

FY05 Post-Secondary Mini-Research Project Summary in Agricultural Education

**AN ASSESSMENT OF THE “CHICK IT OUT” AGRICULTURAL LITERACY PROGRAM’S IMPACT ON
ELEMENTARY STUDENT OUTCOMES**

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Abstract

The researchers of this study sought to assess teacher motivation and student outcomes of a science and agricultural literacy school enrichment program. The school enrichment program was an embryology unit coordinated by the local Extension office to enhance science and agricultural literacy. The sample included eight third grade classes who participated in two separate chick hatches in a county of a Midwestern state over a period of four months. There were 80 students in the four third grade classes for the first hatch and 88 students in four additional third grade classes for the second hatch. Curriculum resources, fertilized eggs, incubators, and incentive t-shirts for each classroom were provided by the county Extension office, after teachers participated in an introductory training session. There were three findings from this study. First, teachers' reported that their motivation increased as they gained confidence after each year of conducting the unit and their motivation to teach the unit was primarily based upon helping students achieve state learning standards and benchmarks. Second, student interest motivation in science and agriculture increased for all classes that participated in the unit. Third, student science and agricultural knowledge comprehension and application increased after the completion of the unit.

Introduction

School enrichment programs are used to supplement the elementary education curricula with activities to enhance student learning. School enrichment programs provide students with meaningful learning experiences while providing teachers with the training, knowledge, and resources to help them feel more comfortable in teaching science and agricultural concepts. Because teachers are expected to teach curricula to help students meet state standards and benchmarks, school enrichment programs are designed to help students learn content-based information and boost standardized test scores (Tocheterman, Carroll, & Steele, 2004). The researchers of this study investigated the "Chick It Out" program as one example of an agricultural and science literacy program that has been anecdotally successful, yet little is known about its educational impact on student outcomes.

School enrichment program coordinators work with local schools to provide students with learning activities that connect the curriculum to science and agriculture. Extension educators serve as school enrichment coordinators for teachers and provide developmentally appropriate curriculum to students and are held accountable by stakeholders (Tocheterman, Carroll, & Steele, 2004). Because a primary goal of Extension educators is to teach and disseminate information to communities, it is important to measure outcomes and evaluate the impact of their efforts on the teaching and learning process (Arnold, 2002). A school enrichment curriculum study regarding environmental concerns and misconceptions was introduced into Oklahoma classrooms to assess student skill areas based on learning standards. This interactive unit increased student awareness regarding recycling and environmental education (Kirby, Chambers & Cuperus, 1995). Although 4-H school enrichment programs are used as an outlet to teach important skills to youth and is becoming a popular method in providing educational experiences through the youth development program, little is known if these school enrichment programs are having an impact on students, especially in the area of agricultural literacy (Diem, 2001). Private foundations and government agencies have stressed the need to

make urban and rural individuals aware of agricultural literacy to stress an awareness and importance of agriculture because the products made from agriculture sustain human life (Frick, Gardner, & Machtmtes, 1995).

If teachers are expected by educational administrators to teach curriculum in meaningful ways, teachers are held accountable and more motivated to incorporate school enrichment activities into their classroom (McNeely & Wells, 1997). Teachers are expected to teach in alignment with state learning standards and use methods that engage students (Smith & Gess-Newsome, 2004). Students learn more when taught by teachers who used experiential learning activities (Powell & Wells, 2002) but some teachers are not comfortable teaching science and agricultural concepts when equipped with knowledge and resources (McNeely & Wells, 1997). One study conducted found that elementary teachers expressed anxiety in incorporating science units when even when training was provided (Horton & Konen, 1997). When experiential science activities are introduced into elementary classrooms, students are able to comprehend and apply knowledge better (Horten & Konen, 1997). Students who learn content aligned with learning standards perform effectively in the classroom (Pense & Leising, 2004).

Teacher motivation plays an important role in integrating agriculture and teaching science in elementary classrooms. Teachers who are familiar with subject matter influence what is taught in classrooms (Humphrey, Stewart, & Linhardt, 1994). Teachers who may not be familiar with content, such as agriculture or science may be less likely to integrate activities into their existing curriculum (Harris & Birkenholz, 1996). Teachers who use school enrichment activities that incorporate agriculture and science are often motivated to implement them to help students who may be struggling with content (Thompson & Balschweid, 2000) as the activities build student interest and excitement (McNeely & Wells, 1997).

