

Competencies Possessed by Students Enrolled in Fundamentals 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. Legislators, educators, and the general public are asking if expenditures for vocational education are producing desired results. Governmental agencies are also 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 are not available (Governor's Commission on Secondary Schools for the State of Florida, 1983).

One commonly used 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, test results 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 in part upon competencies that experts in the field and representatives of industry recognize as necessary for employment. Consequently, one commonly used 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 can be used not only to evaluate program effectiveness but also to evaluate student mastery of instructional objectives (Glasser & Nitko, 1971). Tests composed of valid items keyed to a set of specific measurable objectives are termed criterion-referenced tests (Ivens, 1970).

In order to have a valid criterion-referenced test of the competencies possessed by students enrolled in Fundamentals of Agribusiness and Natural Resources Occupations (hereafter referred to as Fundamentals) in Florida, McGhee and Cheek (1983) conducted a project to develop such a measure. As a result of this activity, a test item bank was developed for the major content areas of the Fundamentals. Selected items from the test bank relative to the program were used in the present study to assess student mastery of competencies. Fundamentals is designed to be taught at the 9th-grade level for one period of instruction per day for the entire school year. Students who enroll may have completed Orientation and Exploration of Agribusiness and Natural Resources Occupations in the seventh and eighth grade.

Purpose and Objectives

This research was completed as part of Project FLA-AE-0198 of the Florida Agricultural Experiment Station, Institute of Food and Agricultural Sciences, University of Florida, Gainesville. The central purpose of the study was to assess the level of mastery of the students enrolled in the Fundamentals of Agribusiness and Natural Resources Occupations

programs in Florida schools. 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 Fundamentals of Agribusiness Occupations Achievement Test (FAOAT).

2. Compare student level of mastery on the Fundamentals of Agribusiness Occupations Achievement Test (FAOAT) according to the following: (a) current grade in school, (b) previous enrollment in agricultural classes, (c) FFA membership, (d) involvement in supervised occupational experience program (SOEP), (e) career plans.

3. Determine whether or not competencies identified in the Curriculum Guide for Fundamentals were being taught by teachers in the schools (Florida Department of Education, 1980a).

4. Determine the percentage of time, as indicated by teachers, devoted to each of the major content areas recommended for inclusion in the Fundamentals program.

Methods and Procedures

The population for the study consisted of schools in Florida in which Fundamentals of Agribusiness and Natural Resources Occupations programs were offered. The five Department of Education regional consultants for agribusiness and natural resources education were contacted and asked to identify the Fundamentals programs and teachers in their region resulting in a list of 190 teachers who were offering the Fundamentals program. Each identified teacher was contacted to determine if they would be willing to administer the FAOAT to their students near the end of the school year. Fifty-seven teachers indicated they would be willing to participate and had approximately 2,250 students enrolled in their Fundamentals classes. Although this represented volunteers or a "self-selected" sample, the researchers believed that the findings and conclusions would be important in terms of baseline information for future research in spite of this limitation in generalizability.

A 60-item multiple choice test was generated from a test bank of 540 test questions developed for the Fundamentals program (McGhee & Cheek, 1983). The questions comprising the test matched competencies identified in the curriculum guide for Fundamentals (Florida Department of Education, 1980a) in each of the six major content areas. These content areas include agribusiness management, animal science, plant science, soil science, agricultural mechanics, and leadership. These competencies were identified by review of validated task inventories. The number of questions for each content area on the test was proportional to the percentage of time recommended to be allocated to instruction in each content area by the aforementioned curriculum guide.

Test questions were selected from those for each major content area in the item banks developed by McGhee and Cheek (1983). The mean item difficulty and mean item discrimination values for the test were .60 and .55, respectively. An estimate of the reliability of each component of the test was determined by calculating a Kuder-Richardson 20 correlation coefficient and was as follows: animal science, .94; agricultural mechanics, .95; leadership, .58; plant science, .86; agribusiness management, .65; and soil science, .79.

In addition to the 60 test items designed to assess performance in Fundamentals, 5 additional items sought information concerning the

student's grade in school, FFA membership, previous enrollment in agricultural classes, supervised occupational experience program involvement, and career plans. A teacher questionnaire was also developed to determine the percentage of time spent on topics related to the six major Fundamentals content areas. Teachers were asked to indicate whether or not each of the 76 competencies identified in the curriculum guide for Fundamentals (Florida Department of Education, 1980a) was included in their instructional program.

