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# Dig into Learning: A Program Evaluation of an Agricultural Literacy Innovation

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# Dig into Learning: A Program Evaluation of an Agricultural Literacy Innovation

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**Approval Page**

This dissertation was submitted by Erica Brown Edwards under the direction of the persons listed below. It was submitted to the Gardner-Webb University School of Education and approved in partial fulfillment of the requirements for the degree of Doctor of Education at Gardner-Webb University.

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## Abstract


Dig into Learning: A Program Evaluation of an Agricultural Literacy Innovation. Edwards, Erica Brown, 2016: Dissertation, Gardner-Webb University, Program Evaluation/Stages of Concern/Levels of Use/Theory of Reasoned Action/Constructivist Theory/Concerns Based Adoption Model/CIPP Model

This study is a mixed-methods program evaluation of an agricultural literacy innovation in a local school district in rural eastern North Carolina. This evaluation describes the use of a theory-based framework, the Concerns-Based Adoption Model (CBAM), in accordance with Stufflebeam's Context, Input, Process, Product (CIPP) model by evaluating the implementation and use of *Dig into learning: An agricultural Literacy Innovation*. This study evaluated teacher perceptions and use of agriculture as a context for teaching and learning in Grades K-5 by utilizing Stages of Concern (SoC) and Levels of Use (LoU) components of CBAM in relation to the CIPP model for program evaluations.

The following research questions were the basis for this study: (1) What needs for professional learning are expressed by elementary teachers with regard to agricultural literacy curriculum integration; (2) How is professional learning developed and implemented based on elementary teachers' expressed needs with regard to agricultural literacy curriculum integration; (3) What are elementary teacher perceptions of the impact of professional learning of agricultural literacy curriculum integration; and (4) What are elementary teacher perceptions of the impact of initial implementation of agricultural literacy curriculum integration?

The findings of this study are significant because they align with previous research on agricultural literacy and evaluation methods of both CBAM and the CIPP model. This study provided the framework in which change facilitators can support teacher participants and encourage them to utilize agriculture as a context for teaching and learning to contextualize STEM education.

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# Chapter 1: Introduction

The use of agricultural concepts as a context for learning has received growing attention over the past decade. Organizations such as National Agriculture in the Classroom (NAITC), the National Institute of Food and Agriculture (NIFA), and the United States Department of Agriculture (USDA) have advocated for education programs to support agriculture, such as Agriculture in the Classroom (Ag in the Classroom), to create more agriculturally literate individuals throughout the nation. It was the creativity of these organizations and a small group of educators during the early 1980s who pushed for more agriculture in education (NAITC, n.d.). From these initiatives, programs such as NAITC began and have since provided educators with resources to help make the use of agriculture as a teaching context a reality. The purpose of this study was to evaluate teacher perceptions and beliefs of the use of agriculture as a context for teaching and learning through the implementation of *Dig into Learning: An Agricultural Literacy Innovation.*

## Background of Problem

McREL (2009) stated, "the mission of the North Carolina State Board of Education is for every public school student to graduate from high school globally competitive for work and postsecondary education and prepared for life in the 21st century" (p. 4). In order to ensure that students achieve this goal and meet the expectations of the 21st century, teachers are faced with creating an atmosphere of learning that promotes academic success. Ainsworth (2010) declared teachers are entrenched with teaching what they know and what they know how to do rather than trying to encourage new, innovative ways of learning that will help students in the 21st century.

**Statement of Problem**

It is proposed that by 2050 the world's population will reach an estimated nine billion people, requiring the demands of agricultural production to nearly double (Borlaug, 2000). This change will increase the need for food; more food will have to be produced in the next 50 years than in the past 10,000 combined (USDA Economic Research Service, 2013). With the rising population and need to increase food production before the year 2050, it is important for the public to become more educated in the area of agriculture. Balschweid and Thompson (2000) noted, "integration of academic principles into agricultural and natural resources can provide a context necessary for students in the 21st century to understand the world they live in" (p. 36). These statistics support the need to educate citizens who are prepared to bridge the gaps in agricultural literacy. Agriculture should be a large part of educating its students, because it is such a vital part of driving the economy (Conroy & Trumball, 1999).

Matsuura (2007) declared,

> the goals toward which we are striving are about the fundamental right to education that should enable every child and every adult to develop their potential to the fullest, so that they contribute actively to societal change and enjoy the benefits of development. (p. 39)

North Carolina public schools utilize the model of 21st century learning to provide students with a learning system based on college and career readiness, imparting skills necessary for success in the workforce. Agriculture as a context for teaching and learning is one option to create an agriculturally literate society fulfilling the needs of 21st century learners. However, an issue is whether teachers have the knowledge to comfortably utilize agriculture as a teaching tool. Balschweid, Thompson, and Cole

(1998) stated, “teachers’ lack of agricultural knowledge and media-shaped stereotypes often match that of their students” (p. 9). Spielmaker and Leising (2013) proclaimed students in the 21st century are becoming less and less aware of food production and have less understanding of what food production actually means.

## Related Literature

**The history of agriculture in education.** Throughout much of history in the United States, agriculture and education have been closely related. Decades ago, many Americans lived on farms or in small towns; students often had farm chores before or after school (USDA, 2005). Old school books are full of agricultural references and examples because farming and farm animals were a familiar part of every child’s life (NAITC, n.d.). The need for agricultural production has increased significantly since the early 21st century. With the continuous growth and necessity for agricultural products, the need to educate the public on agriculture is important to sustain agricultural practices and life (Spielmaker & Leising, 2013). According to Nagle (1998), agriculture remains one of the most important industries in the world. Although less than 2% of society is directly involved in the production of agricultural commodities, all individuals play some role in agriculture. That role may be through employment in a related career or simply as a consumer of agricultural products. Following statistical data and research conducted by organizations such as the USDA and American Farm Bureau, support for the sustainability of agriculture and bringing agriculture knowledge back into our society and our schools is an important priority (USDA, 2005).

Currently, there are multiple programs and efforts being made by state and local governances to promote the use of agriculture as a teaching context for all classrooms. American Farm Bureau, along with 49 other state Farm Bureaus throughout the United

States, supports agriculture as a context for learning through the Ag in the Classroom program. Every state-level Ag in the Classroom program provides resources and materials in the form of lesson plans and workshops to promote agriculture as a context for learning. The North Carolina Farm Bureau offers Ag in the Classroom and has supported the implementation of Dig into Learning for the purpose of this research study.

**Agriculture education.** Knobloch, Ball, and Allen (2007) declared agriculture brings learning to life. The National Association of Agricultural Educators (NAAE, 2015) stated, "agriculture education teaches students about agriculture, food and natural resources" (para. 1). Agriculture education is delivered through three interconnected components: classroom and laboratory instruction, experiential learning, and leadership education (NAAE, 2015). Jackman and Schescke (n.d.) stated classroom and laboratory instruction include units based on natural and social sciences. Students in these courses have a unique opportunity to apply their core content concepts in an agriculturally related context. Experiential learning allows students to gain the application of knowledge and learning outside of the classroom environment. The interaction of the student, teacher, business site, and parent helps to ensure instruction is relevant to each individual student in their own learning environment (Jackman & Schescke, n.d.). Leadership development is provided through student organizations. Student organization activities are designed to enrich the classroom and laboratory experiences. Conroy and Trumball (1999) noted, "when these three components are actualized through a well-designed integrated program, they provide a context for learning necessary content and life skills to prepare students for adulthood, regardless of their ideal career areas" (p. 5).

**Agriculture literacy.** Frick, Kahler, and Miller (1991) leveraged research efforts to operationally define agriculture literacy on a national level. The results of their

research yielded the following definition:

> Agricultural literacy can be defined as possessing knowledge and understanding of our food and fiber systems. An individual possessing such knowledge would be able to synthesize, analyze, and communicate basic information about agriculture. Basic agricultural information includes: the production of plant and animal products, the economic impact of agriculture, its societal significance, agriculture's important relationship with natural resources and the environment, the marketing of agricultural products, the processing of agricultural products, public agricultural policies, the global significance of agriculture, and the distribution of agricultural products. (Frick et al., 1991, p. 52)

NAITC (2014) defined "agriculture literacy as having enough knowledge of agriculture to communicate the source and value of agriculture as it affects our quality of life" (para. 4). Reidel (2007) explained agricultural literacy is especially important for the younger generations, such as elementary students, whose future decisions will have a tremendous impact on their own lives as well as the entire world.

Research of NAITC and USDA has demonstrated how agriculture plays a vital role in our nation. It affects members of society whether they are closely related to the farm or have no connection at all. Birkenholz (1990) proclaimed the general public lives within the world of agriculture as consumers of agriculture products to natural resource management. Agriculture influences the daily lives of everyone, and all are invested in the growth and sustainment of agriculture. Law (1990) stated that agriculture is an absolute necessity, and further prosperity of the industry is dependent upon the agriculture literacy of society. The National Research Council (NRC, 1988) noted agriculture is significant to many and warrants being presented to more than just people

directly connected to agriculture through careers and family origin. With the vast amount of the population removed from the farm, citizens may consider themselves agriculturally literate even if they are not.

The American Association of Agriculture Educators (2012) noted that it is imperative for young people and adults to become informed, agriculturally literate consumers, advocates, and policymakers regarding agricultural issues. One way to inform the public of this issue is to explain what agriculture means, including what it takes to feed the nation. Lipton, Edmondson, and Manchester (1998) declared the food and fiber systems include all economic activities supporting farm production such as machinery repair, fertilizer production, food processing and manufacturing, transportation, wholesale distribution of products, retail sales, and eating establishments. Lipton et al. noted, “The fiber system includes all economic activities that link the production of plant and animal fibers and hides of fabric, clothing, and footwear” (p. 5).

**Educating the 21st century learner.** According to the Partnership for 21st Century Learning (2011), “to succeed in the 21st century, all students will need to perform to high standards and acquire mastery of rigorous core subject material” (p. 2). The Partnership for 21st Century Learning (2011) posed the idea that students will be actively engaged in their learning, creating experiences for them to form beliefs and values of academic success. Caine and Caine (1991) stated, “every complex event embeds information in the brain and links what is being learned to the rest of the learner's current experiences, past knowledge, and future behavior” (p. 5).

To survive in a new, globally competitive world, today’s children will need creativity, problem-solving abilities, a passion for learning, a dedicated work ethic, and lifelong learning opportunities (Partnership for 21st Century Learning, 2011). To meet

the needs of the 21st century learner, schools will need to adopt a 21st century skills curriculum and employ methods of instruction that integrate innovative, research-proven teaching strategies; modern learning technologies; and real-world resources and contexts (Partnership for 21st Century Learning, 2009). Actively engaging students is the key to creating learning experiences.

**Constructivist theory.** Vygotsky (1978) encouraged students to construct knowledge from creating their own understanding of experiences. As a child grows, so does the number of models and experiences obtained. The child's understanding of the world around him or her is acquired through linkages of those models to each other, creating a "rough blueprint for possible types of action in the future" (Vygotsky, 1978, p. 22). This model reiterates the importance of creating effective learning experiences children can relate to in the classroom to increase academic success. Vygotsky's (as cited in Bellah, 2006) analysis of practical intelligence in children and animals lends credence to learning in a context such as agriculture. Todd (2010) believed constructivist learning and inquiry provided the philosophical foundation for curriculum integration. Todd stated, "inquiry-based learning is founded on the belief that learning is a process of personal and social construction" (p. 5). With constructivism, teachers and students are working together to build an education based upon what student experiences are and what they know, so learning becomes meaningful (Public Schools of North Carolina, n.d.).

Theories in education would not be complete without reference to Dewey's philosophy of the role of experience in learning. Dewey (1938) believed students' inexperience, especially in elementary grades, limited their ability to develop their own learning experiences. Gradle (2014) stated, "the ideas of natural selection led Dewey to believe that the interaction between the human being and the environment was important"

(pp. 72-73). Na and Song (2014) stated,

> Dewey (1938) introduced the notion of experience and distinguished different meanings of experience to explain his theory concerning education. He associated experience with education and claimed that to 'learn from experience' is to make a backward and forward connection between what we do to things and what we enjoy or suffer from things in consequence. (p. 1034)

Just as Dewey (1938) described student experiences, educators experience learning in the same context: a "backward and forward" connection. In following Dewey's principle of learning, educators must create learning experiences for students to actively learn.

**Adopting curriculum innovation.** Rogers (2003) stated, "an innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (p. 12). In following 21st Century Learning, educators are no strangers to curriculum innovation. Creating opportunities for innovation to occur within the field of education is critical work for today's education leaders (Bellanca & Brandt, 2010). Rogers indicated an innovation is adopted through the innovation-decision process. Bellah (2006) explained, "a potential user of adopted innovation passes from first knowledge or awareness of an innovation to the final confirmation and reinforcement of the decision to adopt or reject the innovation through this process" (p. 10). These specific roles would be described as the opinion leaders. Opinion leaders are those who assess the value of innovations early on and then influence others in their area of expertise. Opinion leaders are vital in the area of education innovation and curriculum change because it is the experience and belief of these leaders that will promote or refute the idea of doing something different (Hall & Hord, 2015).

**Agricultural education innovation.** As innovations occur, teachers are usually receptive because they want to do the right thing (Rossi, 2014). However, the implementation process of the innovation determines its success as well as adoption. For the purpose of innovations, certain processes must be put into place to ensure educators are aware of its purpose and the role the educator plays in the innovation (Hall & Hord, 2015). Creating an innovation configuration (IC) map may aide teachers in understanding how an innovation takes place. Rayfield, Murphy, Briers, and Lewis (2012) quoted Agriculture Education for the Year 2020, stating, "agricultural education envisions a world where all people value and understand the vital role of agriculture, food, fiber, and natural resources industries in advancing personal and global well-being" (p. 38). Trexler and Meischen (2002) declared little research has been conducted beyond assessment of student and teacher knowledge of agriculture and the willingness of teachers to integrate agriculture concepts into their core curriculum. For the most part, researchers have focused on individual curriculum programs that infuse agriculture as a thematic context across the content areas in secondary education. Very few studies of agricultural education have been conducted in elementary education. Rayfield et al. expressed the idea that the purpose of innovative programs in the future would be as a means to teach skills needed in a changing industry and to encourage students to think outside the box. "Innovative programs will be hands-on, include problem-solving, and critical thinking" (Rayfield et al., 2012, p. 38).

## Setting

The study took place in a school district located in a rural county in eastern North Carolina. The school district consists of 16 public schools, including four kindergarten through fifth-grade schools, one kindergarten through sixth-grade school, three

kindergarten through eighth-grade schools, three middle schools, four high schools, and one early college high school housed at the local community college. The district employs a total of 359 licensed elementary classroom teachers. Of this population, 49 teachers voluntarily registered to attend the *Dig into Learning: An Agricultural Literacy Innovation* workshop training. The study focused on these 49 teacher participants. Through the use of surveys, teachers were asked about the importance of particular elements concerning agriculture as a context for teaching and learning. The responses from an initial needs assessment survey were evaluated by the researcher and used by North Carolina Ag in the Classroom curriculum specialists to instruct teachers on the use of agriculture as a context for learning based on identified needs with regard to *Dig into Learning: An Agricultural Literacy Innovation.*

This study was relevant to this particular school district because the county functions primarily on the presence of large agriculture commodity bases, including swine operations; poultry operations; commercial cow herds; other animal production facilities; and an immense amount of row crop acres producing corn, wheat, soy beans, cotton, and some tobacco. This agriculture-driven county is home to many large agriculture industries serving the public with jobs, income, and taxpayer dollars.

**Purpose Statement**

The purpose of this program evaluation was to study teacher perceptions on the implementation and impact of professional learning of a Science Technology Engineering and Math (STEM) agricultural literacy innovation. The researcher utilized a mixed-methods approach analyzing both descriptive statistics and qualitative analysis of open-ended items and interviews. This study also examined the use of agriculture as a context for teaching and learning in the elementary classroom.

## Research Questions

Four overarching research questions guided this study. Research Question 4 was further broken into two components. These components are explained in the next section.

1. What needs for professional learning are expressed by elementary teachers with regard to STEM agricultural literacy curriculum integration?
2. How is professional learning developed and implemented based on elementary teachers' expressed needs with regard to STEM agricultural literacy curriculum innovation?
3. What are elementary teacher perceptions of the impact of professional learning of a STEM agricultural literacy curriculum innovation?
4. What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation?

## Research Questions according to Context, Input, Process, and Product (CIPP) Model and Concerns-Based Adoption Model (CBAM)

**Context evaluation.** The context of this study assessed participant needs as they related to the use of agriculture as a context for teaching and learning to teach STEM in the elementary classroom. Addressing participant needs allowed the researcher to evaluate current stages of concern (SoC) associated with the use of the innovation. The program evaluation analyzed the following research question related to the context analysis. The researcher utilized both descriptive statistics of the Needs Assessment survey items and qualitative analysis of open-ended response items to determine participant needs in the integration of STEM agricultural literacy. The Needs Assessment provided the foundation for the context analysis.

Research Question 1. What needs for professional learning are expressed by elementary teachers with regard to STEM agricultural literacy curriculum integration?

**Input evaluation.** According to Stufflebeam (2005), an input evaluation focuses on plans and budgets of the program. In relation to CBAM, the researcher focused on participant concerns related to agriculture as a teaching context. The program evaluation analyzed the following research item related to the input analysis.

Research Question 2. How is professional learning developed and implemented based on elementary teachers' expressed needs with regard to STEM agricultural literacy curriculum innovation?

**Process evaluation.** The process evaluation measures the actions and methods used to implement the innovation (Stufflebeam, 2005). When referring to CBAM, this research question addressed concerns and levels of use (LoU) regarding the innovation. The program evaluation analyzed the following research question related to the process analysis.

Research Question 3. What are elementary teacher perceptions of the impact of professional learning of a STEM agricultural literacy curriculum innovation?

**Product evaluation.** The product evaluation analyzes the outcomes of the innovation (Stufflebeam, 2005). The product evaluation is the core of this evaluation. The research questions that guided this study measured both quantitative (4a) and qualitative (4b) data by evaluating the impact of the implementation. With regard to CBAM, the researcher analyzed change of participant concerns and LoU regarding the innovation. The process of this program was evaluated by answering the following research questions.

Research Question 4. What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation?

4a. What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation as measured by the statistical analysis of the change in pre and posttest survey questions?

Null Hypothesis 4a. Elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation remain unchanged from the pre and posttest survey questions.

Alternative Hypothesis 4a. Elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation change from the pre and posttest survey questions.

4b. What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation as measured by teacher interviews?

The research questions guided the development of this mixed-methods study, and each question was addressed throughout data collection and analysis.

**Rationale for Proposing a Program Evaluation**

The researcher met with the school district's superintendent and district curriculum specialists to discuss the implementation of *Dig into Learning: An Agricultural Literacy Innovation*. During this conversation, there was a question as to whether teachers would respond positively to utilizing agriculture as a context for teaching and learning for elementary students. The researcher explained to the school superintendent why an evaluation of the program would be an appropriate way to assess

the effects of this program as related to creating a more interactive, college-ready learning environment connecting students to real-life scenarios. The school superintendent agreed that an evaluation would be helpful. The superintendent authorized the implementation of this innovation. The researcher's role was that of an internal evaluator of *Dig into Learning: An Agricultural Literacy Innovation*. The evaluation results will be shared with appropriate stakeholders. The researcher's recommendations to improve and support continuation of this program are identified in Chapter 5.

**Overview of Study Design**

In this study, the researcher evaluated the implementation and use of an agricultural literacy innovation within elementary grades as a context for teaching and learning related to STEM agricultural literacy. A mixed-method approach through program evaluation was the method of research for this study. Quality program standards were outlined, and pertinent data were gathered to support the research of this study. Evaluation standards were applied in an effort to establish program worth, effectiveness, and rationale. An evaluation approach allowed facilitators and stakeholders involved in the development of this innovation to more effectively determine the perceived impact it had on teacher participants involved and their use of the innovation.

Prior to beginning research for this study, approval was granted by the district superintendent for the implementation and facilitation of *Dig into Learning: An Agricultural Literacy Innovation* training and workshop for elementary teachers interested in utilizing agriculture as a context for learning in kindergarten–fifth grade classrooms (Appendix A).

**Definition of Terms**

The following definitions of terms are provided by the researcher to ensure uniformity and understanding of these terms throughout the study. Multiple resources were used to develop definitions.

**21st century learning.** The purpose of 21st century learning is to provide students with a learning system based around college and career readiness, providing them with the skills they need to be successful in the workforce. The framework of 21st century learning describes the skills, knowledge, and expertise students must master to succeed in work and life; it is a blend of content knowledge, specific skills, expertise, and literacies (Partnership for 21st Century Learning, 2009). The framework focuses largely on student outcomes in areas including life and career skills, critical thinking, communication, collaboration, creativity, and technology and information literacy to accompany core academic subject standards. For educators, 21st century learning skills focus on curriculum and instruction, professional development, and learning environment (Figure 1).

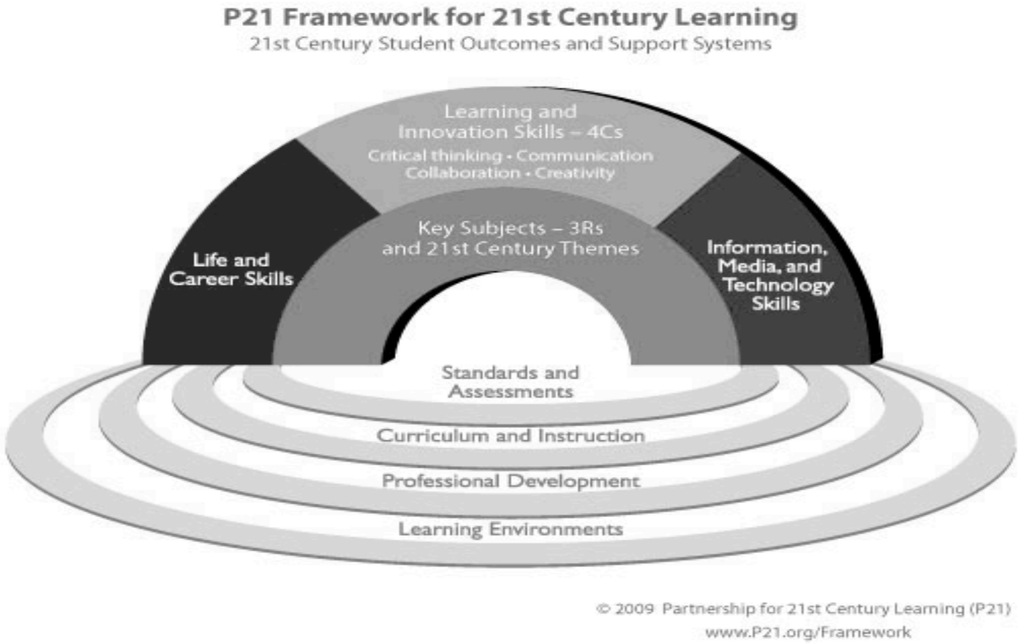


*Figure 1*. P21 Framework for 21st Century Learning.

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Specifically, the focus of life and career skills is on the ability to navigate complex life and work environments. The skills include flexibility and adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, and leadership and responsibility (Partnership for 21st Century Learning, 2015). Citizens and workers in the 21st century must be able to display a range of functional and critical thinking skills related to information, media, and technology skills such as accessing and evaluating information; analyzing and creating media products; and applying technology as a tool to research, organize, evaluate, and communicate information. Learning and innovation skills focus on creativity, critical thinking, collaboration, and communication (Partnership for 21st Century Learning, 2015). In addition to identifying specific skill sets and content knowledge necessary for the 21st century learner, the Partnership for 21st Century Learning identified five critical support

systems to ensure student mastery, one of which focused on professional development.

