Journal of Agricultural Education
Volume 50, Number2, pp. 26 – 37
DOI: 10.5032/jae.2009.02026

SUMMER ENRICHMENT PROGRAMS: PROVIDING AGRICULTURAL LITERACY AND CAREER EXPLORATION TO GIFTED AND TALENTED STUDENTS

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Abstract

As agriculture continues to evolve and become more complex, the demand for qualified college graduates to fill agricultural careers exceeds supply. This study focused on a summer enrichment program that strives to expose gifted and talented students to the diverse nature of agricultural careers through the integration of agriculture and science. The purpose of this study was to examine the program's effect on its alumni. Specific objectives were to develop demographic information, to ascertain the perceptions of the influence of the program on knowledge and perceptions of agriculture, to ascertain the influence of the program on career choices, and to identify career choices. The average alumnus is a white female who resides in an urban area with a population greater than 20,000. She is not an FFA or 4-H member. The program has a considerable influence on alumni knowledge and perceptions of the agricultural industry, specifically for those who do not have a traditional agricultural education background. The program did not have an overwhelming influence over alumni career choices, and the alumni identified numerous career choices, with medicine/physician being chosen by the greatest number of participants.

Introduction

Agriculture in recent decades has become technologically advanced and increasingly complex. As a result, production requires fewer people. Nonetheless, the industry needs a steady supply of well-trained, highly educated professionals to ensure future success (Betts & Newcomb, 1986; Edwards, Leising, & Parr, 2002). Many contemporary jobs in agriculture demand skills in science and math (Shelley-Tolbert, Conroy, & Dailey, 2000) and offer high salaries in profitable sectors of the agricultural industry outside of production in areas such as food processing and agricultural finance (National Research Council [NRC], 1988).

The high predicted demand in agriculture for skilled college graduates in the next five years will most likely outstrip the supply (Goecker, Gilmore, Smith, & Smith, 2005). Studies have predicted that the United States, Japan, China, and India will face a shortfall of 32 to 39 million highly skilled workers between the years 2010 and 2020 (Gordon, 2005). Gifted and talented students comprise a group that could potentially meet a portion of the demands of the agricultural employment market, especially those positions that require scientific and technical skills.

Specific enrichment programs have been developed to provide gifted and talented students with exposure to the agricultural industry. These programs have been used as

a tool to develop gifted and talented students' knowledge of the food and fiber system and serve as vehicle to motivate students to pursue careers in the industry (Cannon, 2005). In Virginia, a 4-week summer residential program sponsored by the state's department of education and hosted by Virginia Tech has been implemented. It is called the Virginia Governor's School for Agriculture (VGSA). Each state school division nominates students identified as gifted and talented, and students in private and home schools also are eligible to participate (Duncan & Broyles, 2004). On campus, VGSA participants are engaged in agriculture and science through classroom, laboratory, and field experiences. Students are exposed to the agricultural industry and careers during the school.

Conceptual Framework

The basis for this study is Fishbein and Ajzen's (1975) conceptual framework of belief, attitude, intention, and behavior. A person's belief system provides the foundation, which leads to the formation of attitudes and intentions (Fishbein & Ajzen). Students receive information, which leads to the development of beliefs. Individuals use their beliefs to develop attitudes toward objects both positive and negative. In turn, attitudes are used to developing one's intention to perform a task or pursue an activity (Fishbein & Ajzen).

The VGSA provides gifted and talented students with hands-on, cutting edge exposure to diverse educational and career opportunities in the agriculture industry. This exposure provides information that influences the knowledge and perceptions of the participants toward agriculture and careers associated with the industry. According to Fishbein & Ajzen's (1975) conceptual framework, this knowledge gained by program participants should influence their beliefs toward agriculture. Those beliefs lead to attitudes, which can influence participants' intentions to either pursue or not pursue further study or careers in agriculture. Stakeholders of the program desired a positive experience with the ultimate goal of participants intending to pursue educational and career opportunities in agriculture and science. This is supported by Bandura (1986), who argued that students were more enthusiastic and motivated toward subjects about which they held positive beliefs.

The Virginia Department of Education, which administers the program, defines gifted and talented students "as those students whose abilities and potential for accomplishment are so outstanding that they require special educational programs to meet their educational needs" (Virginia Department of Education, 1996). Researchers believe that special programs like this are vital to meeting the special needs of gifted and talented students (Olszewski-Kubilius, 1997). The challenge provided by these programs and the pace of learning are vastly different from the regular classroom. These programs provide "opportunities for independent inquiry, in-depth study, and accelerated learning" (Olszewski-Kubilius, p. 180).

