The Effect of an Agricultural Literacy Project on Middle School Students' Agricultural Knowledge

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Abstract

Agricultural literacy efforts are central to the vision for agricultural education as articulated by the National Council for Agricultural Education (1998). An innovative agricultural literacy project known as Pizz-A-Thon uses pizza to connect youth with agriculture. The purpose of this quasi-experimental study was to assess the impact of the Pizz-A-Thon project on middle school students' perception of their agricultural knowledge and on their agricultural knowledge achievement. The population for the study included 61 Iowa middle school students from three schools. Results show that students believed their agricultural knowledge increased after participating in the Pizz-A-Thon project. Results of the agricultural knowledge achievement posttest confirmed their belief. Middle school students in the ISU (Iowa State University) Pizz-A-Thon group surpassed the achievement level of those in the local Pizz-A-Thon group by 10%. The ISU group represents the highest level of participation in the project and includes additional hands-on learning activities beyond those outlined in the Pizz-A-Thon kit used at the local level. The researchers recommended that key enrichment activities unique to the ISU group be adapted for use at the local level, and training be offered to assist middle school teachers in utilizing the Pizz-A-Thon kit to its fullest potential.

Introduction

Colleges and teachers of agriculture have a vested interest in the agricultural literacy of youth. In fact, faculty from all agricultural disciplines have traditionally engaged youth in learning experiences related to agriculture. Faculty engage in such activities to fulfill their responsibilities for service or outreach, but also recognize the value of such activities for promoting a positive public image of their college and academic discipline and for recruiting students. College of Agriculture faculty involvement with middle school and high school students at Iowa State University is extensive and includes biotechnology education, science in agriculture days, resources on departmental websites, the state 4-H conference, and the visiting professor program. The visiting professor program alone involves 36 college of agriculture faculty in teaching middle school and high school students about topics ranging from agricultural careers to antibiotic-eating bacteria. This article reports on the evaluation of a creative agricultural literacy project developed by faculty and staff in the College of Agriculture at Iowa State University. It may serve as a resource for college teachers of agriculture in designing and/or evaluating educational programs for middle school and high school students.

A report from the W. K. Kellogg Foundation (1984) strongly stated the importance of agriculture and agricultural literacy to the world. Shortly thereafter, the National Research Council (1988) issued the landmark publication Understanding Agriculture - New Directions for Education. This publication indicated that agriculture was so important that all students at all levels should have some instruction in agriculture. This report stimulated a flurry of research and development activities related to agricultural literacy. Brown and Stewart (1992) observed that agricultural literacy had become a major concern of educators, agribusinesses, and state and federal agencies. Agricultural literacy continues to be a major concern. The National Council for Agricultural Education's (1998) vision for agricultural education states that “all people value and understand the vital role of agriculture and natural resources in advancing personal and global well being” (p. 2). The mission, goals, and objectives for achieving this vision make it very clear that the agricultural education profession intends to provide education in and about agriculture to all people at all age levels.

Achieving the vision for agricultural education may be difficult. In their conceptual framework for an agricultural literacy program evaluation, Meunier et al. (2002) synthesized research that showed elementary students had significant misperceptions about

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agriculture and that their teachers lacked knowledge and experience needed to teach them about agriculture. Scholars in agricultural education have demonstrated that literacy programs of varying lengths of time and with different foci can be effective in enhancing agricultural literacy among elementary and middle school students. For example, Herren and Oakley (1995) concluded that the Georgia Agriculture in the Classroom program effectively taught agricultural concepts to students regardless of their place of residence or ability level. The Georgia program was designed to integrate agricultural concepts into existing curriculum over a period of six weeks. The agricultural literacy program that was evaluated by Meunier et al. (2002) was designed for fourth grade students in Indiana. The program incorporated hands-on activities related to poultry science. Meunier et al. (2002) concluded that use of the agricultural literacy materials resulted in increased knowledge of agriculture-related science concepts. The Indiana program was shorter in duration. Instruction was delivered over a period of five days with 30 minutes of instruction per day.

In 1996, an agricultural literacy project called the Pizz-A-Thon was begun. According to Weber (2000), the Pizz-A-Thon is a creative educational approach for connecting youth with agriculture. Pizza can be made with a variety of different ingredients all of which can be linked back to the agriculture industry. Pizz-A-Thon participants design a pizza, trace the ingredients back to their agricultural origin, and develop a marketing plan. As an added bonus, students bake and eat their pizzas. The project emphasizes hands-on learning, problem-solving, and cooperative learning. It also accounts for the fact that students possess a range of learning styles (Claxton and Murrell, 1987), and have strengths and weaknesses relative to the seven intelligences identified by Gardner (Brualdi, 1996). Pizza-A-Thon kits are available for purchase through the Curriculum Materials Service at The Ohio State University. At the time of this study, no evaluation of the Pizz-A-Thon project had been conducted, and no research-based evidence existed concerning its effectiveness in increasing students' knowledge of agriculture. Therefore, an evaluation was needed to assess the Pizz-A-Thon project's effectiveness and to determine whether adjustments were warranted.

