

An Evaluation Of Student Knowledge And Perceptions Toward Agriculture Before And After Attending A Governor's School For Agriculture

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Abstract

The purpose of this study was to 1) identify students' knowledge and perceptions of agriculture, 2) determine if participation in a four-week Governor's School for Agriculture Program had an effect on the students' knowledge and perceptions of agriculture through the use of a pre- and post-test; and 3) ascertain the differences in perceptions between students with and without prior agricultural experiences toward specific agricultural issues (biotechnology, animal rights/welfare, and the environment). Results indicate an increase in the students' knowledge of agriculture after completing the Virginia Governor's School for Agriculture. In addition to an increase agricultural literacy, students were more confident in their answers as indicated by a decrease in the number of "not sure" answers on the post-test. The largest change in student perceptions from the pre to post-test results pertained to current agricultural issues (biotechnology and animal rights/welfare). Results also indicate that a larger percentage of students with prior agricultural experiences disagreed or strongly disagreed that livestock should have the same rights as people, and agreed or strongly agreed that farmers are concerned about the humane treatment of animals, in comparison to those with no prior agricultural experience. Both groups of students shared similar concerns over the safety and labeling genetically modified foods.

Introduction

Today's population continues to become more urbanized and less educated about the many aspects of the agricultural industry. Many would agree with the need for a basic understanding of agriculture and its' importance to our country and citizens (Frick, Birkenholz, Gardner & Machtmes, 1995). According to Fishbein and Ajzen (1975), students' and parents' personal experiences, observations, knowledge, and values about agriculture affect their attitudes about agriculture, which in turn affect their beliefs. May (1969) concludes that people base their perceptions on past experience and knowledge; therefore, if a person has limited knowledge and experience about a topic, then he or she cannot accurately perceive it.

Several authors (Case, 1993; Coulter, 1985; Mallory & Sommer, 1986) have researched the lack of agricultural literacy and the relatively poor public image of agriculture. Horn and Vining's (1986) study found that fewer than 30% of a sample (n=2000) of Kansas students, primarily of European descent, could give correct answers to basic agriculture questions. Kansas is one of the top agriculture producing states in the U.S. If fewer than 30% of high school students in Kansas can give correct answers to agriculture related questions, certainly students in more urban areas may score even lower. We as agricultural educators clearly need to increase students' knowledge of agriculture.

High school students' knowledge and perceptions about agriculture can be influenced by a number of factors. Those factors may include the media, family, involvement in agricultural clubs (i.e. 4-H and FFA), etc. According to Whitaker and Dyer (2000), journalists have been trained in how to write but are ill equipped to fully understand their influence in the complex relationship between agricultural producers and consumers. Lichter, Lichter, and Rothman, (1991) noted more than two out of three reporters preferred liberal activist groups of environmental information over more conservative sources. The use of liberal activist groups may create a discrepancy between public understanding and reliable information. If parents are influenced by unreliable reports in the media they may not encourage their son or daughter to enroll in a high school agriculture class or pursue an agricultural degree in college.

Only 31% of Virginia's middle school, high school, and technical centers offer courses in agricultural education (Virginia Association of Agricultural Educators, 2002). In addition to agricultural education classes, students have the option of being a member of the National FFA Organization and/or 4-H. In Virginia there are approximately 9,000 FFA members (National FFA, 2003). This figure represents only 1.6% of the total student population in grades 7-12 in Virginia's public school system. Approximately 28,800 (13.9%) of Virginia 4-H members are between the ages of 14 and 19 (Virginia Cooperative Extension, 2003). As indicated by the aforementioned statistics, a small percentage of students have the option of enrolling in an agricultural education course or are involved in FFA and 4-H. One of the primary goals of the Virginia Governor's School for Agriculture (VGSA), which was established in 2001, is to expose and educate students regarding the

diverse field of agriculture, thus increasing their awareness of the importance of agriculture both locally and globally.