**21st century professional development.** Professional development should emphasize ways teachers can seize opportunities for integrating 21st century skills and teaching strategies into their classroom practice. Teaching should be a balance of direct instruction with project-oriented instruction and promote professional learning communities that cultivate teachers to develop various strategies to improve student achievement.

**Agriculture literacy.** Talbert, Vaughn, and Croom (2005) described agriculture literacy as education about agriculture, including the food, fiber, and natural resources system (Talbert et al., 2005). NAITC (2011b) defined an agriculturally literate person as "a person who understands and can communicate the source and value of agriculture as it affects our quality of life" (para. 3). In addition to being able to communicate about agriculture (in an accurate way), an agriculturally literate person should be able to make informed decisions about what they eat and wear (buy) related to their quality of life (their environment).

**Agriculture education.** NAAE (2015) stated, "agriculture education teaches students about agriculture, food and natural resources" (para. 1). Agriculture education is delivered through three interconnected components: classroom and laboratory instruction, experiential learning, and leadership education (NAAE, 2015).

**CBAM.** A model of assessing educational innovation use based on teacher concerns and comfort with the innovation rather than on simple evaluation measures that ascertain use or nonuse of an innovation (Hall & Hord, 2015). CBAM is important to utilize in the effective implementation of a new program. There are three components for assessing and guiding the process of the model–IC, SoC, and LoU. The use of this

research method can provide evidence of the current extent and quality of implementation that can be used to drive decisions and actions.

**CIPP.** Stufflebeam's (2003) CIPP evaluation model. A conceptual model of evaluation used to address the four components of context, input, process, and product of a program. The CIPP model is a management-oriented evaluation design meant to provide information on the effectiveness and worth of an innovation. Stufflebeam (2003) designed the CIPP model to address four classes of decision making: planning (selecting objectives), structuring (designing the program), implementing (executing the program), and recycling (reaction to the program). These decision-making methods make up the process of the CIPP model: context, input, process, and product of a program.

**Educational innovation.** Pertaining to a product or process as introduced into the educational genre. Hall and Hord (1987) stated an innovation may be characterized as "a new textbook or curriculum materials, or . . . different approaches to discipline, counseling techniques, or instructional procedure" (p. 9). Following this definition, this evaluation plans to evaluate teacher LoU of the agriculture literacy innovation throughout the county. This innovation stems from Ag in the Classroom, a North Carolina Farm Bureau initiative to encourage the use of agriculture as a teaching context in all elementary classrooms. North Carolina Ag in the Classroom has been implementing workshops and trainings for teachers and community leaders for over 20 years.

**Integrated curriculum.** The curriculum is integrated so that learning in all subject areas occurs primarily through projects and centers. Teachers guide children involvement in projects and enrich learning experiences by extending ideas, engaging children in conversation, and challenging their thinking (Bredekamp, 1990).

**LoU**. The sequence of levels through which an educator may pass through an

educational innovation. Hall and Hord (2015) described the eight levels as nonuse, orientation, preparation, mechanical use, routine, refinement, integration, and renewal.

**National Agricultural Literacy Outcomes (NALOs).** A synthesis of influential research and published agricultural literacy frameworks resulted in the development of NALOs. NALOs are identified by five themes.

1. Agriculture and the Environment;
2. Plants and Animals for Food, Fiber, and Energy;
3. Food, Health, and Lifestyle;
4. Science, Technology, Engineering, and Math; and
5. Culture, Society, Economy, and Geography (Spielmaker & Leising, 2013).

**SoC.** Hall and Hord (2015) described seven SoC as awareness, informational, personal, management, consequence, collaboration, and refocusing.

**Summary**

Chapter 1 focused on the purpose and background that are the foundation of this study. This study evaluated teacher perceptions of impact of professional learning and the initial implementation of STEM agricultural literacy innovation for elementary teachers in Grades K-5 as a context for teaching and learning. The scope of this mixed-methods study was focused on teacher experiences and use of the agriculture literacy innovation, *Dig into Learning*. Utilizing teaching methods grounded in constructivist epistemology creates a bridge between the learner and the learned (Bellah, 2006). As a context for teaching and learning, agriculture may be a context that could serve as this bridge.

Chapter 2 provides a literature review of historical, philosophical, and theoretical perspectives on the history of agriculture, the future of agriculture, and the role of

agriculture in education. Agriculture is introduced as a hands-on learning experience for students and a perspective teaching method for elementary school teachers. The theoretical framework regarding the construct of Hall and Hord's (2015) SoC and LoU concerning participant characteristic beliefs and experiences while learning and implementing these methods is described and discussed within the context of this study. Details gathered from the literature were used to mold this study and the methodology used in Chapter 3.

Chapter 3 describes the methodology utilized to conduct this study. Studies that have formed the foundation of this topic were used in order to design a program encouraging the use of agriculture as a context for teaching and learning. A description of the mixed-methods research design, the role of the researcher, and data producers are included. Initial analysis of data collected from the needs assessment drove this study, including the planning of the workshop *Dig into Learning* as explained in Chapter 3.

Chapter 4 includes a brief summary of the study, including the interpretation and discussion of quantitative and qualitative methods that were used to collect and analyze data from survey responses and interviews. The evaluation of data is organized into sections that mirror the process of the CIPP model as it relates to Hall and Hord's (2015) CBAM to support the process of the program evaluation.

Chapter 5 details a summary of findings, interpretation of findings, purpose and overview, research design, and limitations of the study as well as recommendations.

# Chapter 2: Review of Literature

## Overview

A great deal of literature on agricultural literacy and integrating agriculture concepts into elementary and middle school curriculums exist. There is pertinent and valuable literature in relation to the change process and education innovations to improve learning opportunities for teachers and students. In this study, the process of education innovation is part of the purpose of utilizing agriculture as a context for teaching and learning. It is evident that students in the 21st century are becoming less aware of food production (Spielmaker & Leising, 2013). There is a need to integrate agriculture into curriculums, specifically elementary curriculums, to create agriculturally literate youth who will one day be career leaders in the 21st century.

In order to understand the role of agriculture within society and the impact it has on student learning, this chapter examines the literature related to the history of agriculture in North Carolina, the critical role of agriculture within society, and the programs that are already in place to integrate agriculture concepts into the curriculum. Each of these subtopics concludes with how the topic itself relates to the integration of agriculture as a context for learning through the implementation of *Dig into Learning: An Agricultural Literacy Innovation.*

## History of Agriculture in America

In order to understand why agriculture is important to education, it is important to know how agriculture is important to society. North Carolina Department of Agriculture and Consumer Services follows the belief that in order to understand both agriculture and forestry as they are today, one needs to know how they have evolved. Thomas Isern, Professor of History at Emporia State University, declared, “if you know nothing of

agricultural history, then you cannot understand American history" (Lily, n.d., para. 1). In 1790, 93% of the population of the United States was rural, most of them farmers. According to Lily (n.d.), by 1990, only 200 years later, barely 2% of the population are farmers. The lack of people actively farming is a profound societal change that has isolated most people from rural life and from an appreciation of the complexities and uncertainties of food production (Lily, n.d.). Agriculture in history gives a distinct importance to understanding agriculture and its history in society.

> No society can survive without a reliable means of feeding its members, and every society's long-term survival rests upon its efficiency in doing that. The ability of human societies to grow and to develop into complex civilizations has always required the specialization of labor, which becomes possible only when some of their members are liberated from having to spend most of their time gathering and preparing food. Labor specialization requires agricultural systems efficient enough to free substantial numbers of people from food-production work so they can undertake other tasks, such as governing, building structures, and soldiering. Whatever other goals societies have had, all have continuously sought to improve their agricultural systems by making them more efficient, diversifying their produce, and expanding their markets. Moreover, the rapid expansion of the modern world's population—fostered by medical and dietary advances—has intensified the quests for more nutritious foods, improved crop yields, and more equitable distribution of food. All these issues and many more point up the importance of agriculture in human history. (Rasmussen, 2010, p. ix)

**Agriculture Literacy**

A study conducted by NRC (1988) established the Agriculture Education in

Secondary Schools Committee to examine the status and forecast the future of agriculture education. NRC defined agricultural literacy as, "An agriculturally literate person would understand the food and fiber systems and this would include its history and its current economic, social and environmental significance to all Americans" (p. 8).

According to Bodzin and Vallera (2014), "Americans lack sufficient agricultural literacy (NRC, 1988) and hold stereotypical perceptions of farmers in overalls working in barnyards full of chickens, cows, and tractors" (p. 3). Lack of agricultural knowledge is problematic, as agriculture impacts American lives in relation to food and fiber production, the resources and environmental implications involved in their production, and global interconnectedness (Bodzin & Vallera, 2014). Introducing agricultural literacy initiatives early in life can create globally competent consumers who are aware of the countless interconnections within the physical world and make better decisions regarding their health and the environment (Frick et al., 1991, p. 3). Other researchers have theorized their own definition of agriculture literacy. Bellah (2006) defined agricultural literacy "as possessing knowledge and understanding of our food and fiber systems" (p. 8). An individual possessing such knowledge would be able to synthesize, analyze, and communicate basic information about agriculture. Basic agricultural information includes the production of plant and animal products, the economic impact of agriculture, its societal significance, agriculture's important relationship with natural resources and the environment, the marketing of agricultural products, the processing of agricultural products, public agricultural policies, the global significance of agriculture, and the distribution of agricultural products (Bellah, 2006). The weakness in this focus and definition of agricultural literacy is that it assumes all students are aware of where

food comes from and what agricultural products are in the foods we eat. Hess and Trexler (2011) declared most students in today's classroom have no common knowledge of agriculture or the agriculture food system. The problem does not completely lie within the students' lack of agricultural knowledge but also the teachers' lack of knowledge. "Unfortunately, teachers' lack of agricultural knowledge and media-shaped stereotypes often match that of their students" (Bodzin & Vallera, 2014, p. 3).

Fritsch (2013) stated,

> agricultural education, a long-time mainstay in rural schools, is finding a new foot-hold in cities where teachers and administrators are discovering that its unique educational model, which combines hands-on classroom activities, integrated leadership education and carefully selected real-world experiences provides the relevancy and concept reinforcement that can help all students achieve, even those who may be below grade level or at risk of failing. (p. 20)

The importance of agricultural literacy is not only understanding agriculture but the importance of the execution of agriculture literacy in a classroom of students with no prior knowledge of agriculture and its history.

Agricultural literacy differs from agricultural education in that its focus is on educating students about the field of agriculture rather than preparing students for work within the field of agriculture. According to the NRC (1988) report, "Agriculture is too important a topic to be taught only to the relatively small percentage of students considering careers in agriculture" (p. 1) and should be integrated into all levels and fields. Agricultural literacy encourages understandings about food and fiber systems, global economies, nutrition, and environmental conscientiousness (NRC, 1988). Bodzin and Vallera (2014) quoted Frick et al. (1991) stating agricultural educators constructed

definitions necessitating that literate students be able to synthesize, analyze, and communicate about agriculture, as well as appreciate the values and beliefs within the system to become fully engaged.

**Agricultural literacy research methods.** Multiple studies have been conducted in the way of agriculture education related to secondary education. Bellah and Dyer (2009) stated that much of what exists in the way of agricultural literacy research can be categorized into three major areas: student knowledge and attitudes, teacher preparation and professional development, and barriers to implementing agricultural literacy curriculum. One such study conducted by Connors and Elliot (1995) as cited in Bellah and Dyer (2009) sought to determine differences in student achievement scores based on instruction, or lack thereof, in agriscience and natural resource courses in secondary schools. Results of this study were based on an independent and dependent variable on science achievement scores based on standardized exams. Connors and Elliot found a considerable positive correlation between student grade point averages and their science test scores. "The researchers concluded that high school seniors who had taken a course or courses in agriscience and natural resources fared as well as their non-agriscience counterparts on a standardized science achievement test" (Bellah, 2006, p. 24). Bellah and Dyer (2009) stated, "many studies seeking to attribute achievement scores to curricular components, like this one, often raise more questions than are answered" (p. 24).

There have also been studies conducted in the realm of agricultural literacy related to the elementary and secondary education setting. Igo, Leising, and Frick (1999) studied the food and fiber knowledge of 800 kindergarten students through the eighth grade in three sites using a case study method. The "analysis of the pre- and post-test

knowledge scores indicated significant knowledge gains in each of the five agricultural theme areas outlined by the *Food and Fiber Systems Literacy Framework* from which the teachers at the study sites infused agricultural concepts" (Bellah, 2006, p. 25). From this study, the researchers found posttest scores for students in Grades 6-8 were lower than pretest scores (Igo et al., 1999). The researchers reported data based on classroom observations and teacher interviews; these data alluded to teachers who were "having difficulty making both formal and informal connections to food and fiber systems" (Igo et al., 1999, p. 53). The researchers analyzed these data and proposed the recommendation for teacher in-service training to aide in making relevant connections between what the teachers were teaching and the Food and Fiber Systems Literacy Framework. A conceptual model of the Food and Fiber Systems Literacy Framework showed comparisons between the recognition of need for agricultural literacy in Grades K-12 and the definition of agricultural literacy including the themes, standards, and benchmarks (Figure 2). Leising, Igo, Hubert, Heald, and Yamamoto (1998) stated this framework outlined the way students should comprehend agricultural literacy.

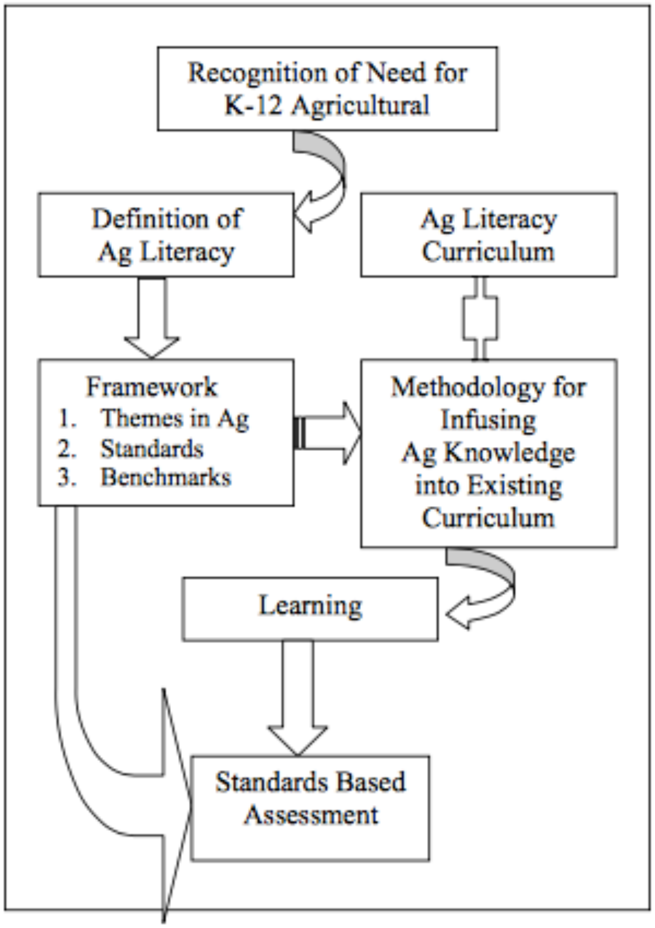


*Figure 2.* Food and Fiber Systems Literacy Framework.

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The Food and Fiber Systems Literacy Framework outlines what an agriculturally literate student should understand regarding agriculture concepts. Leising, Pense, and Igo (2001) conducted a study investigating the effects of the Food and Fiber Systems Literacy Framework on student knowledge. This study sought to compare differences and determine relationships based upon the framework as well as the number of teacher-reported instructional connections made to the framework. "This study used a quasi-experimental nonequivalent control group design with 21 kindergarten through eighth grade classes as the treatment group, and seven kindergarten through eighth grade classes as the control group" (Bellah & Dyer, 2009, p. 26). The researchers administered a

pretest to assess preexisting knowledge of food and fiber systems to a control group and a treatment group. Bellah and Dyer (2009) thoroughly described this study and explained the methodology used in the two-phase professional development program designed to introduce and orient teachers to the framework and then introduced teachers to the project website and were provided assistance in planning instructional time to address the food and fiber systems concepts. A posttest was then administered to these same groups of students. The researchers found that the control group did not demonstrate gain of agricultural literacy knowledge, whereas the treatment group showed significant increases in mean scores following the posttest. Although the Food and Fiber Systems Literacy Framework provides a concrete image to follow when measuring understanding of the food and fiber systems, the researcher did not follow this method for the evaluation of *Dig into Learning: An Agricultural Literacy Innovation*.

Meischen and Trexler (2003) conducted a qualitative study moving away from the trend of only assessing student knowledge of agricultural facts. This study was conducted in an effort to discover student understanding of the process meat undergoes from farm to table. Bellah (2006) stated, “the researchers based their interview items on the benchmarks outlined in the *Food and Fiber Systems Literacy Framework* (Leising et al., 1998), as well as on science literacy benchmarks” (p. 29). The researchers conducted clinical interviews with students and instructed them to draw concept maps explaining the process. From this process, the researchers concluded, “though students grew up in a rural area, all of the students lacked understanding and conversational comprehension of the practices involved in producing and processing meat for consumption” (Bellah, 2006, p. 29). The researchers further expressed the need to continue agricultural literacy efforts to focus on students in urban and suburban schools (Meischen & Trexler, 2003).

Another study related to agricultural innovations was conducted by Wilhelm, Terry, and Weeks (1999) who sought to determine if participation in an in-service program influenced teacher use of an agricultural literacy curriculum (Bellah, 2006). This study conducted research through a mailed questionnaire sent to sample groups of 52 teachers who previously attended a summer institute and 93 who did not. "The mailed questionnaire requested demographic data, as well as information pertaining to teacher use of topics related to agriculture, number of agricultural lessons used to teach core academic areas, and teacher development experiences" (Bellah, 2006, p. 30). The majority of the participants were female. Wilhelm et al. reported that teachers who attended the summer institute utilized concepts related to agriculture in their teaching more, compared to those who did not attend.

Portillo and Leising (2003) used agricultural literacy professional development training as a comparison determinant of 90 elementary teachers' agricultural knowledge. "Specifically, Portillo and Leising assessed the knowledge of 44 Agriculture in the Classroom (AITC) trained teachers and 46 non-AITC trained teachers" utilizing the Food and Fiber Systems Literacy Framework (Bellah, 2006, p. 33). The Food and Fiber Systems Literacy Framework (Leising et al., 1998) was used as the basis for assessing teacher knowledge; the researchers developed a criterion-referenced test to assess this knowledge. This test was comprised of 50 multiple-choice items distributed across the five thematic areas of the framework (Bellah, 2006). Results

> from this study indicated that AITC prepared teachers scored higher across all five of the theme areas than their non-AITC trained contemporaries; however, scores overall were significantly low in all but one of the theme areas (History, Geography, and Culture). (Bellah, 2006, p. 33)

Portillo and Leising's (2003) final recommendation underscored the necessity for overtly establishing the connections between how teachers learn about agriculture and the context regarding the way individuals use agriculture on a daily basis.

Terry, Herring, and Larke (1992) took a different approach in assessing fourth-grade teachers' understanding and use of agricultural concepts. The researchers wanted to not only determine teacher knowledge about and perceptions of agriculture, but they sought to identify the type and degree of assistance most desirable for supplementing teacher agricultural literacy teaching skills (Bellah, 2006). Research demonstrated more than 73% of the teachers earned scores that resulted in categorization into an unacceptably low knowledge category. Due to these reasons, researcher recommendations supported a need for lists of available resources and increased availability of these resources to teachers. Through the investigation of research, it is evident that research has been conducted regarding agricultural literacy in secondary schools and teacher perceptions regarding the use of agricultural concepts in teaching; however, there has been very little research conducted on agricultural literacy innovations as a context to teach elementary standards.

**Ag in the Classroom**

USDA (2002) established Ag in the Classroom, a program focused on agriculture education in 1981 to provide curriculum materials to enhance agricultural literacy. The NAITC program is endorsed by every living former Secretary of Agriculture, the National Association of State Departments of Agriculture, the National Conference of States Legislatures, most state governors, and the major agricultural organizations and commodity groups (USDA, 2002). Ag in the Classroom is a partnership of agriculture, business, education, government, and volunteers coordinated through NIFA: Higher

Education Programs, a department of the USDA, to improve agriculture literacy in the nation's secondary schools. Every U.S. state, territory, and the District of Columbia has a program to integrate agriculture into schools. According to Malecki (2003), Ag in the Classroom programs share the same mission and vision. The goal of Ag in the Classroom is to help students gain a greater awareness of the importance of agriculture in the economy and society so that students may become citizens who are supportive of responsible agriculture policies (Malecki, 2003, p. 10). Dr. Debra Spielmaker, in accordance with the relevance of NAITC programs, collected data demonstrating the number of participating teachers and volunteers as well as the number of students who were touched by these programs (Spielmaker & Warnick, 2013). The survey sought to address the number of teachers, students, and volunteers who were associated or participated in Ag in the Classroom programs. Survey data conducted in 2014 shows that 40 states reported they had developed at least one agricultural resource to utilize in promoting agricultural literacy. There were 61,813 teachers contacted and/or trained face-to-face with Ag in the Classroom programs, curricula, or other components (Spielmaker & Warnick, 2013). Through other facets of the National Ag in the Classroom program and teacher participation in workshops and trainings there were 5,229,566 students across 45 states who experienced agriculture as a context for learning. There were also 44,094 volunteers from local Farm Bureau agencies and the community who assisted with Ag in the Classroom programs (Spielmaker & Warnick, 2013). These programs demonstrated significant growth in the past 10 years, increasing in number of teachers and students who have participated in some sort of educational program integrating agricultural concepts. The connection to volunteerism within this context demonstrates how agriculture can be used as a context to connect teaching experiences to

the community.

**History and design.** Programs such as Ag in the Classroom have been in existence for the better part of 30 years in the United States. Following the decline in farm and rural populations during the first half of the 20th century, groups such as the American Farm Bureau Federation and the USDA became concerned that "Americans were at least two generations removed from the farm and did not understand even the most rudimentary of processes, challenges, and risks that farmers and the agriculture industry worked with and met head-on every day" (NAITC, 2011a, p. 1). In 1981, the USDA formed a task force to explore means of increasing education about agriculture (Spielmaker & Warnick, 2013). The task force recommended that the USDA coordinate the efforts of agriculture literacy and provide means for states to organize their own programs. The AITC program was formally established in 1982 with a challenge to each state to form a committee responsible for organizing a state agriculture literacy program (NAITC, 2011b). The mission of this program is to increase agricultural literacy though K-12 education by applying authentic, agricultural-based content as a context for teaching and learning (NAITC, 2011b). Due to pressures placed on public school teachers to meet state and national standards, most resources provided by AITC programs are aligned with academic standards, increasing Ag in the Classroom program credibility with teachers and state educational agencies (NAITC, 2011a).

**NALOs.** NAITC created a group of NALOs, organized into five themes, by grade-level benchmarks and aligned to education standards (Spielmaker & Leising, 2013). According to Spielmaker and Leising (2013), "this types of design assists educators with the opportunity to contextualize content for multidisciplinary integration and provides for an interdisciplinary approach to teaching and learning" (p. 2). There are

five defined themes within the agricultural literacy outcomes.

1. Agriculture and the Environment;
2. Plants and Animals for Food, Fiber, and Energy;
3. Food, Health, and Lifestyle;
4. Science, Technology, Engineering, and Math; and
5. Culture, Society, Economy, and Geography.

A detailed explanation of each NALO is included in the appendices for further understanding of each theme (Appendix B).

