Learning Styles in Agriculture

Robert M. Torres and Jamie Cano

Abstract

Learning style provides important insight into the way students process information to learn, how teachers teach, how students and teachers interact, and how students make career choices. This study sought to investigate the learning style of students in a College of Agriculture at a mid-western university. A random sample of senior students was selected for the study. The Group Embedded Figures Test (GEFT) was used to assess students' learning style by gender, academic major, and overall learning style. In the test group, males preferred a field independent learning style, whereas females preferred a more field dependent learning style. Recommendations are offered based on the results.

Introduction

A number of factors that influence the educational process have emerged from research on human developmental stages and life phases. Learning style is one factor researchers claimed influence student educational performance (Dunn & Dunn, 1979; Claxton & Murrell, 1987; Garger & Guild, 1984; Saracho, 1989; Witkin, 1973). Gregorc (1979) described learning style as "consisting of distinctive behaviors which serve as indicators of how a person learns from and adapts to his/her environment. It also give clues as to how a person's mind operates" (p. 234).

Learning style research has been applied at an ever-increasing rate to the problems of education (Doebler & Eicke, 1979). Claxton and Murrell (1987) suggested that learning style could be an extremely important element in the move to improve curricula and the teaching process in higher education. Anderson and Adams indicated that more attention than ever was being focused on how to meet the challenge of increasing diversity in the classroom. Anderson and Adams (1992) argued that:

> One of the most significant challenges that university instructors face is to be tolerant and perceptive enough to recognize learning differences among their students. Many instructors do not realize that students vary in the way they process and understand information. The notion that students' cognitive skills are identical at the collegiate level [suggests] arrogance and elitism by sanctioning one groups' style of learning while discrediting the style of others (p. 19).

Field-dependent and field-independent learning styles have been extensively studied and have the broadest application to educational concerns (Witkin, Dyk, Faterson, Goodenough, & Karp, 1962). Witkin, Moore, Goodenough, and Cox (1977) suggested that students who preferred a field-dependent learning style tended to perceive the world globally, found it more difficult to solve problems, were highly sensitive and attuned to the social environment, tended to favor the "spectator approach" to learning, and would adopt the organization of information to be learned. Additionally, students who preferred a field-dependent learning style were more extrinsically motivated and responsive to social reinforcement.

Conversely, students who preferred a field-independent learning style tended to view the world more analytically, found it easier to solve problems, and were more likely to favor "inquiry" and independent study. In addition, field-independent students tended to provide their own structure to facilitate learning, were more intrinsically motivated, and were generally unresponsive to social reinforcement (Witkin et al., 1977).

Currently, research on field-dependent and field-independent learning style in colleges of agriculture is limited to the efforts of a few researchers (Escombe, 1988; Cano & Garton, 1992; Cano, Garton, & Raven, 1991, 1992; and Raven, Cano, Garton, & Shelhamer, 1993), and to a small number of graduate students and undergraduate students majoring in agricultural education. Thus, if educators in colleges of agriculture are to recognize and appreciate differences in students' learning style and meet the challenge set forth by Anderson and Adams (1992), an expansion of this research area is essential.

Purpose

The purpose of this study was to determine the preferred learning style of students enrolled in the College of Agricul-

Torres is an assistant professor in the Department of Agricultural and Extension Education, New Mexico State University, Box 30003, Department 3501 Las Cruces, NM 88003 and Cano is an associate professor in the Department of Agricultural Education, The Ohio State University, 2120 Fyffe Road Columbus, OH 43210

ture at a land-grant university. The following specific research questions were examined.

1. What was the preferred learning style of senior students enrolled in the College of Agriculture by gender as measured by the Group Embedded Figures Test?
2. What was the preferred learning style of senior students enrolled in the College of Agriculture by academic major as measured by the Group Embedded Figures Test?
3. What was the overall preferred learning style of senior students enrolled in the College of Agriculture as measured by the Group Embedded Figures Test?

