FY04 Post-Secondary Mini-Research Project Summary
Agricultural Education

ELEMENTARY STUDENT OUTCOMES OF A YEAR-LONG AGRICULTURAL AND ENVIRONMENTAL LITERACY UNIT

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Elementary Student Outcomes of a Year-Long Agricultural and Environmental Literacy Unit

Abstract

The researchers of this quasi-experiment sought to determine the effects of a year-long agroecosystem unit on student comprehension, application of knowledge, interest motivation, and interest in cooperative learning. The sample included two third grade classes (*N* = 19 in each class) and two fifth grade classes, (*N* = 24 in each class). A third and fifth grade teacher developed the experientially based agricultural and environmental literacy unit as an assignment by participating in their second summer agricultural institute. The teachers implemented the unit by pairing a third and fifth grade student as study buddy teams. The two teachers combined their classes for one-hour of agricultural and environmental literacy instruction on 14 Fridays throughout the school year. There were three findings from this study. First, third and fifth grade students had more interest in agricultural and environmental knowledge and careers after participating in the year-long unit. Second, fifth grade students comprehended more and were able to apply more agricultural and environmental knowledge and concepts than their peers in the control group. There were no differences in knowledge comprehension or application of the third graders in the experimental group. Finally, third and fifth grade students in both, the experimental and control classes, were interested in learning cooperatively with their peers.

Introduction

The study of food and nature in elementary classrooms brings learning to life. Youth have a natural curiosity about plants, animals and the environment and they are excited when they are given the opportunity to study agriculture and the environment. Students learn more through nature-based experiences than through traditional classroom settings (Crompton & Sellar, 1981; Cronin-Jones, 2000). In most classrooms, students memorize facts, take spelling and arithmetic tests, and practice writing through “skill and drill” activities (Conn, 2004; Paris & Cunningham, 1996). In doing so, students become passive, bored, and uninterested in learning (Conn; Paris & Cunningham). Many students lose their natural sense of exploring and learning by third grade (Ramey-Gassert, 1997).

Students are motivated when they learn through *creative and purposeful activities* (Conn, 2004; Kearsley & Shneiderman, 1998; Moulds, 2003-2004; Ramey-Gassert, 1997; Johnson, Wardlow, & Franklin, 1997). Integrating experiential learning activities into a classroom setting creates an environment where students can take what they learn and apply that knowledge to another setting (Mabie & Baker, 1996; Powell & Wells, 2002). Second, students comprehend more information if it is connected to real-life outside of the classroom and their own life experience through an *authentic learning context* (Basile, 2000; Conn; Cronin-Jones, 2000; Kearsley & Shneiderman, 1998; Linn, Songer, & Eylon, 1996; Shuell, 1996; Wehlage, Newmann, & Secada, 1996). Youth who develop connections between the subjects they study and related careers are more

motivated and learn more (Lynch, 2000). Authentic learning helps students find personal meaning of the content through creativity and discovery (Kearsley & Shneiderman; Linn et al., 1996; Smith, 2002), and increases student achievement across social, economic, and cultural variables (Newmann & Associates, 1996). Finally, students are motivated and develop social and communication skills through *social interaction and collaboration* (Conn; Johnson & Johnson, 1985; Kearsley & Shneiderman; Webb & Sullivan Palincsar, 1996). Social collaboration provides students the opportunity to extend their thinking by integrating the thoughts, feelings, and ideas of their peers into their own paradigm (Greeno, Collins, & Resnick, 1996).

People learn how to solve complex problems through rich, sensory stimuli in real-life contexts (Jensen, 2000). Agricultural and environmental education provides a context where students learn educational concepts and skills (Cronin-Jones, 2000; Hillison, 1998; Jaus, 1984; National Research Council, 1988). The philosophical base underpinning the need for learning about the agricultural and environmental literacy in elementary classrooms is based on Dewey's (1938) philosophy of experience. Dewey posited that students would have greater understanding of economic and industrial problems in present society if they learned any subject within the scope of ordinary life experience and social applications. Food production plays a major role in the ecosystems in many parts of the world (Stevenson, 1998). Several changes are currently occurring that increase the complexity of human dimensions in agriculture and the environment. Some of these complex issues involving the food system have major connections with livelihood and quality of life, the environment, land use, and human health (Stevenson, 1998).