**Theme 4: Science, technology, engineering and math.** According to Spielmaker and Leising (2013), most historians believe agriculture resulted in the beginning of civilization. Even so, "agricultural development has relied on evolving scientific understandings, engineering processes, and the application of both to develop innovative technologies to save labor and increase yields" (Spielmaker & Leising, 2013, p. 9). According to Spielmaker and Leising, "agriculture is the 'other' major health science–applying science, engineering, technology, and mathematics to improve the health of plants and animals, of people, and our environment" (p. 9).

> Our quality of life is dependent upon the continued development and appropriate use of science and engineering to provide an abundance of safe, healthy, nutritious food, fibers, and the fuels necessary to sustain the needs of a growing world population. (Spielmaker & Leising, 2013, p. 9)

Theme 4 of the NALOs is a very important aspect to the development of agriculture and its context in learning for all ages. "Understanding the science, engineering, technology, and mathematics of agriculture, food, and natural resources is crucial for the future of all humanity" (Spielmaker & Leisnig, 2013, p. 9).

## Agriculture Education

Knobloch et al. (2007) declared agriculture brings learning to life. NAAE (2015) stated, "agriculture education teaches students about agriculture, food and natural resources" (para. 1). Agriculture education is delivered through three interconnected components: classroom and laboratory instruction, experiential learning, and leadership education (NAAE, 2015). Jackman and Schescke (n.d.) stated classroom and laboratory instruction include units based on natural and social sciences, and students in these courses have a unique opportunity to apply their core content concepts in an agriculturally related context. Experiential learning allows students to gain the application of knowledge and learning outside of the classroom environment. The interaction of the student, teacher, business site, and parent helps to ensure instruction is relevant to each individual student in their own learning environment (Jackman & Schescke, n.d.). Leadership development is provided through student organizations. Student organization activities are designed to enrich the classroom and laboratory experiences. Conroy and Trumball (1999) stated, "when these three components are actualized through a well-designed integrated program, they provide a context for learning necessary content and life skills to prepare students for adulthood, regardless of their ideal career areas" (p. 5).

## Program Evaluation

Program evaluations are commonly used in educational research; however, there is a distinct difference between program evaluation and research. Spaulding (2014) stated, "program evaluation is conducted for decision-making purpose, whereas research is intended to build our general understanding and knowledge of a particular topic" (p. 5). Both research and program evaluations begin with a problem, question, or hypothesis.

Program evaluation typically examines programs to determine their value or worth. Recommendations for program modifications are almost always included in the final program evaluation report of findings and recommendations (Spaulding, 2014). Scriven (1999) stated that educational evaluation focuses primarily on merit, value, and worth of educational programs or significance of an object. The use of program evaluation utilizes both quantitative and qualitative data collection methods. Quantitative approaches rely primarily on positivist methods of inquiry and emphasize objective measurement, representative sampling, experimental control, and the use of statistical techniques to analyze data (Gall, Gall, & Borg, 2007). Qualitative methods involve interviews, focus groups, or observations to supply vivid descriptions of the program or stakeholder perceptions of the program.

**CIPP evaluation model.** The CIPP evaluation model focuses on context, input, process, and product of an innovation. According to Fitzpatrick, Sanders, and Worthen (2011), the context portion of the evaluation determines what needs are to be addressed by a program and informs what programs already exist. The input evaluation serves decisions structured after needs are defined. Input helps managers/implementers select strategies to implement an innovation (Fitzpatrick et al., 2011). Once the program has been implemented, the process is evaluated. The process evaluation focuses on concerns of how to modify an implementation. Finally, the product evaluation serves to recycle decisions (Fitzpatrick et al., 2011). The product evaluation looks at the results that were obtained through the evaluation and if the program should be revised, expanded, or discontinued. The focus of the CIPP evaluation model focuses on serving decisions, judging merit and worth. In conducting a CIPP evaluation, Stufflebeam always emphasized using mixed methods, both quantitative and qualitative (Fitzpatrick et al.,

2011). In the evaluation process, the evaluator always remains in firm control of the evaluation. Stufflebeam's wheel illustrates the impact of core values on each evaluation activity (Figure 3).

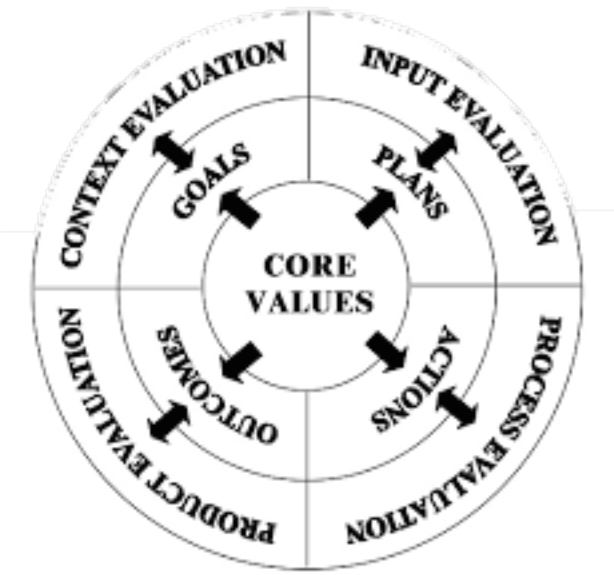


*Figure 3.* Components of the CIPP Evaluation Model.

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**Teacher Beliefs and Experiences**

Teacher beliefs and experiences related to subject matter can play a critical role in the success and continued use of any curriculum innovation. Bellah (2006) stated much of what is known about a person's propensity to behave in a particular way is seen through Fishbein and Ajzen's (1975) Theory of Reasoned Action. According to Madden, Ellen, and Ajzen (1992), the theory of reasoned action declared, "behavioral intentions, which are the immediate antecedents to behavior, are a function of salient information or beliefs about the likelihood that performing a particular behavior will lead to a specific outcome" (p. 3). Research in social psychology has extensively referenced and used this theory. Mostly, this theory is used to predict and understand motivational influences and has been widely used as a model for behavior analysis. Fishbein and Ajzen (1975)

specified three conditions that can affect the magnitude of the relationship between intentions and behaviors, including (a) the degree to which the measure of intention and the behavioral criterion correspond with respect to their levels of specificity; (b) the stability of intentions between time of measurement and performance of the behavior, and (c) the degree to which carrying out the intention is under the volitional control of the individual (Madden et al., 1992).

Knobloch and Martin (2000) used the Theory of Reasoned Action as a theoretical framework to study elementary school teacher perceptions of agriculture and the integration of agriculture awareness activities into the elementary curriculum (Figure 4). Through this study, Knobloch and Martin (2000) researched related factors of teacher beliefs related to integrating agriculture into elementary classrooms.

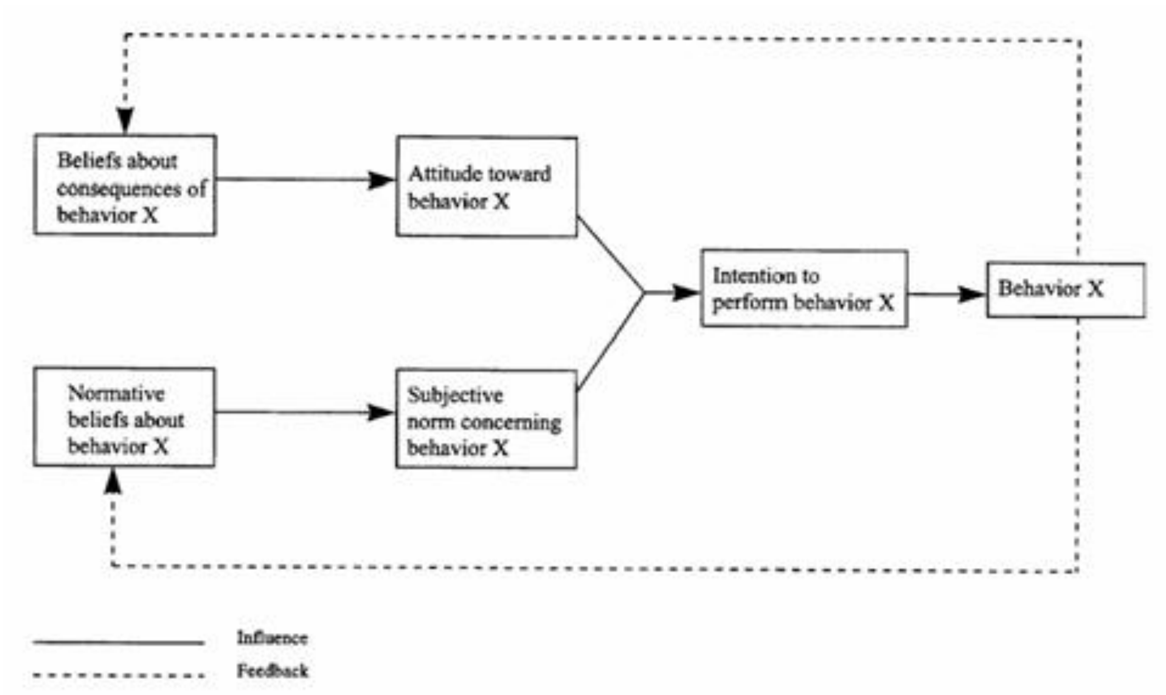


*Figure 4*. Theory of Reasoned Action (Fishbein & Ajzen, 1975).

Knobloch and Martin (2000) stated,

> teacher beliefs influence how teachers connect academic content to real-life applications beyond the classroom. The food, agriculture, and natural resource system provides a venue for teachers to provide real-life contexts for students to engage in experiential learning and apply what they learn in science, math, and social studies. (p. 1)

Knobloch and Martin (2000) continued the belief that teachers think about integrating nonrequired topics into their instruction based on societal norms and what they believe is important to students and society, thus playing into the idea that beliefs and experiences drive instruction. There have been multiple studies relating to agricultural education and agricultural literacy that utilized Fishbein and Ajzen's (1975) work. The Theory of Reasoned Action has more than demonstrated its use in relation to attitudes and perceptions within different contexts. However, the research base, especially in the area of agriculture education, has shown little to explore teacher experiences with agriculture education curricula.

**Theoretical Framework of CBAM**

CBAM is a theoretical framework closely related to the change process and is used to address change implementation on a system. Before the change process can occur, interventions must be put into place, and the purpose of the innovation must be clearly identified and understood by those who are intended to conform to the change. This model offers a means to understand the process of change, response to change, and how actions are followed to help ensure the success of the change initiative. Hall and Hord (2015) stated the elements of the shared vision of change must be clearly defined, and facilitators must continuously communicate this vision to enable implementers to move toward high-quality implementation.

Change means developing a new understanding and doing things in new ways. The willingness to conform to change can be difficult. According to Hall and Hord (2015), leaders of the change effort will need to consider the following interventions and others in the learning and development category: (1) scheduling learning and development sessions across time and (2) changes made as the implementers move from novice to expert.

**CBAM of Empirical Research.** Bellah and Dyer (2009) fully described the use of CBAM in utilizing past research of studies regarding agricultural literacy and agriculture education. As mentioned in other sections, CBAM has not been used as often as other models in agricultural education research, but Bellah advocated for the use and gain in knowledge of the CBAM process. Bellah and Dyer (2009) described a study conducted by Ward, West, and Isaak (2002) “assessing a peer-mentoring program for pre-service teachers in the development and implementation of Internet-based resources and web design” (p. 50). Kember and Mezger (1990), another study that utilized CBAM to develop distance education courses with instructional designer and subject matter writing expert teams, described strategies for assisting lecturers as they moved through each of the seven SoC. “The purpose for the course development teams was for the instructional designers to assist the subject matter experts (writers) with incorporation of more student-centered teaching approaches, and to move away from a traditional lecture-based format” (Bellah & Dyer, 2009, p. 50).

Hall and Hord (2015) created a framework describing SoC with seven specific categories of concerns (p. 86). In SoC, the focus addresses the affective side of change–“people’s reactions, feelings, perceptions, and attitudes . . . LoU deals with behaviors and portrays how people are acting with respect to a specified change” (Hall & Hord, 2015, p.

107). Techniques for assessing SoC include an initial needs assessment survey, follow-up survey, and final interviews. This approach follows a similar method used by Balschweid and Thompson (2000) utilizing both qualitative and quantitative research to collect data. The LoU component is also utilized in describing change, a branching interview process will provide the researcher and participants with insight into how the program was used after implementation of program and training have taken place.

**SoC**. In the CBAM perspective, "diagnostic information about individuals can be aggregated for teams, departments, whole organizations, and across large systems" (Hall & Hord, 2015, p. 286). Hall and Hord (2015) defined SoC as seven specific categories of concerns about an innovation (Figure 5).

| | Stages of Concern | | Expressions of Concern |
|---|---|---|---|
| Impact | 6 | Refocusing | How and what else can I do with this? |
| | 5 | Collaboration | How does this fit with what my peers are teaching? |
| | 4 | Consequence | How is this impacting my students? |
| Task | 3 | Management | Do I spend enough/too much time implementing this? |
| Self | 2 | Personal | Do I know enough to use this effectively in my class? |
| | 1 | Informational | Can you tell me more about this? |
| Unrelated | 0 | Awareness | I don't know. I don't care. What are you talking about? |

*Figure 5.* SoC (Hall & Hord, 2001).

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Figure 5 demonstrates the seven individual SoC with titles and a brief description of each. The SoC component is based on key understanding. The original ideas of unrelated, self, task, and impact have been preserved; but based on findings, the self and

impact areas have been clarified by multiple stages within each. Hall and Hord (2015) stated in the first conception of CBAM, the term SoC was deliberately chosen. It was meant to reflect the idealized, developmental approach to change. According to Willis (1992), the SoC component of CBAM relates directly to how teachers perceive the educational innovation they are asked to implement (Bellah & Dyer, 2009). Through Hall and Hord's (2001) research, the SoC Questionnaire was developed to identify the stage of concern of a teacher with respect to the educational innovation under consideration. The SoC Questionnaire is a 35-item questionnaire asking staff members to rate the extent to which they agree with various statements related to an innovation. For the purpose of this study, the researcher did not specifically utilize the SoC Questionnaire but used it as a guide to create survey items in the needs assessment and follow-up survey.

**LoU**. According to Willis (1992), LoU correspond to teacher behaviors in relation to the educational innovation in question (Bellah & Dyer, 2009). Hall and Hord (2015) defined LoU as behaviors that portray how people are acting with respect to a specified change. It is important to note that the terms SoC and LoU are not to be used interchangeably, solely because SoC addresses the affective side of change–people's reactions, feelings, perceptions, and attitudes; whereas LoU has to do with behaviors. Addressing individuals' perceptions and concerns about their ability to successfully use an innovation is itself a theoretical construct on understanding the LoU. When participants move from unfamiliarity to taking possession of an innovation and using it, they have demonstrated LoU (Hall & Hord, 2015).

LoU is classified by eight levels in which a person can be classified in terms of the extent the innovation is used: nonuse (0), orientation (1), preparation (2), mechanical

use (3), routine (4 A), refinement (4 B), integration (5), and renewal (6). As stated by Newhouse (2001), these levels are the sequence through which a user passes during the change process as he or she gains confidence and skill in using the educational innovation (Bellah & Dyer, 2009). Hall and Hord (2015) stated the first three stages (0: non-use, 1: orientation, and 2: preparation) describe participants who demonstrate non-use, whereas the remaining five stages describe users of the innovation. Table 1 demonstrates explanations that accompany each description of LoU as adapted from Hall and Hord. In addition, this table gives a brief insight into how the researcher and outside observer addressed LoU as they applied to participants in the program *Dig into Learning*.

Table 1

*LoU (Adapted from Hall & Hord, 2001)*

| LoU | Description of Level | Behavioral Indicators of Levels |
|---|---|---|
| 0 | Non-use | The user made no effort in this innovation and is taking no action. |
| 1 | Orientation | The user tried to learn more information in using this innovation. |
| 2 | Preparation | The user definitely plans to begin use of this innovation. |
| 3 | Mechanical | The user made changes to better organize this innovation. |
| 4 | Routine | The user made few or no changes in using this innovation. |
| 5 | Refinement | The user made changes to increase outcomes in using this innovation. |
| 6 | Integration | The user made a deliberate attempt to coordinate with others in using this innovation. |
| 7 | Renewal | The user sought more effective ways to coordinate with others in using this innovation. |

Two configurations of LoU interviews exist, the branching interview for facilitators and the focused interview. In a branching interview, the interviewer asks a series of items in order to gain examples into innovation-related behaviors of the participant. The reported behaviors are then checked against the decision points. The overall design of the LoU interview utilized was a branching format following Hall and Hord's (2015) LoU Branching Interview model (Figure 6).

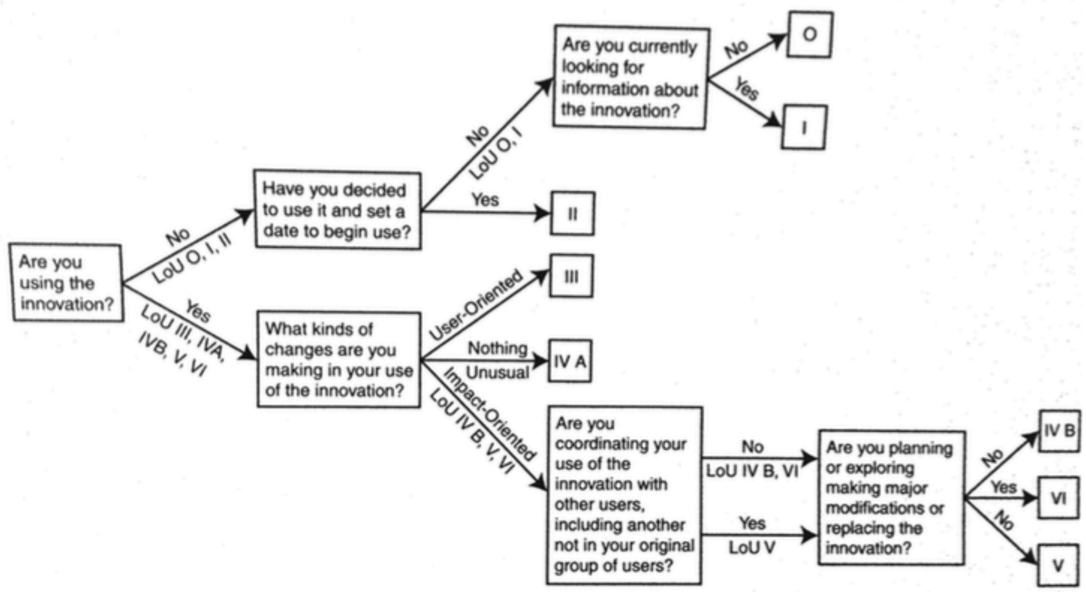


**FIGURE 5.1** Branching Format for the LoU Interview

*Source:* LoU has been described and presented in many publications. An important resource for obtaining more detailed information about LoU is Hall, Dirksen, and George (2006).

*Figure 6.* LoU Branching Interview Process (Adapted from Hall & Hord, 2015, p. 115).

After the initial professional development provided individuals with hands-on experiences, guidelines, manuals, and other materials of "how to use" the tool or practice, the researcher conducted LoU branching interviews. The interview is described as visiting with the "user in a brief and informal way to gain an estimate of his or her LoU in order to offer appropriate assistance" (Hall & Hord, 2015, p. 114). "The key decision

points provide the keys to determining which questions to ask and where to move the interview next. The initial item in both LoU interviews is 'Are you using the innovation?' this answer separates users from non-users" (Hall & Hord, 2015, p. 114). This process enabled the researcher to know the extent and at what stage the participant utilized the program.

Both SoC and LoU are vital parts of CBAM developed by Hall and Hord (2015) used to evaluate the implementation process of change. Hall and Hord's (2001) CBAM was originally developed in 1973. The model is primarily concerned with describing the process of change (Figure 7). CBAM allows facilitators to probe the innovation users and non-users using tools relating to user SoC, LoU, and IC to help identify the needs of users (Hall & Hord, 2001).

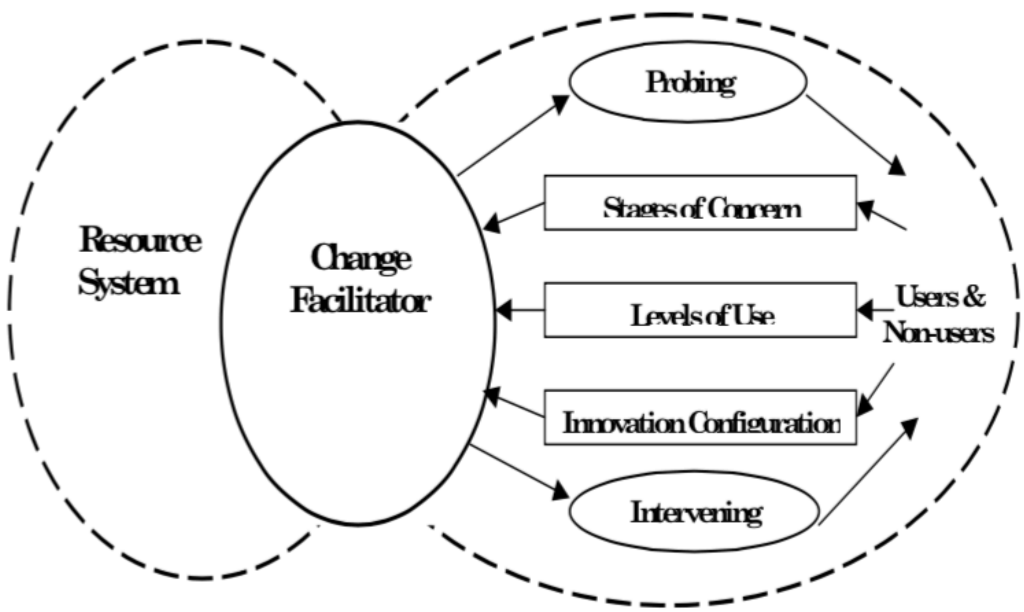


*Figure 7.* CBAM (Hall & Hord, 2001).

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**Summary**

Multiple agriculture literacy innovations and programs have been developed and

implemented throughout the years. These innovations have taken on many forms to infuse and integrate agriculture education concepts in kindergarten through twelfth grade. "Similarly, the agricultural education research genre has reinforced theoretical underpinnings linking attitudes, perceptions, and beliefs to agriculture" (Bellah, 2006, p. 70). Bellah (2006) stated, "The researcher base in agricultural education is significantly lacking information related to elementary teachers' sustained use and success with agriculture literacy curricula" (p. 70). For the purpose of this research study, the researcher evaluated teacher perception of the implementation and use of agriculture as a context for learning through the training workshop *Dig into Learning: An Agriculture Literacy Innovation*.

This chapter reviewed existing literature and studies related to agricultural innovations, especially its usefulness as a context for teaching across subject matter areas in elementary classrooms. Further, the purpose of this literature review was to explain CBAM as it relates to elementary teachers' SoC and LoU when engaged in educational innovations.

# Chapter 3: Methodology

## Introduction

Balschweid et al. (1998) declared, “one factor influencing the decline in agricultural literacy in our nation today is the lack of educational emphasis placed upon this vital component of our society” (p. 4). The researcher developed this study in order to evaluate a program geared toward educating participants on ways to integrate agriculture into the elementary curriculum. The evaluation was conducted utilizing a program evaluation technique developed by Stufflebeam (2003); which included a process of describing, obtaining, reporting, and applying descriptive information about a program’s merit or worth and significance to guide decision making, support accountability, disseminate effective practices, and increase understanding of the program. The program was evaluated utilizing the four components of the CIPP model–context, input, process, and product evaluation–in accordance with Hall and Hord’s (2001) CBAM. The evaluation of this program determined the impact of professional learning based on the implementation of the program *Dig into Learning*. The program focused on ways to utilize agriculture as a context for teaching and learning in elementary classrooms (kindergarten through Grade 5) to create more relevant, hands-on learning experiences for students. This chapter describes the study’s instructional design and methodology.