Data for this study were collected from 2,011 (89.4%) students and 54 (94.7%) of the teachers who were originally contacted. The three teachers who did not respond were found to not differ significantly from the respondents. To analyze data related to Objectives 1 and 2, mean scores were computed for the total of the 60-item Fundamentals of Agribusiness Occupational Achievement Test. Descriptive statistics were also utilized to summarize each of the five demographic variables in Objective 2. One-way analysis of variance was used to determine significant differences among student mean scores on the FAOAT relative to their grade in school and career plans. Likewise, the *t*-test was also used in Objective 2 to determine whether differences existed in student mean scores on the FAOAT with respect to FFA membership, previous enrollment in agricultural classes and involvement in supervised occupational experience programs. The .05 level of significance was established as the critical standard. Descriptive statistics were used to summarize and analyze the data in Objectives 3 and 4.

Results

Student Achievement

Data in Table 1 revealed that the mean percentage score of students for questions in each content area ranged from a low of 50.6% for agricultural mechanics to a high score of 68.1% in agribusiness management. Plant science and animal science questions were second and third in ranking in terms of the percent of questions correctly answered with 62.3% and 59.4%, respectively. The fourth and fifth highest achievement scores were in the areas of leadership (54.9%) and soil science (54.2%). The mean score of the 2,011 students administered the 60-item FAOAT was 34.23 (57.05%). The standard deviation was 9.79, which indicated that approximately two-thirds (68%) of the students' mean raw scores were between 24.4 and 44.0. The raw scores ranged from 3 to 60.

Current Grade in School

The total mean raw scores and standard deviations for the various categories of grade in school of students taking the FAOAT are presented in Table 2. The scores ranged from a high of 36.69 for students in the 12th grade to a low of 25.95 for the 8th grade. A one-way analysis of variance was computed to determine if there were significant differences among the various grade levels of students in the mean scores of students on the FAOAT. The analysis of variance resulted in an *F* value of 20.91, which was significant at the .05 level. Duncan's Multiple Range Test was used to determine where significant differences existed among the mean scores of the five grade level categories. The mean FAOAT scores of students enrolled in 12th grade were significantly higher than students enrolled in either 8th or 10th grade. Likewise, students in the 9th, 10th, 11th and 12th grades scored significantly higher on the FAOAT than students in the 8th grade.

Table 1

Achievement of Students on Major Content Areas of the FAOAT $n = 2011$

| Content Area | Number of Test Questions | Mean Raw Score | <u>SD</u> | Percent Score |
|-------------------------|--------------------------|----------------|-----------|---------------|
| Agribusiness Management | 7 | 4.77 | 1.94 | 68.1 |
| Plant Science | 9 | 5.61 | 2.09 | 62.3 |
| Animal Science | 11 | 6.53 | 2.25 | 59.4 |
| Leadership | 9 | 4.93 | 2.10 | 54.9 |
| Soil Science | 9 | 4.88 | 2.06 | 54.2 |
| Agricultural Mechanics | 15 | 7.60 | 2.61 | 50.6 |
| Total Test | 60 | 34.23 | 9.79 | 57.05 |

Table 2

Mean Raw Score on FAOAT According to Grade in School $n = 1935$

| Current Grade In School | Number | Percent | Mean Raw Score* | <u>SD</u> |
|-------------------------|--------|---------|---------------------|-----------|
| 8th | 89 | 4.59 | 25.95 ^a | 8.56 |
| 9th | 1338 | 69.15 | 35.05 ^{bc} | 9.02 |
| 10th | 265 | 13.70 | 33.85 ^b | 8.34 |
| 11th | 157 | 8.11 | 34.49 ^{bc} | 8.76 |
| 12th | 86 | 4.45 | 36.69 ^c | 9.10 |

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

Previous Enrollment in Agriculture

In response to the question of whether they had ever been in an agriculture class before the current year, 47.5% of the students indicated that they had previously been in an agriculture class while 52.5% had not been enrolled. The t -test was used to determine whether significant differences existed between the two groups of students and their mean raw scores on the FAOAT. This procedure revealed that there was no significant difference between students who had been enrolled and students who had not previously been enrolled in an agricultural class. The mean raw score for previously enrolled students was 35.39, which was slightly more than the score of 34.72 for students who had not previously been in an agricultural class.

Membership In FFA

A majority (57.7%) of students completing the FAOAT indicated that they were currently members of their school's FFA chapter, while 42.3% were not. Students who were currently FFA members scored significantly higher (36.89) on the FAOAT than students who were not FFA members (32.49).

