How Tenth Grade Students Perceive Agriculture and Environmental Science: Comparison by Gender and Ethnicity

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This study addresses the issue of student perceptions of agricultural education in relationship to academic subjects, including gender and ethnicity differences. The study focused on a contemporary curricula problem concerning the integration of academic and vocational subjects. The study was a part of a comprehensive research and evaluation project that will assist school administrators, teachers and guidance counselors to respond to a State Department Mandate for curriculum development, guidance and career counseling; and to implement a Carl Perkins funded Agricultural Technology Preparation Initiative. The model for this analysis could be used with other technology preparation projects in agricultural education.

The number of agriculture programs and student enrollments have declined in recent years. Krueger and Riesenberg (199 1) found that students often have misperceptions of the agricultural industry and agricultural careers. These misconceptions could lead to further enrollment decline unless corrected. To this end, Riesenberg and Lierman (1990) recommended further study of factors affecting enrollment in agricultural education. Unless educators begin to understand current perceptions, they can do little to correct errors in judgment, misinformation or lack of knowledge.

Gender and ethnicity differences in students' perceptions are also a current concern. Gender role stereotyping has been implicated in affecting participation in math and science careers for white women (Maple and Stage, 1991) and in affecting girls' participation in agriculture (Donelan, 1992). Similarly, ethnic differences in perception of agriculture have been identified. Black and Hispanic students are more likely to have a negative perception of agriculture than students in other ethnic groups (Nichols and Nelson, 1992; Talbert and Larke, 1993) which could relate to enrollment decreases in agriculture.

This study is important and timely because of the current movement to integrate academic and vocational subjects, an approach supported by Congress and many educators across the country (Buzzell, 1993). In addition, the concept of subject matter integration explored in this study is related to new innovations to improve teaching and learning such as problem solving, decision making and communications (Grubb and Kraskouskas, 1993). Similarly, the nationally acclaimed Secretary's Commission on Achieving Necessary Skills (SCANS) report that promotes the concept of high-performance schools (Brock, 1993) provides a conceptual background for this investigation. Underlying socio-economic, political and status factors are concepts explored in the study. These are all elements of what Hudelson (1993) describes as roots of reform in public education pertaining to the workforce.

Theoretical underpinnings for this research are found in the works of Ausubel (1968), Vygotsky (1962) and Bandura (1986). These theories are based in cognitive psychology and developed from a constructivist perspective with respect to curriculum development. Appropriate concepts for this research were drawn from their work as well as developmental theories from an ecological perspective such as that of Bronfenbrenner (1979). Collectively, these theories support the importance of student perceptions and conceptualization of subject matter to teaching and learning. The theories suggest that learning is dependent upon previous experiences and understandings. From a theoretical and practical perspective, this study has important implications for improving our understanding of how students perceive subject matter and contributing to the knowledge base of curriculum and guidance.

Purpose and Objectives

The purpose of this investigation was to develop a knowledge of tenth grade students'

perceptions of agriculture, environmental science and the relationship of academic and agricultural courses in order to develop an effective curriculum design and recruitment strategy that provides equitable program access for all high school students. The research objectives were to:

> Determine the perceptions of tenth grade students concerning agriculture and environmental science.
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> Determine the differences by gender and ethnicity in the perceptions of tenth grade students concerning agriculture and environmental science.
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> Identify tenth grade student perceptions of the relationship between agriculture and other academic courses.
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> Identify recommendations for recruiting students and developing curriculum that would attract a diverse student body to study agricultural education.

Procedures

The population consisted of tenth grade students in twelve schools and technical centers geographically distributed across New York State. The schools were pilot centers in a technology preparation project. The school selection process was designed to identify schools that were representative of schools within the State in terms of high schools in urban and rural areas, schools with and without agricultural education in the curriculum, and central high schools and technical centers (Boards of Cooperative Educational Services typically referred to as BOCES). The selection panel to identify schools included representation from Deans of Agriculture in two-year colleges, the New York State Rural Schools Program, public school administrators, and the State Department of Education. All schools in the sample had a tenth grade cohort with the exception of one BOCES Center. Since one of the feeder schools to this BOCES was in the project, this technical center was represented in the data set.