Teacher efficacy is a type of teacher motivation. Self-efficacy theory states that individuals will engage in a particular behavior if it increases their feelings of competence and effectiveness (Breen & Lindsay, 2002; Bandura, 1997). Teachers who have several years of teaching experience tend to express high levels of self-efficacy (Pajares, 1997) and are responsible for building student interest in their classrooms (Bandura, 1997). Teachers with high efficacy levels tend to be open to new ideas and implement new methods to better reach their students (Tschannen-Moran & Hoy, 2001). Teachers who expect students to perform well in the classroom often have a higher sense of self-efficacy (Eccles & Wigfield, 2002). When teachers are more efficacious, they tend to take greater responsibility for student outcomes, and when outcomes are positive, teachers tend to take more responsibility for positive rather than negative outcomes (Tschannen-Moran & Hoy, 2001).

The integration of agriculture into the elementary curriculum helps students connect learning content to the real-world and has been recommended by researchers (Frick, Gardner, & Machtmtes, 1995). The integration of science and agricultural literacy activities offered through school enrichment activities brought into the classroom creates a context to use a variety of methods and instructional materials to help develop student cognition and interest (McNeely & Wells, 1997). Because students tend to lose interest in science during their middle school years, (Jones, Mullis, Raizen, Weiss, & Weston, 1992), efforts to improve performance and interest in science education have more impact during the elementary grades (Catsambis, 1995). Teachers

are likely to use agriculture to teach science literacy through school enrichment programs because the curriculum is user-friendly, enrichment activities are standards based, and the methods use to explain science are hands-on (McNeely & Wells, 1997) and create interest for students in elementary settings.

Getting students interested in science at a young age can produce favorable outcomes as children develop. Students interested in science may be more likely to retain this interest as young adults and decide to pursue careers related to science and agriculture (Meunier, Talbert & Latour, 2003). The “learn-by-doing” approach commonly used in 4-H programming provides children with opportunities to understand science concepts (Williamson & Smoak, 1999). School enrichment activities like Chick It Out may provide students more opportunities to become actively engaged in science classroom instruction because they are experiential in nature. By integrating purposeful activities into classrooms, teachers create student transfer of knowledge from the classroom to real-world application (Mabie & Baker, 1996).

A number of studies have looked at why teachers integrate agriculture into their instruction in Illinois classrooms (Allen & Harper, 2002; Ball, Knobloch, & Allen, 2003; Knobloch & Ball, 2003). Teachers integrated agriculture into their classroom because agricultural literacy programs help integrate agriculture into existing curriculum. Teachers with prior experience with agricultural literacy programs were also more likely to integrate agriculture into their curricula (Allen & Harper, 2002). Teacher who felt confident in integrating agricultural concepts had agricultural backgrounds compared to those in urban areas (Knobloch & Ball, 2003; Knobloch & Martin, 2002). Elementary teachers’ positive attitudes toward agriculture and other agricultural awareness activities were reasons teachers have incorporated agriculture into their classrooms. Other teachers choose to integrate agriculture into the curricula because it can be taught in science units and relate to other topics such as animals, plants, food, and the environment (Knobloch & Martin, 2000).

Several studies have investigated the impact of agricultural literacy programs on students. In 1996, Mabie and Baker found that fifth and sixth grade students developed science processing skills through a garden unit. Interviews with urban fifth grade students who had little interaction with gardening had difficulty processing pest management concepts and issues related to controlling food contamination (Trexler, 2000). In 2003, Meunier, Talbert and Latour found that an embryology unit in the fourth grade created student interest in agricultural careers. In 2004, Knobloch and Van Tine conducted a study on the integration of an agroecology unit in elementary classrooms and found that agricultural and environmental literacy instruction created third and fifth graders’ interest motivation and increased the fifth graders’ comprehension and application of knowledge. Although these studies indicate that agricultural literacy programs have a positive impact on student motivation and learning, more research studies are needed to determine the impact of different programs, in different schools, and across different grade levels.

Purpose and Objectives

The purpose of this study was to assess teacher motivation and student outcomes of an Extension-based agricultural literacy school enrichment program. The objectives investigated

the impact of the “Chick It Out” program regarding: (1) teacher motivation; (2) student interest motivation in science and agriculture; and (3) student comprehension and application of science and agricultural knowledge related to the Illinois learning standards.

Methods and Procedures

The following procedures were conducted to complete the research project.