Prior research has shown the influence of programs similar to the VGSA that provide students with applied scientific experiences. Jelinek (1997) found that applied science, presented in the form of real-life activities, helped eliminate obstacles that minimize student attitudes and interest toward scientific study. Other researchers have found that the integration of science and agriculture is an effective approach for science instruction (Balschweid & Thompson, 2002; Conroy & Walker, 2000; Shelley-Tolbert et al., 2000). Balschweid (2002) found that science taught in the context of agriculture by one trained in agricultural education had a positive effect on student attitudes toward the industry and careers in the industry. A student's positive experience in science that was integrated with agriculture has been found to increase enthusiasm and a belief in the ability to pursue a science career (Lindner et al., 2002).

Purpose and Objectives

The purpose of this specific study was to examine the perceived effect of the gifted and talented program on participants' knowledge and perception of the agricultural

industry and career goals. Specific objectives were to determine:

1. Demographic characteristics of the gifted and talented program participants;
2. Perception of the influence of the program on alumni knowledge and perception of the agricultural industry by ethnicity, residential background, FFA membership, and 4-H membership;
3. Perception of the influence of the program on alumni career goals by ethnicity, residential background, FFA membership, and 4-H membership; and
4. Career goals of alumni.

Procedures

This study used a descriptive design. A mail survey was developed with procedures suggested by Dillman's (2000) tailored design method. Items used in the instrument were developed with the assistance of a panel of university faculty members. The instrument was field tested by both college and high school students. The final instrument consisted of items to gather demographic characteristics of the alumni and Likert-type items to determine alumni perceptions of the program's influence on their knowledge, perception of the agricultural industry, and career goals. The Likert-type items used a scale of 1 to 5, with 1 representing *no influence* and 5 representing *much influence*. University faculty examined the instrument for face and content validity.

The instrument was mailed to alumni of the program in early January 2005. Follow-up correspondence was sent to students at intervals until data collection was complete. All program alumni (N = 316) for 2001 through 2004 were mailed the survey based on contact information provided by the school. Of the instruments mailed, 11 were returned as undeliverable by the postal service, resulting in an accessible population of 305. In all, 188 alumni, or 62% of the accessible population, completed instruments. According to Lindner, Murphy, and Briers (2001), nonresponse error can pose a threat to a study's external validity when response rate is below 100%. Protocol to address nonresponse error was used for this study (Lindner et al., 2001). Data from a follow-up phone survey of 10 randomly selected nonresponders was combined with data from 20 late responders to determine nonresponse error. Late responders were defined as the last 50% of those who returned the instrument (Lindner et al., 2001). No significant difference existed between the sample and the nonresponder/late responder group.

Data were statistically analyzed with SPSS 13.0 Student Version for Windows. Frequencies were used to describe the demographic characteristics of the alumni. Means and standard deviations were used to measure the perception of the program's influence on alumni knowledge and perception of the agricultural industry and on career goals. Mean scores of groups developed on the basis of key demographic variables were compared with independent samples t-test and analysis of variance (ANOVA). An independent samples t-test is used to compare differences between two means, whereas an ANOVA is used to compare mean differences among two or more variables (Burns, 2000). The demographic characteristics determined to be pertinent through a review of the literature were gender, ethnicity, current educational situation, home location, FFA membership, and 4-H membership.

Findings

The first research objective was to determine the demographic characteristics of the population. A demographic picture of the respondents is provided in Table 1. Female alumni (63.4%) constituted a majority of the respondents. Alumni of the program were predominately white (83.0%). Asian alumni (11.7%) comprised the next highest represented group. Black alumni (3.7%) comprised a small portion of the respondents, and Hispanics and others (1.6%) comprised the smallest group of the respondents. Alumni lived in a variety of community settings. Community settings were developed by using the U.S. Department of Agriculture's (USDA)

classification of labor markets as a guide. The settings were farm, small town (population less than 5,000), small urban (population of 5,000 to 20,000), and urban (20,000 and over) (USDA, 2003). Alumni who resided in urban areas with more than 20,000 residents (38.3%) comprised the largest group in the sample. Alumni from small urban areas (population of 5,000 to 20,000; 23.9%) represented the second largest group respondents, alumni from farms (20.7%) was the third largest group, and alumni from small towns (population of less than 5,000; 16.0%) represented the smallest portion of respondents. Alumni who reported membership in FFA, the agricultural education student organization, comprised just over one third (35.6%) of the sample, and those who were 4-H members comprised just over one quarter (26.6%).