Schools were contacted to solicit cooperation, identify school contact persons and to determine the number of students in the tenth grade. Tenth grade students were selected because they would be the first class to enroll as juniors in a technology preparation program. A packet of instruments was mailed to each contact person along with standardized instructions on how to administer it to the students.

Data Source

A representative, statistically significant sample of tenth grade students from each school completed the instrument based on the size of the tenth grade class. The school contact assigned each student a number to identify the research instruments and to assure respondent anonymity. Similarly, the schools were coded by number. Completed surveys were mailed to Cornell University. In the majority of schools, the same students completed both forms of the survey. Two schools experienced difficulty with survey administration procedures. In these schools, a student completed either Form 1 or Form 2 but not both. Of the 1,253 total respondents, 927 respondents completed Form 1 and 925 respondents completed Form 2. Other than this difficulty, all schools complied with the data collection procedures. Sampling procedures with this slight modification provided valid and reliable data for this study.

Instrumentation

The researchers developed a Career and Educational Interest instrument to address the research objectives. The instrument consisted of two separate forms: Form 1, Home and School and Form 2, Agriculture and Technology Preparations. The instrument and data collection procedures were field tested to determine reliability for subscales on agriculture, environmental science and relationship of agriculture and academic courses. Subscale reliability coefficients were .8 1, .83, and .90, respectively. Prior to the field test, a panel of experts had determined that the instruments were content valid. Based on pretest results, the questionnaires were revised as necessary.

The revised instruments were submitted to a commercial vendor to convert to opscan format. This provided an easy to follow, self-contained booklet that had a professional appearance. It transformed the instruments to machine readable form that could be quickly scanned to a data file. The final questionnaire consisted of Likert-type scales using a strongly disagree to strongly agree

response scale. The survey collected nominal level data. The final survey was administered to students participating in the study. Survey reliability coefficients for subscales for agriculture, environment science and the relationship of agriculture and academic courses were .82, .85, and .90, respectively.

Analysis of Data

Data was analyzed using SPSS on the PC. Frequencies were obtained on all data. Scale results were summarized using means and standard deviations. In order to calculate means and standard deviations on scales, interval level data were assumed. Comparisons of means of both scales and individual items were calculated using analysis of variance or t-tests. Duncan's least significant difference was calculated to identify the groups which differed in cases when significant differences were found. An alpha level of .05 was established a priori.

Results

Percentions of Agriculture

Respondents rated their agreement and disagreement with 13 descriptors of agriculture on a Likert-type scale of 1 (strongly disagree) to 5 (strongly agree). Subscales of the instruments were subjected to factor analysis to assist validity determination. Scales were found to be reliable and valid.

The mean scores of the 13 descriptors of agriculture among high school tenth grade students ranged from 2.3 to 4.0. Three of the mean scores were 3.5 or higher as shown in Table 1. These more popular descriptors were "important to the economy" (Mean=4.0), "important to the future" (Mean=4.0) and "important to society" (Mean=3.9).

Perceptions of Environmental Science

The same 13 descriptors used for agriculture were repeated again for environmental science. The mean scores among high school tenth grade students ranged from 2.3 to 4.1. Four of the mean scores were 3.5 or higher as shown in Table 1. These more popular descriptors were "importance to the future" (Mean=4.1), "important to society" (Mean=3.9), "important to the economy" (Mean=3.8), and "politically important" (Mean-3.6). These results are shown in Table 1.