1. The researchers of the quasi-experimental study purposively selected eight teachers who implemented the embryology school enrichment unit during the spring of the 2004-2005 academic year based upon geographic distance, location of school, similar teacher to student ratio. Three schools were located in rural communities. Three schools were located in suburban communities, and 2 schools were located in an urban community. There were 80 students in the four third grade classes for the first hatch (February) and 88 students in four additional third grade classes for the second hatch (April).

2. There were four (50%) teachers in the first hatch group four first hatch group teachers were female. There were four (50%) teachers in the second hatch group. Three females (75%) and one male (25%) comprised the teachers in the second hatch group. Teacher experience with the unit ranged from 1 year to 15 years.

3. The researchers collaborated with the elementary teachers to ensure teachers completed embryology activities during observation dates and times over the course of the three-week unit. The embryology unit focused on teaching students science and agricultural concepts and knowledge through experiential learning activities (National 4-H Council, 2001). The unit was aligned with Illinois learning standards and benchmarks: (a) the application of accepted practices of science, (b) the life cycle, (c) how living things function, (d) adapt and change, (e) how living things interact with each other and with their environment, and (f) the ability to know and apply concepts, principles and processes of scientific inquiry (National 4-H Council, 2001). Lessons and activities on parts of the egg and candling the egg to follow the development and life cycle of the chicks were included in the unit.

4. Students participated in classroom activities to develop their interest motivation and knowledge of science and agriculture. The embryology unit was integrated into the eight classrooms through experiential learning activities, teacher-directed activities, student projects, and authentic learning experiences. The units of study took place during regular science periods from 30 to 60 minutes to one hour per day for three weeks during late February (1st hatch) and early April (2nd hatch) of the 2004-05 academic year.

5. Elementary students from the first hatch engaged in the following activities outside of school: church activities (65%), sports (59%), Boy Scouts (15%), Girl Scouts (14%), and 4-H (8%). Elementary students from the second hatch engaged in the following activities outside of school: sports (71%), church activities (47%), Boy Scouts (23%), Girl Scouts (19%), and 4-H (13%).

6. To study teacher motivation, the research assistant interviewed classroom teachers to determine teacher confidence and motivation regarding why they implemented the embryology unit into their classroom. The interviews were audio-taped, transcribed, and open-coded for key findings. Direct quotes from teachers were also included for the qualitative data.

7. Two instruments were used to assess student outcomes. The instruments used to collect the data for this study were a motivation questionnaire and a science and agricultural knowledge questionnaire. For motivation, students in the first hatch completed a posttest motivation questionnaire, and students in the second hatch completed both pretest and posttest motivation questionnaires. A post-only control group design was used for the between group comparison on the first hatch. A pretest-posttest design was used for the within group comparisons to assess motivation and knowledge outcomes for both hatches.

8. The Interest Motivation Questionnaire assessed students' interest motivation in knowledge and careers related to science and agriculture. The motivation questionnaire contained 25 interest motivation items and 3 student characteristic items. The scale for the motivation items was: (1) agree; (2) don't know; (3) disagree. Example items for interest motivation were: "Looking at the eggs in the incubator was fun," "Making predictions about the chicks was fun", "I would like to work with animals when I grow up." The Interest Motivation Questionnaire was adapted and revised from a questionnaire developed for an agroecology unit study conducted with third and fifth grade students during the 2003-2004 school year. The questionnaire was reviewed by a panel of experts and teachers and field-tested for content and face validity. The first hatch yielded a post-hoc reliability coefficient of 0.68 and the second hatch yielded a post-hoc reliability coefficient of 0.60.

9. The science and agricultural knowledge assessment assessed the student's knowledge of embryology concepts. The researchers created a science and agricultural knowledge questionnaire based life science concepts and agricultural knowledge that was included in the Chick It Out curriculum guide (National 4-H Council, 2001). The second and third grade level Illinois Learning standards and benchmarks were used in development of the Embryology and Agricultural/Science Assessment. The science and agricultural knowledge questionnaire contained 10 knowledge comprehension (lower level of cognition) items and 13 knowledge application (higher level of cognition) items, and one student characteristic item. Knowledge comprehension and knowledge application items assessed student's retention of life cycle and embryological concepts and the application of concepts to situations they may encounter in the real-world. Learning in elementary classrooms depends on students' stages of development. Each stage of development has limits for learning and can influence learning outcomes. Piaget's work on cognitive development of children focused on how learning occurs, rather than the learning outcomes on standardized tests (Dembo, 1977). Factors that influence changes from one stage to the other include maturation, physical experience, social transmission and self-regulation. Students in this study aligned with the concrete operational stage, normally occurring for children between the ages of seven and eleven (Dembo, 1977). The science and agricultural concept items were true—false or multiple choice in format. Example items for knowledge comprehension were: "A rooster lays eggs." "Baby animals need heat, food and clean water to survive. Example items for knowledge application were: "A hen in her nest works like an incubator for baby chicks." "If we wanted to see how a baby chick is growing inside an egg, we