Materials and Methods

The purpose of this quasi-experimental study was to assess the impact of the Pizz-A-Thon project on middle school students' perception of their agricultural knowledge and on their agricultural knowledge achievement. The study was guided by one objective and two hypotheses.

Objective: Compare demographic characteristics of middle school students by experimental group.

Hypothesis 1: Middle school students' perception of their own agricultural knowledge will increase as their level of participation in the Pizz-A-Thon project increases.

Hypothesis 2: Middle school students will attain higher levels of agricultural knowledge achievement as their level of participation in the Pizz-A-Thon project increases.

The population for the study included 61 Iowa middle school students from three schools. Teacher volunteers were recruited to participate in the evaluation of the Pizz-A-Thon project. Teachers decided which class(es) would serve as the control group, which class(es) would participate in the local Pizz-A-Thon, and eventually which students would represent their school at the ISU Pizz-A-Thon. School A assigned no students to the control group, had 22 students in the local Pizz-A-Thon group and sent six students to participate in the ISU Pizz-A-Thon. School B assigned eight students to the control group, eight to the local Pizz-A-Thon group and sent five students to participate in the ISU Pizz-A-Thon. School C assigned no students to the control group, had 12 students in the local Pizz-A-Thon group, and sent no one to participate in the ISU Pizz-A-Thon. Overall, the control group consisted of eight students, the local Pizz-A-Thon group consisted of 42 students, and the ISU Pizz-A-Thon group consisted of 11 students.

The nonequivalent control group design (Campbell and Stanley, 1963) was used to test the hypotheses. The primary weakness of this design is the potential interaction of group selection differences with other internal validity threats like regression and history. Demographic data were collected for each group to assist the researchers in determining whether such an interaction posed a threat to the internal validity of this study. A discussion of potential threats is included with the results.

The active independent variable was level of participation in the Pizz-A-Thon project. The independent variable had three levels; control, local, and ISU. Middle school students in the control group did not participate in the Pizz-A-Thon project. Middle school students in the local Pizz-A-Thon group learned about agriculture by designing a pizza, tracing the ingredients back to their agricultural origin, and developing a marketing plan. Teachers used a Pizz-A-Thon education kit to facilitate students' participation in the project. Activities emphasized cooperative learning, problem-solving, and communication. Middle school students in the ISU Pizz-A-Thon group participated in the local Pizz-A-Thon and in the ISU Pizz-A-Thon event that was held on the campus of Iowa State University. Students who participated in the two-day ISU Pizz-A-Thon project explored campus resources related to agriculture and participated in activities at ISU farms. In addition, students visited a local pizza restaurant to learn about management issues, baked a pizza,

participated in a sensory evaluation, and presented marketing reports.

The dependent variables for the study included students' perception of their agricultural knowledge and agricultural knowledge achievement. Students were asked to rate their own level of agricultural knowledge using a five-point scale. On this scale, one meant "I know nothing about agriculture" and five meant "I know lots about agriculture." This same scale was used on the pretest and posttest.

Agricultural knowledge achievement was measured with a thirty-item test developed by the researchers and a panel of experts. The panel of experts included middle school teachers, ISU Pizz-A-Thon personnel, and faculty and graduate students in agricultural education. The test was designed to measure attainment of the Pizz-A-Thon project objectives using multiple choice and true-false questions at a level appropriate for middle school students. One hundred and five questions were pilot tested with middle school students not involved in the study. The middle school teacher who assisted with the pilot test had previously participated in the Pizz-A-Thon project and was a member of the panel of experts. Pilot testing led to the elimination of seven questions. The remaining 98 questions had a Cronbach's alpha reliability coefficient of .87. Thirty questions were randomly selected from the 98-question pool for the pretest. The posttest consisted of 30 questions randomly selected from the remaining 68 in the test-item pool. The panel of experts judged the pretest and posttest to be content and face valid.

Pizz-A-Thon education kits were mailed to participating middle school teachers. Middle school teachers were instructed to administer to each group the pretest and then the appropriate level of the Pizz-A-Thon project. The Pizz-A-Thon project at the local and ISU levels were completed over a period of about six weeks. Upon completing the project, middle school teachers administered the posttest to students in each group.

All data were analyzed with the SPSS personal computer program. Means and percentages were used to describe the groups. Analysis of covariance was used to adjust posttest mean scores for agricultural knowledge achievement using the pretest as a covariate. Confidence intervals were developed to determine whether treatment groups differed significantly on their adjusted posttest scores for agricultural knowledge. The alpha level was established a priori at 0.05.