SOEP Involvement

Almost two-thirds (61.9%) of the students indicated that they did have a Supervised Occupational Experience Program (SOEP) while 38.1% did not. The t-test was used to determine if students with an SOEP performed significantly different on the FAOAT from students with an SOEP. Data indicated that students with an SOEP had mean scores significantly higher (35.87) than students who indicated they did not have an SOEP (33.75).

Career Plans

Students were asked to indicate their career plans after high school graduation. Data in Table 3 revealed that the students who plan to attend college and students who were unsure of what their plans were comprised the largest proportion (30.35% and 30.83%, respectively) of the respondents. Only 14.26% of the students indicated plans to enter an agricultural occupation. The military was indicated by 15.66% of the students as being in their future career plans. The smallest proportion (9.97%) of the students indicated that they planned to work in a non-agricultural occupation.

Table 3

Career Plans after Graduation and Mean FAOAT Scores According to Career Plans n = 1865

| Career Plan | Number | Percent | Mean* |
|------------------------------------|--------|---------|--------------------|
| Agricultural Occupation | 266 | 14.26 | 34.49 ^b |
| Non-Agricultural Occupation | 186 | 9.97 | 30.08 ^c |
| College/Post High School Education | 576 | 30.83 | 36.82 ^a |
| Military | 292 | 15.66 | 34.49 ^b |
| Do Not Know | 575 | 30.83 | 33.66 ^b |

*Means with same letter are not significantly different at the .05 alpha level.

A one-way analysis of variance was computed to determine if there were significant differences among the various career plans of students and their mean scores on the FAOAT. The analysis of variance resulted in a F value of 20.06, which was significant. Duncan's Multiple Range Test was used to contrast the mean scores for the five categories of career plans. As indicated in Table 3, the mean raw FAOAT scores of students who planned to attend college were significantly higher than

the scores of students in the other categories. Likewise, students with plans to enter an agricultural occupation, the military, or who did not know their plans scored significantly higher on the FAOAT than students planning to enter a non-agricultural occupation.

Competencies Taught

Data in Table 4 identified the degree to which the 76 competencies included in the curriculum guide for Fundamentals (Florida Department of Education, 1980a) were being taught by the teacher respondents in this study. The data revealed that 34 (44.7%) of the competencies were taught by 75-100% of the teachers. Nineteen competencies (25%) were taught by 50-75% of the teachers. Twenty competencies (26.3%) were included in the programs of 25-50% of the teachers. Only three (4%) of the 76 competencies were taught by 0-25% of the teacher respondents.

Table 4

Degree to Which Fundamental Competencies are Being Taught by Teachers

n = 54

| Percent of Teachers | Number of Competencies | Percent |
|---------------------|------------------------|--------------|
| 0- 24.9 | 3 | 4.0 |
| 25- 49.9 | 20 | 26.3 |
| 50- 74.9 | 19 | 25.0 |
| 75-100.0 | 34 | 44.7 |
| Total | 76 | 100.0 |

The 34 competencies identified by over 75% of the teachers as being included in their Fundamentals program came from each of the six major content areas. The largest number of competencies was in the area of plant science (10) and the smallest number was related to agricultural mechanics (2). The other content areas of animal science, soil science, leadership, and agribusiness management contained 7, 6, 5, and 4 competencies, respectively.

The number of competencies identified by over 75% of the teachers as being included in their programs was compared with the total number of competencies identified in the teacher questionnaire. Data in Table 5 revealed that 100% of the competencies in the area of leadership were identified by over 75% of the teachers as being included in their program. Soil science had the second highest proportion (66.7%) of competencies being taught by over 75% of the teachers. Slightly over one-half of the 18 plant science competencies (55.5%) and 57.1% of the 7 agribusiness management competencies were indicated by the teachers as being included in their program. Little more than one-third of 19 animal science competencies (36.8%) and only 12.5% of the agricultural mechanics competencies were being taught by 75% or more of the 54 teachers responding to this study.

Table 5

Percentage of Competencies by Content Area Identified by More Than 75% of Teachers as Being Taught in Fundamentals Program n = 54

| Content Area | Total Number of Competencies | No. of Competencies Identified by 75% of the Teachers | Percent |
|-------------------------|------------------------------|---|---------|
| Animal Science | 19 | 7 | 36.8 |
| Agricultural Mechanics | 16 | 2 | 12.5 |
| Leadership | 5 | 5 | 100.0 |
| Plant Science | 18 | 10 | 55.5 |
| Agribusiness Management | 7 | 4 | 57.1 |
| Soil Science | 9 | 6 | 66.7 |
| Total | 74 | 34 | |

Time Devoted to Major Content Areas

Teachers were asked to estimate the percentage amount of time spent teaching topics related to animal science, agricultural mechanics, leadership, plant science, agribusiness management, and soil science. They also indicated a percentage of time spent on miscellaneous activities.