Table 1
Demographics of Respondents (N = 188)

	Gender					
	Female		Male		Total	
	n	% of total	*n*	% of total	*n*	% of total
Ethnicity						
White	100	53.2	56	29.8	156	83.0
Asian	15	8.0	7	3.7	22	11.7
Black	3	1.6	4	2.1	7	3.7
Other	1	0.5	2	1.1	3	1.6
Residence						
Farm	27	14.4	12	6.4	39	20.7
Small town/rural	18	9.6	12	6.4	30	16.0
Small urban	30	16.0	15	8.0	45	23.9
Urban	42	22.3	30	16.0	72	38.3
FFA membership						
Member	38	20.2	29	15.4	67	35.6
Non-member	80	42.6	39	20.7	119	63.4
Total	119	63.4	69	36.6	188	100.0

The second research objective was to determine the effect of the program on alumni knowledge and perception of the agricultural industry. On a 5-point Likert-type scale with 5 representing *much influence* and 1 representing *no influence*, the overall mean for alumni perception of the extent to which the program influenced their knowledge and perception of the agricultural industry was 4.20 with a standard deviation of 0.93. Almost one-half the respondents (46.8%) believed that the program had much influence on their knowledge and perception of the agricultural industry. Female alumni (M = 4.25, SD = 0.87) had a higher mean score than male alumni (M = 4.11, SD = 1.04).

Mean scores for the influence of the program on knowledge and perception of the agricultural industry as a function of ethnicity are shown in Table 2. Alumni that identified themselves as "other" had the

highest mean score; however, the number of students in this group was too small to make comparisons with the other groups. Asian alumni had the next highest mean score (M = 4.50, SD = 0.60), followed by Black alumni (M = 4.29, SD = 0.95) and White alumni (M = 4.14, SD = 0.97). No significant differences were found when the means were compared by using a one-way ANOVA at the .05 level.

Table 2
Influence of the Program on Knowledge and Perception of Agriculture by Ethnicity

Ethnicity	*M*	*SD*
White (n = 153)	4.14	0.97
Asian (n = 29)	4.50	0.60
Black (n = 7)	4.29	0.95
Other (n = 3)	4.67	0.58

Note. Scale of 1 = *no influence*, 5 = *much influence*. F = 1.22, df = 3, 179, p < .05.

Alumni that did not have a traditional agricultural background reported that the program had a higher influence on their knowledge and perception of the agricultural industry than those with a traditional background. Table 3 shows the alumni's perception of the influence of the program on knowledge and perception as a function of their residential background. Alumni from urban areas (M = 4.49, SD = 0.83) reported that the program had a higher influence on their knowledge and perception of the agricultural industry, whereas alumni from farms reported the lowest influence (M = 3.63, SD = 0.97). When compared by using a one-way ANOVA, responses of the program alumni from farms and those from other categories of residence were significantly different at the .05 level. Significant differences also were found between farm students and students from all other categories of residence by performing a Tukey HSD post hoc test. There was also a significant difference between alumni from small town/rural and those from urban areas.

Table 3
Influence of the Program on Knowledge and Perception of Agriculture by Residential Background

Residential background	*M*	*SD*
Farm (n = 38)	3.63	0.97
Small town (n = 29)	4.07	1.03
Small urban (n = 45)	4.29	0.79
Urban (n = 71)	4.49	0.83

Note. Scale of 1 = *no influence*, 5 = *much influence*. F = 8.21, df = 3, 179, p < .05.

The program was found to have influenced non-FFA members more than members. Table 4 shows the perception of the program's effect on knowledge and perception of the agricultural industry by membership in FFA and 4-H. Non-FFA members (M = 4.40, SD = 0.79) had higher mean scores than members (M = 3.83, SD = 1.06). There was a statistical difference at the .05 level between the mean scores of the two groups. Non-4-H members (M = 4.37, SD = 0.82) had higher mean scores than members (M = 3.74, SD = 1.07). There was a statistical difference at the .05 level between the mean scores of the two groups.

Table 4
Influence of the Program on Alumni Knowledge and Perception of Agriculture by FFA and 4-H Membership

	Member		Non-member	
	M	*SD*	*M*	*SD*
FFA	3.83	1.06	4.40	0.79
4-H	3.74	1.07	4.37	0.82

Note. Scale of 1 = *no influence*, 5 = *much influence*. $p < .05$.

The third research objective was to determine the program's influence on alumni career goals. The overall mean score for the respondents was 2.81 with a standard deviation of 1.44. Just over one quarter (25.5%) of the alumni reported that the program had no influence on career choice, whereas less than 20% (17.6%) reported much influence. Female alumni (M = 2.94, SD = 1.45) had a slightly higher mean than males (M = 2.59, SD = 1.41).