Methods/Procedures

The accessible population for the descriptive study was senior students enrolled in the College of Agriculture at a land grant university during the Fall Term, 1992 (n=388). An up-to-date list of seniors was obtained from the College Office and served as the frame for the study. A sample of 196 students was randomly drawn from the population of senior students. The sample size (n=196) was determined using Krejcie and Morgan's (1970) table of sample sizes, specifying a five percent margin of error.

The Group Embedded Figures Test (GEFT), (Witkin, Oltman, Raskin, & Karp, 1971) was used to assess the preferred learning style of students, as either field-dependent or field- independent. Individuals scoring greater that the national mean (11.3) were considered to be preferring a field-independent learning style, while subjects scoring less than the national mean were considered to be preferring a field-dependent learning style (Witkin et al..). The total possible raw score on the GEFT was 18.

The validity of the GEFT has been established by determining its relationship with its "parent" test, the Embedded Figures Test (EFT), as well as the Rod and Frame Test (RFT), and the Body Adjustment Test (BAT) (Witkin et al., 1971). Because the GEFT was a speed test, internal consistency was measured by treating each scored section (sections two and three) as split-halves. Witkin et al. reported a corrected Spearman-Brown reliability coefficient of .82 on the GEFT.

Data collection was initiated by mailing students a letter of invitation encouraging participation in the study. The letter was structured according to Dillman (1978) and specified four dates and times with two data collection sessions on each date. Students were invited to attend one of the eight sessions. Ten days after the initial mailing, follow-up efforts were conducted via telephone to determine students' willingness to participate in the study. A make-up data collection session was offered to students unable to attend their scheduled session. All data collection sessions were located in the same room.

A total of 47 percent (n=92) of the students in the sample participated in one of the eight scheduled or one make-up data collection sessions. Students who did not participate in the study were treated as non-respondents and considered to be non-response error. Non-response error was controlled by sampling the non-respondents and comparing them with the respondents. Using a t test analysis, no significant differences ($p<.05$) were found between the sample of non-respondents and respondents. Thus, the non-respondent data were pooled with the respondent data, yielding a sample size of 103 (53.0%) and allowing generalization to the sample/population (Miller & Smith, 1983).

The data were analyzed using SPSS/PC+. Descriptive statistics such as frequencies, percentages, central tendencies, variance, and ranges were used to present the data. A t test statistic was used to determine significant differences between groups. An alpha level of .05 was set a priori.

Results

The Group Embedded Figures Test (Witkin et al., 1971) was used to gather data on the preferred learning styles of senior students enrolled in the College of Agriculture at The Ohio State University during the Autumn Quarter, 1992. The preferred learning style of senior students was dichotomized as either field-dependent or field-independent. Senior students scoring less than the national mean (11.3) were considered to be preferring a field dependent learning style, while students scoring greater than the national mean were considered to be preferring a field independent learning style.

A gender analysis (Table 1) indicated that 28.8 percent of the males preferred a field- dependent learning style, while a majority (71.2%) of the males preferred a field-independent learning style. Among females, approximately 50 percent preferred both field-dependent and field-independent learning styles. The raw GEFT scores ranged from 1 to 18 for males and 2 to 18 for females (Table 2). The raw mean GEFT score for males was 13.4 and 11.1 for females. Using a t test, the gender difference in raw mean scores on the GEFT was found to be significant (t=-2.71; $p<.05$).

An analysis of the overall GEFT scores (Table 1) indicated that 38.8 percent of the senior students preferred a field-dependent learning style. Conversely, 61.2 percent of the senior students preferred a field-independent learning style. The raw mean GEFT score for senior students was 12.4 (Table 2). The raw GEFT scores for senior students ranged from 1 to 18.

An analysis, using frequencies, percentages (Table 3), means, standard deviation, and ranges (Table 4) of students' preferred learning style by nine academic majors (Animal Science, Agricultural Economics, Horticulture, Agricultural Education, Food Science, Dairy Science, Agronomy, Agricultural Mechanics) in the College of Agriculture revealed that of the 27 senior students majoring in Animal Science, 29.4 percent preferred a field-dependent learning style and 70.4 percent preferred a field-independent learning style. The raw GEFT scores ranged from 2 to 18 with a raw mean GEFT score of 13.1.