can use a light.” A panel of education experts established content validity for the knowledge questionnaire. Both hatches yielded a post-hoc reliability coefficient of 0.99.

10. Motivation and knowledge questionnaires were administered and read aloud to each classroom by the researcher. The questionnaire took 15 minutes to complete. Incentives were used to encourage participation.

11. The knowledge test was graded by the research assistant and percent correct was reported. Student assessment data were entered and analyzed using computerized data analysis software. Students who disagreed or agreed with interest motivation items were averaged into a group mean for interest motivation. Students who marked “did not know” on interest motivation items were not included in the group mean. Means, standard deviations, and effect sizes were reported and rounded to the nearest 1/100th. T-tests were used to determine significance. Alpha was set *a priori* at 0.05. Cohen’s (1988) indices were used to interpret effect sizes for *d*. Medium effect sizes were considered to be practically different (Fraenkel & Wallen, 2004).

Results

For the first objective, teacher motivation was assessed. Expectancy value and self-efficacy provided the theoretical framework to analyze and interpret why teachers were or were not motivated to incorporate curriculum into their classroom (Tschannen-Moran & Hoy, 2001). Four major themes of teachers’ task value of motivation surfaced throughout teacher interviews. These four themes included the embryology unit being aligned with state learning standards, providing a hands-on experience for students, the importance of teaching agriculture and student excitement and motivation (Table 1).

Teachers were motivated to incorporate Chick It Out into their classroom because of pressure and expectations placed upon them to teach to Illinois Learning Standards. All eight teachers’ primary motivation for incorporating the Chick It Out unit because the science curriculum was aligned with Illinois Learning Standards and life cycle goals within the school districts’ requirements. A first year teacher said, “It’s part of our curriculum. They do Chick It Out in every third grade in the district. It’s also because we study life cycles.” The unit serves a dual purpose for the teacher to follow curriculum standards while also creating student interest. A teacher who has incorporated the unit for eight years commented, “One of the state standards is that we have to teach the life cycle—a tradition that most 3rd grades do—the life cycle fits into the curriculum and Chick It Out program. The kids love it; the big thing is we are supposed to teach from the standards. We talk about it from the beginning of the year. I pre-teach to build excitement; the students point to the incubator several times, and it (the interest) takes care of itself.”

Teachers with more years of mastery teaching experience in incorporating Chick It Out into their classrooms are motivated to teach the unit because they have expressed more confidence in their ability to effectively teach the unit to their students. Teachers with more than two years of experience with the unit ($N = 6$) expressed more confidence in their ability of teaching the unit to their students. One of the fourth year teachers commented, “I’ve gotten more confident. I’ve come across different websites and more literature that’s given me more ideas to

Teacher Motivation to Teach the “Chick It Out” Embryology Unit								
Teacher	Hatch	Gender	Years Taught	Type of Community	Aligned with Learning Standards	Hands-On Experience	Importance of Agriculture	Motivates Students
A	1	F	4	Rural	X	X		
B	1	F	1	Urban	X		X	
C	1	F	10	Suburban	X	X		
D	1	F	8	Suburban	X	X		
E	2	F	4	Urban	X	X		X
F	2	F	15	Rural	X	X	X	X
G	2	F	2	Suburban	X			
H	2	M	5	Rural	X	X	X	

expand it and put it across to the kids better.” A teacher with 15 years of experience said, “My level of confidence has increased. I wish a couple of the other 3rd grade teacher would get into it (the unit). But, it’s to be feared a little bit at first.” Some of the more experienced teachers within the school building where they taught have gone from being the novice teacher to the one providing support and resources for some of the other teachers within the building who incorporated the unit.

