

The Relationship Between Students' Learning Styles, Instructional Performance, and Student Learning in a Plant Propagation Course

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Abstract

Relationships between students' learning styles, an instructor's teaching performance, and student learning were investigated in an upper-level horticulture course. Results indicated that a majority of the students in the course preferred a field-independent learning style. Mid-semester analysis indicated that relationships existed between students' learning styles and perceptions of the instructor's teaching performance. After a mid-semester evaluation, the instructor met with a faculty member in agricultural education to analyze and discuss the results relative to student learning styles. Students' perception of the instructor's overall teaching performance increased from mid-semester to semester end, with students rating the instructor higher on 12 of 13 items. At semester end, low positive relationships were found between students' learning styles and academic performance in the course.

Introduction

How individuals learn has been defined in a myriad of ways, dependent upon the theoretical perspective. Cognitive learning theorists "explain learning by focusing on changes in the mental process that people use in their efforts to make sense of the world" (Eggen and Kauchak, 1999, p. 242). From this perspective, "learning is a change in a person's mental structures that provides the capacity to demonstrate different behaviors" (Eggen and Kauchak, 1999, p. 242). With regard to acquiring and processing information, researchers have suggested that individuals possess different learning styles.

Schroeder (1993) concluded that students were entering institutions of higher learning with greater diversity in their learning styles. Additionally, the learning styles of students, their academic performance, and the relationship these variables have with an instructor's teaching style

have come under increased scrutiny in higher education (Claxton and Murrell, 1987; Schroeder, 1993).

Learning style has been defined as "... distinctive behaviors which serve as indicators of how a person learns and adapts to his/her environment" (Gregorc, 1979, p. 234). Others (Dunn and Dunn, 1979; Garger and Guild, 1984) have described learning style as the educational conditions under which an individual is most likely to learn. Witkin (1973) also indicated that an individual's learning style influences preferences for particular teaching strategies and learning environments. Furthermore, research has suggested that a teacher's style of teaching is related to his/her learning style (Avery, 1985; Dunn and Dunn, 1979; Gregorc, 1979; Lyons, 1984; Witkin, 1973).

In the investigation of learning styles, the field-dependence/independence learning style construct has been one of the most extensively researched (Guild and Garger, 1985; Kogan, 1971). Chickering (1976) specifically noted that the field-dependence/independence construct had major implications for university faculty who make decisions about learning environments and practices. Within this learning style construct, individuals are categorized as having a preference for a field-dependent, field-neutral, or field-independent learning style. Field-dependent learners thrive best in structured social environments, think globally, have difficulty solving problems, and are extrinsically motivated (Table 1). Field-independent learners prefer individual effort and study, are analytical thinkers, enjoy problem-solving and tend to be intrinsically motivated (Witkin et al., 1977b). Individuals classified as field-neutral typically possess characteristics of both field-dependence and field-independence (Garton et al., 1999b).

Just as an individual's learning style influences the way he/she cognitively constructs meaning to subject matter, learning style also influences a teacher's style of teaching. According to Witkin (1976) "... it is easy to see that a teacher's cognitive [learning] style may influence his/her way of teaching." Field-dependent and field-independent teaching styles are consistent with those characteristics of field-dependent/independent learning styles (Cano, 1993). Field-dependent teachers typically are very student-centered, establish a warm personal learning environment, and avoid the use of negative feedback (Witkin, et al., 1977b). Conversely, field-independent teachers generally

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Table 1. Learning and teaching style characteristics