Table 5 shows the means and standard deviations as a function of ethnicity. Black alumni (M = 3.00, SD = 1.52) had the highest mean score, white alumni (M = 2.86, SD = 1.47) had the second highest mean score, and Asian alumni (M = 2.50, SD = 1.22) had the lowest mean score. It must be remembered that Black alumni (3.7%) comprised a small portion of the respondents. No statistical differences were found at the .05 level when the means were compared by using a one-way ANOVA.

Table 5
Influence of the Program on Career Choice by Ethnicity

Ethnicity	*M*	*SD*
White (n = 154)	2.68	1.47
Asian (n = 22)	2.50	1.22
Black (n = 7)	3.00	1.52
Other (n = 3)	2.33	1.53

Note. Scale of 1 = *no influence*, 5 = *much influence*. $F = 0.54$, $df = 3, 182$, $p < .05$.

When alumni were divided by residential factors, alumni from small town/rural (population less than 5,000) (M = 3.33, SD = 1.32) had the highest mean for the influence of the program on career choices. Alumni from a farm residence (M = 2.92, SD = 0.97) had the second highest, those from urban (population greater than 20,000) (M = 2.67, SD = 1.43) had the third highest, and those from small urban areas (population 5,000 to 20,000) (M = 2.62, SD = 1.39) had the lowest. Table 6 displays the influence of the program on alumni career choices by residence. No statistical differences were found at the .05 level when means were compared by using a one-way ANOVA.

Table 6
Influence of the Program on Alumni Career Choices by Residence

Ethnicity	*M*	*SD*
Farm (n = 37)	2.92	0.97
Small town (n = 30)	3.33	1.32
Small urban (n = 45)	2.62	1.39
Urban (n = 72)	2.67	1.43

Note. Scale of 1 = *no influence*, 5 = *much influence*. F = 1.91, df = 3, 180, p < .05.

Table 7 displays the influence of the program on alumni career choices by FFA and 4-H membership. The program had a slightly higher influence on FFA members (M = 3.00, SD = 1.57) than on non-members (M = 2.70, SD = 1.35). Similarly, 4-H members (M = 3.00, SD = 1.46) had a higher mean score than non-members (M =2.73, SD = 1.43). There was no statistical difference at the .05 level between the means for FFA members and non-members. There was no statistical difference at the .05 level between the means for 4-H members and non-members.

Table 7
The Influence of the Program on Career Choices by FFA and 4-H Membership

	Member		Non-member	
	M	*SD*	*M*	*SD*
FFA	3.00	1.57	2.70	1.35
4-H	3.00	1.46	2.73	1.43

Note. Scale of 1 = *no influence*, 5 = *much influence*. p < .05.

The fourth research objective was to determine program's influence on career goals of the program's alumni. Table 8 displays the career choices of the program's alumni. Thirty participants (16.0%) indicated that their career choice was medicine/physician. Veterinarian was the highest agriculture-related career choice with 24 (12.8%) participants indicating this area. Nineteen (10.1%) responded as undecided, which comprised the third highest group.

Table 8
Career Choices of Program Alumni

Career choice	*n*	Career choice	*n*
Medicine/physician	30	Psychologist	2
Veterinarian	24	Animal science/zoologist	2
Undecided	19	Advertising	1
Engineer	11	Aerospace	1
Medicine non-physician	10	Agricultural communications	1
No response	8	Architecture	1
Agricultural teacher	7	Astronomer	1
Teacher non-agriculture	7	Biology	1
Military	6	Business	1
Farmer/farm manager	4	Construction management	1
Lawyer	4	Economic development	1
Agricultural extension	3	Electrician	1
Agribusiness	3	Equine	1
Agronomist/plant science/soil science	3	Extension non-agriculture	1
Environmental protection	3	Forensic anthropology	1
Food and nutrition	3	Geophysics	1
Forestry	3	Information technology	1
Government/politics	3	Law enforcement	1
Horticulture/landscaping	3	Ministry	1
Science research	3	Nanotechnology	1
Agriculture/natural resources	3	Real estate	1
Cultural anthropology	2	Social justice	1
Government/politics	2	Wine making	1

Conclusions and Discussion

The majority of participants in this study were white and female. This has been consistent for each of the 4 years of the program for which the alumni were surveyed. In comparison, females make up 38% of the membership of the FFA, and whites comprise 77%. Hispanics and Blacks comprise 17% and 4%, respectively of the national FFA (National FFA, 2005). The majority of program alumni lived in urban areas and had not participated in either FFA or 4-H. Only 34% of the membership of the national FFA resides in urban and suburban areas (National FFA). This program is providing opportunities to students who have not participated in a traditional

agricultural education program. The NRC (1988) recommended that the nature and scope of agricultural education be broadened to provide exposure to more students than those in vocational agriculture courses. The NRC also argued, "Career exploration programs need to emphasize professional agricultural careers to a greater degree, showing the connection between college preparation and agricultural leadership, business, and scientific occupations" (p. 24).