The more educated people were about environmental knowledge, the less alienated they felt in society (Rodriguez & Peterson, 1999) and the more favorable their attitudes were toward the environment (Bradley, Waliczek, & Zahjicek, 1999). Interdisciplinary education is the key to engaging people to think deeply about agriculture and its role in the environment (Lockwood, 1999). Integrating agriculture across the curriculum could enrich student understanding of agricultural and environmental concepts and ways of thinking (Ivanitskaya, Clark, Montgomery, & Primeau, 2002) because diversity of concepts and epistemologies from one content can enrich student understanding in a different content area (Boix-Mansilla, Miller, & Gardner, 2000).

Researchers have found that interdisciplinary education is the key to engaging people to think deeply about agriculture and its role in society (Lockwood, 1999). The theory of integration underpins the incorporation of agricultural topics across the general curriculum because integrating agriculture will likely enhance learning experiences. Although several studies in Illinios have been conducted regarding why teachers integrate agriculture into their instruction (Allen & Harper, 2002; Ball, Knobloch, Silberhorn, & Allen, 2003; Knobloch & Ball, 2003), this study was conducted to determine student outcomes when they actively engage in learning about agricultural topics in natural settings throughout the school year. This study addresses the FY04 Mini-Research Project Topic #2, "Agricultural Literacy."

Purpose & Research Questions

The purpose of this study was to determine the effects of agricultural and environmental literacy instruction on elementary students' cognition and motivation. There were four research questions for the study. Will students in the experimental group have: (1) higher comprehension of agricultural and environmental knowledge; (2) higher levels of application of agricultural and environmental knowledge; (3) more interest motivation in agricultural and environmental literacy; and, (4) more interest in cooperative learning?

Methods & Procedures

The following procedures were conducted to complete the research project.

1. Eighty six students in an elementary school participated in this quasi-experimental study throughout the 2003-04 academic year. The sample included two experimental classes (*N* = 19, 24) and two control classes (*N* = 19, 24). The third and fifth grade teachers in the experiment have been teaching 21 and 23 years, respectively. The third grade teacher's specialization was language arts and the fifth grade teacher's specialization was science.

2. The researchers collaborated with elementary teachers in organizing the research project and implementing the agricultural and environmental literacy instruction (the treatment). The two teachers collaboratively developed a year-long unit to integrate agricultural and environmental literacy in their classes throughout the school year. The agricultural and environmental literacy unit focused on making their students aware of their natural surroundings by using all of their senses. A primary interest of the teachers was to have the students observe how nature changes throughout the seasons and help the students make connections between nature and their everyday lives. Lessons on how nature and the seasons affect the food system and products that students use as consumers were also included into the unit.

3. Students participated in classroom activities to develop their comprehension knowledge, application knowledge, interest movitation, and social motivation. The agricultural and environmental literacy unit was integrated into two classrooms using experiential learning activities, cooperative learning, and authentic nature-based learning experiences. The unit of study took place for one hour per week for 14 weeks (September-May) during the 2003-04 academic year.

4. Prior to the start of the unit, the third and fifth grade teachers paired the students together so that every fifth grade student had a third grade buddy. The unit started during the fourth week of school when the third and fifth grade students met their respective buddy when the fifth grade students went to the third grade classroom. Each week the fifth grade students met their grade buddy in the third grade classroom. Once the students had a few minutes to talk with his or her buddy, the teachers began

introducing and facilitating instructional activities on the agricultural or environmental topic of the day (Table 1).

5. Students completed a 3-part questionnaire on three different occasions after participating in the agricultural literacy units to measure their comprehension knowledge, application knowledge, interest motivation, and social motivaiton. Incentives were used to encourage participation. Data were entered and analyzed using computerized data analysis software.

6. Data were entered and analyzed using computerized data analysis software. Because random assignment of students was desired but not possible, selection error was controlled using academic ability (IQ), special learning needs, and socioeconomic status (free/reduced lunches). The experimental and control groups were not different on the three selection variables.