Field-Dependent	
Learning Style	Teaching Style
<ul style="list-style-type: none"> • Perceives globally • Makes broad general distinctions among concepts • Demonstrates a social orientation; learns best in social context • Requires externally defined goals and reinforcements • Needs provided organization 	<ul style="list-style-type: none"> • Teaching situations allowing interaction and discussion • Uses questions to establish student learning • Uses student-centered activities • Viewed as teaching facts • Provides less feedback, avoids negative evaluation • Strong in establishing a warm and personal environment
Field-Independent	
Learning Style	Teaching Style
<ul style="list-style-type: none"> • Perceives analytically • Makes specific concept distinctions, little overlap • Demonstrates an impersonal orientation • Interested in new concepts for their own sake • Has self-defined goals and reinforcement • Can use self-structured situations 	<ul style="list-style-type: none"> • Prefers impersonal teaching situations • Uses questions to introduce topics • Uses teacher-oriented learning situations • Viewed as encouraging to apply principles • Gives corrective feedback, uses negative evaluation • Strong in organizing and guiding student learning

Source: Garger, S. and P. Guild. (1984, February). Learning styles: The crucial differences. Curriculum Review, 9-12.

have a subject-centered classroom, assume an authoritarian atmosphere, and guide students through the learning process.

Learning style has been found to be an important variable in students' academic achievement, how students learn and teachers teach, and student-teacher interaction (Witkin, 1973). Because of the diverse learning styles found in students entering institutions of higher education, it is crucial for instructors to identify learning style differences and incorporate teaching strategies that address the learning needs of all students. Based upon students' preferred learning styles, research findings have been applied to assist educators in developing compatible instructional methods (Keefe, 1982; Keefe and Ferrell, 1990). However, many educators are still presented with a challenge "to assess the learning style characteristics of students [in order to] provide learning opportunities that are compatible with those characteristics" (Garton, et al., 1997, p. 38).

Research has been conducted to assess the preferred learning style of university students (Anderson and Adams, 1992; Torres and Cano, 1994) and the interaction of teaching approach and learning style on student achieve-

ment (Garton, et al., 1999b; Honeyman and Miller, 1998). Additional studies have suggested that students' learning style influences their cumulative grade point average (Torres, 1993; Torres and Cano, 1994). The previously identified research has focused on describing how different groups of students learn relative to their overall academic performance. However, modest research has been conducted to connect students' learning styles to instructors' teaching styles and methods of instruction. Research is warranted that assesses an instructor's ability to adapt his/her teaching style to meet the diverse needs of students.

Purpose and Objectives

The purpose of this study was to describe relationships that existed between students' learning styles, a teacher's teaching performance, and students' performance in an upper-level horticulture course. The specific objectives of the study were to: (1) Describe students' preferred learning styles; (2) Describe the relationship between students' preferred learning style and the instructor's teaching performance, as perceived by students, at mid-semester and

at the conclusion of the course; and (3) Describe the relationship between students' preferred learning style and academic performance in the course.

Methods

The population for this correlational study consisted of an intact group of students enrolled in a plant propagation course ($n=31$) at the University of Missouri. The Group Embedded Figures Test (GEFT) (Witkin, et al., 1971) was administered to assess the preferred learning style of students. GEFT scores range from 0 to 18, with a standardized mean of 11.4. Individuals scoring 14 or greater are considered to prefer a field-independent learning style, 10 or less a field-dependent learning style, and 11 to 13 a neutral learning style.

The GEFT is a standardized instrument that has been used in educational research for over 25 years (Guild and Garger, 1985). Validity and reliability of the GEFT was established by the instrument's developers (Witkin, et al., 1971). Students rated the instructor's teaching performance at mid-semester and at the conclusion of the 16 week course using a university instructor evaluation. The instructor evaluation was a standardized evaluation that had been previously assessed for validity and reliability.

The GEFT was administered to all students enrolled in the plant propagation course during the second week of the semester. One instructor, possessing a field-dependent learning style, and consequently teaching style, taught the course. At the time of this study, the instructor was participating in the College's Teaching Scholars program, a program designed as a support system to help faculty at different stages in their development as teachers. Following the mid-semester evaluation, the course instructor discussed the results with an Agricultural Education faculty member knowledgeable and experienced in adapting teaching styles based on students' learning styles.

