Assessment of Competencies Possessed by Students Enrolled in Applied Principles of Agribusiness and Natural Resources Education

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Currently, a great deal of attention is being given to the concept of educational accountability. In this atmosphere, legislators, educators, and the general public are asking if expenditures for vocational education are producing desired results. Funding agencies, too, are asking for evaluative information upon which policy decisions are based. Effective evaluation is vital for improving educational programs because it makes it possible to determine the merits of existing programs, the need for new programs, or the need for revision of existing programs. However, based on a review of a report to the Governor of Florida, and similar reports in other states, it is obvious that sufficient data substantiating the effectiveness of vocational education is not available (Governor's Commission on Secondary Schools for the State of Florida, 1983).

One measure of the effectiveness of a curriculum is the performance of students. The assessment of student mastery of skills and knowledge may also be a measure of teacher effectiveness. Thus, tests provide an indication of how much is being learned in an instructional program and how well the objectives are being mastered. In order to properly use student tests as a measure of program effectiveness, a set of measurable objectives must be developed. These objectives should be based upon competencies that industry recognizes as necessary for employment. Consequently, one measure of program effectiveness is the extent to which students completing an instructional program possess or fail to possess the competencies specified in the instructional objectives. Therefore, test information cannot only be used to evaluate program effectiveness, but can also be used to evaluate the students' mastery of instructional objectives (Glasser & Nitko, 1971). Tests composed of items keyed to a set of specific measurable objectives are termed criterion-referenced tests (Ivens, 1970).

In order to have valid criterion-referenced tests of the competencies possessed by students enrolled in Applied Principles of Agribusiness and Natural Resources Occupations (hereafter referred to as Applied Principles) in Florida, Cheek and McGhee (1983a, 1983b, 1983c, 1983d, 1983e, 1983f) conducted a series of projects to develop

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such measures. As a result of their activities, test item banks were developed for the major content areas of the Applied Principles. Selected items from the banks relative to the Applied Principles program were used in the present study to assess student mastery of competencies. Applied Principles is designed to be taught at the tenth grade level for one hour of instruction per day for the entire school year. Students who enroll should have completed Fundamentals of Agribusiness and Natural Resources Occupations in the ninth grade.

Purpose

The purpose of this study was to assess the level of mastery of Florida students enrolled in the Applied Principles program. In order to achieve this purpose, the following objectives were developed as guidelines for conducting the research:

1. Determine the level of mastery of currently enrolled vocational agriculture students on the Applied Principles Achievement Test (APAT).

2. Compare students' level of mastery on the APAT according to the following:

   a) Current grade in school.

   b) Previous enrollment in agricultural classes.

   c) FFA membership.

   d) Involvement in the supervised occupational experience program.

   e) Career plans.

3. Determine whether competencies identified in the state curriculum guide for Applied Principles were being taught by the teachers.

Research Procedure

The population for the study was schools in Florida where Applied Principles courses were taught during the 1982-83 school year. The five Department of Education regional consultants for agribusiness and natural resources education were contacted and asked to identify the schools in which Applied Principles was being taught and the names of the teachers teaching the course. This resulted in a list of 127 teachers who were offering Applied Principles. Each of these teachers was contacted and 52 teachers indicated they would be willing to administer the APAT test to the 1587 students in their classes.

Applied Principles consists of three instructional components, each designed to utilize one-third of the school year. All students complete the common core component which consists of agricultural business management, agricultural mechanics, and leadership and citizenship development; then, instructors select two specialized components from the following taxonomies: agricultural mechanics; agricultural production; agricultural resources; forestry; and ornamental horticulture. Because of this, six component tests of 20 questions each were constructed and various test combinations were administered depending upon the components an instructor taught.

Questions comprising the criterion-referenced test related to competencies identified in the State Curriculum Guide (Panhandle Area Education Cooperative and Florida Department of Education, 1980). Test questions were selected from test item banks developed by Cheek and McGhee (1983 a, b, c, d, e, and f). Items were selected using the following criteria: an item discrimination index greater than 0.30 which indicate that the item can discriminated among students who do poorly on the test from those who obtain high scores and an item difficulty between .50 and .80. Item difficulty is a measure indicating the proportion of students who correctly answer an item.

