor, S.K., Shapiro, J.Z., & Niemiec, R. (1988). Effects of computer augmented learning environment on math achievement for students with differing cognitive style. Journal of Educational Computing Research, A(4): 453-465.
- Post, P.E. (1987). The effect of field independence/field dependence on computer-assisted instruction achievement. Journal of Industrial Teacher Education, 25(1): 60-67.
- Rasinski, T. (1983). Cognitive style and read' Implications from field dene de ce esearch for reading instruction. International Reading Association, Springfield, Illinois, 1983. (ERIC Document Reproduction Service No ED 241 899).
- Roden, S. (1991). Multimedia: The future of training. Multimedia Solutions, 5( 1): 17- 19.
- Witkin, H.A., Moores, C., Goodenough, D., & Cox, P. (1977). Field-dependent and field-independent cognitive styles and their educational implications. Review of Educational Research, 47: 1-64.
- Witkin, H., Oltman, P.K., Raskin, E., & Karp, S.A. (1971). Group Embedded Figures Test. Consulting Psychologists Press, Inc.