Results and Discussion

Objective: Compare demographic characteristics of middle school students by experimental group.

Table 1 compares the demographic characteristics of middle school students who participated in each level of the Pizz-A-Thon project. The local and ISU Pizza-A-Thon groups were very similar. However, the control group was, on average, older and at a higher-grade level than the local and ISU Pizz-A-Thon groups. When compared to the local and ISU Pizz-A-Thon groups, a much lower proportion of students in the control group lived in town and a much higher proportion of the control group had parents who were employed in agricultural occupations.

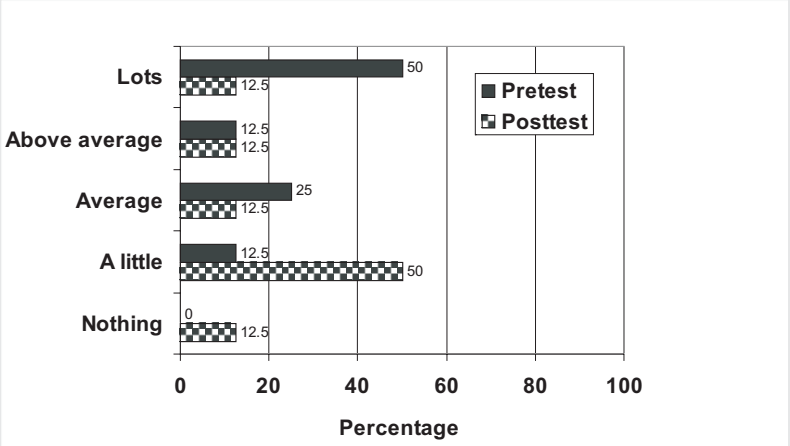
Hypothesis 1: Middle school students' perception of their own agricultural knowledge will increase as their level of participation in the Pizz-A-Thon project increases.

Middle school students in the control group rated their level of agricultural knowledge higher on the

Table 1. Demographic Characteristics by level of Participation in the Pizz-A-Thon Project

Characteristic	Control (n=8)	Local (n=42)	ISU (n=11)
Mean age in years	13.63	12.40	12.82
Mean grade level	8.00	6.67	6.91
Percentage of students who lived in town	25.00	59.52	54.55
Percentage of students whose parents were employed in an agricultural occupation	62.50	28.57	27.27
Percentage of students who were female	50.00	59.52	45.45

Figure 1. Middle School Students' Perceived Level of Agricultural Knowledge (Control Group, n=8)



pretest than on the posttest (Figure 1). Middle school students tended to rate their level of agricultural knowledge higher after participating in the local Pizz-A-Thon project (Figure 2). Middle school students rated their level of agricultural knowledge much higher after participating in the ISU Pizz-A-Thon project (Figure 3). Results of this study support the hypothesis that middle school students' perception of their own agricultural knowledge will increase as their level of participation in the Pizz-A-Thon project increases.

Hypothesis 2: Middle school students will attain higher levels of agricultural knowledge achievement as their level of participation in the Pizz-A-Thon project increases.

An analysis of covariance (ANCOVA) procedure was used to adjust middle school students' agricultural knowledge achievement posttest scores based on group differences observed on the pretest. The ANCOVA procedure also revealed that at least two of the Pizz-A-Thon groups differed significantly on their adjusted posttest means [$F(2, 57) = 10.32$, $p < .05$]. Confidence intervals around each group mean were constructed to pinpoint specific group differences (Table 2). Results indicate that the control group and the ISU Pizz-A-Thon group attained significantly higher adjusted posttest mean scores than the local Pizz-A-Thon group. There was no difference in the adjusted posttest mean scores between the ISU Pizz-A-Thon group and the control group. Results of the study partially support the hypothesis that middle school students will attain higher levels of agricultural knowledge achievement as their level of participation in the Pizz-A-Thon project increases. Students who experienced the highest level of participation (ISU Pizz-A-Thon group) also had the highest adjusted mean score for agricultural knowledge achievement.