- Of the 21 senior students majoring in Agricultural Economics, 52.4 percent preferred a field-dependent learning

Table 1 Preferred Learning Style by Gender (n=103)

	GEFT			
	Field-Dependence		Field-Independence	
Gender	*f*	%	*f*	%
Male	17	28.8	4	71.2
Female	23	52.3	2	47.7
Total	40	38.8	6	61.2

Table 2 Mean Preferred Learning Score by Gender (n=103)

Gender	*n*	Mean	SD	Range	*t* Value
Male	59	13.4	.75	1–18	-2.71*
Female	44	11.1	.62	2–18	
Overall	103	12.4	.27	1–18	

*p<.05

Note: Raw scores are based on a maximum possible score of 18

style and 47.6 percent preferred a field-independent learning style. The raw GEFT scores ranged from 4 to 18 with a raw mean GEFT score of 11.1.

- Of the 16 senior students majoring in Horticulture, 7 preferred a field-dependent learning style and 9 preferred a field-independent learning style. The raw GEFT scores ranged from 3 to 18 with a raw mean GEFT score of 12.1.
- Of the 11 senior students majoring in Agricultural Education, 1 preferred a field-dependent learning style and 10 preferred a field-independent learning style. The raw GEFT scores ranged from 9 to 18 with a raw mean GEFT score of 15.6.
- Of the 8 senior students majoring in Food Science, 3 preferred a field- dependent learning style and 5 preferred a field-independent learning style. The raw GEFT scores ranged from 1 to 17 with a raw mean GEFT score of 11.3.
- Of the 7 senior students majoring in Dairy Science, 1 preferred a field- dependent learning style and 6 preferred a field-independent learning style. The raw GEFT scores ranged from 11 to 17 with a raw mean GEFT score was 13.7.
- Of the 7 senior students majoring in Agronomy, 5 preferred a field- dependent learning style and 2 preferred a field-independent learning style. The raw GEFT scores ranged from 10 to 17 with a raw mean GEFT score of 12.3.
- Of the 4 senior students majoring in Agricultural Communication, 3 preferred a field-dependent learning style and 1 preferred a field-independent learning style. The raw GEFT scores ranged from 2 to 15 with a raw mean GEFT score of 8.8.
- Of the 2 senior students majoring in Agricultural Mechanics, 1 preferred a field- dependent learning style and 1 preferred a field-independent learning style. The raw GEFT scores ranged from 8 to 13 with a raw mean GEFT score of 10.5.

Because of gross disproportionate group sizes by major, statistical differences were not calculated among the nine academic majors. Rather, the group statistics reported in Tables 3 and 4 serve only as descriptive data for those senior students in the study. Caution should be exercised not to extrapolate data in Tables 3 and 4 to the population.

Conclusions, Recommendations, and Practical Importance

Senior students enrolled in the College of Agriculture tended to prefer a field-independent learning style. The raw

Table 3 Preferred Learning Style by Academic Major (n=103)

	GEFT			
	Field-Dependence		Field-Independence	
Major	*f*	%	*f*	%
Animal Science	8	29.6	19	70.4
Agr. Economics	11	52.4	10	47.6
Horticulture	7	43.8	9	56.2
Agr. Education	1	9.1	10	90.9
Food Science	3	37.5	5	62.5
Dairy Science	1	14.3	6	85.7
Agronomy	5	71.4	2	28.6
Agr. Communication	3	75.0	1	25.0
Agr. Mechanics	1	50.0	1	50.0
Total	40	38.8	63	61.2

Table 4 Mean Preferred Learning Style Score by Major (n=103)

Major	*n*	Mean	SD	Range
Animal Science	27	13.1	3.99	2-18
Agr. Economics	21	11.1	4.65	4-18
Horticulture	16	12.1	4.69	3-18
Agr. Education	11	15.6	2.70	9-18
Food Science	8	11.3	5.23	1-17
Dairy Science	7	13.7	2.29	11-17
Agronomy	7	12.3	2.63	10-17
Agr. Communication	4	8.8	5.38	2-15
Agr. Mechanics	2	10.5	3.54	8-13

Note: Raw scores are based on a maximum possible score of 18
Group range = 8.8 - 15.6

mean GEFT score for senior students enrolled in the college was 12.4 of a maximum possible score of 18. Witkin et al. (1977) reported a mean GEFT score of 11.6 for college graduates.