## Research Questions

Based on the review of the literature and the theoretical framework that guided this study, research questions were generated and designed to examine teacher perceptions and use of agriculture as a context for teaching and learning in the elementary

classroom. The following research questions were addressed through the program evaluation of *Dig into Learning: An Agricultural Literacy Innovation*.

1. What needs for professional learning are expressed by elementary teachers with regard to STEM agricultural literacy curriculum integration?
2. How is professional learning developed and implemented based on elementary teachers' expressed needs with regard to STEM agricultural literacy curriculum innovation?
3. What are elementary teacher perceptions of the impact of professional learning of a STEM agricultural literacy curriculum innovation?
4. What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation?
    a. What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation as measured by the statistical analysis of the change in pre and posttest survey questions?
        i. Null Hypothesis 4a. Elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation remain unchanged from the pre and posttest survey questions.
        ii. Alternative Hypothesis 4a. Elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation change from the pre and posttest survey questions.
    b. What are elementary teacher perceptions of the impact of initial

implementation of a STEM agricultural literacy curriculum innovation as measured by teacher interviews?

**Program Evaluation**

Program evaluations are commonly used in educational research; however, there is a distinct difference between program evaluation and research. Spaulding (2014) stated, "program evaluation is conducted for decision-making purposes, whereas research is intended to build our general understanding and knowledge of a particular topic" (p. 5). Both research and program evaluations begin with a problem, question, or hypothesis. Program evaluations typically examine programs to determine their value or worth. Recommendations for program modifications are almost always included in the final program evaluation report of findings and recommendations (Spaulding, 2014). Educational evaluation focuses primarily on merit, value, and worth of educational programs and utilizes both quantitative and qualitative data collection methods. Quantitative approaches rely primarily on positivist methods of inquiry and emphasize objective measurement, representative sampling, experimental control, and the use of statistical techniques to analyze data (Gall et al., 2007). Qualitative methods involve interviews, focus groups, or observations to supply vivid descriptions of the program or stakeholder perceptions of the program.

The Joint Committee on Standards for Educational Evaluation (1994) created a set of steps and standards for use in program evaluations. The Center for Disease Control and Prevention (2012) tailored these standards to conduct program evaluations (Figure 8).


*Figure 8.* Systematic Process of a Program Evaluation (Center for Disease Control and Prevention, 2012).

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Because a number of program evaluation approaches exist, it is important for the researcher to identify an evaluative measure that will meet the needs of stakeholders (Stufflebeam, 2003). One of these evaluation methods includes the CIPP model, which the researcher used as an evaluative method for this study.

**CIPP model.** A CIPP evaluation model, created by Stufflebeam (2003), provided the foundation for evaluating the program's components relating to the theoretical framework. The purpose of the CIPP evaluation model was to help program leadership and personnel to systematically collect information about a program and to use that information as programs are implemented and carried out (Stufflebeam, 2003). The CIPP model involved the examination of four components of a particular program: context, input, process, and product. The evaluation of the context measures the extent to which the goals and objectives of the program match the assessed needs of the program (Stufflebeam, 2003). The information obtained through this study allowed district and

community leaders and other stakeholders to determine areas where additional professional learning needed to occur and evaluated the worth and effectiveness of this program as a context for teaching in elementary grades. In addition to the theoretical framework applied to this study, the CIPP model was utilized to support the evaluation of this program.

**Participants**

On September 23, 2015, participants attended *Dig into Learning: An Agricultural Literacy Innovation* training workshop. This workshop lasted 3½ hours. Participants for this study were selected based on voluntary sign up for this district-wide professional development session. As participants signed up to attend the workshop, a number was assigned to participant emails. This number was used to verify and connect data to participants as they responded to the needs assessment and follow-up survey.

Forty-nine teachers participated, and seven of the eight elementary schools were represented. The majority (approximately 67%) of the participants taught in primary grades, kindergarten through second. The remaining 33% of participants were Grade 3 through Grade 5 teachers. Table 2 demonstrates participant demographics based on grade-level subgroups.

Table 2

*Participant Demographics*

| Grade Level Subgroups | Frequency (*N*) | Frequency (%) |
|---|---|---|
| Kindergarten | 14 | 28.57% |
| First grade | 12 | 24.49% |
| Second grade | 7 | 14.25% |
| Third grade | 7 | 14.25% |
| Fourth grade | 5 | 10.20% |
| Fifth grade | 4 | 8.16% |

In order to adequately prepare for the program workshop, the researcher utilized participant demographics to categorize participant groups. The researcher forwarded this information to Ag in the Classroom curriculum specialists. The curriculum specialists used this information to gather materials and resources provided during the workshop.

**Methodology**

A quasi-experimental, mixed-methods design was used to evaluate the impact of the implementation of the program *Dig into Learning*. According to Wang (2009), program evaluation involves collecting and documenting information about a particular program to enable valid decision making pertaining to a particular aspect of that program. The Center for Disease Control and Prevention (2012), in accordance with the Joint Committee on Standards for Educational Evaluation (1994), described steps of an effective evaluation to include engaging stakeholders, describing the program, focusing the evaluation, gathering credible evidence, justifying conclusions, ensuring use, and sharing lessons learned. The ultimate goal of a program evaluation is to arrive at a conclusion regarding specified questions related to a program's effectiveness (Wang, 2009). To gain an in-depth understanding of participant perceptions, a mixed-methods

study was employed in order to gather multiple sources of information in three phases.

During the first phase, quantitative data collection and analysis concentrated on participant needs associated with the integration of agriculture as a context for teaching and learning in the form of a needs assessment (Appendix C). These data were collected using a researcher-created survey. This approach assumed a formative program evaluation. Fitzpatrick, Saunders, and Worthen (2004) utilized formative evaluations when a direct impact on program improvement was to be made by the researcher or evaluator. These data were used to drive the program workshop conducted by the researcher in collaboration with North Carolina Farm Bureau Ag in the Classroom curriculum specialists.

In the second phase, a follow-up survey was sent to participants who had participated in the workshop (Appendix D). The second survey evaluated the effectiveness and worth of the program training and determined if participants felt their identified needs were met. The follow-up assessment was used as a posttest to determine common trends in participant Stages of Change. As stated previously, participant responses were connected by a number assigned to their email address as they completed the needs assessment; these participants were given the opportunity to complete the follow-up assessment 1 month after attending the program workshop.

In addition to the surveys utilized as quantitative methods of research, the researcher conducted qualitative research. According to Merriam (2009), a qualitative method was required because the overall purpose of the study was to construct meaning from participant perceptions and experiences.

In the third phase, qualitative data were collected, documented, examined, and communicated through the use and results of open-ended items on the surveys and

branching interviews between the researcher and participants. The researcher fashioned a figure to guide interview items and responses in accordance to Hall and Hord's LoU regarding an innovation (Appendix E). Using a constructivist viewpoint, the researcher looked for themes associated with participant perceptions of the impact on professional learning and implementation of the program *Dig into Learning* to further examine the impact of this Ag in the Classroom professional learning experience.

**Instrumentation.** The researcher conducted a mixed-methods study utilizing both quantitative and qualitative inquiry of the program *Dig into Learning* to answer research questions using a needs assessment, follow-up survey, and branching interviews. The research questions were aligned to the CIPP model for program evaluations and CBAM. The researcher selected these frameworks in a unified fashion to support the efforts of a program evaluation. These frameworks focused on the SoC and LoU reported from elementary teachers who participated in the program workshop *Dig into Learning*. By evaluating participant perceptions, the researcher was able to evaluate the worth and effectiveness of this innovation. Table 3 demonstrates the alignment of the research questions to the theoretical framework utilized in data collection and to the program evaluation framework.

Table 3

*Alignment of Research Questions, Rationale and Connection to Methodology*

| Research Questions | CIPP | CBAM | Analysis |
|---|---|---|---|
| 1. What needs for professional learning are expressed by elementary teachers with regard to STEM agricultural literacy curriculum integration? | Context (Goals to address for professional learning) | Needs Assessment | Descriptive statistical analysis of frequency distribution from needs assessment data and coding for themes built foundation for program; qualitative analysis of open ended response items |
| 2. How is professional learning developed and implemented based on elementary teachers' expressed needs with regard to STEM agricultural literacy curriculum integration? | Input (Plans to reach goals identified from needs assessment – development of professional learning) | SoC | Descriptive statistical analysis of frequency distribution in comparison to needs assessment data |
| 3. What are elementary teacher perceptions of the impact of professional learning of STEM agricultural literacy curriculum integration? | Process (Actions – what was done to address these needs and were goals met through professional learning) | SoC<br>LoU – comparison of needs assessment and Follow-up assessment | Analysis of needs assessment and Follow-up survey, open response item 26<br>Branching interview process – transcribed interview responses and code for common themes to determine perceptions of impact 3 |
| 4. What are elementary teacher perceptions of the impact of initial implementation of agricultural literacy curriculum integration? (LoU) | Product (What is the outcome of the program? Were the goals met?) | LoU – Branching Interview | Branching Interview responses transcribed and code for common themes Items 1-7 |

(continued)

| Research Questions | CIPP | CBAM | Analysis |
|---|---|---|---|
| 4a. What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation as measured by the statistical analysis of the change in pre and posttest survey questions? | What is the outcome? Were the goals met? | Needs Assessment and Follow-up surveys analyzed using paired samples t test | Needs Assessment & Follow-up Analyze responses, describe change variances in mean score - paired samples statistics |
| 4b. What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation as measured by teacher interviews? | What is the outcome? Were the goals met? | LoU Branching Interviews | Code for common themes and LoU, participant perceptions of agriculture Items 1-7 |

**Engaging Stakeholders**

According to the Joint Committee on Standards for Educational Evaluation (1994) fostering input and participation among those persons who are invested in a program and its findings is especially important. Engaging stakeholders creates an increased chance that the evaluation will be useful (Joint Committee on Standards for Educational Evaluation, 1994). For this study, the researcher identified key stakeholders including the district superintendent, school administrators, local agriculture agencies, community leaders, elementary teacher participants, and Ag in the Classroom curriculum specialists. All of these parties had a unique investment related to the role of agriculture and the potential use of agriculture as a context for learning.

**Timeline.** The program evaluator/researcher analyzed innovation characteristics and collaborated with district officials to determine which aspects of the innovation were most beneficial to those who would be directly involved. An initial meeting with stakeholders was held at the county board office in May 2015. Principals and teachers were allowed to share common concerns about the use of agriculture as a context for learning and were asked to share their thoughts on what the impact may be at their individual schools. Principals and teachers alike had positive reactions to the idea of using agriculture as a teaching context for STEM education but were interested in how the population of elementary teachers would react to this innovation. From this meeting, the researcher identified questions and created an initial needs assessment survey. The researcher and curriculum specialists from North Carolina Ag in the Classroom completed this survey as a trial run to validate question clarity and to determine the approximate amount of time needed for completion. The survey was sent out to teachers via school email as participants registered to attend the workshop in early September 2015. As participants registered, their email addresses were filed. As participants completed both the needs assessment and follow-up assessment, participant responses were directly connected to their email addresses. This ensured validity of the pre and postsurvey. Before the survey's hyperlink appeared in the email, a brief explanation of its purpose was given along with assurance that all responses would be kept confidential. The initial needs assessment survey and explanation can be found in Appendix C. On September 23, 2015, the program workshop was held with a duration of 3½ hours.

**Describing the Program**

The second step in conducting an educational evaluation begins with describing the program. According to the Joint Committee on Standards for Educational Evaluation

(1994), the program begins with inspecting the features of the program being evaluated. The program *Dig into Learning* is an agricultural literacy innovation encouraging teachers to use agriculture as a context for teaching and learning throughout this county. This innovation was geared towards elementary teachers in the general education classroom in kindergarten through Grade 5.

Prior to the workshop, a needs assessment survey was sent to enrolled participants. The researcher utilized components such as Hall and Hord's (2015) SoC Questionnaire as a means to guide question creation for the purpose of this study as well as Professional Learning Standards that support professional learning. According to Learning Forward (2015), "the learners' backgrounds, experiences, beliefs, motivation, interests, cognitive processes, professional identity, and commitment to school and school goals affect how educators approach professional learning and the effectiveness of various learning designs" (para. 7). The needs assessment evaluated current LoU and SoC participants had regarding their current understanding of agriculture as a teaching context, their understanding of agricultural literacy, and current LoU regarding agriculture. Forty-nine surveys were distributed via email to teachers who voluntarily signed up to attend the *Dig into Learning: An Agricultural Literacy Innovation* training workshop. The researcher received 35 completed needs assessment surveys, 71.4% of the total population. The emails of these 35 participants were filed and they received a follow-up survey 1 month after the workshop.

**Quantitative.** Descriptive statistics in the form of frequencies were used to show participant responses from the needs assessment survey. This quantitative data allowed the researcher to determine the common needs of participants regarding agriculture as a context for learning in the elementary classroom. Utilizing frequency distribution of

survey responses allowed the researcher to identify common needs. These data drove the professional learning associated with the innovation, *Dig into Learning*. The survey used a 5-point Likert scale consisting of the following responses for participants: strongly agree (5), agree (4) neutral–neither agree nor disagree (3), disagree (2), and strongly disagree (1).

It was necessary to analyze each needs assessment item separately to get a true picture of stated needs. For example, a response of 1 (strongly disagree) or 2 (disagree) was viewed by the researcher as a strongly expressed need that should be addressed during the professional learning workshop. However, some responses that fell in the 5 (strongly agree) or 4 (agree) range also demonstrated need. For instance, item 2 asked participants if they "wanted" to use agriculture as a context for teaching and learning. Responses of 5 (strongly agree) and 4 (agree) expressed an interest on ways to use agriculture as a teaching context. The researcher was able to identify teacher perceptions regarding their current knowledge of agricultural literacy and teacher-perceived concerns of using agriculture as a context for teaching and learning based on their responses to the survey. The frequency of responses served the basis to analyze further research.

**Qualitative.** The researcher utilized qualitative data in unison with quantitative data to explore and understand the meaning individuals or groups held in regard to the program (Creswell, 2014). Qualitative data collection focused on teacher perceptions of their experience with the program *Dig into Learning* and the creativity, communication, and critical thinking through the integration of agriculture into the elementary curriculum. To gain an in-depth understanding of participant perceptions, the researcher included open-ended items on both the needs assessment and follow-up survey and conducted branching interviews in order to determine LoU.

The final items of the survey were open-ended in part because open-ended survey items are appropriate when examining feelings, recollections of past events, and likes or dislikes (Creswell, 2014). Transcription of teacher responses were analyzed qualitatively and then coded for common themes. An online word analysis tool (www.wordle.com) was utilized as an initial tool for analysis. McNaught and Lam (2010) found that the use of word cloud tools, specifically Wordle, was a “fast and visually quick way to give the researchers a basic understanding of the data at hand” (p. 630). Words with greater frequency in the responses were represented as a larger word in the word cloud. An example of a word cloud using text from the introduction of this study is shown in Figure 9.


*Figure 9.* Word Cloud Example (Chapter 1 Introduction).

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Based on the text, one can expect that this study discussed agriculture, agriculture literacy, teacher perceptions, and innovations. Similar to this Wordle, after identifying

the most frequent words found in the open-ended responses, the researcher was able to determine common themes that arose initially through this word frequency analysis tool.

The qualitative components of data collection were in the form of responses to open-ended items attached to the survey. According to Creswell (2009), asking participants open-ended items allows respondents to voice their opinion in relation to responses to survey items.

**Categorizing themes.** Responses from both the needs assessment and follow-up surveys were used to identify areas of need specific to the population of teachers who would attend the professional learning workshop in a way to support their professional learning experience. Research questions, including Research Question 2, "How is professional learning developed and implemented based on elementary teachers' expressed needs with regard to STEM agricultural literacy curriculum innovation," were answered by analyzing needs assessment data and categorizing common themes identified by participants. These themes were then categorized into core values and goals measuring the value and worth of the program *Dig into Learning: An Agricultural Literacy Innovation* and its impact on participants.

## Focusing the Evaluation Design

Following the implementation of the program *Dig into Learning: An Agricultural Literacy Innovation*, the researcher focused the evaluation design. According to the Joint Committee on Standards for Educational Evaluation (1994), planning in advance where the evaluation is headed is imperative. The purpose of this program evaluation was to study the implementation process and examine teacher perceptions of the impact of professional learning of a STEM agricultural literacy elementary curriculum innovation and teacher use of agriculture as a context for learning.

In utilizing Hall and Hord's (2015) SoC Questionnaire, the researcher tailored a follow-up survey that was sent via email to teacher participants who had completed the needs assessment. Emails of participants who completed the needs assessment were filed in an Excel document; the researcher sent each participant the follow-up survey based on collection of emails in completing the needs assessment. The follow-up survey was sent to participants 1 month after the workshop per specifications from the district superintendent. This time frame could have limited participant responses to the follow-up survey, and it is discussed in more detail in Chapter 5. Once 50% of participants who completed the needs assessment survey responded to the follow-up survey, the researcher analyzed data and compared it to initial data collected from the needs assessment. Seventeen participants completed the follow-up assessment; however, only 15 of the follow-up surveys could be analyzed for research purposes due to insufficient data on two of the 17 surveys. Research Question 3, "What are elementary teacher perceptions of the impact of professional learning of a STEM agricultural literacy curriculum innovation," was answered by using data collected from item 26 of the needs assessment and follow-up survey, "What concerns if any, do you have using agriculture as a teaching context?" The researcher specifically addressed item 26 because it focused on participant concerns. Hall and Hord (2015) addressed participant feelings, perceptions, worries, and moments of satisfaction regarding an innovation through SoC. In evaluating participant concerns, the researcher was able to analyze their perceptions of the impact of professional learning. The researcher determined SoC from each participant response to item 26 in the needs assessment and compared these changes to concerns reflected in item 26 of the follow-up assessment. Participant responses were coded and displayed in a table to demonstrate area of concern. In doing so, the researcher was able to identify the level of

impact of professional learning based on study findings.

In addition to answering Research Question 3, “What are elementary teacher perceptions of the impact of professional learning of a STEM agricultural literacy curriculum innovation,” the researcher utilized survey responses to build concurrent themes regarding the understanding of agriculture and the knowledge of agricultural literacy. From these themes, interview items were created fostering the LoU of agriculture as a context for teaching and learning. Interview items were geared toward the use, understanding, concerns, support, and management of the innovation. Hall and Hord’s (2001) branching interview approach was utilized to conduct interviews in relation to the theory of reasoned action. Table 4 demonstrates items and format utilized during the branching interview process.

Table 4

*LoU Branching Interview Items and Explanation*

| | | |
|---|---|---|
| 1 | Are you currently using or have you used the innovation? *If respondent answers "yes" continue to question two.* | *If respondent answers "no" continue with this question:*<br><br>Do you have plans to use this innovation in the future? Have you set a date to begin use?<br><br>*Researcher may identify as a LoU 0, I, II.* |
| 2 | What are your beliefs of worth or effectiveness regarding the use of agriculture as a context for teaching and learning?<br><br>Do you have plans to make any changes? | *If respondent answers "no" researcher may identify as LoU III, IV A continue to question 3.*<br><br>*If respondent answers "yes" refer to question 3 and 4.* |
| 3 | Do you feel your needs were met in regards to the use of agriculture as a context for teaching and learning? | *All participants may answer this question regardless of answer to question 2.* |
| 4 | What kinds of changes are you making in your use of the innovation? | *If respondent answers yes refer to question 5. Researcher may identify as LoU IV B, V, VI continue to question 5.* |
| 5 | Are you coordinating your use of the innovation with other colleagues utilizing the innovation? | *If respondent answers "no" continue to question 6.*<br><br>*If respondent answers "yes" researcher may identify as LoU V. Continue to question 6 and 7.* |
| 6 | Do you feel the integration of agriculture as a context for teaching and learning is beneficial to your students? | *All participants should answer this question regardless of response to question five.* |
| 7 | What are your intentions of continuing this innovation? | *Researcher may identify as LoU IV B, V, VI* |

The researcher included a final item on the follow-up survey that asked

participants if they wanted to participate in an interview discussing current LoU regarding agriculture as a context for teaching and learning. Participants responded by entering yes into the dialogue box, which indicated they agreed to participate in an interview. Participants were then sent a letter of consent stating their responses could be used for research purposes (Appendix F). Five of the 15 participants who completed the follow-up survey agreed to participate in the LoU branching interview process. The researcher conducted interviews with those five participants to gain a deeper insight into whether they had actively taken what they experienced through *Dig into Learning* back into their own classrooms. Four interviewees taught in primary grades, and one interviewee taught third grade.

Responses to interview items were analyzed to construct response patterns and then categorized thematically (Creswell, 2009). The researcher used the interviews to gain insight into teacher perceptions of the actual use of agriculture as a context for teaching in the elementary classroom. If interviewees demonstrated use of the innovation through response to interview items, the researcher made note and coded responses as they applied to the impact of professional learning. Specifically, interview item 3 addressed participant needs: “Do you feel your needs were met in regards to the use of agriculture as a context for teaching and learning?” Other interview items addressed participant LoU as it pertained to Research Question 4.

An outside observer attended the interviews as a way to eliminate bias. The outside observer was a prominent community leader and retired education professional who was knowledgeable in the district’s educational practices. The observer attended the workshop to ensure understanding of participant responses to interview items. The researcher and outside observer were able to subjectively discuss participant responses to

interview items.  The outside observer was able to relate to interviewee responses due to having an understanding of the workshop and the proposed intent to integrate agriculture into elementary classrooms.  The use of multi-modal techniques such as multiple surveys, follow-up interviews, and an outside observer helped triangulate data in order to gain a more expansive understanding of the SoC and current LoU regarding the use of agriculture in elementary classrooms as a means to promote 21st century learning.

**Gathering Credible Evidence**

According to the Joint Committee on Standards for Educational Evaluation (1994), gathering credible evidence means compiling information that stakeholders perceive is trustworthy and relevant.  The design of this study was a mixed-methods program evaluation that utilized CBAM and the CIPP model.  Quantitative data were collected in the form of surveys, and qualitative data were collected through open-response items and interviews.

Research Question 1, “What needs for professional learning are expressed by elementary teachers with regard to STEM agricultural literacy curriculum integration,” was addressed utilizing a researcher created initial survey, the needs assessment, which defined the context the program was formatted from.  The needs assessment included both quantitative–Likert scale response–and qualitative–open response–items.  The responses from the needs assessment also served to answer Research Question 2, “How is professional learning developed and implemented based on elementary teachers’ expressed needs with regard to STEM agricultural literacy innovation?”  Research Question 2 provided the input into which this program was evaluated.

Research Question 3, “What are elementary teacher perceptions of the impact of professional learning of a STEM agricultural literacy curriculum innovation,” was

addressed utilizing the researcher-created follow-up survey which addressed similar items as the needs assessment. In utilizing a pre/posttest survey, the researcher was able to clearly address participant perceptions and concerns regarding professional learning of the innovation. The researcher collected follow-up data and compared these data to the needs assessment data as they applied to participants who completed both the needs assessment and follow-up assessment. The researcher utilized a pairing system based on participant email addresses to ensure that pre and postsurveys were matched based on participant emails used for registration. In order to delve deeper into participant responses to survey items, the researcher conducted LoU branching interviews. Item 3 of the LoU branching interviews allowed the researcher to gain insight into data collected from the needs assessment and follow-up survey. In addition, these interviews served to answer parts of Research Question 3, as well as Research Question 4b.