The VGSA has had an influence on participants' knowledge and perceptions. Alumni who have not had exposure to agriculture through traditional means, such as the FFA or residing on a farm or in a rural area, were influenced more than other participants. Alumni beliefs, attitudes, and intentions toward agriculture will be affected by their knowledge and perception of the industry.

Participation in the program does not have an overwhelming influence on alumni's career choices and goals. It should be noted that participants who were FFA members and from rural and farm residences reported that the program had a higher influence on their career choices than non-FFA members and participants from urban areas. Participants whose knowledge and perception of agriculture were influenced the most were influenced the least in regard to career choices and goals.

Participation in this program does not necessarily mean that students will flock to agricultural careers. Respondents reported a wide variety of career choices. These choices include a variety of agriculture-related careers such as veterinary medicine and agricultural education. Also, a vast majority of these careers require scientific and technical skills that gifted and talented students possess. Participants come to the program with preconceived beliefs, attitudes, and intentions. Educational and career goals have already been influenced by other factors such as parents and prior experiences. However, exposure to agriculture during this program may open participants' eyes to the numerous and diverse career opportunities that require skills that gifted and talented students possess.

Implications and Recommendations

As mentioned previously, the NRC (1998) recommended changes in agricultural education: "Special applied science courses on agricultural topics should be available as optional elective courses for those students who wish to go beyond the traditional science course curriculum" (p. 15). The gifted and talented enrichment program that was the focus of this study and similar programs in other states demonstrate successful implementation of the NRC's recommendations. This type of program offers gifted and talented students exposure to agriculture that they do not receive in their high schools because agricultural education is not offered, an integrated curriculum is not available, or students are steered into academic courses because of the demands for higher academic standards.

Numerous recommendations arise from the findings of this study. The agricultural education profession should encourage and implement similar innovative programs for gifted and talented students in states that do not currently offer such opportunities and should use the successful programs already in existence as models. The profession should promote the development of suburban and urban secondary programs that offer exposure to agriculture through an integrated approach that encourages higher academic standards, thus attracting gifted and talented students.

Gifted and talented students should be provided with challenging, integrated agricultural science curriculum in their schools, and these opportunities should be provided at an earlier grade level. Science curriculum with an agricultural context at the elementary and middle school level could provide students with the opportunity to develop positive beliefs and attitudes toward the industry at a younger age. With a higher level of knowledge and a more positive perception of agriculture that has been nurtured from an early age, gifted and talented students may be more inclined to pursue career opportunities in the industry that require skills that these students possess.

Several recommendations for further research arise from this study. A longitudinal study should be conducted to determine the careers that VGSA alumni pursue and the effect that the program had on that decision. Participants of this study have not entered the workforce, and their career goals and choices could change upon the completion of further education that they will receive in college. A better picture of the influence of the program on career choices should be developed when alumni begin their careers. Also, research should be conducted to determine the feasibility of providing this type of program for gifted and talented students at an earlier age, specifically during the formative years of middle school. Researchers should look for ways to develop challenging agricultural science curriculum for elementary and middle school gifted and talented students with the goal of providing exposure to the many career opportunities in the industry. Research should also be conducted to find ways to recruit more participants from minority groups. Asian students have been attracted to the program; however, other minority groups have not participated in high numbers. Researchers should look for innovative methods of attracting those underrepresented groups to apply for participation in the program. Finally, pretests and posttests should be given to future participants to determine their level of knowledge and perception of agriculture at the beginning and end of the program in order to compare participants with traditional agricultural education experience with those who do not have that experience. Also, the pretests and posttests could be used to determine the influence of the program on the participants' desire to enroll in agricultural education programs in high school and college.

The VGSA was developed with the goal of increasing agricultural literacy and exposing gifted and talented students to the diverse careers in the agriculture industry. Given the changing nature of education, especially the demands for higher academic standards, programs like this can be used to help strengthen student academic skills and, at the same time, open students' eyes to numerous career opportunities for which they can use their talents, skills, and knowledge.

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