The mean item discrimination for test questions included on each of the component tests were: Common Core .61; Agricultural Production .56; Ornamental Horticulture .52; Agricultural Mechanics .30; Forestry .51; and Agricultural Resources .49. The mean item difficulties for each component tests were Common core .65; Agricultural Production .61; Ornamental Horticulture .56; Agricultural Mechanics .38; Forestry .61; and Agricultural Resources .74.

Reliability of each item bank of questions was determined by calculating a Kuder-Richardson 20 correlation coefficient. The Kuder-Richardson 20 correlation coefficients for each of the component was as follows: Common Core .89; Agricultural Production .80; Ornamental Horticulture .89; Agricultural Mechanics .77; Forestry .88; and Agricultural Resources .94.

In addition to the test items designed to assess performance in Applied Principles, five additional items sought demographic information concerning the students. A teacher questionnaire was developed to obtain data necessary to accomplish objective three. The questionnaire was designed to determine whether or not each of the competencies identified in the State Curriculum Guide was included by teachers in their Applied Principles course.

Data for this study were collected from 44 teachers and 1039 students. To analyze data related to objective one, total mean scores were computed for each component of the APAT and the total test. Descriptive statistics were used to summarize each of the five demographic variables in objective two. One way analysis of variance was used for students' mean scores on the APAT when considering grade in school and career plans. The *t*-test was used in objective two to

determine whether or not differences existed in students' mean scores on the APAT with respect to previous enrollment in agricultural classes, FFA membership, and involvement in supervised occupational experience programs. Descriptive statistics were used to analyze data in objective three.

Results

Student Achievement

Data presented in Table 1 illustrates that students had the highest mean scores on the core component 12.35 (61.75%) followed by agricultural production 11.14 (55.7%), agricultural resources 10.06 (50.30%), ornamental horticulture 8.81 (44.05%), agricultural mechanics 8.25 (41.25%), and forestry 8.11 (40.55%). The common core component was composed of three sub-components: agricultural business management, agricultural mechanics; and citizenship and leadership. It was found that students performed best on the leadership and citizenship portion of the test and poorest on agricultural mechanics. In order to determine how students performed on the APAT, regardless of component, a total test score was derived. The mean total raw score was 31.37 (52.28%) with a standard deviation of 10.81 which indicates that two-thirds of the students had a mean score somewhere between 20.56 (34.27%) and 42.18 (70.03%).

Table 1

Achievement of Students on the APAT

Component	Raw score $\bar{X}$	Questions n	SD	N	Percentage score
Core	12.35	20	4.08	1038	61.75
Agricultural Business Management	4.27	7	1.61	1038	61.00
Agricultural Mechanics	3.92	7	1.83	1038	56.00
Leadership and Citizenship	4.17	6	1.71	1038	69.50
Agricultural Production	11.14	20	4.10	823	55.70
Ornamental Horticulture	8.81	20	4.43	633	44.05
Agricultural Mechanics	8.25	20	3.22	380	41.25
Forestry	8.11	20	3.21	190	40.55
Agricultural Resources	10.06	20	3.36	34	50.30
Total Test	31.37	60	10.81	1039	52.28

Current Grade in School

Of the students completing the APAT the vast majority (66.3%) were tenth graders, 19.2% in the eleventh grade, 10.0% in the twelfth grade, and 4.5% were in the ninth grade.

The total mean scores and standard deviations for students taking the APAT ranged from a high of 34.05 for students in the 11th grade to a low of 25.76 for the 9th grade students (Table 2). A one-way analysis of variance to determine if there were significant differences in the mean scores of students on the APAT for the various grade levels, resulted in an *F* value of 7.28, which was significant at the .0001 level. Duncan's multiple range test identified differences among mean score for ninth grade students and the mean scores of tenth, eleventh, and twelfth grade students. There were no significant differences among the mean scores of tenth, eleventh, and twelfth graders.

