

## THE RELATIONSHIP BETWEEN LEARNING STYLE AND LEVELS OF COGNITION OF INSTRUCTION OF HORTICULTURE TEACHERS

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### Abstract

*The flexibility for learners to learn begins with the teacher's style of learning and the levels of cognition utilized in the classroom. Teachers have the basic capability to learn and teach; however, they are not all able to learn and teach effectively in the same exact way. The current study sought to determine the learning style and cognitive level of instruction of central Ohio horticulture teachers. The Florida Taxonomy of Cognitive Behaviors (FTCB) and the Group Embedded Figures Test (GEFT) were used to assess the level of cognitive instruction (FTCB) and the learning style (GEFT). The results indicated that 44% of the teachers preferred the field dependent learning style and 56% preferred the field-independent learning style. Furthermore, 84% of the teaching occurred at the lower levels of cognition. The mean weighted cognitive score for the teachers was 23.03. The mean weighted score reflected a cognitive level of teaching concentrated near the cognitive level of translation. A moderate positive ( $r=.32$ ) relationship was found between learning style and the weighted cognitive level of instruction. Correlation coefficients between GEFT scores and the seven levels of cognition ranged from a substantial negative association ( $r=-.53$ ) to a moderate positive association ( $r=.41$ ).*

Bloom, Madaus, and Hastings (1981) labeled education as a "process of change," a process in which students must be changed in some way through the instruction they receive. Thus, when teaching in the classroom, educators need to be cognizant of the contribution to the development of the affective, psychomotor, and cognitive domains of learning. Regarding the cognitive domain, the educational literature (Gall, 1970; Roberts, 1974) has suggested that the emphasis in schools has been teaching students facts even though teachers and curriculum designers attested to the importance of teaching students to think.

Supporting Gall's (1970) and Roberts' (1974) findings, studies conducted in agricultural education at the secondary level found that teachers concerned themselves with the subject matter students learned, more so than the cognitive level of their instruction (Cano, 1988; Cano & Newcomb, 1990). If insufficient instruction occurs at the higher levels of cognition, then students are not

graduated adept at problem solving, analysis, and evaluation (Newcomb & Trefz, 1987).

The use of problem solving, analysis, and evaluation skills are also related to how students learn (Witkin, 1973). Furthermore, the art of delivery, and teaching method utilized, makes a difference in how a student learns (Zippert, 1985; Koppleman, 1980; Dunn & Dunn, 1979). Gregorc (1979) claimed that "individuals all have the basic capability to learn and teach; however, they are not all able to learn and teach effectively in the same exact way" (p. 234-237).

Agricultural education professionals (Raven, Cano, Garton, & Shelhamer, 1993; Cano, Garton, & Raven, 1992) have been examining differences among teachers of agriculture in an effort to better prepare teachers of agriculture to teach to an increasingly diverse student population. Research to date has concluded that not all students learn the same, just as not all teachers teach the same (Raven,

Cano, Garton, & Shelhamer, 1993; Cano, Garton, & Raven, 1992; Cox, Sproles, & Sproles, 1988; Rollins, Scholl, & Scanlon, 1992). The teacher must learn to be flexible to adjust to a learner's capability (Turner, 1979).

The flexibility for learners to learn at higher levels of cognition begins with the teacher's style of learning and the levels of cognition that are utilized in the classroom (Clegg, Farley, & Curran, 1967; Dunn & Dunn, 1979). If teachers utilize higher levels of cognition, student cognitive levels can be increased (Cano, 1988; Newcomb & Trefz, 1987; Cano & Newcomb, 1990).

But, what was the level of cognitive instruction and the preferred learning style of horticulture teachers? No data existed to indicate what was the learning style and the cognitive level of instruction of horticulture teachers.

### **Purpose and Research Questions**

The purpose of the study was to determine horticulture teachers' learning style and cognitive level of instruction. In addition, the study sought to determine if any relationship existed between learning style and level of cognition of instruction. In an effort to achieve the purpose of the study, the following research questions were developed:

1. What was the learning style of central Ohio secondary horticulture teachers?
2. What were the cognitive levels of instruction utilized by central Ohio secondary horticulture teachers?
3. What was the relationship between the learning style and cognitive level of instruction of central Ohio secondary horticulture teachers?

### **Methodology**

#### Population and Sample

The target population for the study was secondary horticulture teachers in Ohio (N=89). The target population was derived from the Ohio Agricultural Education Directory (Agricultural Education Service, 1991).

The horticulture teachers purposefully selected for the study (n=11) were from central Ohio, otherwise known as District Seven in the Ohio Agricultural Education Directory (Agricultural Education Service, 1991). The responding sample (n=9) included three female and six male teachers of horticulture. Due to sample selection techniques, the results of the study were generalizable to only the responding sample.

#### Instrumentation

The Group Embedded Figures Test (GEFT) (Oltman, Raskin, & Witkin, 1971) was administered to determine the preferred learning style of the teachers as either field-dependent or field-independent. Teachers who scored above the national mean of 11.3 were considered to be field-independent learners. Likewise, those teachers who scored below the national mean (11.3) were considered field-dependent learners.