Table 1. Topics, Activities, and Contexts for Agricultural and Environmental Literacy Unit

	Topic	Activity	Context
Week 1 (9/19)	Nature	Observation of a flower garden and an apple tree	Outside the school, but on school grounds
Week 2 (9/26)	Nature	Observation of a butterfly garden and a buckeye tree	Outside the school, but on schools grounds
Week 3 (10/03)	Scientific Method	Video on asking scientific questions and forming hypotheses	In the third grade classroom because it was raining
Week 4 (10/10)	Changing Seasons	Leaf collecting and pressing leaves	Outside the school and off the elementary school grounds
Week 5 (10/24)	Trees & Leaves	Making animals from leaves	In the third grade classroom
Week 6 (11/14)	Food	“What’s in my Tootsie Roll?” using an agricultural magazine	In the third grade classroom
Week 7 (11/21)	Food	Making pumpkin pie	In the third grade classroom
Holiday Break			
Week 8 (2/06)	Soil	Video on soil formation, erosion, and the layers of soil	In the third grade classroom
Week 9 (2/20)	Soil	Pantomiming state facts on soil and soil related facts	In the school cafeteria
Week 10 (2/27)	Soil	Finished pantomiming state soil facts and observed a flower garden and an apple tree	In the school cafeteria and outside the school, but on school grounds
Week 11 (3/12)	Soil	Examining soil and making Soil Sammies	In the school cafeteria
Week 12 (4/02)	Soil	Decorating Soil Sammies	In the school cafeteria
Week 13 (4/23)	Nature	Observation of a flower garden, butterfly garden, buckeye tree, and an apple tree	Outside the school, but on school grounds
Week 14 (5/07)	Nature	Observation of a flower garden, butterfly garden, buckeye tree, and an apple tree	Outside the school, but on school grounds

Results

Fifty percent of the students were male in the third grade experimental class, and 53% were male in the third grade control class. Thirty-six percent were male in the fifth grade experimental class, and 44% were male in the fifth grade control class. Over 70% of the elementary students reported that they engage in the following activities outside of school: Being with friends (95%); playing outside (87%); sports (85%); being with family (75%); camping (73%); drawing (73%); and watching TV (73%). Less than 30% of the elementary students reported that they engage in the following activities outside of school: Boy Scouts (15%); Girl Scouts (20%); 4-H (20%); cheerleading (27%); and gymnastics (27%).

The third grade students in the experimental group were compared to students in the control group (Table 2). The students in the control group averaged 83% on the knowledge comprehension test and the experimental group had an average of 81% (rounded to whole numbers in text). The experimental group did not have higher comprehension of agricultural and environmental knowledge. The third grade students in the control group had an average of 76% on the knowledge application test and the experimental group had an average of 79%. The students in the agricultural and environmental literacy instructional treatment did not have higher levels of cognition through application of agricultural and environmental knowledge. The students in the control group had a mean of 2.85 on student interest motivation in agricultural and environmental concepts and careers and the experimental group had a mean of 3.24. The experimemental group had more interest motivation in the agricultural and environmental concepts and careers. For social motivation, the control and experimental classes were interested in cooperative learning. The control group had a mean of 3.24 and the experimental group had a mean of 3.20 on interest in cooperative learning. Third grade students in the experiental learning unit about agriculture and the environment did not have more interest in cooperative learning.

Table 2. Third Grade Results

Assessment	Group	*X*	*SD*	*T*	*p*	*d*
Knowledge Comprehension[1]	Control (*N* = 19) Experimental (*N* = 19)	83.00 80.97	8.73 15.88	.487	.629	.16 None
Knowledge Application[1]	Control (*N* = 19) Experimental (*N* = 19)	76.32 79.47	10.65 16.49	.488	.488	.23 Small
Interest Motivation[2]	Control (*N* = 18) Experimental (*N* = 17)	2.85 3.18	.41 .26	2.797	.009	.96 Large
Social Motivation[2]	Control (*N* = 19) Experimental (*N* = 19)	3.24 3.20	.53 .57	.279	.782	.07 None

Note. [1] = Percentage of correct items; [2] = 1 – Strongly Disagree, 2 – Disagree, 3 – Agree, 4 – Strongly Agree