A potential internal validity threat inherent in the nonequivalent control group design may be responsible for the unusual result in the control group. Data clearly show that the control group was different from the other groups on key demographic characteristics. While ANCOVA can adjust posttest scores based on initial group differences on the pretest, it cannot remove the potential effect of the interaction of selection and regression or the interaction of selection and history. The researchers believe that the middle school students in the control group may have possessed greater knowledge of agriculture at the beginning of the study. This belief is based on the fact that students in this group were older, tended to come from rural environments, and were more likely to have parents who were employed in agriculture-related occupations. Their pretest scores may have been lower than the mean for a potentially larger population of middle school students with similar backgrounds. Therefore, this group may have realized a gain from pretest to posttest due to statistical regression. Another potential explanation for their pretest posttest gain could be a result of history unique to their group. The pretest may have stimulated their interest in agricultural topics addressed by the Pizz-A-Thon project. These students may have sought information from parents or others in their rural communities to satisfy this interest. While this explanation is clearly speculative, it

Figure 2. Middle School Students' Perceived Level of Agricultural Knowledge (Local Pizz-A-Thon Group, n=42)

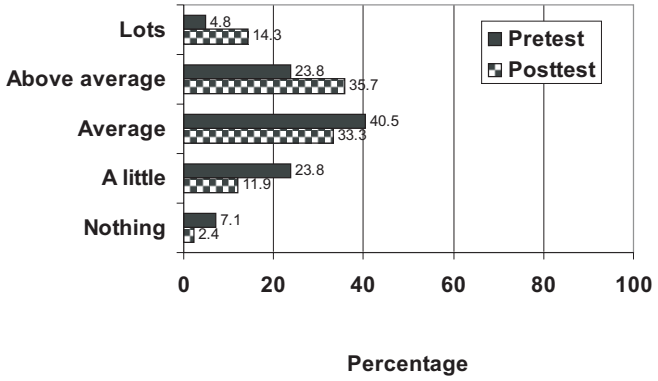
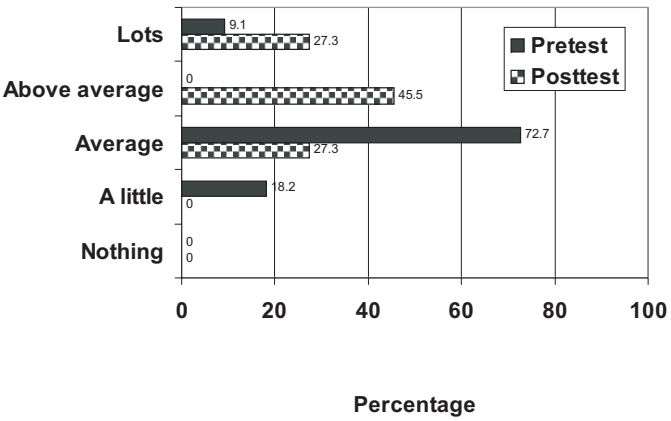


Figure 3. Middle School Students' Perceived Level of Agricultural Knowledge (ISU Pizz-A-Thon Group, n=11)



is consistent with Campbell and Stanley's (1963) discussion of potential threats to the internal validity of the nonequivalent control group design.

Table 2. Middle School Students' Agricultural Knowledge Achievement by Group

Groups	Pretest Mean	Posttest Adjusted Mean	SE	95% Confidence Interval for Adjusted Posttest Means	
				Lower Bound	Upper Bound
Control	23.50	25.74	.78	24.17	27.31
Local	22.83	23.30	.34	22.62	23.99
ISU	23.27	26.31	.67	24.98	27.65

Summary

Students believed that their agricultural knowledge increased after participating in the Pizz-A-Thon project. Data from the agricultural knowledge achievement posttest support their belief. In addition, adjusted posttest mean scores for middle school students in the ISU Pizz-A-Thon group were 10% (3 out of 30 questions) higher than those in the local Pizz-A-Thon group. The ISU group represents the highest level of participation in the project and includes additional hands-on learning activities beyond those outlined in the Pizz-A-Thon kit used at the local level. It would not be practical to dramatically increase the number of middle school students participating in the Pizz-A-Thon project on the Iowa State University campus. However, the researchers recommend that key enrichment activities that were unique to the ISU group be integrated into the Pizz-A-Thon kit and be used at the local level. Field trips to Iowa State University regional research centers, local farms, agribusinesses, and a pizza restaurant could be accomplished on the local level. Teachers should be encouraged to work with county extension education directors to assist them in coordinating such activities.

Middle school teachers should be offered training to assist them in utilizing the Pizz-A-Thon kit to its fullest potential. This training could be aimed at helping them to increase their own level of agricultural knowledge and at assisting them in identifying and cooperating with resource persons in their local communities. Wilhelm et al. (1999) summarized work done by scholars in agricultural education that indicates a need to support teachers with their efforts to integrate agriculture into their teaching. Wilhelm et al. also note that teachers in various states have responded favorably to programs designed to provide such support.

This study served as a formative evaluation that resulted in specific and practical suggestions for improving the Pizz-A-Thon project. After implementing recommendations, additional research should be conducted to determine whether the local Pizz-A-Thon project has become more effective in accomplishing its objectives. This research should be conducted on a larger scale involving a larger number of teachers and students from a broader range of communities.

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