The collection and analysis of quantitative and qualitative data within the same study allowed the researcher "to expand an understanding from one method to another, to converge or confirm findings from different data sources" (Creswell, 2014, p. 210). The surveys served as the primary data source, while interviews were utilized to validate the LoU of agriculture as a context for teaching and learning in elementary classrooms. Table 5 demonstrates the connection to LoU as described in CBAM as it related to participant perceptions of the program *Dig into Learning*. Utilizing the LoU branching interview process allowed the researcher to gather in-depth information related to the process of this evaluation.

Table 5

*LoU (Adapted from Hall and Hord, 2001)*

| LoU | Description of Level | Behavioral Indicators of Levels | Dig into Learning |
|---|---|---|---|
| 0 | Non-use | The user made no effort in this innovation and is taking no action. | The user did not start using resources gained from Dig into Learning and has not sought to use other concepts to integrate agriculture into the daily curriculum. |
| 1 | Orientation | The user tried to learn more information in using this innovation. | The user did not begin use but is actively trying to find more resources to integrate agriculture as a context for teaching and learning. |
| 2 | Preparation | The user definitely plans to begin use of this innovation. | The user found resources to support the implementation of Dig into Learning to support STEM learning. |
| 3 | Mechanical | The user made changes to better organize this innovation. | The user utilized resources from Dig into Learning and has found other ways to integrate agriculture into STEM learning. |
| 4 | Routine | The user made few or no changes in using this innovation. | The user utilized resources from Dig into Learning, but has not made any effort to integrate more agriculture concepts into learning |
| 5 | Refinement | The user made changes to increase outcomes in using this innovation. | The user utilized resources from Dig into Learning and found other resources to continue learning with agriculture as a context for teaching and learning. |
| 6 | Integration | The user made a deliberate attempt to coordinate with others in using this innovation. | The user used resources to integrate agriculture into the daily curriculum and has begun sharing these opportunities with grade level team, etc. |
| 7 | Renewal | The user sought more effective ways to coordinate with others in using this innovation. | The researcher sought outside support to continue utilizing agriculture as a context for teaching and learning. |

**Quantitative.** According to Muijs (2011), "quantitative research is explaining phenomena by collecting numerical data that are analyzed using mathematically based methods (in particular statistics)" (p. 1). Quantitative research was collected as numerical data. The needs assessment and follow-up survey was a five-level Likert agreement scale to determine the level participants' SoC and LoU of the agricultural literacy innovation after attending the workshop. The five-level scale included numeric responses from strongly agree (5) to strongly disagree (1). These data allowed the researcher to determine the overall mean assessment score for each participant and cumulative percentages regarding the impact of professional learning on the integration of agriculture as a context for teaching and learning.

Research Question 4, "What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation," was answered by collecting data that compared responses from the needs assessment and the follow-up survey. Data from both instruments were analyzed quantitatively and qualitatively. Research Question 4a, "What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation as measured by the statistical analysis of the change in pre and posttest survey questions," addressed quantitative evaluation of participant responses to Likert scale items of the needs assessment and follow-up survey. Research Question 4b addressed qualitative analysis of participant responses to LoU branching interview items, specifically items 1, 2, and 4-7.

In the quantitative analysis to address Research Question 4a, the researcher conducted a paired samples *t* test to compare the mean scores of the initial data collected from the needs assessment and the follow-up data. The differences of mean were then

converted into a code based on the following:

1. Low -0.50-0.25
2. Moderately Low -0.25-0
3. Moderate 0-1
4. Moderately High 1-1.5
5. High 1-2

The researcher established a classification of codes to clarify the evaluation of survey responses. These codes were related to the Likert scale range and the mean average of responses with regard to this scale. The needs assessment and follow-up assessment mean scores were used to determine the difference between participants' SoC and LoU with regard to agriculture as a context for teaching and learning. The differences were used to determine the impact of professional learning. The differences in the needs assessment and follow-up assessment were displayed in a table. A paired samples *t* test was applied to determine if there was a significant difference in the needs assessment and follow-up assessment scores based on participant perceptions of the impact on professional learning whereas $p<0.05$ to indicate significance. The researcher determined significance on the 95% confidence interval ($p<0.05$).

**Qualitative.** In addition, the researcher used data collected from interviews to further analyze the impact of professional learning as it related to agriculture as a context for teaching and learning addressing Research Question 4b, "What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation as measured by teacher interviews?" The responses from interview items were analyzed and coded for themes to address participant perceptions. According to Saldana (2013), "a code in qualitative inquiry is most often a word or short

phrase that symbolically assigns as a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data" (p. 3). When coding data, "some categories may contain clusters of coded data that merit further refinement into subcategories" (Saldana, 2013, p. 12). The use of coding aided the researcher in identifying common themes connected to the initial survey responses (Figure 10). The summary of these data was shared with stakeholders to determine the perceived effectiveness and worth of the professional learning opportunity *Dig into Learning: An Agricultural Literacy Innovation*.

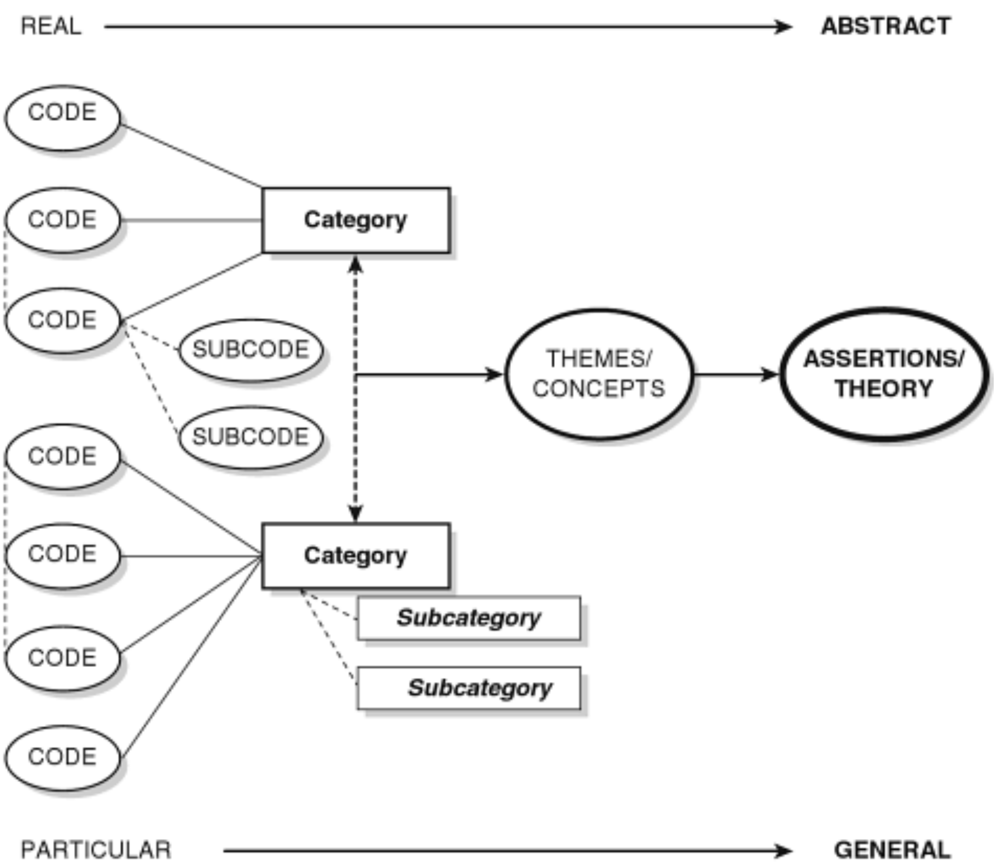


**Figure 1.1** A streamlined codes-to-theory model for qualitative inquiry

*Figure 10*. Coding for Theory.

The figure established by Saldana (2013) is an ideal scenario for approaching themes within coding: The scenario shown does not happen in every case but gives an example of how the process is used. Saldana stated, “the actual act of reaching theory is much more complex and messy than illustrated” (p. 12). When forming themes, it is important for the researcher to note a theme is an outcome of coding, categorization, or analytic reflection (Saldana, 2013). For this study, coding for themes allowed the researcher to compile interview responses and categorize the dominant findings to finalize the overall theme for this study. Written responses on the surveys were transcribed and initially analyzed by using the word frequency tool Wordle. By using this word frequency analysis, the researcher was able to gain understanding of common phrases used from participant responses that aided in theme analysis.

**Justifying Conclusions**

According to the Joint Committee on Standards for Educational Evaluation (1994), justifying conclusions means making claims regarding the program that are based on data that have been compared against pertinent ideas of merit or significance. For the purpose of this study, the researcher utilized a mixed-methods approach employing both quantitative and qualitative data. Concurrent triangulation of the mixed-method approach was used to support data collection and reinforce conclusions. Creswell (2009) defined concurrent triangulation as when the “researcher collects both quantitative and qualitative data concurrently and then compares the two databases to determine if there is convergence, differences, or some combination” (p. 213). This method was employed when the researcher used “two different methods in an attempt to confirm or corroborate findings within a single study” (Creswell, 2009, p. 213). Creswell (2005) also supported the use of triangulation of data in order to increase accuracy of study findings and

eliminate researcher subjectivity. The sequential design of this study allowed for quantitative data collection and analysis to precede qualitative data collection and analysis.

**Ensuring Use and Learned Experiences**

According to the Joint Committee on Standards for Educational Evaluation (1994), the researcher should ensure that stakeholders are aware of the evaluation findings, and the findings are considered in the decisions that affect the program. The researcher asked the questions, "Did the program meet its intended goal?" and "Have participants utilized agriculture as a context for teaching and learning?" The overall purpose of this study was to evaluate teacher perceptions of the impact of professional learning and the initial implementation of *Dig into Learning: An Agricultural Literacy Innovation* regarding STEM education. The researcher developed a document following the format of the CIPP model in relation to CBAM with data collected from the conducted research instruments. This document was put into place to provide stakeholders with insight into the implementation and evaluation of the program *Dig into Learning* (Appendix G).

**The researcher's role as a change facilitator.** The researcher acted as a change facilitator, putting in place certain processes to encourage the implementation and use of agriculture as a teaching context. Hall and Hord (1987) "characterized principals, teachers, and other district personnel in an educational system, as *change facilitators* serving as key factors in the success or failure of an educational innovation" (Bellah & Dyer, 2009, p. 41). Bearing this definition in mind, a *change facilitator* might also be a developer or trainer involved in introducing a particular educational innovation. For this study, the researcher acted as a change facilitator initiating the movement of an

agricultural literacy innovation to provide teachers with resources to use agriculture as a context for teaching and learning in elementary classrooms, kindergarten through Grade 5. The researcher took the role as an internal evaluator by collaborating in the design and facilitation of a training workshop to provide elementary teachers with knowledge necessary to implement this innovation. This action served as the context of the program evaluation. Hall and Hord (1987), as cited in Bellah and Dyer (2009), stated, "while other adoption models treat change as an event, the developers and subsequent users of CBAM view change as a process" (p. 43). The researcher's role in accordance with CBAM followed Hall and Hord's (2015) framework utilizing both SoC and LoU. In utilizing CBAM, the context, input, process and product of this program evaluation were analyzed. The researcher used a mixed-methods approach to gathering research to support the implementation and use of agriculture as a context for teaching and learning and then analyzed the results to draw conclusions.

**Limitations**

It is necessary for the researcher to address a certain bias that is associated with personal beliefs and experiences related to agricultural literacy. The researcher has a deep connection grounded in agriculture and utilizes agriculture to contextualize teaching and learning in areas of science and math encouraging agricultural literacy in her own classroom. Another limitation of this study is the threat of using self-reported data from teacher participants. It is also necessary for the researcher to recognize that the research results gained from this study may only be applicable to elementary classrooms in this particular school district. An additional limitation to this study is that teachers voluntarily signed up for the workshop, which had a cap of 50 participants, perhaps indicating that participants already had an interest in learning to utilize agriculture as a

context for teaching and learning. It is also important for the researcher to acknowledge that some teachers already utilized agriculture concepts to contextualize learning, and they may have chosen to attend the professional development session to gain more information and to gain access to supplied resources. In addition, this workshop was only offered once during this district-wide professional development day and only lasted 3½ hours. This in itself could limit impact on participants due to limited time in which to provide information regarding the program.

A final limitation of this study is the selected methodology. Results are only meant to evaluate this program as it applies to the needs of teachers attending the workshop, which limits its scope relating to the use of agriculture to contextualize teaching and learning in the areas of STEM and literacy. The overall purpose of this study was to evaluate the implementation and effectiveness of the program *Dig into Learning: An Agricultural Literacy Innovation*. In addition, this evaluation examined how teachers integrated the use of agriculture as a context for learning after attending this workshop.

**Delimitations**

The researcher only studied the implementation of the agricultural innovation of *Dig into Learning* for elementary teachers attending the workshop from one school district. The school district's administration supported the need to encourage the use of agriculture to contextualize learning in elementary classrooms, and study findings may not be applicable for other school districts. For the purpose of this study, the researcher addressed the SoC and LoU participating teachers had regarding the use of agriculture as a context for teaching and learning.

**Summary**

This chapter addressed the research methods and design the researcher employed to meet the objectives introduced in Chapter 1. Specifically, the research perspective and use of quantitative and qualitative inquiry were presented. The population and sample, instrumentation, evaluation design, and data collection were introduced.

The design of this study was descriptive in nature; and the attributes of quantitative research, supported with qualitative approaches, were discussed. The population of this study was elementary teachers who registered for and completed a professional development workshop. The sample of the study was selected based on initial data collection from the population. The sample was used to collect in-depth and rich data that investigated the experiences of the teachers who plan to use the agricultural literacy innovation as a teaching context. The instruments used in this study were common to CBAM and include formats similar to the SoC and LoU branching interview protocol. Initial data collection and analysis of methods serve as the purpose in this chapter. In Chapter 4, the researcher presents collected data and analysis using SPSS software and qualitative thematic coding. Using the research design described in Chapter 3, Chapter 4 details research findings for each research question.

# Chapter 4: Results

## Introduction

Chapter 1 outlined the basis for conducting this study. The researcher evaluated teacher perceptions of the impact of professional learning and the implementation of STEM agricultural literacy innovation for elementary teachers in Grades K-5. The scope of this mixed-methods study was to focus on teacher experiences and use of the agriculture literacy innovation *Dig into Learning*.

Chapter 2 provided a literature review of historical and theoretical perspectives on the history of agriculture, the future of agriculture, and the role of agriculture in education. Further, the purpose of the literature review explained the purpose of a program evaluation and its connection to CBAM as it related to elementary teachers' SoC and LoU when engaged in an educational innovation.

Chapter 3 discussed the methodology used to conduct this study. A description of the mixed-methods research design and rationale, the role of the researcher, methodology of research as it related to program evaluation, program evaluation design, and data procedures were provided.

The purpose of this chapter is to present the findings that emerged from this study. The results address the research questions of the study and explore the SoC and LoU regarding the innovation of agricultural literacy integration into STEM learning. Results from qualitative and quantitative analyses are displayed in tables and accompanied by narrative descriptions.

## Research Questions

This study focused on four research questions in order to determine the impact of professional learning with regard to integrating agriculture into the K-5 curriculum. The

first research question focused on the need for professional learning with regard to STEM agricultural literacy integration into the K-5 curriculum. The second research question focused on the development and implementation of professional learning based on the expressed needs with regard to STEM agricultural literacy. The third research question focused on teacher perceptions of the impact of professional learning of STEM agricultural literacy curriculum innovation. Finally, the fourth research question, having two parts, addressed teacher participant perceptions of the initial implementation of the agricultural literacy innovation *Dig into Learning*. Research Question 4a addressed the quantitative component of evaluating participant responses to the needs assessment and follow-up assessment utilizing a paired samples *t* test. Research Question 4b addressed the qualitative component of evaluating participant responses to LoU branching interviews conducted by the researcher. The research questions are listed below.

1. What needs for professional learning are expressed by elementary teachers with regard to STEM agricultural literacy curriculum integration?
2. How is professional learning developed and implemented based on elementary teachers' expressed needs with regard to STEM agricultural literacy curriculum innovation?
3. What are elementary teacher perceptions of the impact of professional learning of a STEM agricultural literacy curriculum innovation?
4. What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation?
    a. What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation as measured by the statistical analysis of the change in pre and posttest

survey questions?

i. Null Hypothesis 4a. Elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation remain unchanged from the pre and posttest survey questions.

ii. Alternative Hypothesis 4a. Elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation change from the pre and posttest survey questions.

b. What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation as measured by teacher interviews?

Table 6 displays the alignment of research questions with the needs assessment, the follow-up survey, and the interview items in conjunction with the theoretical framework utilized for this study and the CIPP model of program evaluation.

Table 6

*Alignment of Questions*

| Research Questions | Alignment of Survey Items | CBAM | CIPP |
|---|---|---|---|
| 1. What needs for professional learning were expressed by elementary teachers with regard to STEM agricultural literacy curriculum integration? | Needs Assessment Likert Scale Items: 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22<br>Needs Assessment Open Response Items: 7, 23, 24, 25, 26 | SoC and LoU | Context evaluation focuses on areas of need. |
| 2. How is professional learning developed and implemented based on elementary teachers' expressed needs with regard to STEM agricultural literacy curriculum innovation? | Needs Assessment Likert Scale Items: 4, 9, 10, 11, 13, 14, 15, 16, 17,18, 19, 20, 21, 22<br>Needs Assessment Open Response Item: 26 | SoC and LoU | Input this phase is actually where the plan is created. The plan is utilized to implement the process evaluation. |
| 3. What are elementary teacher perceptions of the impact of professional learning of a STEM agricultural literacy curriculum innovation? | Follow-up Survey Likert Scale Items: 4, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22<br>Follow-up Survey Open Response Items: 26<br>Interview Item: 3 | SoC and LoU | Process evaluation consists of the evidence needed to determine the effectiveness of a program. |
| 4. What are elementary teacher perceptions of the impact of initial implementation of agricultural literacy curriculum integration?<br><br>4a. What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation as measured by the statistical analysis of the change in pre and posttest survey questions? | Needs Assessment Likert Scale Items: 1, 2, 3, 4, 5, 8, 10, 11, 12, 13, 14<br>Follow-up Survey Likert Scale Items: 1, 2, 3, 4, 5, 8, 10, 11, 12, 13, 14<br>Interview Items: 1,2,4-7 | SoC and LoU | Product evaluation is the final phase of the CIPP model. This step measured and evaluated if the program reached the intended goal. This step collects information utilized to determine the impact of the innovation. |

(continued)

| Research Questions | Alignment of Survey Items | CBAM | CIPP |
|---|---|---|---|
| 4b. What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation as measured by teacher interviews? | | | |

## Participants

The target population for this study included elementary teachers from an eastern North Carolina school district who participated in a professional learning workshop that introduced instructional activities for integrating agriculture into the elementary curriculum (*N*=49). As outlined in Chapter 3, initial data collection occurred via a researcher-developed needs assessment survey that assessed current SoC, LoU, and apparent needs associated with participant attitudes toward agriculture. Of the 49 members identified in the target population, 35 responded to the needs assessment. The accessible population was reduced to 35 participants. After the implementation of the program workshop *Dig into Learning*, the researcher sent a follow-up survey to participants who completed the needs assessment. Of the 35 participants who completed the needs assessment, 15 correctly completed the follow-up survey. Regarding the needs assessment, all 35 surveys were evaluated to determine participant concerns and need for professional learning.

## Findings of the Study

In following the CIPP model of program evaluation, in accordance with CBAM, the researcher addressed four research questions in relation to the impact of STEM

agricultural literacy integration in the elementary curriculum. These four research questions addressed participant perceptions of the impact on the program *Dig into Learning*.

**Research Question 1.** What needs for professional learning are expressed by elementary teachers with regard to STEM agricultural literacy curriculum integration? Research Question 1 provided the context in completion of the program evaluation. The context of the study assessed the needs of participants with use of agriculture as a context for teaching and learning. To evaluate the context of this program, the researcher utilized the needs assessment as found in Appendix C to identify specific areas of concern with regard to agricultural literacy and STEM education. Thirty-five participants completed the needs assessment, and those data were used to evaluate participant concerns. The needs assessment survey was composed of ordinal items measured by Likert scale responses; yes or no responses; and open-ended items. Survey items 1-14 were answered by all participants regardless of grade level taught. Items 15-18 were answered by K-2 teachers, and items 19-22 were answered by Grades 3-5 teachers. The subgroup (K-2 and 3-5) items were addressed by connecting specific Common Core and North Carolina essential standards to the integration of agricultural concepts to contextualize STEM. The open-response items were answered by all K-5 teacher participants. The needs assessment data were analyzed and compiled into tables and word cloud examples. The program Wordle was specifically chosen to highlight words used to describe areas of need mentioned often by participants in the needs assessment. For Research Question 1, needs assessment responses to items 1-6 and 8-22 were analyzed. In addition, the open responses to items 7, 23, 24, 25, and 26 were analyzed. In conducting initial research, IRB processes were followed in relation to approval given from the district as found in

Appendix A.

**Survey items.** To address participant concerns, the researcher created a needs assessment. Participant responses from the needs assessment gave insight into participant needs and concerns with regard to the use of agriculture as a context for teaching and learning of STEM education. Participants used a 5-point Likert scale consisting of the following responses: strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4), and strongly agree (5). Item 1 of the survey addressed teachers' current LoU regarding agriculture as a context for teaching and learning. The next step was to determine if participants were interested in utilizing agriculture as a context for teaching and learning. Item 2 addressed participant desires to use agriculture in their daily curriculum. Following this statement, item 3 addressed teacher current concerns regarding the effectiveness of agriculture as a context for teaching and learning in science and math. In order to utilize agriculture as a context for teaching and learning, a teacher has to be versed in concepts of agriculture. Item 4 addressed participant understandings of their personal agricultural literacy. Furthermore, item 5 addressed personal perceptions of participant knowledge of agriculture.

Table 7 demonstrates participant responses to items 1-5 of the needs assessment addressing use of agriculture and understanding of agricultural literacy.

Table 7

*Needs Assessment Items Addressing Agriculture and Understanding of Agricultural Literacy–Items 1-5*

| Item # | Strongly Disagree | | Disagree | | Neither Agree nor Disagree | | Agree | | Strongly Agree | |
|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | n | % | n | % | n | % | n | % |
| 1. I have used agriculture in the past to contextualize STEM concepts and the NC Standards. | 17 | 48.6 | 6 | 17.15 | 6 | 17.15 | 4 | 11.4 | 2 | 5.7 |
| 2. I want to use agriculture as a context for learning | 2 | 5.7 | 0 | 0 | 8 | 22.85 | 8 | 22.85 | 17 | 48.6 |
| 3. I believe agriculture is a relevant resource for teaching core subjects | 1 | 2.9 | 1 | 2.9 | 5 | 14.3 | 8 | 22.9 | 20 | 57 |
| 4. I understand the meaning of agricultural literacy | 3 | 8.6 | 11 | 31.4 | 15 | 42.9 | 4 | 11.4 | 2 | 5.7 |
| 5. I consider myself agriculturally literate | 5 | 14.3 | 8 | 22.9 | 11 | 31.4 | 7 | 20 | 4 | 11.4 |

Item 1 of the survey addressed teachers' current LoU regarding agriculture as a context for teaching and learning. Of the 35 surveys returned, 17 participants (48.6%) selected strongly disagree (1); and six participants (17.15%) selected disagree (2), indicating over half of participants (63.75%) had not used agriculture as a context for teaching and learning to contextualize STEM concepts within the past year.