While experienced teachers have become more confident with the unit, they probably experienced similar challenges that novice teachers (N = 2) faced with this year’s hatch. Thinking back to their first year of teaching the unit, two fourth year teachers expressed these challenges: “Did we turn them (the eggs) often enough? Did I put the sponges in (on day 18)? When do I take the plugs out? It was stressful to know if everything was going right. I was always second guessing the temperature and came in on the weekends and the kids were bumping the incubator and I didn’t know what was going to hurt it and what was going to be okay.” However, there is always the discovery of new challenges teachers have found and trying to figure out ways to overcome them. “The biggest part I’ve had with 3rd graders is fertilization and they are fascinated by that, but it’s kind of side-stepping around the gory details. That’s still something I haven’t quite figured out how to explain to them in general,” explained a fourth year teacher. Because the embryology unit is geared towards the life cycle, which can be unpredictable at times, each teacher and classroom had different hatchability outcomes. Watching the miracle of birth, explaining deformities that may have occurred while hatching, and discussing lack of development and death, each teacher and classroom had unique

experiences with success and challenges they encountered this year. From the challenges, they can build their experiences to enrich their classroom the following year in adapting the enrichment activities and project to try to ensure better hatchability.

Several teachers ($N = 6$) identified their motivation comes from the unit being a hands-on attempt to explain a complex concept of teaching the life cycle and used this unit to build upon concepts introduced during a plant life cycle at the beginning of the year. Because Chick It Out is a school enrichment activity, most of the recommended activities for the program are experiential in nature. While the activities and responsibilities integrated into the classroom vary by teacher, teachers ($N = 6$) were motivated to use this unit because of the hands-on responsibilities that students take on to care for developing chicks within the fertilized eggs. Before the project, one of the fourth year teacher approaches Chick It Out with his students in the following manner: “We’ll have a discussion with the students about what we are going to be doing and we talk about where the incubator will be, and then we vote on where it will be. Each year it’s a little different, tweaking it and making it their project, rather than my project.” Unlike many of the other teachers interviewed, this teacher builds upon past stumbling or success through a democratic approach to help students take ownership and responsibility for the project. A fourth year teacher said, “I try to make it as organized as possible with the egg rotating list and who gets to be in charge of the water and turning, and the kids help me set up the incubator—as much hands-on as they can possibly be—the more involved they are, the better, the more interested they are, the more they learn.” Novice teachers were a little apprehensive in making Chick It Out hands-on the first year, but stressed next year to make the project more hands-on to give the students more responsibility and ownership.

The importance of teaching students about agriculture tends to motivate teachers ($N = 3$) in two rural areas and one urban community to incorporate Chick It Out into their curriculum. “We do a bit with agriculture. With third grade, we learn a lot about Illinois, so we talk about incorporating agriculture with Illinois and a lot of these students live on farms, and if not, several are surrounded by cornfields, and they always know the time the farmers are out.” Another rural teacher credits the unit and a Summer Ag. Institute for making sure the students know a lot about agriculture because the students live in a rural area surrounding the school district. A tie to a family farm motivated the urban teacher to incorporate agriculture to connect concepts from the Chick It Out unit to a future unit on production agriculture in social studies.

Teachers ($N = 2$) who valued the outcomes of this unit also incorporate it in their instruction because they feel the unit excites and motivates their students to engage in the unit. “I think it’s the most exciting thing they do all year. Some of them had no idea about the connection between the egg you eat and the actual chick. Everybody knows in third grade, you do Chick It Out, you get your shirt, and chicks hatch. It’s a huge motivator for the kids. They come in on Day 1 (of third grade) and we talk about the things we learn about during the year and that’s one of they think they know they’ll learn that year. The motivation for the unit is at a high all year long. When the kids come in the morning with those t-shirts on the morning we have a hatch, everybody is in awe of them- and they are so proud of it,” described a teacher with 15 years of experience.

Part of the interest that generated from this unit was apparent when the t-shirts given to each student involved with the hatching process. Students looked forward to their third grade hatching experience after seeing t-shirts and hearing about past hatches from previous third grade classes. Extrinsically, these students were motivated by receiving a t-shirt for their efforts and being able to share their hatched results with other classrooms in the school. Intrinsically, these students were able to feel genuinely responsible and concerned for the life that was developing inside the egg for three weeks in their classroom and several students were able to make the connection and see relevance between animal and human life development. In addition, the students were engaged in the experiential learning activities that correlated with the knowledge gained. The unit allowed the students to be proud of something they have cared and nurtured to be able to share with other classrooms in the school.