Descriptive statistics were calculated on GEFT scores, university instructor evaluations (mid-semester and end-of-semester), and student performance as measured by scores in the lecture and lab portion of the course. Lecture grades for the course were based on two hourly exams and a comprehensive final examination, four quizzes, and nine random attendance scores. Laboratory grades were based on a daily plant care grade (based on a 12 week time period), 22 laboratory reports, two quizzes, and one comprehensive final laboratory examination. Pearson product-moment correlation coefficients were interpreted utilizing Davis' (1971) descriptors.

Results and Discussion

An analysis of students' learning styles indicated GEFT scores ranged from 3 to 17, with an overall mean of 13.2 ($SD = 3.8$). A majority (55%, $n = 17$) of the students preferred a field-independent learning style, 19% ($n = 6$) a field-dependent learning style, and 26% ($n = 8$) a field-neutral style.

The second objective sought to describe the relationship between students' learning style and the instructor's teaching performance, as perceived by students, on a mid-term and end-of-semester evaluation (Table 2). The mid-semester evaluations ranged from 4.57 for "instructor is very knowledgeable of subject matter" to 3.69 for "instructor feedback regarding subject matter." The relationships between the mid-semester evaluation and student GEFT scores ranged from a moderate positive correlation ($r = .46$) for "instructor available for extra help when needed" to a low negative correlation ($r = -.13$) for "instructor's ability to present alternative explanations." The positive correlations indicated that as students' learning style moved toward field-independence their rating of the instructor was more positive. Conversely, a negative correlation indicated that as students' learning style moved toward field-independence their rating of the instructor was less positive.

The end-of-semester evaluation of the instructor's teaching performance, as perceived by students, ranged from a mean of 4.71 for "instructor's voice is clear and easy to understand" and "instructor available for extra help" to a mean of 4.13 for "instructor has provided feedback regarding my learning of subject matter." The relationship between the instructor's end-of-semester and GEFT scores revealed a low positive correlation ($r = .11$) for "instructor's examples and illustrations were helpful," and moderate negative correlations for "instructor's voice was clear and easy to understand" ($r = -.30$), "instructor's organization was easy to follow" ($r = -.34$), "explanations were easy to understand" ($r = -.37$), and "alternative explanations have been effective" ($r = -.38$). A positive shift was identified between the instructor's mid-semester and end-of-semester evaluation on 12 of 13 items with the exception being, "instructor is very knowledgeable of subject matter".

A low positive relationship ($r = .20$) existed between students' GEFT scores and their performance on exams and quizzes in the course (Table 3). A negligible positive relationship ($r = .07$) existed between student GEFT scores and their performance in laboratory practicums, and a low positive relationship ($r = .11$) was found between students' GEFT scores and their overall course performance.

Table 2. Relationship between learning style and teacher performance as perceived by students

Teacher Performance Assessment Item ^z	Mid-Semester Evaluation		End-of-Semester Evaluation	
	Mean (SD)	r	Mean (SD)	r
1. Instructor's organization of the subject matter has made it easy to follow.	4.10 (.76)	.17	4.45 (.81)	-.34
2. Instructor's explanations have been easy to understand.	4.07 (.64)	-.03	4.42 (.68)	-.37
3. Instructor's voice has been clear and easy to understand.	4.47 (.68)	-.04	4.71 (.46)	-.30
4. Instructor's ability to present alternative explanations has been effective.	4.00 .64	-.13	4.35 (.66)	-.38
5. Instructor's use of examples and illustrations have been helpful.	4.17 (.53)	-.01	4.52 (.68)	.11
6. Instructor has been enthusiastic (excited) about teaching.	4.20 .76	.05	4.58 (.56)	.08
7. Learning (course) objectives have been clearly communicated.	3.80 (1.16)	.01	4.19 (.98)	-.14
8. Instructor has been available when extra help was needed.	4.30 (.79)	.46	4.71 (.46)	-.04
9. Instructor is very knowledgeable of the subject matter.	4.57 (.57)	.01	4.47 (.44)	-.23
10. Assignments/projects have been helpful in learning the course content.	3.90 (.84)	-.12	4.39 (.84)	-.06
11. Instructor has provided feedback regarding my learning the subject matter.	3.69 (.76)	-.12	4.13 (.85)	.01
12. Instructor's examinations contributed to my learning the subject matter.	3.90 (.61)	.01	4.45 (.57)	-.26
13. Overall teaching effectiveness of the instructor? ^y	4.10 (.76)	-.06	4.58 (.56)	-.13