Item 2 addressed participant desires to use agriculture in their daily curriculum. In all, 25 participants (or 71.4%) selected strongly agree (5) or agree (4) as an answer to item 2 on the survey. Almost three-quarters of the total population showed a positive attitude toward the desire to use agriculture as a context for teaching and learning. Item 3 addressed teacher current concerns regarding the effectiveness of agriculture as a context for teaching and learning in science and math. The majority of teacher participants indicated a belief in the importance of utilizing agriculture as a context for teaching and learning in core subjects such as science and math. In all, 28 participants selected strongly agree and agree, indicating 80% of participants believed agriculture was a relevant topic for teaching core curriculum in the subject areas of science and math. Item 4 addressed participant understandings of their personal agricultural literacy. Of the 35 participants, 42.9% of participants selected neither agree nor disagree (3); 31.4% of participants selected disagree (2); and 8.6% selected strongly disagree (1). In all, scores indicated 40% of participants felt they were not agriculturally literate, and 42.9% were undecided.

Item 5 addressed personal perceptions of participant knowledge of agriculture. Eleven participants (31.4%) chose the neutral response neither agree nor disagree (3), eight participants selected disagree (2), and five participants selected strongly disagree (1). Results indicated that a total of 68.6% of participants believed they were either not agriculturally literate or were neutral regarding their knowledge of agriculture literacy; however, almost one-third (31.4%) of participants considered themselves agriculturally literate. Survey responses indicated a need to educate teacher participants on the meaning of agricultural literacy.

Item 6 was a closed-response question; it addressed participant previous

experiences with the integration of agricultural-based projects or activities in classrooms within the last year. Table 8 displays participant closed responses to item 6.

Table 8

*Item 6: I have integrated agricultural-based projects within the last school year.*

| Item | Yes | No |
|---|---|---|
| 6. I have integrated agricultural-based projects within the last year. | 13 | 22 |

Thirteen participants (37.1%) responded yes to previously utilizing agricultural based projects in their classrooms within the last year. The majority of participants (62.9%) selected "no" to utilizing agricultural based projects.

Item 9 of the survey addressed the knowledge of NALOs. Table 9 displays participant closed responses to item 9.

Table 9

*Item 9: I am aware of the NALOs.*

| Item | Yes | No |
|---|---|---|
| 9. Awareness of NALOs | 4 | 30 |

Thirty participants (88.2%) responded "'no," which indicated most participants had no knowledge of NALOs. The use of NALOs was addressed during the workshop focusing on connections to Common Core and North Carolina essential standards in ways that contextualized STEM learning.

Items 8 and 10-14 were also analyzed with regard to Likert scale responses. Item

8 addressed the use of STEM specifically associated with agriculture integration activities in daily lessons. The researcher polled participant desires to learn about these objectives/themes in item 10. Item 11 addressed the interest of teachers in learning and using agricultural resources to integrate agriculture into STEM learning by using resources such as hands-on experiences and books relating to agriculture. Item 12 addressed teacher access to agricultural concepts. In addition to locating resources, the researcher addressed participant knowledge of ways to teach STEM utilizing agriculture concepts in item 13. Item 14 addressed teacher participant current feelings and interests in knowing how integrating NALOs and agriculture as a context for learning may be more effective in integrating instruction. Participants used a 5-point Likert scale consisting of the following responses: strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4), and strongly agree (5) to indicate their LoU. Table 10 demonstrates participant responses to items 8 and 10-14 of the needs assessment addressing LoU and understanding of STEM and NALOs with regard to agricultural literacy.

Table 10

*Understanding Agriculture as it Relates to STEM and NALOs–Items 8 and 10-14*

| Item | Strongly Disagree | | Disagree | | Neither Agree nor Disagree | | Agree | | Strongly Agree | |
|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | n | % | n | % | n | % | n | % |
| 8. I use STEM activities in daily lessons | 3 | 8.6 | 8 | 22.9 | 13 | 37.1 | 6 | 17.1 | 5 | 14.3 |
| 10. I want to learn more about NALOs and connections to grade level standards | 2 | 5.7 | 0 | 0 | 1 | 2.9 | 16 | 45.7 | 16 | 45.7 |
| 11. I am interested in using agricultural resources to promote STEM learning | 2 | 5.7 | 0 | 0 | 1 | 2.9 | 9 | 25.7 | 23 | 65.7 |
| 12. I have access to agricultural resources | 9 | 25.7 | 7 | 20 | 8 | 22.9 | 9 | 25.7 | 2 | 5.7 |
| 13. I have a solid grasp of agricultural concepts that could be a part of my STEM instruction | 9 | 25.7 | 12 | 34.3 | 8 | 22.9 | 4 | 11.4 | 2 | 5.7 |
| 14. I would like to know how integrating NALOs and agriculture as a context for teaching and learning may be more effective in integrating instruction than resources I currently use. | 2 | 5.7 | 0 | 0 | 5 | 14.3 | 13 | 37.1 | 15 | 42.9 |

Item 8 addressed the use of STEM specifically associated with agriculture

integration activities in daily lessons. Thirteen participants (37.1%) chose the neutral response of neither agree nor disagree (3); eight participants selected disagree (2); and three participants selected strongly disagree (1). In all, 68.6% of participants demonstrated a need to learn more ways to integrate STEM education into daily lessons.

In order to better understand agriculture as it relates to STEM education, NALOs are an available resource to use. Item 10 addressed participant desires to learn more about NALOs connecting to specific grade-level standards. A total of 16 participants (45.7%) selected strongly agree (5), and 16 participants (45.7%) selected agree (4). A total of 91.4% of participants wanted to learn more about NALOs connecting to specific grade-level standards. Item 11 addressed the interest of teachers in learning and using agricultural resources to integrate agriculture into STEM learning by using resources such as hands-on experiences and books relating to agriculture: 23 participants (65.7%) selected strongly agree (5) and nine participants (25.7%) selected agree (4). A total of 91.4% of participants wanted to learn more about using agricultural resources such as books about agriculture to promote STEM learning. Responses indicated positive perceptions from teacher participants who wanted to learn more about NALOs. Item 12 addressed teacher access to agricultural concepts. Two participants (5.7%) selected strongly agree (5); nine participants (25.7%) selected agree (4); eight participants (22.9%) selected the neutral response–neither agree nor disagree (3); seven participants (20%) selected disagree (2); and nine participants (25.7%) selected strongly disagree (1). It is evident that some, but not all, participants had access to resources to utilize agriculture as a context for teaching and learning.

In addition to locating resources, the researcher addressed participant knowledge of ways to teach STEM utilizing agriculture concepts in item 13: 21 participants (60%)

selected strongly disagree (1) or disagree (2) in relation to understanding agriculture integrated in STEM learning. Item 14 addressed teacher participant current feelings and interests in knowing how integrating NALOs and agriculture as a context for learning may be more effective in integrating instruction. Fifteen participants (42.9%) selected strongly agree (5) and 13 participants (37.1%) selected agree (4). A total of 80% of participants wanted to learn more about integrating NALOs and agriculture as a context for teaching and learning.

**Subgroup items.** In addition to the survey items geared to all participants, other survey items were specific to the grade-level subgroup kindergarten through Grade 2 and subgroup Grade 3-Grade 5. A total of nine items were asked to each subgroup within the needs assessment. These items were focused on NALOs connected to North Carolina standards in relation to STEM education. The items specifically asked teachers to record their interest in the integration of agricultural literacy into science and math standards. Specific standards addressed included plant life cycles, genetics–inherited traits, DNA extraction of strawberries, commodity prices, states of matter–solids, liquids and gases, measurement, and other standards relative to the elementary curriculum. Frequencies of responses were collected through Likert scale responses of strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4), and strongly agree (5). Comparison of survey items and the frequency distribution of item responses showed nine participants (25.7%) taught in Grades 3-5, while the remaining 26 participants (74.3 %) taught in K-2.

Table 11 demonstrates a comparison of participant responses from item 15 completed by the K-2 subgroup and item 19 completed by 3-5 subgroup. Both items 15 and 19 assessed each subgroup with the statement, “I understand NALOs connect STEM focused learning to North Carolina Standards.”

Table 11

*Response to Grade-Level Subgroup Items 15(K-2) and 19(3-5): I understand NALOs connect STEM focused learning to North Carolina Standards.*

| | Strongly Disagree | | Disagree | | Neither Agree nor Disagree | | Agree | | Strongly Agree | |
|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % |
| Item 15 | 8 | 30.8 | 9 | 34.6 | 5 | 19.2 | 3 | 11.5 | 1 | 3.8 |
| Item 19 | 1 | 11.1 | 1 | 11.1 | 6 | 66.7 | 1 | 11.1 | 0 | 0 |

The researcher evaluated data with regards to teacher current understandings of NALOs and STEM learning. Five participants (19.2%) of the K-2 subgroup selected the neutral response–neither agree nor disagree (3). Responses indicated that 65.4% of the K-2 subgroup selected either strongly disagree (1) or disagree (2) to their current understanding of NALOs and STEM learning; however, six participants (66.7%) of the 3-5 subgroup selected the neutral response–neither agree nor disagree (3). Two participants (22.2%) of the 3-5 subgroup selected strongly disagree (1) and disagree (2). Table 12 demonstrates the comparison of responses given for two subgroup items. Item 16 addressed the K-2 subgroup, and item 20 addressed the 3-5 subgroup. Participants responded to the statement, "I would like to know how using agriculture as a context for teaching and learning will help my students to become agriculturally literate."

Table 12

*Subgroup Responses to Items (K-2) 16 and (3-5) 20: I would like to know how using agriculture as a context for teaching and learning will help my students to become agriculturally literate.*

| | Strongly Disagree | | Disagree | | Neither Agree nor Disagree | | Agree | | Strongly Agree | |
|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % |
| Item 16 | 1 | 3.7 | 1 | 3.7 | 2 | 7.4 | 14 | 51.9 | 9 | 33.3 |
| Item 20 | 2 | 20 | 0 | 0 | 2 | 20 | 3 | 30 | 3 | 30 |

Responses to item 16 indicated that 23 participants (85.2%) of the K-2 subgroup selected strongly agree (5) and agree (4). Responses to item 20 indicated that six participants (60%) indicated strongly agree (5) and agree (4).

An additional subgroup focus statement was, “I would like to know how to use agriculture-focused STEM lessons in my classroom.” Item 17 addressed the K-2 subgroup, and item 21 addressed the 3-5 subgroup. Table 13 demonstrates responses regarding participant desires to know how to use agriculture focused STEM lessons in the elementary classroom.

Table 13

*Subgroup Responses to Items (K-2) 17 and (3-5) 21: I would like to know how to use agriculture focused STEM lessons in my classroom.*

| | Strongly Disagree | | Disagree | | Neither Agree nor Disagree | | Agree | | Strongly Agree | |
|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % |
| Item 17 | 1 | 3.7 | 1 | 3.7 | 1 | 3.7 | 9 | 33.3 | 15 | 55.6 |
| Item 21 | 2 | 22.22 | 0 | 0 | 2 | 22.22 | 2 | 22.22 | 3 | 33.4 |

In all, 24 participants (88.9%) selected strongly agree (5) and agree (4). Five participants (55.5%) of the 3-5 subgroup indicated strongly agree (5) and agree (4).

Finally, item 18 for the K-2 subgroup and item 22 for the 3-5 subgroup asked participants to respond to the statement, “I would like to know what other Common Core State Standards can be addressed by using agriculture as a context for teaching and learning.” Table 14 demonstrates responses to item 18 (K-2) and 22 (3-5) regarding participant desires to know what other Common Core State Standards can be addressed by using agriculture as a context for teaching and learning.

Table 14

*Subgroup Responses to Items (K-2) 18 and (3-5) 22: I would like to know what other Common Core State Standards can be addressed by using agriculture as a context for teaching and learning.*

| | Strongly Disagree | | Disagree | | Neither Agree nor Disagree | | Agree | | Strongly Agree | |
|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % |
| Item 18 | 1 | 3.7 | 1 | 3.7 | 2 | 7.4 | 12 | 44.4 | 11 | 40.7 |
| Item 22 | 1 | 12.5 | 0 | 0 | 2 | 25 | 3 | 37.5 | 2 | 25 |

Of the K-2 subgroup, 23 participants (85.1%) selected strongly agree (5) and agree (4). From the 3-5 subgroup, five participants (62.5%) selected strongly agree (5) and agree (4). From these responses, the researcher perceived participants from both subgroups were interested in learning how Common Core standards were addressed utilizing agriculture concepts.

**Summary.** For Research Question 1, "What needs for professional learning are expressed by elementary teachers with regard to STEM agricultural literacy curriculum integration," the needs assessment data with regard to SoC and LoU were analyzed to determine areas of need to be addressed during the program workshop initiating *Dig into Learning: An Agricultural Literacy Innovation*.

**Research Question 2.** How is professional learning developed and implemented based on elementary teachers' expressed needs with regard to STEM agricultural literacy curriculum innovation? Research Question 2 provided the input in completion of the program evaluation. The researcher collected initial data from the needs assessment to determine topics for professional learning associated with STEM agricultural literacy. In

addition to frequency distribution of needs assessment responses, the researcher specifically evaluated item 26 of the needs assessment. This question addressed participant areas of concern regarding the use of agriculture as a context for teaching and learning. First, the researcher analyzed responses to identify themes. From these themes the researcher and curriculum specialists formatted a plan for professional learning. This plan included professional learning strategies focused on the implementation of concepts regarding agriculture as it connected to Common Core and North Carolina essential standards to contextualize STEM. Second, the researcher analyzed participant responses with regard to Hall and Hord's (2015) SoC as it related to agriculture as a teaching context. Lastly, the researcher compiled the results to identify concepts that supported the development and implementation of professional learning.

**Analysis of responses to identify themes.** Following the subgroup questions of the needs assessment, the researcher ended the survey with open-ended questions to offer a deeper insight into feelings, recollections of past events, and likes or dislikes in relation to agriculture as a context for teaching and learning. An online word analysis tool was utilized as an initial tool for analysis. The researcher was able to initially determine common themes that arose through this word frequency analysis tool. The needs assessment provided the foundation the researcher and North Carolina Farm Bureau AITC specialists used to formulate the key topics discussed during the workshop. These key topics were addressed as workshop themes and included becoming agriculturally literate; NALOs; Theme 4: Science, Technology, Engineering, and Math; integration of agriculture and STEM literacy; connections to Common Core and state standards; and how to locate resources, manage time, and find monetary means to support these activities. For Research Question 2, needs assessment open-response question 26 was

analyzed. A word analysis tool, Wordle, was used to determine themes related to participant concerns and the use of agriculture as a context for teaching and learning. The researcher selected Wordle because this analysis tool enabled key words participants used to define agricultural literacy to be shown in large print. Each time a word appeared in a response, the font for that particular word became larger.

Table 15 displays participant responses from survey item 26, “What personal concerns, if any, do you have using agriculture as a teaching context?”

Table 15

*Participant Responses to Concerns Using Agriculture as a Teaching Context: What personal concerns, if any, do you have using agriculture as a teaching context?*

| Responses to Open-Ended Question 26 |
|---|
| No major concerns except time. |
| Just one more thing to learn and be proficient at teaching it!!!! One more thing. . . . BUT a very important one, I will add! |
| As usual, having the money to provide the resources and materials for all the activities you wish to do with the students. |
| My biggest concern is the cost and how much the supplies would cost me in order to use agriculture as a teaching context. |
| Adding additional time to an already overloaded block of time spent in lesson planning. |
| I do not know how to integrate it into the concepts my students need to learn. |
| None |
| Not enough information |
| No concerns. I think it would be a great learning experience. |
| Having appropriate materials (I usually have to buy them myself) |
| Resources available, time, value/connection to students |
| Having the resources and time that would be required. |
| No major concerns except time. |
| I am concerned about the cost that would be involved and the amount of planning time it would require to do effectively in a time where we don't even have a true planning time. |
| Teachers already spend a great amount of their time at home planning and doing some type of schoolwork. |

The researcher compiled responses in the form of a word cloud, Wordle, in order to identify obvious themes that would be addressed during the workshop (Figure 11). The words agriculture, agricultural, and literacy were omitted since they were a part of the original question and did not disclose additional themes.


*Figure 11*. Word Cloud Explanation of SoC Themes (http://www.wordle.net/create).

For the analysis of item 26, "What personal concerns, if any, do you have using agriculture as a teaching context," the researcher evaluated participant responses and identified themes that were commonly seen in responses. These themes were addressed during the workshop. Themes included time, teaching, integration, cost, and materials/resources.

**Implementing professional learning.** The researcher and curriculum specialists identified methods and plans used to address themes based on participant concerns. To address "time," curriculum specialists provided resources and materials to limit teacher

participant needs to search for resources. Methods of integration were discussed to support the concern of time. In addition, other concern themes were addressed with supports that were suggested by the curriculum specialists, as they have had past experience in conducting professional learning for adult learners. The researcher fashioned a table identifying themes and other supports of professional learning to address participant needs relating to STEM agricultural literacy (Table 16).

Table 16

*Participant Responses to Areas of Concern Regarding STEM Agricultural Literacy Survey Item 26: What concerns, if any, do you have using agriculture as a teaching context?*

| Category | Topics for Support |
|---|---|
| Time | Provide resources, share information, skills to manage time; STEM, NALOs, Common Core<br>Integrate agriculture into the elementary classroom, instructing participants on becoming agriculturally literate |
| Teaching | Common Core Standards, NALOs, Ag in the Classroom lessons |
| Cost/Materials | Provide resources supporting STEM agricultural literacy integration; Resources to locate funding and aide in teaching agriculture in the elementary classroom |
| Planning | Instruct participants on becoming agriculturally literate; Integrating agriculture into STEM and Common Core |

Based on identified themes associated with participant concerns related to agriculture as a context for teaching and learning, the researcher created a plan for implementation of the program *Dig into Learning*. Obara and Sloan (2010) believed successful professional development requires that problems are identified and then addressed through teacher-driven sessions allowing for teachers to gain ownership of an

innovation. The researcher identified common themes through the word analysis tool (Wordle) and addressed these themes by covering them in different sessions of the workshop. These sessions included becoming agriculturally literate, STEM, NALOs, integrating agriculture into STEM literacy, connection to Common Core and state standards, time management and cost. The researcher and curriculum specialists supported participant concerns of teaching agriculture by teaching facts about agriculture to help them become agriculturally literate. In addition, the participants were supported in teaching and integrating agriculture through group sessions that focused on Common Core state standards, NALOs, and STEM education. Finally, participants were shown ways to manage time spent integrating agriculture while maintaining the daily schedule and also ways to receive funding to help begin agriculturally based projects. Table 17 demonstrates the identified needs and plans employed to address identified concerns.

Table 17

*Topics to Support Identified by Needs for Dig into Learning Participants*

| Themes Compiled from Needs Assessment | Plan that Addressed Themes of STEM Agricultural Literacy |
|---|---|
| | <u>Teaching</u> |
| Becoming Agriculturally Literate | A presentation was formatted by the North Carolina Ag in the Classroom curriculum specialists that informed participants about the importance of agriculture. In addition participants were shown an example of what agriculturally literate meant.<br><br>Activity: What is agriculture?<br>This activity addressed state facts regarding the import and export of agriculture commodities from North Carolina and specifically the county in which this program was implemented.<br><br>To test teacher knowledge regarding key facts about agriculture, a beach ball was passed/tossed around randomly to quiz individual participant's understanding of key facts learned. |
| STEM (Science, Technology, Engineering, and Math) | Common Core and North Carolina State Standards associated with STEM.<br><br>How to tie STEM and Literacy together–integrated lesson plans were presented to participants.<br><br>Science, Technology and Engineering concepts associated with NALOs (Theme 4) in relation to Grades K-5.<br>Connections to STEM related job growth for future generation college and jobs (session explained relevance to students in order to help teachers to recognize the topic's importance). |
| NALOs | Presenters showed participants the curriculum matrix found on National Ag in the Classroom (NAITC) website (www.agclassroom.org) and briefly reviewed the five outcomes identified by NAITC–specifically target theme 4–STEM. |
| | <u>Cost/Materials</u> |
| Integrating agriculture into STEM literacy in the elementary classroom | Lesson plans issued from North Carolina Ag in the Classroom:<br>K-1–All About Me Corn Activity<br>2–Chickens and Genetics<br>3–Life cycle of Plants<br>4-5–Strawberry DNA/Esperanza (agriculture and literacy)<br>** These lessons were chosen based on participant needs and were relatable to the area. In addition the workshop was held during the Fall of 2015–these lessons could be easily implanted into classrooms as the end of the workshop. |

(continued)

| Themes Compiled from Needs Assessment | Plan that Addressed Themes of STEM Agricultural Literacy |
|---|---|
| | <u>Planning</u> |
| Connection to Common Core and State Standards | Provided lessons associated with grade level specific common core standards: specifically ways to contextualize STEM through agriculture integration. |
| | Explained how to tailor a lesson that integrates multiple common core/state standards. |
| | Provided materials relatable to common core state standards. |
| | <u>Time</u> |
| Time and Money | Professional Learning Communities–How working together as a team can save time, require less effort, and benefit everyone. |
| | Methods of collaboration and team planning. |
| | Provided participants with access to websites that have premade lessons; NAITC curriculum matrix. |
| | Presenters discussed possible local business donations, grant opportunities and ways to receive free product to integrate agriculture into any classroom. |

In educating participants on information associated with the innovation *Dig into Learning*, the researcher had to be certain that participants regarded themselves as agriculturally literate individuals. To be agriculturally literate, a person knows and understands the concepts of agriculture and can discuss them with others. In order to address the need for participants to be agriculturally literate, the curriculum specialists created a power point presentation that included facts about agriculture. The next step was relating it to the curriculum. In doing so, the researcher and curriculum specialists included information about STEM learning, curriculum integration, connections to Common Core and state standards, and NALOs. The largest portion of the workshop was spent on teaching the participants how to integrate agriculture into the daily curriculum by covering these themes. The researcher and curriculum specialists modeled ways to

collaborate with colleagues and locate premade resources such as the curriculum matrix from the National Ag in the Classroom website to limit the concern on time. In addition, the researcher and curriculum specialists encouraged teachers to utilize resources that were already provided to them or to which they had access. They were also encouraged to seek support through grants to fund agriculturally based projects. The ultimate goal was to ensure that participants felt their needs were met.

As topics were formed based on the evaluation of needs, the researcher and curriculum specialists formatted the program workshop around professional learning strategies. Professional learning strategies employed included individual reflection, group collaboration, hands-on learning, discussion, and question/answer sessions. Learning Forward (2015) stated, "educators are responsible for taking an active role in selecting and constructing learning designs that facilitate their own learning" (para. 7). Conducting the needs assessment allowed the researcher and program presenters to understand the specific needs or concerns participants had regarding the use of agriculture as a context for teaching and learning.

**Identifying SoC.** Hall and Hord (2015) identified seven categories of concerns as SoC. Following the SoC chart as depicted in Chapter 3, the researcher identified the general SoC based on participant responses. In assessing item 26, the researcher compiled survey responses into a table. An outside observer was solicited to assist the researcher in review of participant responses. The outside observer was a retired educational professional and prominent community leader. The researcher identified participant stages of concern based on responses from needs assessment responses to item 26. The researcher then had an outside observer read through the responses and review the identified stages for each participant. The outside observer had experience in

statistical analysis of educational-related objectives and offered detailed insight into the SoC as explained through Hall and Hord (2015). The researcher analyzed participant responses providing a brief overview of classification supported by the explanation of each stage of concern based on Hall and Hord's SoC design. Because the outside observer did not have previous experience utilizing SoC, the researcher provided the outside observer with explanations of each stage of concern as described in Hall and Hord (2015). The outside observer then reviewed the researcher's notes and participant classification to eliminate potential bias. Fortunately, the researcher and outside observer were in agreement on each identified SoC for each participant. There were no changes made to the researcher's identification of each participant's SoC. Table 18 shows participant responses to item 26 and the researcher's classification with regard to Hall and Hord's (2015) SoC.