Of the senior students, males preferred a field-independent learning style, whereas females preferred a more field-dependent learning style. Persistent gender differences have been found in the field dependence/independence dimension by several researchers (Garger & Guild, 1984; Witkin, 1976), a finding supported by the current study.

Senior students in the study majoring in Animal Science, Horticulture, Agricultural Education, Food Science, and Dairy Science tended to prefer a field-independent learning style. Conversely, senior students in the study majoring in Agricultural Economics, Agronomy, and Agricultural Communication tended to prefer a field-dependent learning style.

Instructors should perceive learning style as referring to actions rather than ability of students. The key to utilizing information on students' learning style is to incorporating students' learning style in the planning and delivery of instruction, while also helping students "stretch" their preference for learning by teaching through other learning styles.

Because learning style affects the learning success of students in specific kinds of situations, instructors need to be sensitive to learning style differences. Instructors should have insight of students' preferred learning style. Workshops on recognizing student learning styles should be offered to instructors. With leadership from the College of Agriculture teaching committee, learning style workshops should be designed and implemented by teacher educators in agricultural education with expertise in learning theories. At the styles workshops, faculty can gain knowledge about learning styles by having their own learning style assessed. Pat Guild, a leading researcher on learning styles, indicated that it is important for instructors, when working with students, to understand both their own and the students' learning perspectives (Brandt, 1990), because as Dunn and Dunn (1979) suggested, instructors tend to teach the way they learn.

Students' learning style should be used to direct instructors to incorporate various teaching methods (e.g., discussion, role play, supervised study, lecture, case study, demonstrations, field trips, resource people, experiments), curriculum materials (e.g., textbooks, handouts, worksheets), and evaluation techniques (e.g., multiple choice, case studies, essays) into classroom discourse to reach students of differing learning styles.

Diversity in student learning styles identified in this study anchors the argument of the need for instructors to have a repertoire of teaching methods. Teacher educators in agricultural education should command leadership with the support from the college academic dean in offering seminars or workshops to instructors not having coursework in pedagogy to augment instructors' repertoire of teaching methods.

Students should have knowledge of their preferred learning style. During freshmen orientation programs, students should be assessed for their preferred learning style and offered counseling on how to adapt their learning style to various teaching styles they are destined to encounter in college classrooms. As a result, students should gain confidence in their learning strengths and develop various learning strategies for handling challenging situations that are certain to arise. Students will also begin to see how they learn most effectively and efficiently, thus allowing them to be better able to take more responsibility for their own learning.

Students and instructors need to accept and value the diversity of learning styles. Beginning as entering college freshmen, students should be counseled on learning and teaching style differences and begin work on coping with these differences. Understanding differences in learning and teaching styles should enable students to improve their learning.

Academic advisors and college counselors should become knowledgeable about learning styles and should be offered workshops. Knowledge about learning styles will allow academic advisors to diagnose students' preference for utilizing media, teaching methods, and curriculum materials that will capitalize on students' strengths, strengthen their weaknesses, and ensure success in coursework. Additionally, knowledge of student learning styles has great potential as a tool for college counselors to aid students in career planning (Witkin et al., 1977). Dembo (1988) suggested that students preferring a field independent learning style will tend to choose occupations where there is less emphasis on interpersonal interaction, whereas students preferring a field dependent learning style will tend to favor occupations that require involvement with others.

References

Anderson, J. A., & Adams, M. (1992). Acknowledging the learning styles of diverse student populations: Implications for instructional design. In L. L. Border & N. Van Note Chism (Eds.), *New Directions for Teaching and Learning*, (pp 19-33). San Francisco: Jossey-Bass Publishers, Inc.

Brandt, R. (1990). On learning styles: A conversation with Pat Guild. *Educational Leadership*, 48(2). Association for Supervision and Curriculum Development.