^zScale 5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, 1 = strongly disagree

^yScale 5 = excellent, 4 = quite good, 3 = satisfactory, 2 = fair, 1 = poor

Table 3. Relationship between students' learning style and performance

Variable	X ₁	X ₂	X ₃	X ₄
Learning Style GEFT (X ₁)	1.0	.20	.07	.11
Exam/Quiz Percentage(X ₂)		1.0	.57	.81
Lab Practicum Percentage(X ₃)			1.0	.94
Course Percentage (X ₄)				1.0

Summary

A majority of the students enrolled in the plant propagation course preferred a field-independent learning style. This finding was consistent with previous research where a majority of college agriculture students preferred a field-independent learning style (Cano and Porter, 1997; Garton, et al., 1999a and 1999b; Torres and Cano, 1994). The mean GEFT score of 13.2 was nearly two points above the established norm of 11.4 (Witkin et al., 1977a).

There was a moderate positive relationship between students' learning style and the instructor's availability of extra help when needed on the mid-semester evaluation. This would imply that field-dependent learners viewed the instructor as less approachable for extra assistance out-side the formal learning environment. Prior research has indicated that students possessing a field-dependent learning style express a greater need for assistance out-side the formal learning environment. Based on the direction and strength of the relationship it was recommended to the course instructor at mid-semester to clearly communicate to the students that she was available to assist them with help out-side the formal learning environment. Based upon these recommendations, the instructor implemented practices that stressed an 'open door' policy and encouraged students to visit the instructor for additional assistance as needed.

There were moderate negative relationships on the instructor's evaluation of teaching performance at the conclusion of the course between students' learning styles and the following items: 1) organization of subject matter, 2) clarity of explanations, 3) clarity of voice, and 4) ability to present alternative explanations. This finding would imply that field-dependent students rated the instructor higher than field-independent learners on these four items. Although relationships existed, the instructor's teaching performance, as perceived by students, improved from mid-semester to the completion of the course on all four items. Students' perceptions of the instructor's overall teaching performance increased from the mid-semester evaluation to the end-of-semester evaluation on 12 of the 13 items. This finding would imply that the modifications made by the instructor at mid-semester had a positive influence on the students' perceptions of the instructor's teaching performance. Also, it would appear these modifications were directed toward those who possessed a field-dependent learning style.

Low positive relationships were found between students' learning styles and their performance on ex-

ams and quizzes, and in their overall course performance. Although the relationships were low, they were in the positive direction, indicating that as students moved toward a field-independent learning style their achievement in the course slightly increased.

Students' learning styles were analyzed to assist the instructor in meeting the instructional needs of all students. One method of assessment was the use of a mid-semester and end-of-semester evaluation by students. By analyzing the relationships between learning styles and mid-semester instructor evaluations, and modifying teaching strategies, this instructor was able to raise her feedback evaluation scores by nearly half a point (.5), on a five-point scale, on 12 of the 13 evaluation items. Further investigation into this line of inquiry should address the following questions: 1) What instructional changes can be made to meet the individual needs of students? 2) How can changes in instructional techniques affect field-dependent/independent learners? 3) How can providing mid-semester instructor feedback impact students' overall perception of a course and instructor?

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