Relationship of Agriculture to Other Academic Courses

Students' mean score ratings of 2.8 or higher on a five-point Likert-type scale indicated a relationship between agriculture and their academic courses. Students highly rated agriculture examples as a good way to understand science and vice versa (Mean=3.5). By comparison, using math to understand agriculture was rated less highly (Mean=3.1) and the reverse relationship even lower (Mean=2.9). The use of agricultural examples to understand communication and computer skills and vice versa were rated between 2.9 and 3.1. Significant differences in the perceptions of the use of agricultural examples to understand math were detected (p=.02). Caucasian students (Mean=2.99) rated this relationship higher than Hispanic students (Mean=2.7 1).

Gender Differences on Percentions of Agriculture and Environmental Science

The t-test was used to compare the perceptions of male and female students at the .05 alpha level. There were no significant differences by gender for agriculture and environmental science composite scales.

Ethnicity Differences on Perceptions of Agriculture and Environmental Science

Analysis of variance was used to compare the perceptions of Black, White, American Indian or Alaskan Native, Asian of Pacific Islander and Hispanic students at the .05 alpha level. A significant difference (P=.02) was found for the composite agriculture scale. Asian and Hispanic students had a lower perception of agriculture (p=.0237) and environmental science (p=.0010)in comparison with Caucasians in this study. Scale means for agriculture were as follows: Whites=3.33, Hispanics=3.21, and Asians=3.15, and for environmental science; Whites=3.41, Hispanics=3.24 and Asians=3.15.

Individual items within the scales were examined for gender and ethnicity differences. These results are shown in Table 2. Ethnic differences ($p<.05$) were detected in the perceptions of both agriculture and environmental

Table 1. Perceptions of agriculture environmental science as perceived by tenth grade students

Items	Agriculture		Environmental Science	
	Mean	SD	Mean	SD
Important to the economy	4.0	.86	3.8	.86
Important to the future	4.0	.89	4.1	.86
Important to society	3.9	.84	4.0	.81
Business oriented	3.4	.90	3.3	.86
Rough, outdoor work	3.4	.97	3.1	.90
Politically important	3.3	1.02	3.6	.96
A good way to make money	3.3	.94	3.2	.88
A place of high school graduates to work	3.1	.93	3.2	.91
A good career	3.3	1.01	3.4	.86
High tech		.91	3.5	.86
Something anyone can do	3.0	1.08	3.1	1.03
High status	2.9	.89	3.2	.84
A place for college graduates to work	2.9	1.04	3.5	.91

Based on scale: 1=Strongly disagree, 5=Strongly agree.

science for "important to the future", "a place for high school graduates to work", "high tech", and "a place for college graduates to work". In cases when significant differences were found, means for white students were higher than other ethnic groups for every descriptor except "important to the future", "important to society" and "a place for high school graduates to work".

Tender differences were also detected at $p<.05$ alpha in the perceptions of both agriculture and environmental science for "a place for high school graduates to work" (males higher) and "important to the economy" (females higher).

Conclusions and Recommendations

Generally, tenth grade students have a positive view of the importance of the fields of agriculture and environmental science.

There were no significant differences in how male and female students perceive the integration of agriculture and other academic courses, nor were there ethnic differences in perception with the exception of one comparison. White students rated the use of agriculture to understand math higher than Hispanic students.

Students, regardless of ethnicity and gender, generally felt agriculture was most closely related to science followed by mathematics, communication and computers.

For the composite scale of 13 descriptors of agriculture and environmental science, there were no significant gender differences among tenth grade students.

When individual items were examined, significant gender differences were detected for two out of 13 items for agriculture and for five out of 13 items for environmental science. The relative homogeneity of the two groups could be useful when planning educational interventions in agriculture. Even so, environmental science appears to be a more gender sensitive subject. This sensitivity has implications for recruitment strategies, curricular development and educational interventions for environmental science.

White students felt the socio-economic, political and career-oriented descriptors were more applicable to agriculture and environmental science than Asian or Hispanic students, more so for environmental science.