As the data in Table 6 revealed, the content areas of plant science and animal science were quite similar in mean time spent by the 54 responding teachers with 21.8% and 21.4% respectively. Teaching related to leadership topics consumed 15.5% of the time. Agricultural mechanics content consumed 12.8% of the school year, and soil science and agribusiness management topics were taught 10.7% and 7.5%, respectively. Miscellaneous topics used 10.3% of the time. The data also revealed differences between the percentage of time recommended for the various content areas (Florida Department of Education 1980a, 1980b) and the actual estimate of time as perceived by the teacher respondents. The greatest difference (12.2%) was between recommended time for the agricultural mechanics component (25%) and the teacher estimate of actual time spent (12.5%). All the rest of the differences were between 3.4% and 4.5%.

Conclusions

The following conclusions were drawn from the findings of this study and are limited to the students and teachers supplying data for the study.

Student level of mastery of the FAOAT was relatively low, with a mean percentage score of 57%.

Over three-fourths of the students completing the FAOAT were in the 9th and 10th grades. Students in 12th grade scored significantly higher on the FAOAT than 8th and 10th graders. Also, students in grades 9, 10, 11 and 12 scored better than 8th graders.

Previous enrollment in agricultural classes did not influence achievement on the FAOAT.

Table 6

Comparison of Recommended Percentage and Teacher Estimate of Mean Percentage of School Year Devoted to Major Content Areas in the Fundamentals Program n = 54

| Content Area | Recommended Percentage | Teacher Estimate | <u>SD</u> | Percentage Difference |
|--------------------|------------------------|------------------|-----------|-----------------------|
| Animal Science | 18 | 21.4 | 11.7 | +3.4 |
| Ag. Mechanics | 25 | 12.8 | 11.2 | -12.2 |
| Leadership | 12 | 15.5 | 9.3 | +3.5 |
| Plant Science | 18 | 21.8 | 13.9 | +3.8 |
| Agribusiness Mgmt. | 12 | 7.5 | 5.3 | -4.5 |
| Soil Science | 15 | 10.7 | 6.8 | -4.3 |
| Miscellaneous | 0 | 10.3 | 9.0 | +10.3 |
| Total | 100 | 100.0 | | |

Students who were FFA members and who were involved with SOE had significantly higher FAOAT scores than those students who were not FFA members and were not involved in SOE.

Students who planned to enroll in post-secondary education scored significantly higher on the FAOAT than those who did not plan to pursue post-secondary education after high school graduation.

Almost 70% of the Fundamental competencies were taught by 50% or more of the teacher respondents. All of the competencies in the leadership content areas were taught by 75% or more of the teachers; however, only 2 of the 16 (12.5%) competencies in the agricultural mechanics content area were taught by 75% or more of the teachers.

Animal science and plant science topics consumed the largest percentages of the school year as perceived by the teachers. Topics related to agribusiness management used the smallest percentage. A much smaller percentage of time was actually spent in agricultural mechanics instruction than was recommended by state curriculum guidelines.

Recommendations

Because such a small percentage of competencies related to agricultural mechanics are being taught by a majority of the teachers and, considering that students performed the poorest on FAOAT questions in this content area, emphasis should be given to strengthening the development of fundamental competencies in agricultural mechanics. Strategies for strengthening this component might include but not be limited to: (a) inservice education activities to develop the agricultural mechanics skills of teachers; (b) special attention by Department of Education regional consultants for agribusiness during the program review process to note deficiencies related to agricultural mechanics instruction; and (c) increased attention at the preservice level to emphasize the role and need for instruction in agricultural mechanics at the Fundamental level in the program of vocational agriculture.

This study indicated that approximately 70% of the competencies specified in the Curriculum Guide were being taught by 50% of the teachers. This statistic raises 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.

Teachers of agriculture who teach Fundamentals of Agribusiness and Natural Resources should encourage all students to be members of the FFA chapter and to become involved with appropriate supervised occupational experiences. This recommendation is made because of the significantly higher performance of students on the FAOAT who were members and indicated some involvement with supervised occupational experiences.

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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