Table 2

Mean Score on APAT According to Grade in School

Current grade in school	n	$\bar{X}$ score*	Percentage score	SD
9th	41	25.76B	42.9	9.34
10th	604	32.08A	53.5	10.25
11th	175	34.05A	56.8	11.23
12th	91	33.14A	55.2	10.59

Note. *Mean scores with the same letter are not significantly different at the .05 alpha level.

Previous Enrollment in Agriculture

Most (77.5%) of the students indicated that they had previously been in an agricultural course. The *t*-test used to determine whether significant differences existed between the mean scores of these two groups on the APAT revealed that there was no significant difference at the .05 level between mean scores of students who had not previously been enrolled in an agricultural course. The *t*-test resulted in a value of 1.47 which was not significant at the .05 level. The mean score for students with previous agricultural course experience was 32.78 compared to 31.55 for students who had not enrolled in a course

Membership in FFA

Almost three-fourths (74.5%) of the students completing the APAT indicated that they were members of their schools' FFA chapter. To determine whether there were significant differences between mean scores on the APAT according to membership in FFA, the *t*-test resulted in a *t*-value of 3.93 which was significant at the .0001 level. Students who were FFA members scored significantly higher (33.42) than those who were not (30.32).

SOEP Involvement

Almost two-thirds (64.8%) of the students indicated they had an SOEP experience. A *t*-test ($p < .05$) indicated that students with an SOE had significantly higher mean scores (33.48) than students who indicated that they did not have an SOEP (30.92).

Career Plans

Students who planned to attend college or pursue other post-secondary education and students who were unsure of what their plans were, comprised the largest proportion (31.77% and 27.10%, respectively) of the respondents (Table 3). Only 17.95% of the students indicated plans to enter an agricultural occupation directly from high school. The military was indicated by 15.34% of the students as being in their future career plans. The smallest proportion (7.84%) of the students indicated that they planned to work in a non-agricultural occupation.

Table 3

Career Plans After Graduation and Mean APAT Score According to Career Plans

Career plans	n	%	$\bar{X}$*	SD
Agricultural occupation	165	17.95	32.51AB	10.37
Non-agricultural occupation	72	7.84	28.61C	10.63
College/post high school education	292	31.77	34.29A	10.15
Military	141	15.34	30.35BC	11.37
Unsure	249	27.10	30.91BC	10.44

Note. *Mean score with the same letter are not significantly different at the .05 alpha level.

The total mean scores and standard deviations for the various categories of career plans of students completing the APAT are also presented in Table 3. The scores ranged from a high of 34.29 for students planning to attend college to a low of 28.61 for individuals planning to enter a non-agricultural occupation.

A one-way analysis of variance computed to determine if there were significant differences among mean scores on the APAT by the five categories of career plans resulted in an *F* value of 6.99, which was significant at the .0001 level. Duncan's multiple range test revealed that students who planned to attend college or post-secondary school had significantly higher scores than students who were unsure of their career plans, or planned to enter the military, or planned to enter a non-agricultural occupation scored significantly lower than students planning to enter an agricultural occupation or attend college or post-secondary school.

Competencies Taught

The third objective was to determine if the competencies identified in the Applied Principles Curriculum Guide were actually being taught by teachers in this study. Only teachers teaching a specific curriculum component were asked to respond to the competencies related to that component. Thus, each teacher responded to the common core component and two specialized components.

Table 4

Degree to Which Applied Principles Competencies are Being Taught by Teachers

% of teachers teaching the competency	n of competencies	% of competencies
0 - 29.9	5	3.6
30 - 49.9	19	13.5
50 - 74.9	51	36.4
75 - 100	65	46.5
Total	140	100.0

Data in Table 4 identify the degree to which the 140 competencies included in the Curriculum Guide were being taught by the teacher respondents in this study. The data show that 65

(46.5%) of the competencies were taught by 75 - 100% of the teachers who taught a specific program area. Fifty-one competencies (36.4%) were taught by 50 - 74.9% of the teachers. Nineteen competencies (13.5%) were included in the program of 25 - 49.9% of the teachers and the five (3.6%) of the competencies were taught by 0 - 24.9% of the teacher respondents.