The GEFT is considered to be a standardized instrument. The validity of the GEFT has been established by determining its relationship with the parent test the Embedded Figures Test (EFT). The correlations between the GEFT and EFT ranged from .84 to .90. The reliability coefficient for the GEFT is .82 (Witkin, Oltman, Raskin, & Karp, 1971).

The Florida Taxonomy of Cognitive Behavior (FTCB) (Brown, Ober, Soar, & Webb, 1968) was designed to identify specific cognitive behaviors of teachers. The FTCB is a derivative of the Taxonomy of Educational Objectives in the Cognitive Domain which was developed by Bloom, Engelhart, Furst, Hill, and Krathwohl (1956). Because the FTCB is derived from Bloom's Taxonomy, it can be considered valid in identifying

behaviors at various levels of cognition (Miller, 1989; Whittington, 1991). Reliability of the FTCTB is dependent upon the raters' utilization of the instrument (Pickford, 1988; Whittington, 1991). In the current study, a single rater observed all the participants. The inter-rater reliability was determined to be .94.

### Data Collection

Participants for the study were administered the GEFT during a district meeting for agricultural instructors. The GEFT was administered and scored by a consultant who had extensive experience with the GEFT.

Use of the FTCTB instrument involved the categorization of cognitive behaviors observed during classroom observations. The teachers were observed three times during a three-month period. Observations were made at two-week intervals. All classroom observations were audio recorded. The observer noted statements reflecting each six-minute transition point as recommended for using the FTCTB.

### Data Analysis

To analyze the data regarding the learning styles, the data was hand scored as either correct or incorrect. The total number of correct responses constituted the score for each respective horticulture teacher. The minimum possible score was zero (0) and the maximum possible score was eighteen (18). Learning style scores of the horticulture teachers were reported as field-dependent or field-independent using frequencies and percentages. Additionally, the mean, standard deviation, and range of scores on the GEFT were analyzed.

Cognitive level of instruction was calculated using the process employed by Miller (1989). The number of behaviors observed at each of the seven levels of cognition included in the FTCTB were totaled for each class observation, and then summed

for the three class observations of each teacher. Next, the percentage of cognitive behaviors which each teacher exhibited at the various levels of cognition was determined. The scores for levels of cognition of instruction could range from zero (0) percent to 100 percent. Descriptive statistics were calculated for each of the levels of cognition.

A single value representing each of the instructor's relative cognitive level of instruction was calculated by multiplying the percentage value of each cognitive level by their respective cognitive weighing values (Table 1) (Miller, 1989; Whittington, 1991; Pickford, 1988). Weighted cognitive scores at each level were summed in order to obtain a single interval score which was representative of the cognitive level of instruction of each teacher.

Relationships were established using Spearman Rank correlations. Spearman Rank correlation was used because the researchers wanted to find the coefficient of correlation between two sets of measures that were rank ordered or ordinal, rather than interval. Correlation coefficients were interpreted utilizing Davis' (1971) descriptors.

Table 1. Cognitive Weighing Values

Levels of Cognition	Value
Knowledge	.10
Translation	.20
Interpretation	.30
Application	.40
Analysis	.50
Synthesis	.60
Evaluation	.70

## **Results**

Research question one sought to determine the learning style of central Ohio horticulture teachers. Results (Table 2) indicated that 44% of the teachers preferred the field-dependent learning style and

55% preferred the field-independent learning style. A gender analysis indicated that 33% of the females preferred a field-dependent learning style while 67% preferred a field-independent learning style. In addition, the male teachers were split equally at 50% each on either field-dependent or field-independent. The mean learning style score, as measured by the GEFT was 12.7, which was greater than the national mean of 11.3.

Research question two sought to determine the cognitive level of instruction utilized by central Ohio horticulture teachers. Of the seven levels of cognition identified by the FTCE, the teachers' taught 47% of the time at the knowledge level

(Table 3); and, the translation and interpretation levels each accounted for 17% of the cognitive level of teaching. The application level accounted for four percent; analysis accounted for 12%; and, the synthesis level of cognition accounted for three percent of the cognitive level of instruction. In addition the teachers' taught at the evaluation level of cognition less than one percent of the time. Furthermore, 84% of teaching occurred at the lower levels of cognition (knowledge, translation, interpretation and application). Teaching at higher levels of cognition (analysis, synthesis, and evaluation) occurred 16% of the time (Table 3).