Table 18

*Participant Responses to Areas of Concern Regarding STEM Agricultural Literacy: What concerns, if any, do you have using agriculture as a teaching context?*

| ID | Response | Code/ Theme | SoC Identification |
|---|---|---|---|
| 2 | No major concerns except time. | Time | Task (3) Management |
| 3 | Just one more thing to learn and be proficient at teaching it! One more thing. . . . BUT a very important one, I will change my way of teaching to add it! | Time | Impact (6) Refocusing |
| 4 | As usual, having the money to provide the resources and materials for all the activities you wish to do with the students. | Cost | Self (2) Personal |
| 6 | My biggest concern is the cost and how much the supplies would cost me in order to use agriculture as a teaching context. | Cost | Self (2) Personal |
| 10 | Adding additional time to an already overloaded block of time spent in lesson planning. | Time | Task (3) Management |
| 11 | I do not know how to integrate it into the concepts my students need to learn. | Integrate | Self (2) Personal |
| 14 | My main concern is how it will affect/impact the students and their learning. | Students/ Integrate/ Time | Self (2) Personal |
| 15 | Not enough information to integrate into my lessons. | Integrate | Self (1) Informational |
| 17 | No concerns. I think it would be a great learning experience. | No Theme | Self (1) Informational |
| 19 | Having appropriate materials (I usually have to buy them myself). | Materials and Cost | Self (2) Personal |
| 20 | Resources available, time, value/connection to students. | Time | Self (2) Personal |
| 21 | I am concerned about the cost that would be involved and the amount of planning time it would require to do effectively in a time where we don't even have a true planning time. Teachers already spend a great amount of their time at home planning and doing some type of schoolwork, which takes away from their time with family. | Time | Self (2) Personal |
| 27 | Having the resources and time that would be required. | Time | Task (3) Management |

(continued)

| ID | Response | Code/ Theme | SoC Identification |
|---|---|---|---|
| 28 | I am concerned about the cost that would be involved and the amount of planning time it would require to do effectively in a time where we don't even have a true planning time. | Time | Self (2) Personal |
| 32 | Teachers already spend a great amount of their time at home planning and doing some type of schoolwork. | Time | Self (2) Personal |

The researcher's classifications of SoC were based on Hall and Hord's (2015) explanation of the individual SoC. The researcher and an outside observer read all survey responses and coded them separately. In defining participants' SoC, the researcher compiled brief explanations of each participant's response. The outside observer then reviewed responses to eliminate bias and provide a second opinion on the researcher's opinion of participants' SoC. Fortunately, the researcher and outside observer were in agreement on the SoC identified for each participant's response.

Subsequent to the selection of the sample population and further analyses of teacher concerns, each survey participant was asked to identify concerns associated with the use of agriculture as a context for teaching and learning. The responses were analyzed by the researcher and categorized into SoC; the responses to item 26 of the needs assessment was placed in a graph to demonstrate variation of participant SoC (Figure 12).

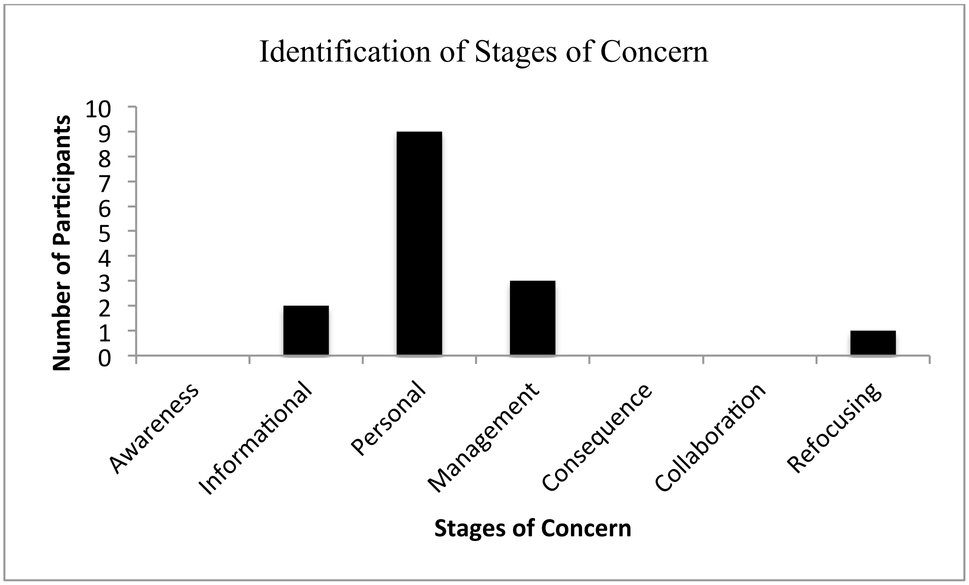


*Figure 12*. SoC Item 26.

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Hall and Hord (2001) clearly identified seven SoC: awareness (unrelated–Stage 0), informational (self–Stage 1), personal (self–Stage 2), management (task–Stage 3), consequence (impact–Stage 4), collaboration (impact–Stage 5), and refocusing (impact–Stage 6). No participants were identified with *unrelated* SoC. Participants in the awareness stage (Stage 0) have concerns unrelated to the topic and do not care anything about the innovation. Eleven participants were identified in the *self* SoC. The *self* stage of concern includes informational (Stage 1) and personal (Stage 2) concerns. Two participants were identified with *informational* SoC, and nine participants were identified in the personal SoC. Three participants were identified in the *task* SoC. Participants in the management stage (Stage 3) are concerned with time spent on the innovation. The *impact* SoC include the consequence stage (Stage 4), the collaboration stage (Stage 5), and the refocusing stages (Stage 6). Participants in the consequence stage are mainly concerned with the impact on students and student achievement. Participants in the collaboration stage are concerned with if their colleagues will find this innovation useful.

Participants in the refocusing stage are concerned with what else they can do with the innovation and how can they do new things using the innovation. One participant was identified in the refocusing stage (Stage 6). Above all, data indicated that participants were consistently in the lower levels of concern.

**Summary.** Research Question 2, "how is professional learning developed and implemented based on elementary teachers' expressed needs with regard to STEM agricultural literacy curriculum innovation?" In answering Research Question 2, the researcher analyzed item 26 of the needs assessment. Initially, the researcher analyzed participant responses with the use of a word analysis tool Wordle. Based on themes, the researcher and AITC curriculum specialists formatted and implemented a plan for professional learning to support participant needs. In addition, the researcher and an outside observer reviewed participant responses and identified SoC. In addressing participant SoC, the researcher better understood how to address participant needs with regard to the innovation.

**Research Question 3.** What are elementary teacher perceptions of the impact of professional learning of a STEM agricultural literacy curriculum innovation? Research Question 3 provided the process in completion of the program evaluation. In order to evaluate the process, the researcher assessed the implementation of this workshop and its impact on participant perceptions of agriculture as a context for teaching and learning. The researcher compared data from the needs assessment and follow-up assessment to determine the impact of professional learning with regard to the STEM agricultural literacy. The researcher evaluated responses from the follow-up assessment that addressed issues of concern and compared these responses to the same questions from the needs assessment. Follow-up surveys were sent out 1 month after the program workshop

via email to participants who had completed the needs assessment. Participants were given a 2-week window to complete and return surveys. Of the 35 surveys sent out, 17 surveys were completed; however, the researcher discarded two of the surveys due to insufficient responses completed. Therefore, the accessible population for research was 15 participants (*N*=15). The low number of participant responses was viewed as a limitation to this study and is discussed in more detail in Chapter 5. The researcher utilized the responses from the 15 surveys to conduct an evaluation of the impact on professional learning in order to inform district of results within the time frame allotted. For Research Question 3, follow-up responses to items 1-14 and 15-22 were analyzed. In addition, the open responses to question 26 were analyzed, as well as interview questions 1-7.

**Follow-up survey.** After attending the program workshop *Dig into Learning,* participants were given time to go back into their classrooms and utilize resources gathered and concepts learned regarding agriculture as a context for learning. The researcher allowed 1 month for participants to begin use of the innovation before sending out the follow-up survey. The follow-up survey addressed similar questions to the needs assessment which focused on participants' SoC and LoU of agriculture as a context for teaching and learning. Of the 35 participants who completed the needs assessment, 15 participants of the total population completed the follow-up survey. Table 19 demonstrates participant responses to items 1-7 of the follow-up survey, addressing participants' SoC and LoU after attending the program workshop.

Table 19

*Follow-Up Survey Responses: Items 1-7*

| Item | Strongly Disagree | | Disagree | | Neither Agree nor Disagree | | Agree | | Strongly Agree | |
|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | N | % |
| 1. I will use agriculture to contextualize STEM concepts. | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 46.7 | 8 | 53.3 |
| 2. I plan to use agriculture as a context for teaching and learning. | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 46.7 | 8 | 53.3 |
| 3. I believe agriculture is a relevant resources for teaching and learning. | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 46.7 | 8 | 53.3 |
| 4. I understand the meaning of agricultural literacy. | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 46.7 | 8 | 53.3 |
| 5. I consider myself an agriculturally literate person. | 0 | 0 | 0 | 0 | 1 | 6.7 | 12 | 80 | 2 | 13.3 |
| 6. I plan to integrate agricultural based projects in my classroom. | 0 | 0 | 0 | 0 | 2 | 13.3 | 9 | 60 | 4 | 26.7 |
| 7. I plan to integrate small agricultural based projects in my instruction. | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 46.7 | 8 | 53.3 |

Item 1 of the follow-up survey addressed participant plans to use agriculture to contextualize STEM concepts and North Carolina state standards. Based on evaluation of responses from item 1 of the follow-up survey, seven participants (46.7%) selected strongly agree (5); and eight participants (53.3%) selected agree (4).

Item 2 addressed teacher plans to use agriculture as a context for teaching and learning in relation to STEM education after attending the *Dig into Learning* workshop. Participant responses indicated a positive impact on professional learning in that eight participants (53.3%) selected strongly agree (5), and seven participants (46.7%) selected agree (4). In all, 88.3% of participants who completed the follow-up survey planned to use agriculture as a context for teaching and learning.

Item 3 of the follow-up survey addressed teacher current concerns with the relevance of using agriculture context for teaching and learning in science and math. Of the 15 participants who completed the follow-up survey, eight participants (53.3%) selected strongly agree (5); and seven participants (46.7%) selected agree (4).

Item 4 focused on participant knowledge and understanding of agricultural literacy after attending *Dig into Learning*. Eight participants (53.3%) selected strongly agree (5), and seven participants (46.7%) selected agree (4).

Item 5 of the Follow-up survey addressed participants' personal understanding of agriculturally literate individuals. Five indicated two participants (13.3%) selected Strongly Agree (5) and twelve participants (80%) selected Agree (4). One participant (6.7%) selected the neutral response of neither agree nor disagree.

Item 6 of the follow-up survey addressed participant plans to integrate agricultural-based projects or activities in instruction during the school year. Four participants (26.7%) selected strongly agree, (5) and nine participants (60%) selected

agree (4); with a combined percentage of 86.7% of participants who completed the follow-up survey have used and/or plan to integrate agriculture-based projects in the elementary classroom. Two participants (13.3%) selected the neutral response of neither agree nor disagree.

Item 7 addressed participant plans to integrate small agriculturally based projects or activities. Eight participants selected strongly agree (5), and seven participants selected agree (4). All participants who returned the follow-up survey indicated that their understanding of agricultural literacy had grown after attending the *Dig into Learning* workshop. Table 20 demonstrates participant responses to items 8-14 of the follow-up survey, addressing participants' SoC and LoU after attending the program workshop.

Table 20

*Participant Responses to Follow-Up Addressing STEM and NALOs Items 8-14*

| Item | Strongly Disagree | | Disagree | | Neither Agree nor Disagree | | Agree | | Strongly Agree | |
|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % |
| 8. I plan to use STEM activities in lessons. | 0 | 0 | 0 | 0 | 4 | 26.7 | 7 | 46.6 | 4 | 26.7 |
| 9. I am aware of NALOs. | 0 | 0 | 0 | 0 | 2 | 13.3 | 10 | 66.7 | 3 | 20 |
| 10. I feel more knowledgeable about NALOs. | 0 | 0 | 0 | 0 | 2 | 13.3 | 9 | 60 | 4 | 26.7 |
| 11. I feel supported in using agricultural resources. | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 66.7 | 5 | 33.3 |
| 12. I know how to access agricultural resources to integrate agricultural concepts. | 0 | 0 | 0 | 0 | 1 | 6.7 | 11 | 73.3 | 3 | 20 |
| 13. I have a solid grasp of agricultural concepts that could be part of grade level STEM instruction. | 0 | 0 | 0 | 0 | 2 | 13.3 | 10 | 66.7 | 3 | 20 |
| 14. I know how integrating NALOs and agriculture as a context for learning may be more effective in integrating instruction. | 0 | 0 | 0 | 0 | 2 | 13.33 | 8 | 53.33 | 5 | 33.34 |

Item 8 addressed participant plans to use STEM in daily lessons. From evaluation of responses, four participants (26.65%) selected strongly agree; seven (46.7%) participants selected agree; and four participants (26.65%) selected the neutral response of neither agree nor disagree. Responses indicated 73.35% of participants who returned the follow-up survey had plans to integrate STEM activities in the school year.

Item 9 addressed participant knowledge and awareness of NALOs. Evaluation of participant responses indicated three participants (20%) selected strongly agree (5), 10 participants (66.7%) selected agree (4), and two participants (13.3%) selected the neutral response of neither agree nor disagree (3). None of the returned responses indicated that participants who completed the follow-up survey were unaware of the NALOs.

Item 10 addressed participant knowledge of NALOs connecting to specific grade-level standards. Four participants (26.7%) selected strongly agree (5), nine participants (60%) selected agree (4), and two participants (13.3%) selected the neutral response of neither agree nor disagree (3). Overall, 86.7% of participants who returned the follow-up surveys selected either strongly agree (5) or agree (4).

Item 11 addressed participant views of support in regard to using agriculture resources such as books or hands-on projects. Five participants (33.3%) selected strongly agree (5), and ten participants (66.7%) selected agree (4).

Item 12 addressed participant knowledge of how to access agricultural resources to integrate agricultural concepts into STEM instruction after attending the program workshop *Dig into Learning*. Responses indicated that three participants (20%) selected strongly agree (5), 11 participants (73.3%) selected agree (4), and one participant (6.7%) selected the neutral response of neither agree nor disagree (3).

Item 13 addressed participant understanding of agricultural concepts that could be

used in STEM instruction. Evaluation of responses indicated only 15 participants answered item 13. Based on evaluation of research, three participants (20%) selected strongly agree (5); 10 participants (66.7%) selected agree (4); and two participants (13.3%) selected the neutral response of neither agree nor disagree (3).

Item 14 addressed participant knowledge of how integrating NALOs and agriculture as a context for learning could be an effective teaching tool. Responses indicated five participants (33.3%) selected strongly agree (5), eight participants (53.4%) selected agree (4), and two participants (13.3%) selected the neutral response of neither agree nor disagree.

In addition to items address to all K-5 participants, the researcher analyzed responses from subgroup items K-2 and 3-5. Tables 21, 22, 23, and 21 display responses from subgroup items.

Table 21

*Responses to Grade-Level Subgroup Items 15 (K-2) and 19 (3-5): After attending Dig into Learning, I now understand how NALOs connect STEM focused learning to Common Core state standards.*

| | Strongly Disagree | | Disagree | | Neither Agree nor Disagree | | Agree | | Strongly Agree | |
|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % |
| Item 15 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 46.7 | 5 | 33.3 |
| Item 19 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6.7 | 2 | 13.3 |

Of the K-2 subgroup, five participants (33.3%) selected strongly agree (5) and seven selected (46.7%) agree (4). From the 3-5 subgroup, two participants (13.3%)

selected strongly agree (5) and one participant (6.7%) selected agree (4). From these responses, the researcher perceived participants from both subgroups understood how NALOs (Theme Four) connected to STEM education. Table 22 displays responses to subgroup items that addressed how to use agriculture as a context for teaching and learning.

Table 22

*Response to Grade-Level Subgroup Items 16 (K-2) and 20 (3-5): After attending Dig into Learning, I now know how using agriculture as a context for teaching and learning will help my students to become agriculturally literate.*

| | Strongly Disagree | | Disagree | | Neither Agree nor Disagree | | Agree | | Strongly Agree | |
|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % |
| Item 16 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 33.3 | 7 | 46.7 |
| Item 20 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 13.3 | 1 | 6.7 |

Of the K-2 subgroup, seven participants (46.7%) selected strongly agree (5) and five selected (33.3%) agree (4). From the 3-5 subgroup, one participant (6.7%) selected strongly agree (5) and two participants (13.3%) selected agree (4). From these responses, the researcher perceived participants of both subgroups now understood how to integrate agriculture as a context for teaching and learning. Table 23 displays responses to subgroup items that addressed agriculture-focused STEM lessons.

Table 23

*Response to Grade-Level Subgroup Items 17 (K-2) and 21 (3-5): After attending Dig into Learning, I now know how to use agriculture focused STEM lessons in my classroom.*

| | Strongly Disagree | | Disagree | | Neither Agree nor Disagree | | Agree | | Strongly Agree | |
|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % |
| Item 17 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 40 | 6 | 40 |
| Item 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 20 |

Of the K-2 subgroup, six participants (40%) selected strongly agree (5) and six selected (40%) agree (4). From the 3-5 subgroup, three participants (20%) selected strongly agree (5). From these responses, the researcher perceived participants of both subgroups now understood how to integrate agriculture into STEM focused lessons. Table 24 displays participant responses from subgroup items focused on Common Core standards and agriculture.

Table 24

*Response to Grade-Level Subgroup Items 18 (K-2) and 22 (3-5): After attending Dig into Learning, I now know what other Common Core standards can be addressed by using agriculture as a context for teaching and learning.*

| | Strongly Disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | |
|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % |
| Item 18 | 0 | 0 | 0 | 0 | 3 | 20 | 5 | 33.3 | 4 | 26.7 |
| Item 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 20 |

Of the K-2 subgroup, four participants (26.7%) selected strongly agree (5), five selected (33.3%) agree (4), and three participants (20%) selected the neutral response of neither agree nor disagree. From the 3-5 subgroup, three participants (20%) selected strongly agree (5). From these responses, the researcher perceived participants of both subgroups now understood how Common Core standards could be addressed using agriculture as a teaching context.

In addition to the Likert scale items, the researcher analyzed participant responses to item 26 of the follow-up survey to determine participant perceptions of the impact of the professional learning experience and the use of agriculture as a context for teaching and learning. Table 25 provides a description of participant responses with regard to item 26 on the follow-up assessment, “What personal concerns, if any, do you still have using agriculture as a teaching context?”

Table 25

*Participant Responses to Areas of Concern Regarding STEM Agricultural Literacy Follow-up Item 26*

| ID | Participant Responses | Identified SoC |
|---|---|---|
| 2 | No major concerns except time. | Task (Management) |
| 3 | None cannot wait to share with team members | Impact (Collaboration) |
| 4 | No concerns. I think it would be a great learning experience for my students. | Impact (Consequence) |
| 6 | Having appropriate materials and how to use them | Self (Personal) |
| 10 | Having the resources and time that would be required. | Task (Management) |
| 11 | No major concerns. Great experience! I just hope I have learned enough to use this the rest of the year. | Self (Personal) |
| 14 | As usual how will this impact my students, especially in a tested grade. | Impact (Consequence) |
| 15 | My biggest concern is if I will be good at teaching it. | Self (Informational) |
| 17 | None; except how it will impact my students learning. | Impact (Consequence) |
| 19 | None; except I wonder how else I can use this outside of STEM. | Impact (Refocusing) |
| 20 | I wonder how my colleagues will feel about using this. | Impact (Collaboration) |
| 21 | Concerned if other teachers are using it. | Impact (Collaboration) |
| 27 | None. Would like to learn more ways to get my students involved. | Impact (Consequence) |
| 28 | Having appropriate materials (I usually have to buy materials my self, but I will organize my materials for multiple uses). | Task (Management) |
| 32 | No concerns. I think it would be a great learning experience, but I wonder if my colleagues will think so. | Impact Collaboration |

Evaluation of responses to item 26 of the follow-up assessment showed one participant (6.7%) made no change from the informational stage. Two participants

(13.3%) were identified in the personal stage associated with the *self* stage of concern. Three participants (20%) were identified in the *management* stage associated with the *Task* stage of concern. Four participants (26.7%) were identified with the *consequence* stage associated with the *Impact* stage of concern. Four participants (26.7%) were identified with the *collaboration* stage associated with the *Impact* stage of concern. Comparison of individual SoC demonstrated change from participant initial concerns and concerns after attending the workshop *Dig into Learning*. The researcher included these responses in a Wordle to follow the data analysis of identified needs as conducted for Research Question 2. The Wordle was used to show dominant responses of concern participants had regarding the implementation and use of the program *Dig into Learning* after attending the program workshop (Figure 13). The researcher omitted words relating to item 26 of the follow-up survey to address participants' SoC: words included none, no, teaching, experience, impact; and transitional words including and, the, etc. The researcher found that images describing item 26 in the needs assessment and follow-up survey had similar wording, but there is a difference in the occurrence of some words. The words time, concerns, learning, and experience are readily observable as are the words concern, learning, experience, impact, think, and colleagues.

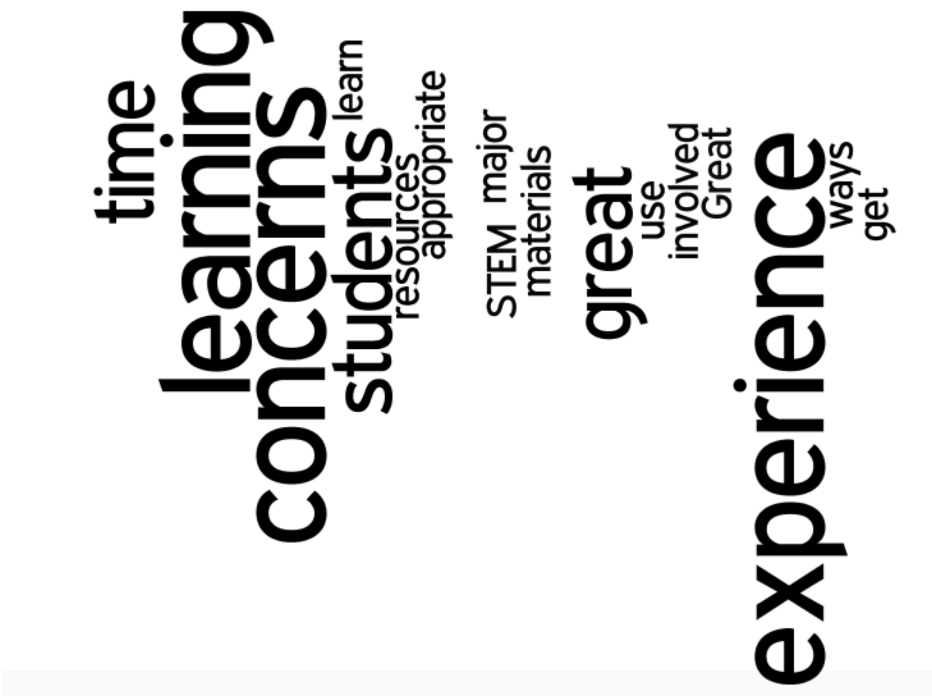


*Figure 13.* Word Cloud Explanation of SoC Follow-up Assessment
http://www.wordle.net/create

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Although responses of the follow-up survey were not very different from the needs assessment, the researcher specifically looked at key words in responses to gauge the impact of this implementation. The objective of this research question was to address teacher concerns and perceptions of the impact of professional learning. The researcher and curriculum specialists carefully formatted the workshop by analyzing needs assessment responses to support participants in professional learning growth. Table 26 compares data from the needs assessment and the follow-up assessment to show participant movement through SoC as they learned and began implementing the program *Dig into Learning*.