Data were also examined to determine the degree to which the competencies in the State curriculum Guide were being taught by 75% or more of the teachers. Data in Table 5 reveals over 75% of the teachers taught 48.2% of the core competencies, 35.3% of the agricultural mechanics competencies, 75% of the ornamental horticulture competencies, 52.4% of the forestry competencies, 25% of the agricultural production competencies, and 58.3% of the agricultural resources competencies. A common core sub-component of leadership had the highest proportion (78.3%) of the competencies being taught by 75% or more of the teachers.

Table 5

Percentage of Competencies by Instructional Component Identified by 75% or More of Teachers as Being Included in the Applied Principles Program

Component	n of competencies	n of competencies identified by 75% or more of the teachers	%
Core	54	26	48.2
Agricultural business management	14	2	14.3
Agricultural mechanics	17	6	35.3
Leadership	23	18	78.3
Agricultural mechanics	17	6	35.3
Ornamental horticulture	12	9	75.0
Forestry	21	11	52.4
Agricultural production	24	6	25.0
Agricultural resources	12	7	58.3
Total	140	65	46.4

Conclusions

The following conclusions were drawn from the findings of this study:

1. Based upon the performance of students of the APAT, student mastery of the Applied Principles curriculum was slightly over 52%. This indicates that the average student had learned approximately 52% of the curriculum as prescribed by the Curriculum Guide. Additionally, it was concluded that less than 50% of the competencies specified in the Curriculum Guide were being taught by teachers.

2. Students in the tenth, eleventh, and twelfth grade scored significantly higher on the APAT than did ninth graders.

3. There was no significant difference between mean score on the APAT for those students who were previously enrolled in an agricultural class and those who were not.

4. Students taking the APAT who were currently members of the FFA scored significantly higher on the APAT than students who were not in FFA. In addition, those involved in SOEP scored significantly higher on the APAT than those who indicated no involvement with SOEP.

5. Students who planned to attend college or post-secondary school scored significantly higher on the APAT than students who were unsure of their career plans, or those who planned to enter the military, or those who planned to enter a non-agricultural occupation. There was not a significant difference between students who planned to enter an agricultural occupation and those with plans for post-secondary school education. In addition, those students planning to enter an agricultural occupation scored significantly higher than those students planning to enter a non-agricultural occupation.

Recommendations

Based upon the findings and conclusions of this study, the following recommendations are made:

1. This study indicates that less than 50% of the competencies specified in the Applied Principles Curriculum Guide were being taught by 75% or more of the teachers and the percentage test score on the APAT was approximately 52%. The statistics raise several questions such as: Are teachers teaching what should be taught? Are students learning what they should learn? Does the State Curriculum Guide reflect what should be taught? If the Curriculum guide does reflect

what should be taught, why are teachers not teaching the competencies specified? Further study should be conducted to determine answers to these questions.

2. Emphasis should be given to strengthen instruction in Applied Principles. Strategies for strengthening this program might include, but are not limited to: (a) a review of the Applied Principles Curriculum Guide by teachers, advisory committee members, regional consultants, vocational directors, teacher educators, and others to make certain that the competencies contained therein are appropriate; (b) inservice educational activities designed to improve the competencies of teachers related to the instructional components of Applied Principles; (c) special attention by Department of Education regional consultants for vocational agriculture during the program review process to noted deficiencies related to competencies not included in the instructional program; (d) increase attention at the preservice level to emphasize the structure of Applied Principles and the competencies included in the Curriculum Guide. In addition, an effort should be made to determine if appropriate facilities and equipment are available to teach the competencies specified in the Curriculum Guide.

3. Teachers of agriculture who teach Applied Principles should encourage all students to be members of the FFA chapter and to become actively involved with appropriate supervised occupational experiences. This recommendation is supported by the significantly higher mean scores on the APAT by students who were FFA members and who also indicated involvement with supervised occupational experiences. A study should be designed to assess students' level of mastery of the competencies that teachers indicate they are including in the Applied Principles program.

4. Other researchers should conduct similar research in their states to provide empirical evidence which further describes the outcomes of vocational agriculture programs.

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