Cano, J., & Garton, B. L. (1992). A longitudinal assessment of the learning and teaching styles of preservice teachers of agriculture: 1990, 1991, 1992. *Proceedings of the Nineteenth Annual National Agricultural Education Research Meeting*, St. Louis, MO.

Cano, J., Garton, B. L., & Raven, M. R. (1991). An assessment of selected teacher characteristics of preservice teachers of agricultural education. *Proceedings of the 45th Annual Central States Research Conference in Agricultural Education*, Springfield, IL.

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

Claxton, C. S., & Murrell, P. H. (1987). *Learning styles: Implications for improving education practices.* ASHE-ERIC Higher Education Report No. 4. Washington, D.C.: Association for the Study of Higher Education.

Dembo, M.H. (1988). *Applying educational psychology in the classroom* (Third Edition). New York: Longman.

Dillman, D. A. (1978). *Mail and telephone surveys: The total design method.* New York: John Wiley & Sons.

Doebler, L. K., & Eicke, F. J. (1979). Effects of teacher awareness of the educational implications of field-dependent/field-independent cognitive style on selected classroom variables. *Journal of Educational Psychology.* 71(2), 226-232.

Dunn, R. S., & Dunn, K. J. (1979). Learning styles/teaching styles: Should they... can they... be matched? *Educational Leadership, 36,* 238-244.

Escombe, K. M. (1988). *Cognitive style of international and domestic graduate students in agricultural education and agricultural economics.* Unpublished Master's thesis, The Ohio State University, Columbus.

Garger, S., & Guild, P. (1984). Learning styles: The crucial differences. *Curriculum Review,* 23(1), 9-12.

Gregorc, A. F. (1979). Learning/teaching styles: Potent forces behind them. *Educational Leadership, 36,* 234-236.

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30,* 607-710.

Miller, L. E., & Smith, K. (1983). Handling non response issues. *Journal of Extension, 24,*45-50.

Raven, M. R., Cano, J., Garton, B. L., & Shelhamer, V. (1993). A comparison of learning styles, teaching styles, and personality styles of preservice Montana and Ohio agriculture teachers. *Journal of Agricultural Education, 34*(1).

Saracho, O. N. (1989). Cognitive styles and classroom factors. *Early Child Development and Care, 47,* 149-157.

Witkin, H. A. (1973). *The role of cognitive style in academic performance and in teacher -student relations.* Paper presented at a symposium sponsored by the GRE Board, Montreal, Canada. Princeton, NJ: Educational Testing Service.

Witkin, H. A. (1976). Cognitive style in academic performance and in teacher-student relations. In S. Messick & Associates (Eds.), *Individuality in Learning,* (pp 38-72). San Francisco: Jossey-Bass Publishers, Inc.

Witkin, H. A., Dyk, R. B., Faterson, H. F., Goodenough, D. R., & Karp, S. A. (1962). *Psychological Differentiation.* New York: John Wiley & Sons.

Witkin, H. A., Moore, C. A., Goodenough, D. R., & Cox, P. W. (1977). Field-dependent and field-independent cognitive styles and their educational implications. *Review of Educational Research, 47*(1), 1-64.

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

THE NACTA FOUNDATION NEEDS YOUR SUPPORT

The NACTA Foundation was established in 1985 by a small group of former NACTA Presidents. Individual contributions have slowly but steadily increased our assets to a balance that now exceeds $10,000.

To endow the current NACTA Awards program, the NACTA Foundation Board has established a goal of $100,000. We are currently seeking contributions from both individual NACTA members and private corporations.

I encourage you to help NACTA continue to recognize outstanding college teachers of agriculture. Will you please add your name to the donors list by sending a contribution to Murray Brown, NACTAF Treasurer, P.O. Box 2088, Huntsville, TX 77341-2088.

Thomas J. Lindahl
President, NACTA Foundation

Send your donation to:

Murray A. Brown, Secretary-Treasurer, NACTAF
P.O. Box 2088
Sam Houston State University
Huntsville, TX 77341

Plan Ahead Today for NACTA '96

June 15–19, 1996
University of Minnesota at Crookston
42nd Annual Conference