Faculty, staff, and administrators at Virginia Tech offer a four week residential program during the months of July and August. The College of Agriculture and Life Sciences (CALs) serves as the administrative unit and host College. CALs also works collaboratively with the colleges of Liberal Arts and Human Sciences, and the Virginia-Maryland College of Veterinary Medicine with the VGSA. The VGSA is designed to provide fieldwork, develop laboratory skills, and provide an intensive educational foundation for careers and further education in the area of agriculture. The School's mission is to provide hands-on, cutting-edge scientific and academic instruction to future leaders and scientists to develop their understanding of the scope, opportunities, challenges, and both academic and scientific rigor of the broad fields of agriculture and natural resources.

The VGSA is intended for a highly selective group of rising juniors and seniors in public, private, and home schools throughout the Commonwealth of Virginia. In order to apply for admission to VGSA, students must be identified as gifted in their local school. Home schooling students must apply through the local public school serving their geographic areas. Students apply for admission and are screened at the local level based on a limited number of nominations allocated to the school division. Students selected for nomination by their local schools are submitted to the Virginia Department of Education for a second round of evaluations.

Each student attending VGSA selects a "major". Majors include agricultural economics, animal science, food science and technology, veterinary medicine, and plant science. Students in a given major completed one specialized (in-major) course not open to other students. The specialized course was designed to provide more in-depth exposure to the disciplines related to that major. Students also take "core" courses in the agricultural sciences and "elective" courses in areas such as GIS/GPS, food safety, genetics, biotechnology, and leadership.

Purpose and Objectives

The purpose of this study was to identify high school students' knowledge and perceptions of agriculture before and after attending the Virginia Governor's School for Agriculture (VGSA). Specific objectives of this study were to:

1. Identify the demographic profile of the respondents;
2. Identify students' knowledge of agriculture before and after completing the VGSA;
3. Identify students' perceptions toward current agricultural issues (i.e. biotechnology, animal rights/welfare, the environment, etc.) before and after completing the VGSA; and
4. Identify differences in perceptions toward specific agricultural issues (biotechnology, animal rights/welfare and the environment) between students who were involved in a 4-H Program, completed a high school agriculture/horticulture class(s), and those whose families own or work on a farm.

Procedures

This study used a descriptive survey design. The population for the study included all Virginia high school students (juniors and seniors) enrolled in the 2003 Virginia Governor's School for Agriculture at Virginia Tech ($N=86$).

The instrument was developed based upon a review of literature of prior studies (Moore, Ingram & Dhital, 1996; Frick & Wilson, 1996; Talbert, 1996). The questionnaire was divided into three sections. Section I measured students' knowledge of agriculture using true/false statements. Section II measured students' perceptions toward specific agricultural issues (pesticides and the environment, soil erosion, animal rights/welfare and biotechnology) using questions based on a five-point Likert-type scale (5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, and 1 = strongly disagree). Section III consisted of demographic variables (gender; age; home location; relatives who work on a farm or in the agribusiness industry; completed a high school agriculture/horticulture course; and FFA and/or 4-H membership).

Face and content validity were established by the Academic Dean and Associate Dean in the College of Agriculture and Life Sciences, faculty in the Agricultural and Extension Education Department, and a former high school agriculture educator. Revisions were made based on recommendations from the group. A pilot study was conducted using eight randomly selected Virginia State FFA officers with varying experiences with agriculture. Cronbach's alpha reliability for Section II of the instrument was .74.

The Governor's School Assistant Director administered pre-test to all participants at orientation and post-test the final week of the Governor's School. Descriptive statistics including means, standard deviations, frequencies, percentages, and cross tabulations were used to identify students' knowledge and perceptions.

Findings

Objective One: Demographic profile of the respondents

As indicated in Table 1, 63% of the respondents were female. Forty-five percent identified that they live in a suburb, 22% in a town or city, and 19% in a rural area. Forty-eight percent indicated that they have a relative(s) who own or work on a farm and 35% have a relative(s) who work in the agribusiness industry. Twenty percent have taken a high school agriculture/horticulture course and 22% are/were an FFA member. Nineteen percent indicated that they are/were a 4-H member.