For agriculture, ethnic differences were observed for six out of thirteen descriptors. White students had more positive perceptions than other ethnic groups. Particularly obvious was the limited appeal of agriculture as a place for high school or college graduates to work for Asian students. As discussed in our literature review, cultural differences in experience and differential socialization processes may lead to the observed ethnicity differences in perception. Results suggest that educational interventions are needed to encourage minority groups to better understand agriculture and develop a more positive view of

Table 2. Perceptions of Agriculture and Environmental Science: Comparison by Gender and Ethnicity P-Values and Mean Scores

Items	Agriculture		Environmental Science	
	Gender	Ethnicity	Gender	Ethnicity
Important to the economy (p-values) (Means of significant variables)	.0229 M=3.94 F=4.06	.0151 W=4.06> AI=3.44 and H=3.80	.0165 M=3.74 F=3.88	.0044 W=3.87> H=3.55
Important to the future		.0046 W=4.08> H=3.82 and B=3.77	.0009 M=3.98 F=4.17	.0131 AS=4.27> AI=3.56 and H=3.86 W=4.11> H=3.86
Important to society			.0006 M=3.87 F=4.05	
Business oriented				.0009 W=3.32> H=3.00 and B=2.98
Politically important		.0000 B=3.49 and W=3.40> H=2.87		.0020 W=3.66> H=3.31 and AS=3.27
A good way to make money			.0134 M=3.27 F=3.13	.0114 W=3.24> AS=2.78
A place for high school graduates to work	.0062 M=3.36 F=3.20	.oooo W=3.39> H=2.97 and B=2.93 and AS=2.68	.0121 M=3.29 F=3.14	.0033 AI=371 and W=3.26> AS=2.78
A good career				.0157 W=3.43> AS=2.97
High tech		.0020 W=3.33> B=3.02 and H=2.99		.0276 W=3.50> AS=3.11
A place for college graduates to work		.0009 W=2.29 and B=2.88 and H=2.83> AS=2.27		.0002 W=3.57> AS=3.11 and H=3.22

Note: Table includes only the 10 items from the scales "Perceptions of Agriculture" and "Perceptions of Environmental Science" which were significant. Based on scale 1=Strongly disagree to 5=Strongly agree.

KEY: Gender: F=female, M=male; Ethnicity: B=black, W=white; AI=American Indian; AS=Asian, H=Hispanic.

education and careers in this area.

For environmental science, similar differences were identified. For all but one descriptor (important to society), significant differences were found. White students tend to have a more positive perception of environmental science than minority groups. This suggests that educational interventions are necessary to enhance the concerns for and view of environmental science by minority students. Causal factors were not examined in this study and should be considered in future research. In support of the theoretical basis of this study, potential areas of exploration include differential experiences including socialization processes and factors such as socio-economic variables.

Homogeneous view of agriculture are stronger among ethnic groups and genders than for environmental science. Further research is needed to determine contributing factors.

Educational interventions to increase the understanding of agriculture are necessary to assure equal access and enhance enrollment due to the less positive perceptions of agriculture held by minority groups. Agriculture teachers, administrators, and guidance counselors should consider students' perceptions of agriculture and environmental science during curriculum design and implementation to encourage students to enroll in courses.

Females appear to consider agriculture less a place for high school graduates to work than males and may be less' apt to take elective agricultural courses in order to find a job immediately after high school graduation. As discussed by Maple and Stage (1991), differential gender socialization processes may affect perceptions of the subject matter which are then further accentuated by gender differences in enrollment in agriculture courses. Recruitment strategies for courses in agriculture should be sensitive to gender even though there are limited significant differences in perceptions of agriculture and environmental science, particularly since agriculture may be only an elective.

Further research should be conducted to examine cultural and gender differences concerning perceptions of agriculture and environmental science. In particular, factors contributing to differences in perception should be probed further. More in depth qualitative analyses would be particularly useful.

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