Two comparisons were conducted to assess motivation outcomes for the second objective (Table 2). Using a post-only control group design, students in the first hatch (treatment group; posttest = 1.84, SD = .16) were compared to students in the second hatch (control group; pretest mean = 1.15, SD = .15) on interest motivation. The treatment group had significantly higher interest motivation than the control group. This between group difference had a large effect size. A pretest-posttest design was used for the second comparison. Students had a pretest mean of 1.15 (SD = .16) and a post test mean of 1.85 (SD = .18) for interest motivation on the posttest. Students' interest motivation increased significantly after participating in the embryology unit. This within group difference in interest motivation had a large effect size.

Student Interest Motivation Outcomes						
Comparison	Group	\bar{x}	<i>SD</i>	<i>t</i>	<i>p</i>	<i>D</i>
Between Groups	Control (<i>N</i> = 61)	1.15	.15	-26.63	<.001	4.42
	Treatment (<i>N</i> = 94)	1.84	.16			Large
Within Groups	Pretest (<i>N</i> = 55)	1.15	.16	-16.90	<.001	4.11
	Posttest (<i>N</i> = 55)	1.85	.18			Large

Note. Scale: 1 = Disagree, 2 = Agree

Two comparisons were conducted for the third objective to study knowledge outcomes. First, third grade students in the first and second hatches were studied for within group differences on knowledge comprehension (Table 3). The students in the first hatch had a mean of 73% and 83% on the posttest on the pretest for knowledge comprehension. The students in the second hatch had a mean of 75% and 81% on the posttest on the pretest for knowledge comprehension. The differences between the two means were significant with large effect sizes.

Students' comprehension of science and agricultural knowledge significantly increased after participating in the embryology units in both hatches. These within group differences had a large effect sizes for both hatches.

Group	Assessment	\bar{X}	<i>SD</i>	<i>t</i>	<i>p</i>	<i>D</i>
1 st Hatch (<i>N</i> = 72)	Pretest	73.18	.13	-5.85	<.001	80.89 Large
	Posttest	82.92	.11			
2 nd Hatch (<i>N</i> = 78)	Pretest	74.87	.13	-3.51	.001	52.15 Large
	Posttest	81.15	.11			

Note. Means represent percentage of correct items.

Second, third grade students in the first and second hatches were studied for within group differences on knowledge application (Table 4). The students in the first hatch had a mean of 73% on the pretest and 83% on the posttest for knowledge comprehension. The students in the second hatch had a mean of 75% on the pretest for knowledge comprehension and 81% on the posttest. Students' comprehension of science and agricultural knowledge significantly increased after participating in the embryology units in both hatches. These within group differences had a large effect sizes for both hatches.

Second, third grade students in the first hatch and second hatches were studied for within group differences on knowledge application (Table 4). The students in the first hatch had a mean of 70% on the pretest and 85% on the posttest for knowledge application. The students in the second hatch had a mean of 73% on the pretest and 83% on the posttest for knowledge application. Students' application of science and agricultural knowledge significantly increased after participating in the embryology units in both hatches. These within group differences had a large effect sizes for both hatches.

Student Knowledge Application Outcomes						
Group	Assessment	\bar{X}	SD	t	p	d
1 st Hatch ($N = 73$)	Pretest	69.65	.12	-8.62	<.001	132.70
	Posttest	84.93	.11			
2 nd Hatch ($N = 78$)	Pretest	73.34	.12	-5.75	<.001	86.18
	Posttest	83.26	.11			

Note. Means represent percentage of correct items.

Conclusions – Implications – Recommendations

Teachers were motivated to teach science and agricultural literacy using the embryology unit because it was aligned with state learning standards, motivated students, and engaged students to learn agricultural knowledge through hands-on experiences.

Within this embryology unit, teachers focused on the application of accepted practices of science, the life cycle, how living things function, adapt and change, how living things interact with each other and with their environment, and an overall sense of being able to know and apply concepts, principles and processes of scientific inquiry in accordance with the state learning standards. Teacher experience and familiarity with curriculum influences what is taught in the classroom environment (Humphrey, Stewart, & Linhardt, 1994). Teachers with a lack of agriculture background or knowledge may be less likely to incorporate agricultural topics into the curriculum (Allen & Harper, 2002; Harris & Birkenholz, 1996). Self-efficacy theory suggests individuals will engage in a particular behavior if it increases their feelings of competence and effectiveness (Breen & Lindsay, 2002). High levels of self-efficacy can result in increased motivation for teachers to build interest in school settings (Bandura, 1997). Mastery experience is a source of self-efficacy (Pajares, 1997). Teachers reported their confidence with the materials increased with years of teaching experience with the unit. Teachers who are confident in teaching science and agricultural content to students have the ability to mold student interest through various teaching methods and delivery of curriculum in an experiential manner (Bandura, 1997). If teachers are comfortable teaching their students these concepts and incorporate these activities into their classrooms, students benefit from a science and agricultural integrated unit by being able to make connections and build upon previous knowledge.