Table 1.
Demographics of Governor's School Participants

Variable		%
Gender	Female	63.0
	Male	37.0
Age	15	5.0
	16	42.0
	17	52.0
	18	1.0
Home	Farm	14.0
	Suburb	45.0
	Town or city	22.0
	Rural Area	19.0
Relative(s) on a farm	Yes	48.0
	No	52.0
Relative(s) in agribusiness	Yes	35.0
	No	65.0
High school agriculture/horticulture	Yes	20.0
	No	80.0
FFA member	Yes	22.0
	No	78.0
4-H member	Yes	19.0
	No	81.0

Objective Two: Students' Knowledge of Agriculture Before and After Completing the Governor's School

At least 90% of the students correctly answered seven of the 21 statements (3, 5, 8, 14, 15, 20, and 21) in Section I of the pre-survey (Table 2). For each statement, students had three options to choose from; true, false, or not sure. Of the aforementioned statements, 3 and 21 identify one's knowledge of food and food safety; 5, 8, and 20 focus on global agriculture; and statements 14 and 15 identify ones knowledge of biotechnology. Only 34% of the students correctly answered statement 9, 44% were "not sure", and just 8% correctly answered statement 19 on the pre-test. Statement 9 asked the student if they agreed/disagreed that approximately 25 cents of every dollar spent on food in the U. S. goes to the farmer or producer, and 19 stated that animal welfare and animal rights are one and the same.

At least 90% of the students correctly answered 10 of the 21 statements (3, 5, 7, 8, 10, 12, 14, 15, 20, and 21) on the post-survey. Statement 7 focused on animals as a source of medicinal products; statement 10 on soil erosion; and 12 focused on food safety. The largest percent increase in correct student responses on the post-survey were for statements 4, 9, 11 and 19, although fewer than 90% correctly answered each statement. The largest percent increase (as noted in Table 2) is statement 19, concerning the difference between animal welfare and animal rights. The number of students "not sure" about statements 4, 9, 11, and 16 declined.

Table 2.
Students' Knowledge of Agriculture

Statement	Pre		Post	
	Correct	Not Sure	Correct	Not Sure
	%	%	%	%
1. There are more farmers in the U.S. than there were 10 years ago.	80	11	89	3
2. Less than 3 percent of the U.S. gross national product is from agriculture.	71	11	69	7
3. E. Coli bacteria is found only in hamburger.	90	5	94	4
4. The use of pesticides has increased the yield of crops.	71	18	81	7
5. U.S. research has improved farming methods in other countries.	98	2	97	1
6. To kill E. Coli or Salmonella bacteria in meat, one must freeze it before cooking.	87	7	78	5
7. Animals can be a valuable source of medical products.	80	9	90	5
8. The U.S. does not sell its feed grains (corn, soybeans, wheat, etc.) on the world market.	93	7	91	6
9. For every \$1.00 consumers spend on food in the U.S., the farmer/rancher receives approximately 25 cents.	34	44	56	17
10. Soil erosion does not pollute U.S. lakes and rivers.	88	5	93	2
11. One of every five jobs in the U.S. is related to agriculture.	58	21	75	9
12. Salmonella bacteria is most often found in eggs and poultry meat.	84	6	91	3
13. Pesticides can't be used in organic food production.	57	7	64	6
14. Biotechnology has increased the pest resistance of plants.	95	4	93	2
15. Tomatoes that stay fresh longer are an example of biotechnology.	90	7	90	5
16. The average U.S. farm is larger than 500 acres.	57	24	52	9
17. Grain exports are usually transported between continents by airplane.	52	26	47	19
18. Biotechnology has increased animal production in the U.S.	8	12	20	9
19. Animal welfare and animal rights are the same.	8	12	78	7
20. Several countries depend on U.S. agriculture exports for food and fiber.	93	5	92	2
21. Hamburger is made from the meat of pigs.	97	1	90	3

Note. N=86 on pre and post-tests.