Table 2. Preferred Learning Styles of Central Ohio Secondary Horticulture Teachers (n = 9)

	Learning Style			
	Field-Dependent		Field-Independent	
	f	%	f	%
Females	1	33.3	2	66.6
Males	3	50.0	3	50.0
Total	4	44.4	5	55.6

Note. Mean: 12.7; Standard Deviation: 3.74; Range: 4 - 16

Table 3. Mean, Standard Deviation, Cumulative Percent, and Range of Cognitive Levels of Instruction of Central Ohio Secondary Horticulture Teachers (n = 9)

	Mean	Standard Deviation	Cumulative Percent	Range
Knowledge	46.8	11.5	46.8	31.1-66.8
Translation	16.6	6.1	63.4	6.0-28.3
Interpretation	16.8	2.3	80.2	14.3-20.3
Application	3.7	4.0	83.9	0.0-11.1
Analysis	12.4	10.4	96.3	1.4-32.4
Synthesis	3.1	3.2	99.4	0.0- 8.5
Evaluation	.6	1.5	100.0	0.0- 4.5

Note. Figures are expressed in percentages

Research question three sought to describe the relationship between learning style and cognitive level of instruction of central Ohio horticulture

teachers. The mean weighted cognitive score for the teachers was 23.03. The mean weighted score reflected a cognitive level of teaching concentrated

near the cognitive level of translation.

A moderate positive relationship ( $r=.32$ ) was found between the teachers learning style and the teachers weighted cognitive level of instruction (Table 4). Correlation coefficients between the central Ohio horticulture teachers' GEFT scores and the seven levels of cognition ranged from a substantial negative association ( $r=-.53$ ) among learning style and knowledge, to a moderate positive association ( $r=.41$ ) between learning style and the application level of cognition (Table 4).

Table 4. Correlation Coefficients Between Central Ohio Secondary Horticulture Teachers' Learning Style (GEFT) and Cognitive Level of Instruction and Weighted Score of Cognitive Level of Instruction

Levels of Cognition	r
Knowledge	-.53
Translation	.20
Interpretation	.22
Application	.41
Analysis	.26
Synthesis	.05
Evaluation	-.10
Overall Weighted Score	.32

### Conclusions and Recommendations

From the data it was concluded that the horticulture teachers in the study generally preferred a field-independent learning style. The conclusion drawn was consistent with other research (Cano, Garton, & Raven, 1992; Raven, Cano, Garton, & Shelhamer, 1993) which indicated that individuals who taught agricultural subject matter preferred a field-independent learning style. In addition, the related data (Cano, Garton, & Raven, 1992; Raven, Cano, Garton, & Shelhamer, 1993) concluded that females who teach agricultural subject matter

tended to prefer a field-independent learning style. In general, the opposite is true, females tend to prefer a field-dependent learning style (Witkin, et al., 1971).

It is recommended that teachers of horticulture in the study be made aware of their preferred learning style and the implication that their preferred learning style has on their classroom instruction. With learning style knowledge, the horticulture teachers should be in a better position to recognize the learning style characteristics of themselves and their students, and thus adapt their teaching styles to meet the learning styles of students.

It is also recommended that further research be conducted with a greater pool of horticulture teachers to determine if the preferred learning styles are consistent. In addition, further research needs to be conducted to determine why females who teach agricultural subject matter (horticulture) tend to prefer a field-independent learning style which is in contrast with the learning styles of females in general.

In regard to the cognitive levels of instruction, of the seven levels identified by the FTCE, the teachers taught 84% of the time at the lower levels (knowledge, translation, interpretation, application) (Bloom, et al., 1956) of cognition. Only 16% of the teachers' time was spent teaching at higher levels (analysis, synthesis, evaluation) (Bloom, et al., 1956) of cognition. The findings of the study are consistent with the production agriculture teachers as reported by Cano (1988), and resembled similar research findings by Fischer and Grant (1983), Pickford (1988), Miller (1989), and Whittington (1991).

It is recommended that continual education on enhancing teaching at higher levels of cognition be a priority of inservice seminars so that the teachers of horticulture in the study can increase the level of cognition at which they teach. The State Department of Education needs to invoke

responsibility upon the horticulture teachers in the study to raise the levels of cognition at which they teach. Furthermore, the teachers of horticulture in the study need to evaluate their course objectives, lesson plans, assignments, quizzes, and tests, along with their teaching practices, to ensure that the attainment of objectives by the students are at high levels of cognition.

In regards to the relationship between learning style and level of cognition of instruction, as the scores from the GEFT increased towards a field-independent learning style, the percentage of teaching at the higher levels (analysis, synthesis, evaluation) of cognition also increased. Furthermore, the field-dependent teachers tended to use a higher percentage of their teaching time at the knowledge level of cognition.

Field-independent teachers tended to use a higher percentages of their teaching time teaching at the translation, interpretation, application, and synthesis levels of cognition. Both field-dependent and field-independent teachers tended to use the same amount of teaching time at the evaluation level of cognition.

It is critical that inservice and preservice education be targeted towards increasing the cognitive level of instruction. Because field dependent teachers tended to teach at the lower levels of cognition, it is recommended that inservice and preservice education coordinators be made aware of the tendency for field-dependent teachers to teach at the lower levels of cognition so that an emphasis may be placed on cognitive development of field-dependent teachers. It is further recommended that the inservice and preservice education coordinators determine the learning styles of teachers and develop individualized educational programs which would specifically address the needs of individual teachers.

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