Teachers believed this school enrichment activity motivated students to learn more about science and agricultural concepts because the unit was delivered through various hands-on methods and activities that aid students in the concrete-operational stages of development absorb information better. Expectancy value predicts “that certain behavior can secure specific outcomes and the more highly those outcomes are valued, the greater is the motivation to perform the activity (Bandura, 1997).” Teachers who are influenced by pressures to improve

student learning are likely to choose instructional activities that will motivate students to learn content that is aligned with state learning standards (Thompson & Balschweid, 2001). Activities were aligned with the Illinois Learning Standards and fit into the science curriculum for all school districts with few adaptations made to reach all students. Teachers who buy-in to school enrichment programs ensure continuing and diverse program offerings that are necessary for future development of experiential learning activities in classrooms and develop relationships with agricultural literacy professionals. More experiential learning activities and units surrounding plants, animals, environment and food should be developed for elementary students that align to science standards to help teachers connect remaining gaps in science and agricultural concepts to improve standardized test scores and funding for school districts. Further, workshops, instructional resources, and support systems are needed for teachers across Illinois to feel confident in learning how to use experiential learning activities. Further research should be conducted across varied school enrichment curriculum to address teacher motivation across curriculum in varied content areas.

The embryology unit created interest in science and agriculture among third grade students. The integration of an embryology school enrichment unit created interest in science in third grade students. By receiving the extrinsic reward of a t-shirt and having a teacher build up excitement within the classroom to see the development of an animal life in their classroom, students were excited about being able to watch the growth of a fertilized egg while nurturing and being responsible for the care of an animal upon the hatch of the chick. Using experiential and purposeful activities that connected to real-world application increased student motivation (Mabie & Baker, 1996). This study also supported the findings that agricultural literacy increased elementary students' motivation to learn about science, agriculture, and the environment (Knobloch & Van Tine, 2004; Meunier, Talbert & Latour, 2003). Because this unit allows students to take ownership and responsibility for animal life in their classroom, future agricultural literacy curriculum and classroom instruction should stress more connectivity of science to the meaning of agriculture to ensure teachers stress to students that they are learning about agriculture, when studying animals, plants, food and fiber systems. Further research should assess whether interested created from this unit will have long-term effects on science and agricultural interest in upper elementary.

The embryology unit increased third grade students' comprehension and application knowledge of science and agriculture concepts and knowledge. This conclusion supported a Knobloch and Van Tine's (2004) study that found agricultural and environmental literacy unit increased fifth grade students' comprehension and higher level thinking. This conclusion was different than Knobloch and Van Tine's (2004) study that did not find a difference in students' comprehension and application of knowledge. The knowledge assessment was conducted immediately after the treatment in this study compared to the Knobloch and Van Tine study. This conclusion suggests that third grade students are not as likely to retain their knowledge of agricultural literacy over several months after a school enrichment activity. Experiential based programs that directly engage the student in the learning process promote learning (Powell & Wells, 2002). Experiential activities within the classroom enabled students to better grasp abstract concepts presented experientially. Teachers use school enrichment and 4-H science curriculum because they are designed to engage students in experiential learning modules (McNeely & Wells, 1997). Because the Chick It Out curriculum

was an experiential unit that aligned with state science standards and incorporated agriculture, students were able to transfer knowledge from embryology to real-world application problems. Current science curriculum or standards should be revised to ensure more tactile, sensory, and cross-curricular activities for elementary science teachers to include in classroom instruction to increase student comprehension in science to be applied in other areas of science and curriculum. Although educational materials were designed to meet Illinois Learning Standards and student questionnaires contained science and agricultural knowledge related to embryology concepts, a study should be conducted to evaluate actual performance on science standardized tests to assess how much standards based knowledge was learned and applied during the unit. Future studies should also investigate student's mental structures of embryology in relationship to life science curriculum.

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