Objective Three: Students' Perceptions Toward Current Agricultural Issues Before and After Completing the Governor's School

Students were asked to rate 19 statements using the following scale: Strongly Disagree ($M=1.0-1.49$), Disagree ($M=1.5-2.49$), Neutral ($M=2.50-3.49$), Agree ($M=3.5-4.49$), and Strongly Agree ($M=4.50-5.0$). On the pre-test (Table 3), students agreed (4.32) that biotechnology has increased crop yields in the U.S., but didn't agree or disagree (3.48) that foods derived from biotechnology should be labeled in U.S. supermarkets. Students were

neutral (2.53) that only organic methods should be used to produce foods but agreed (3.70) that organic production methods are a realistic alternative to using pesticides. Students agreed that livestock (cattle, pigs, etc.) have the same rights as people (3.61) but disagreed (1.58) that livestock should not be used for food.

Table 3.
Students' Perceptions Toward Current Agricultural Issues

Statement	Pre Test		Post Test	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
1. U.S citizens spend higher percent of their income on food than in other countries.	2.30	1.20	2.10	1.09
2. Agriculture employs a large number of people in this country.	3.48	1.14	2.30	1.05
3. Pesticides can be used safely when producing food.	3.51	1.01	2.13	0.90
4. Organic production methods are a realistic alternative to using pesticides.	3.70	0.76	2.48	0.92
5. Confinement housing is an acceptable practice when raising livestock.	2.75	1.07	2.74	1.10
6. Biotechnology has increased the yield of crops in the U.S.	4.32	0.71	1.74	0.65
7. Agriculture is the largest polluter of groundwater.	3.17	0.98	2.89	1.08
8. Farmers are concerned about the humane treatment of animals.	3.54	1.10	2.35	0.97
9. The world food supply has increased as a result of improved technology.	4.27	0.80	1.73	0.74
10. Foods derived from biotechnology should be labeled in U.S. supermarkets.	3.48	1.01	2.45	1.11
11. Only organic methods should be used to produce foods.	2.53	.86	2.50	0.95
12. Farmers should not use chemicals in crop production.	3.42	0.96	2.55	0.94
13. Livestock (cattle, pigs, etc.) have the same rights as people.	3.61	1.09	2.36	1.08
14. Processing adds more to the cost of food than the raw product.	3.69	0.75	2.15	1.04
15. Farmers have no control over food prices in the supermarket.	3.05	1.17	2.70	1.13
16. Foods derived from biotechnology are safer than food grown by conventional practices.	3.28	0.68	3.04	0.83
17. The government should exert more control over farming.	3.39	0.98	2.81	0.92
18. Agriculture is the greatest polluter of our water supplies.	3.50	0.92	2.60	1.05
19. Livestock (cattle, pigs, etc.) should not be used for food.	1.58	0.93	1.88	1.06

Note. N=86 on the pre and post-tests; scale: 1 = Strongly Disagree to 5 = Strongly Agree.

On the post-test (Table 3) students disagreed that pesticides can be used safely when producing food (2.13) and were neutral that organic production methods are a realistic alternative to using pesticides (2.48). Students were neutral (2.50) when asked if only organic methods should be used to produce food. The students disagreed that foods derived from biotechnology should be labeled in U.S. supermarkets (2.45) and were neutral (3.04) when asked if food derived from biotechnology were safer than food grown by conventional practices. Students were neutral (2.74) when asked if confinement housing is an acceptable

practice when raising livestock; agriculture is the largest polluter of our groundwater (2.60); and farmers have no control over food prices in the supermarket.

Objective 4: Identify differences in student perceptions toward specific agricultural issues (biotechnology, animal rights/welfare and the environment) between students who were involved in a 4-H Program, high school agriculture/horticulture class(s), and those whose families own or work on a farm.

The researchers used crosstabs on Likert-type data collected from the pre-test to compare differences in perceptions of VGSA students involved in an agricultural activity (4-H or high school agriculture/horticulture class) and whose relatives owned and/or worked on a farm versus those students who were not involved in an agricultural activity or farming. As previously stated, 19% of the students indicated they were a 4-H member, 20% had taken an agriculture/horticulture class and 48% had a relative(s) involved in farming. Results are reported in Tables 4, 5, and 6.