The fifth grade students in the experimental group were compared to students in the control group (Table 3). The students in the control group averaged 77% on the knowledge comprehension test and the experimental group had an average of 85%. The experimental group had higher comprehension of agricultural and environmental knowledge. The fifth grade students in the control group had an average of 80% on the knowledge application test and the experimental group had an average of 89%. The students in the agricultural and environmental literacy instructional treatment had higher levels of performance when applying agricultural and environmental knowledge. The students in the control group had a mean of 2.63 on student interest motivation in agricultural and environmental concepts and careers and the experimental group had a mean of 3.05. The experimemental group had more interest motivation in the agricultural and environmental concepts and careers. For social motivation, the control and experimental classes were interested in cooperative learning. The control group had a mean of 3.22 and the experimental group had a mean of 3.15 on interest in cooperative learning. Fifth grade students in the experiental learning unit on agricultural and environmental literacy did not have more interest in cooperative learning.

Table 3. Fifth Grade Results

Assessment	Group	*X*	*SD*	*t*	*P*	*D*
Knowledge Comprehension[1]	Control (*N* = 24) Experimental (*N* = 22)	76.60 84.62	10.99 9.79	2.602	.013	.78 Medium
Knowledge Application[1]	Control (*N* = 24) Experimental (*N* = 22)	79.58 88.64	12.33 11.67	2.552	.014	.75 Medium
Interest Motivation[2]	Control (*N* = 24) Experimental (*N* = 24)	2.63 3.05	.41 .35	3.868	<.001	1.10 Large
Social Motivation[2]	Control (*N* = 24) Experimental (*N* = 23)	3.22 3.15	.46 .57	.824	.636	.14 None

Note. [1] = Percentage of correct items; [2] = 1 – Strongly Disagree, 2 – Disagree, 3 – Agree, 4 – Strongly Agree

Conclusions, Implications & Recommendations

The integration of agricultural and environmental literacy created interest in third and fifth grade students. This is a key finding because student interest about the agricultural and environmental literacy was sustained until the end of the academic year. Teachers should focus on motivating students to learn through creative and purposeful activities. Teachers can create an environment for students to learn and apply knowledge by integrating experiential learning activities about the agricultural and environmental literacy into a classroom setting. In doing so, students are likely to be more motivated and comprehend more knowledge when they connect the content to careers and applications outside of the classroom. In the future, a longitudinal study

should investigate the long-term effects of experiential learning and agricultural and environmental literacy education on student interests and cognitive development.

Fifth grader students had greater comprehension and application knowledge of agriculture and the environment than their peers who were not taught agricultural and environmental literacy. Teachers should integrate agriculture into their instruction to increase upper level elementary students' knowledge about agricultural careers and science process skills. Elementary teachers should engage students to learn about the agricultural and environmental literacy through experiential learning activities because students comprehend more when they are motivated to learn. Further analysis of student knowledge, thinking, and motivation should be conducted using qualitative research methods for deeper understanding of these effects.

The agricultural and environmental literacy instruction did not influence third grade students' comprehension and application of knowledge. This finding may be due to their cognitive development, and scope and sequence of the curriculum. Third grade students may not be developmentally ready to learn science-based concepts about agriculture and the environment and these concepts are not introduced in some schools until the fourth and fifth grades. Third grade students may not be cognitively capable of grasping the higher-level concepts of agriculture and the environment. Third grade students should be assessed in more concrete and frequent approaches. Further inquiry into students' cognitive development should be conducted to determine age-appropriate agricultural and environmental knowledge and concepts for elementary school students.

Students in all of the classes, both experimental and control, were motivated to learn cooperatively. Teachers should engage students to learn about agriculture and the environment through cooperative learning activities. The researchers observed that cooperative learning motivated and engaged students in learning agricultural and environmental knowledge. Further study of the social and life skills that were developed throughout the unit should be explored and conducted. Qualitatively, the social effects were evident, yet the quantitative nature of this instrument did not capture the social phenomena that occurred. Further, students' interests in learning cooperatively should also be investigated to determine if differences exist between the control and experimental groups in how students interact socially. This study should be replicated with other agricultural concepts and in different educational contexts to determine the generalizabilty of the effects of integrating agricultural and environmental literacy into elementary classrooms.

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