Over 88% of all students agreed or strongly agreed that biotechnology has increased crop yields in the United States. Greater than 50% of students who indicated they were not a 4-H member; had not taken an agriculture/horticulture class; and/or did not have a relative involved in farming agreed or strongly agreed that GMO foods should be labeled, in comparison to 44% and 41% are/were a 4-H member and who had taken an agriculture/horticulture class. Fifty-three percent of students who had a relative(s) on a farm agreed or strongly agreed that GMO foods should be labeled and 35% were undecided. Between 52-59% of all students were undecided if GMO foods are safer than foods grown conventionally and only 5% of students who indicated they had a relative on a farm agreed or strongly agreed with that statement.

Only 34% of students who are/were a 4-H member and 30% who had taken an agriculture/horticulture class agreed or strongly agreed that confinement housing is an acceptable practice, 43% of students with a relative(s) involved in farming agreed or strongly agreed that confinement housing is an acceptable practice, and 36% were neutral. Seventy-three percent who are/were a 4-H member and 69% of students who had taken an agriculture/horticulture class agreed or strongly agreed that farmers were concerned about humane treatment of animals. Approximately 50% of the students who indicated no involvement in agriculture (4-H; agriculture/horticulture class; or family farm) agreed or strongly agreed with the aforementioned statement. An average of 90% of all students disagreed or strongly disagreed that livestock (cattle, pigs, etc.) should not be used for food. Over 62% of the students enrolled in 4-H, had taken an agriculture/horticulture class, and did have relatives on a farm disagreed or strongly disagreed that livestock have the same rights as humans in comparison to approximately 56% of the students who were not enrolled in 4-H, not taking an agriculture/horticulture class, and do not have relatives on a farm.

Approximately 60% of all students not enrolled in 4-H, not taking an horticulture/agriculture class, and do have relatives on a farm agreed that organic production

is a realistic alternative to using pesticides. Forty-three percent of students enrolled in 4-H agreed or strongly agreed that organic production is a realistic alternative to using pesticides in comparison to 50% of the students who were undecided. A low percentage ranging from six to 14% percent of all students agreed or strongly agreed that only organic methods should be used to produce food, and 47% to 63% of all students disagreed or strongly disagreed with the statement. Over 65% of students who are/were a 4-H member and had taken an agriculture/horticulture class disagreed or strongly disagreed that agriculture is the largest polluter of groundwater versus 14% of those students who hadn't participated in 4-H or an agriculture/horticulture class.

Table 4.
Students' Perceptions of Biotechnology

Biotechnology has increased crop yields in the U.S.						
Scale	4-H		Ag Class		Relatives on a Farm	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
SA-A	88	93	88	93	93	91
N	6	7	6	7	5	9
D-SD	6	0	6	0	2	0
GMO foods should be labeled in the U.S.						
SA-A	44	55	41	55	53	53
N	50	30	35	33	35	32
D-SD	6	15	24	12	12	15
GMO foods are safer than foods grown conventionally						
SA-A	19	5	18	7	5	11
N	56	57	52	57	53	59
D-SD	25	38	30	36	42	30

Note. Scale: SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree or SD = Strongly Disagree. N=86.

Table 5.
Students' Perceptions of Animal Rights/Welfare

Confinement housing is an acceptable practice						
Scale	4-H		Ag Class		Relatives on a Farm	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
SA-A	34	42	30	35	43	41
N	25	34	40	31	36	30
D-SD	31	24	30	24	21	29
Farmers are concerned about humane treatment of animals						
SA-A	73	49	69	50	56	50
N	27	31	31	30	34	27
D-SD	0	20	0	20	10	23

Livestock have the same rights as people						
SA-A	25	15	23	15	21	13
N	0	29	6	28	17	30
D-SD	75	56	71	57	62	57

Livestock should not be used for food						
SA-A	0	6	0	6	2	7
N	6	7	6	7	7	7
D-SD	94	87	94	87	91	86

Note. Scale: SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree or SD = Strongly Disagree

Table 6.
Students' Perceptions of Environmental Issues

Scale	Organic production is a realistic alternative to using pesticides					
	4-H		Ag Class		Relatives on a Farm	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
SA-A	43	66	59	62	55	68
N	50	30	41	32	43	25
D-SD	7	4	0	6	2	7

Agriculture is the largest polluter of ground water						
SA-A	43	21	23	26	26	25
N	0	40	23	35	31	34
D-SD	56	39	54	39	43	41

Only organic methods should be used to produce food						
SA-A	6	16	6	16	14	14
N	31	37	35	36	36	36
D-SD	63	47	59	48	50	50

Agriculture is the greatest polluter of water supplies						
SA-A	12	14	11	15	12	16
N	12	36	24	33	19	43
D-SD	76	50	65	52	69	41

Note. Scale: SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree or SD = Strongly Disagree

Conclusion

The VGSA was designed for a selective group of individuals that are identified as gifted by the local school system and recognized by the Virginia Department of Education. The 2003 demographics revealed that 45% of the population lived in suburbs, and 80% of the

population did not participate in a agriculture/horticulture class. The researchers then question the agricultural knowledge of the VGSA scholars prior to attending the school since 31% of the Virginia secondary schools offer agriculture education.

Eleven of the 21 statements about the students' knowledge of agriculture changed from the pre-test to post-test. During the four week interval, the students participated in coursework, research projects, field trips and other experiences relating to agriculture. The four week intense experience increased the agricultural literacy of the scholars. Not only did the student's change their answers about agriculture during the four week period, but they also changed their answers from "not sure" to a definitive answer (agree or disagree). All twenty-one questions showed a decrease in the "not sure" category. As stated earlier, the VGSA is an intense program where the students must complete rigorous coursework, cutting edge research projects, field trips, and other experiences relating to agriculture which causes a students' confidence level to increase.

The major area of agriculture that displayed the greatest discrepancy was the area of agricultural economics. Current public concerns are pollution, environmental issues, animal rights, and genetically modified foods. Agricultural economics knowledge and awareness may not be strong due to the lack of media coverage. Lichter et al (1991) noted that reporters preferred liberal activist groups of environmental information over more conservative sources.

Awareness through the use of media and prior experiences will affect a student's perceptions. The results of this study reach the same conclusions as Nordstrom et al (1999) that all VGSA students knew something about agriculture, but the students with agricultural experience were more knowledgeable.

The VGSA students' perceptions of biotechnology were positive, especially when asked if biotechnology has increased production. However, the students perceived that genetically modified foods should be labeled, due to safety concerns. The VGSA offered a course on biotechnology which may have affected their concern about labeling.

Perceptions about the cruelty of farm animals varied greatly. The students agreed that animals should be used for food; however, they had mixed perceptions about confinement of animals. Confinement of farm animals has entered the media depicting the negative side of livestock production. Richards et al (2000) noted that farm practices if not understood can be misinterpreted and considered cruel and inhumane. The misunderstanding of farm practices may have influenced the VGSA students' perceptions.

The VGSA students also noted that organic is a realistic alternative to pesticides but disagreed that organic method should be the sole procedure for producing food. The researchers conclude that the VGSA students perceived pesticides as an issue which coincides with other findings (Richards et al, 2000; Trexler & Meischen, 2002).

Recommendations/Implications

Based on the findings of this study, the VGSA did prove to be a successful tool for expanding participants' literacy of agriculture. Thus, it is recommended that the VGSA be used as a model for other land-grant institutions. Currently there are only two known Governor's schools across the nation; The VGSA, and the Pennsylvania Governor's School for Agricultural Sciences (PGSAS). This type of program not only serves as an agricultural literacy tool, but also provides an opportunity for administrators and faculty to recruit future scholars to colleges of agriculture. Because of VGSA's success, the researchers suggest that additional funding be identified to support a larger number of participants. It is also recommended that VGSA administrators change the admissions policy so students that are not labeled as "gifted" be given the same opportunity to participate. As a final note, a longitudinal study should be conducted to determine if in fact the VGSA did persuade student participants to enroll in a college level agriculture program and move into the ever expanding field of agriculture upon graduation.

The population for this study was limited to the participants of the 2003 VGSA; therefore, the knowledge and perceptions of agriculture identified in this study may not reflect that of the general population of high school aged students in the Commonwealth of Virginia. Results of the post-test true/false statements indicated a decrease in the number of answers, especially in the agricultural economics area. This could be due to the fact that not all topics (statements) were addressed during in VGSA classes, projects, etc.

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