Table 26

*Participant Movement through SoC*

| ID | Stage Identification Needs Assessment | Stage Identification Follow-up Assessment |
|---|---|---|
| 2 | Task (3) Management | Task (3) Management |
| 3 | Impact (6) Refocusing | Impact (5) Collaboration |
| 4 | Self (2) Personal | Impact (4) Consequence |
| 6 | Self (2) Personal | Self (2) Personal |
| 10 | Task (3) Management | Task (3) Management |
| 11 | Self (2) Personal | Self (2) Personal |
| 14 | Self (2) Personal | Impact (4) Consequence |
| 15 | Self (1) Informational | Self (1) Informational |
| 17 | Self (1) Informational | Impact (4) Consequence |
| 19 | Self (2) Personal | Impact (6) Refocusing |
| 20 | Self (2) Personal | Impact (5) Collaboration |
| 21 | Self (2) Personal | Impact (5) Collaboration |
| 27 | Task (3) Management | Impact (4) Consequence |
| 28 | Self (2) Personal | Task (3) Management |
| 32 | Self (2) Personal | Impact (5) Collaboration |

Evaluation of responses to item 26, “What concerns, if any, do you have in regards using agriculture for teaching,” from the needs assessment and follow-up surveys indicated participant attitudes, perceptions, and concerns associated with the use of agriculture as a context for teaching and learning in STEM for elementary grades. Data

analysis demonstrates a shift in participants' SoC.

Of the 15 participants who completed both the needs assessment and follow-up survey, one participant, participant 3, actually deflected concerns by focusing more on collaboration with team members after attending the workshop. Participant 3 remained in the *Impact* stage of concern. In addition, five participants (33.3%) demonstrated no change. Participant 2 remained in the t*ask* stage with a focus on time and cost of the innovation. Participants 6, 10, and 11 remained in the *self* stage, focusing on personal concerns (Stage 2). Participant 10 remained in the *task* stage (Stage 3) focusing on time concerns. However, the remaining 10 participants (66.7%) demonstrated a change of concerns, with some moving through multiple SoC. Participant 2 shifted from the personal stage to the management stage. Four participants (4, 14, 17, and 27) all shifted SoC to consequence stage (Impact). Four participants (3, 20, 21, and 32) were identified in the collaboration stage (Stage 5). Finally, one participant (19) was identified in the refocusing stage of concern (Stage 6). Data indicated that overall most participants' SoC had changed. Table 27 provides the number of participants associated with SoC prior to the workshop (needs assessment) and after attending the workshop (follow-up).

Table 27

*Frequency of Concern Stages for Participants of Dig into Learning*

| Participants | Stage 0 *Uncon-cerned* | Stage 1 *Informa-tional* | Stage 2 *Personal* | Stage 3 *Manage-ment* | Stage 4 *Conse-quence* | Stage 5 *Collab-oration* | Stage 6 *Refocusing* |
|---|---|---|---|---|---|---|---|
| Needs Assessment | 0 | 2 | 9 | 3 | 0 | 0 | 1 |
| Follow-up Assessment | 0 | 1 | 2 | 3 | 4 | 4 | 1 |

The needs assessment showed two participants (13.3%) were identified in the informational stage of concern, and nine participants (60%) were identified in the *personal* stage of concern. Eleven participants (73.3%) were identified in the *self* stage of concern. Three participants (20%) were identified with the management stage (Stage 3) associated with the *task* stage of concern. Finally, one participant (6.7%) was identified with the refocusing stage (Stage 6) associated with the *impact* stage of concern. However, the researcher found that after participants attended *Dig into Learning* and were exposed to professional learning promoting the use of agriculture as a context for teaching and learning in STEM education, participants' SoC began to shift. Of the 15 participants who completed the needs assessment and follow-up assessment, one participant (6.7%) made no change from the informational stage. Two participants (13.3%) were identified in the personal stage associated with the *self* stage of concern. Three participants (20%) were identified in the *management* stage associated with the *task* stage of concern. Four participants (26.7%) were identified with the *consequence* stage associated with the *impact* stage of concern. Four participants (26.7%) were identified with the *collaboration* stage associated with the *impact* stage of concern. Comparison of individual SoC demonstrated change from participant initial concerns and concerns after attending the workshop *Dig into Learning*. In the evaluation of the follow-up assessment, the researcher identified nine participants (60%) identified under the *impact* stage of concern, versus the needs assessment with only one participant (6.7%) who was identified in the *impact* stage. In both the follow-up and needs assessment, three participants (20%) were identified in the management stage associated with the *task* stage of concern. In the needs assessment, 11 participants (73.3%) were identified in the *self* stage of concern; and in the follow-up survey, only three participants (20%) were

identified in the *self* stage. In the needs assessment, only one participant (6.7%) was identified with the *impact* stage of concern; however, the researcher identified nine participants in the *impact* stage of concern. The evaluation of these data indicated that participant concerns had changed.

**Interview items.** In addition to analyzing participant concerns, the researcher analyzed participant perceptions of the impact of professional learning offered through the workshop from specific interview items. There were five participants interviewed utilizing a researcher-created branching interview process as found in Appendix E. To address Research Question 3, "What are elementary teacher perceptions of the impact of professional learning of a STEM agricultural literacy curriculum innovation," the research utilized participant responses from item 3 of the LoU branching interview.

Table 28 provides participant responses to item 3 as it addresses participant perceptions of needs and support of those needs.

Table 28

*Responses to Interview Item 3: Do you feel your needs were met in regards to the use of agriculture as a context for teaching and learning?*

| Participant ID | Answer | Analysis |
|---|---|---|
| 4 | "Oh yes, I would have never considered myself an agriculturally literate person, much less someone who would choose to teach agriculture in my lessons, but the resources provided and specific skills discussed to manage time were so helpful. It was a great way to network with other teachers across the county on ways they integrate lessons to save on time when there is so much to do in a day" (Teacher 4, personal communication, November 4, 2015). | Needs were met<br><br>Positive |
| 1 | "The Ag in the Classroom workshop was great and I feel like I need to use their website and resources more often...Hope we can have an Ag Day that will bring students, parents, teachers and the community on board for showing more agriculture appreciation especially since our county is so dependent on it. It was a fun workshop and enjoyed doing the activities in small groups. It helped us see how we could do these things with our students. I truly felt like my needs were met and my voice was heard in completing the needs assessment and Follow-up survey" (Teacher 17, personal communication, November 14, 2015). | Needs were met<br><br>Positive |
| 21 | "I had very little experience before the training. I had done experiments using vegetables or fruits or animals but had never made the connection to Ag in our area. After attending the workshop I have a totally new understanding and consider myself an agriculturally literate person. I have never attended a workshop that I truly felt like my voice had been heard and applied to our learning, I wish more workshops asked what we wanted before we attended" (Teacher 21, personal communication, November 10, 2015). | Needs were met<br><br>Positive |
| 32 | "The breakout session was very motivating to me! We had a great time with corn in our kindergarten classroom as part of our Thanksgiving unit. The examples she showed us, the materials she provided us with and the opportunity to actually engage in the activities was very motivating. Once I was back in my classroom I enjoyed looking at all of the materials provided for us on the flash drive and in the handouts" (Teacher 32, personal communication, November 19, 2015). | Needs were met<br><br>Positive |
| 4 | "Yes, I did not have specific needs I was just curious about the idea of using agriculture. But I will say that this was the most effective workshop I have attended and I have since been very supported in my hopes to use agriculture in my classroom. I love going to a workshop that provides usable resources, you know the things that you can actually take back to your classroom and use. Not just papers that I am never going to read" (Teacher 14, personal communication, December 3, 2015). | Needs were met<br><br>Positive |

All five participants who completed the LoU branching interview process made

clear responses that were analyzed into common themes to further describe participant perceptions of the impact of professional learning after attending the workshop. The researcher identified all five participants had positive perceptions of professional learning, and professional learning had indeed impacted participants' SoC.

**Summary.** Research Question 3, "What are elementary teacher perceptions of the impact of professional learning of a STEM agricultural literacy curriculum innovation," was addressed utilizing data collected from the needs assessment and follow-up survey. The researcher then went a step further to analyze participant open responses to item 26 of the needs assessment and follow-up survey. The researcher utilized Hall and Hord's (2015) SoC to categorize participant levels of concern. A table was formatted to demonstrate participant change in SoC. The researcher also utilized responses from five participants who participated in the LoU branching interview process. In utilizing these final results, the researcher was able to finalize data and provide an explanation to support data findings.

**Research Question 4.** What are elementary teacher perceptions of the impact of initial implementation of agricultural literacy curriculum integration?

**Research Question 4a.** What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation as measured by the statistical analysis of the change in pre and posttest survey questions?

**Null Hypothesis 4a.** Elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation remain unchanged from the pre and posttest survey questions.

**Alternative Hypothesis 4a.** Elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation change

from the pre and posttest survey questions.

**Research Question 4b.** What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation as measured by teacher interviews?

Research Question 4 provided the product in completion of the program evaluation. The product evaluation assessed the outcomes of the innovation. The impact of this innovation was measured with both a quantitative (4a) and qualitative (4b) component. To answer Research Question 4a, the researcher considered needs assessment and follow-up assessment data from the treatment group in order to determine the impact of the implementation of an agricultural literacy innovation. The treatment group consisted of participants who had completed both the needs assessment and the follow-up assessment. The researcher was able to ensure participant pre/postscores of the needs assessment and follow-up assessment by assigning participant ID numbers associated with participant email addresses. Participant email addresses were logged as participants signed up for the workshop and were logged each time participants completed surveys. Table 29 demonstrates each participant's Likert scale responses to items 1-5, 8, and 10-14 for the needs assessment and follow-up surveys.

Table 29

*Participant Likert Responses to Needs Assessment and Follow-up Items 1-5, 8, 10-14*

| | | Q 1 | Q 2 | Q 3 | Q 4 | Q 5 | Q 8 | Q 10 | Q 11 | Q 12 | Q 13 | Q 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Participant 2 | Needs Assessment | 1 | 4 | 4 | 1 | 2 | 4 | 3 | 5 | 2 | 2 | 3 |
| | Follow-up | 5 | 5 | 5 | 5 | 3 | 4 | 4 | 4 | 4 | 4 | 4 |
| Participant 3 | Needs Assessment | 1 | 5 | 5 | 3 | 3 | 2 | 4 | 5 | 1 | 1 | 5 |
| | Follow-up | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Participant 4 | Needs Assessment | 5 | 5 | 5 | 2 | 5 | 5 | 5 | 4 | 1 | 2 | 5 |
| | Follow-up | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 5 | 4 | 3 | 3 |
| Participant 6 | Needs Assessment | 2 | 3 | 3 | 4 | 1 | 3 | 5 | 5 | 1 | 2 | 5 |
| | Follow-up | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 3 |
| Participant 10 | Needs Assessment | 2 | 5 | 5 | 3 | 1 | 1 | 4 | 4 | 3 | 3 | 5 |
| | Follow-up | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 3 | 3 | 5 |
| Participant 11 | Needs Assessment | 2 | 5 | 5 | 1 | 5 | 2 | 4 | 4 | 1 | 2 | 4 |
| | Follow-up | 4 | 5 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 |
| Participant 14 | Needs Assessment | 2 | 5 | 5 | 4 | 2 | 3 | 5 | 4 | 5 | 5 | 5 |
| | Follow-up | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 |
| Participant 15 | Needs Assessment | 2 | 4 | 5 | 2 | 3 | 3 | 5 | 5 | 1 | 1 | 5 |
| | Follow-up | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 5 | 5 |
| Participant 17 | Needs Assessment | 2 | 3 | 5 | 2 | 2 | 3 | 4 | 5 | 2 | 2 | 4 |
| | Follow-up | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 |

(continued)

| | | Q 1 | Q 2 | Q 3 | Q 4 | Q 5 | Q 8 | Q 10 | Q 11 | Q 12 | Q 13 | Q14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Participant 19 | Needs Assessment | 3 | 5 | 5 | 2 | 3 | 3 | 4 | 5 | 2 | 2 | 3 |
| | Follow-up | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 |
| Participant 20 | Needs Assessment | 3 | 5 | 4 | 2 | 1 | 3 | 4 | 5 | 3 | 3 | 5 |
| | Follow-up | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 4 |
| Participant 21 | Needs Assessment | 3 | 3 | 3 | 2 | 2 | 4 | 4 | 4 | 3 | 2 | 3 |
| | Follow-up | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 |
| Participant 27 | Needs Assessment | 3 | 4 | 4 | 3 | 2 | 3 | 4 | 5 | 2 | 1 | 4 |
| | Follow-up | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Participant 28 | Needs Assessment | 3 | 3 | 5 | 3 | 3 | 2 | 4 | 5 | 3 | 2 | 3 |
| | Follow-up | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 |
| Participant 32 | Needs Assessment | 3 | 5 | 5 | 3 | 4 | 2 | 5 | 5 | 4 | 1 | 5 |
| | Follow-up | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |

Evaluation of data shows responses from 15 participants who completed both the needs assessment and follow-up assessment. These data were utilized in statistical tests to determine if data were statically significant. The mean score of each survey item was collected and mean differences were recorded. A paired samples *t* test was applied to the needs assessment and follow-up assessment items (mean score) to determine the impact on implementation of the agricultural literacy curriculum integration. For Research Question 4, needs assessment and follow-up responses to items 1-5, 8, and 10-14 were analyzed. In addition to Likert scale items, qualitative data in the form of interview items

were analyzed to deepen understanding of data collected from the needs assessment and follow-up surveys.

**Research Question 4a.** The first analysis completed to determine the impact of *Dig into Learning* included a statistical analysis of the mean difference in the needs assessment and follow-up assessment scores for the treatment group and the total population. One limitation noted in Chapter 5 was that the treatment group sample size was small (*N*=15) in comparison to the total population (*N*=35). The final treatment group for evaluation included 15 participants (*N*=15). All of these participants had fully completed both the needs assessment and the follow-up survey.

To measure the effectiveness of the initial implementation of *Dig into Learning*, the researcher analyzed responses from the 15 participants who completed both the needs assessment and follow-up assessment to determine the change in mean score of assessment responses. The mean of participant responses was taken per item, and the change variance was recorded. Each item was analyzed separately to distinguish participant continued interest and/or lack of concern for the use of agriculture as a context for teaching and learning. Participant survey responses were analyzed to determine the impact of teacher perceptions of the initial implementation of *Dig into Learning*. The researcher utilized the statistical analysis tool SPSS software to collect and evaluate data. As the researcher began evaluation, data were input into an Excel document and then cross-examined for any recurrent patterns. In doing so, the researcher found that not all surveys were completed correctly. The researcher then went through and selected participants who had fully completed both the needs assessment and follow-up survey. This process limited the researcher to only 15 participants for final evaluation of data. The researcher then input the compiled data into SPSS software and ran a paired samples

*t* test to evaluate change in pre/postsurvey responses. A paired samples *t* test was applied to the needs assessment and follow-up assessment scores (mean) in the treatment group sample (*N*=15). The researcher collected and evaluated data utilizing SPSS software and had a retired statistics professor look at the data to make sure correct samples were collected and evaluated to ensure relevant data evaluation. Table 30 demonstrates the average mean scores for items 1-5, 8, and 10-14 from the needs assessment and follow-up assessment.

Table 30

*Changes in Mean Scores from Needs and Follow-up Assessment*

| Survey Items | Needs Assessment | Follow-up | Difference |
|---|---|---|---|
| 1. I use agriculture to contextualize STEM concepts and the North Carolina State Standards. | 2.467 | 4.467 | 2 |
| 2. I use agriculture as a context for learning in my elementary classroom. | 4.267 | 4.533 | 0.266 |
| 3. I believe agriculture is a relevant resource to use for teaching core curriculum subjects such as science and math. | 4.533 | 4.533 | 0.0 |
| 4. I understand the meaning of agricultural literacy. | 2.467 | 4.4 | 1.933 |
| 5. I consider myself an agriculturally literate person. | 2.6 | 4 | 1.40 |
| 8. I use STEM (Science, Technology, Engineering, and Math) activities in my daily lessons. | 2.867 | 4.067 | 1.2 |
| 10. I want to learn more about NALOs connecting to my specific grade level standards. | 4.267 | 4.133 | -0.13 |
| 11. I am interested in how to use agricultural resources such as integrating books about agriculture into reading lessons, hands-on experiences, etc. to promote STEM learning. | 4.67 | 4.333 | -0.337 |
| 12. I have access to agricultural resources (lesson plans, books, videos, science kits, etc.) to integrate agricultural content/concepts into my STEM instruction. | 2.267 | 4.133 | 1.866 |
| 13. I have a solid grasp of agricultural concepts that could be part of my grade level STEM instruction. | 2.067 | 4.067 | 2 |
| 14. I know how integrating NALOs and Agriculture as a context for learning may be more effective in integrating instruction than resources I currently use. | 4.267 | 4.2 | -0.067 |

Overall, the change in mean difference from the needs assessment and follow-up assessment responses showed positive growth. The positive impact accepts the alternative hypothesis that participant perceptions of the use of agriculture had indeed changed after attending the workshop *Dig into Learning*. The researcher utilized a coding system to identify the level of impact based on the survey items assessed to answer

Research Question 4. The researcher, to identify change variances of mean scores from the needs assessment and follow-up survey, created codes. The codes were identified in accordance to the difference of means associated with each research question evaluated. If average of responses demonstrated a negative difference, the researcher addressed this with low impact on teacher perceptions. If the response demonstrated positive growth, the researcher addressed the change as an impact on teacher perceptions regarding agriculture as a context for learning. The difference in change variance was then turned into a code in order to analyze participant perceptions of the use of agriculture and the impact of professional learning. The codes for change variance of mean score for pre/postassessment items were as follows: Low, -0.50-0.25 change in mean score; Moderately Low, -0.25-0 change in mean score; Moderate, 0-1 change in mean score; Moderately High, 1-1.5 change in mean score; and High, 1.5-2 change in mean score.

Table 31 provides an explanation of impact coding created by the researcher to determine level of impact based on mean of participant responses to the needs assessment and follow-up surveys.

Table 31

*Impact Coding of Needs Assessment and Follow-up Surveys*

| Survey Items | Difference | Impact Code |
|---|---|---|
| 1. I use agriculture to contextualize STEM concepts and the North Carolina State Standards. | 2 | High |
| 2. I use agriculture as a context for learning in my elementary classroom. | 0.266 | Moderate |
| 3. I believe agriculture is a relevant resource to use for teaching core curriculum subjects such as science and math. | 0.0 | Moderate |
| 4. I understand the meaning of agricultural literacy. | 1.933 | High |
| 5. I consider myself an agriculturally literate person. | 1.40 | Moderately High |
| 8. I use STEM (Science, Technology, Engineering, and Math) activities in my daily lessons. | 1.2 | Moderately High |
| 10. I want to learn more about NALOs connecting to my specific grade level standards. | -0.13 | Low |
| 11. I am interested in how to use agricultural resources such as integrating books about agriculture into reading lessons, hands-on experiences, etc. to promote STEM learning. | -0.337 | Low |
| 12. I have access to agricultural resources (lesson plans, books, videos, science kits, etc.) to integrate agricultural content/concepts into my STEM instruction. | 1.866 | High |
| 13. I have a solid grasp of agricultural concepts that could be part of my grade level STEM instruction. | 2 | High |
| 14. I know how integrating NALOs and Agriculture as a context for learning may be more effective in integrating instruction than resources I currently use. | -0.067 | Moderately Low |

In order to determine statistical significance in the pre/postscores of the needs

assessment and follow-up surveys, a paired samples *t* test was conducted to determine if the change in mean was significantly different. The needs assessment (M=3.34) average and the follow-up (M=4.26) average have a positive difference in change (0.92). Table 32 displays the results of the paired samples statistics of the needs assessment and follow-up assessment mean scores.

Table 32

*Statistical Analysis of Items 1-5, 8, and 10-14 Pre and Postsurvey*

| Form of Assessment | Mean | Standard Deviation | Standard Error Mean |
|---|---|---|---|
| Needs Assessment | 3.34 | 1.04 | .31 |
| Follow-up | 4.26 | 0.19 | .06 |

In assessing the data presented from the paired samples statistics the follow-up assessment had a higher mean score, indicating that participants recorded higher Likert scale scores after attending the program workshop *Dig into Learning*. The average of responses from the follow-up assessment was calculated at 4.3 with a standard deviation 0.20 as opposed to the needs assessment survey with a mean score of 3.34 and a standard deviation of 1.04. Table 33 shows the results of the paired samples *t* test in order to determine significant difference ($p<.05$) in the pre/postscores. The difference in the needs assessment and follow-up assessment scores were statistically significant at the 95% confidence interval as indicated by the paired samples *t* test ($p=.01$) rejecting the null hypothesis.

Table 33

*Pre and Postsurvey Differences for Needs Assessment and Follow-up Scale Items*

| Needs Assessment/Follow-up Assessment Items 1-5, 8, and 10-14 | Mean Difference | SD | *t* | Sig (2-tailed) |
|---|---|---|---|---|
| Pre and postsurvey | .92 | .97 | 3.13 | .01 |

*Note.* * p<.05.

Quantitative data instruments evaluated by the researcher concluded significance of teacher perceptions of the initial implementation of *Dig into Learning*. Based on the results ($p$=0.01), the paired $t$ test revealed a statistically significant difference in the needs assessment and follow-up assessment at the 95% confidence interval, rejecting the null hypothesis.

**Research Question 4b.** The researcher collected qualitative data from open-response items and branching interviews. The researcher used qualitative data to further explain data collected from the needs assessment and follow-up surveys. Of the 15 participants who completed the needs assessment and follow-up surveys, five participants stated yes to the final item regarding their participation in individual interviews. The researcher conducted LoU branching interviews with these five participants. For purposes of reliability, the researcher utilized Hall and Hord's (2015) explanation of the branching interview protocol and an outside observer to eliminate bias and subjectivity. The outside observer was a prominent community member who attended the workshop in support of the innovation, because it was so important to our community and school district.

**Branching interviews.** Branching interviews were the qualitative component of

Research Question 4. The researcher utilized the process of LoU branching interviews to answer Research Question 4b, "What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation as measured by teacher interviews?"

The first interview item asked participants if they were currently using or had used the innovation *Dig into Learning.* If respondents answered yes, the researcher asked interview item 2, "What are your beliefs on the worth or effectiveness regarding the use of agriculture as a context for teaching and learning?" If the participant responded no, the researcher asked participants the item, "Do you have plans to use this innovation in the future? Have you set a date to begin use?" Once the participant answered this item, the researcher identified the participant as a LoU 0, I, II. Regardless of response, all participants answered item 2. Table 34 provides responses given to interview item 1, "Are you currently using or have you used the innovation?"

Table 34

*Responses to Interview Item 1: Are you currently using or have you used the innovation?*

| Participant ID | Answer | Analysis | Next Step |
|---|---|---|---|
| 4 | "No, I have not begun use of program materials. I have been so caught up in progress monitoring that I have given little thought to anything else. But I am extremely excited about the things I learned and resources that were made available to me at the workshop. I have every intention of beginning several projects in the Spring and have sought other resources to use in addition to those I already have. The workshop provided me with the know how to navigate to find really cool and beneficial materials to use for my students" (Teacher 4, personal communication, November 4, 2015). | Not yet begun<br>Positive<br>Excited | Q. 2 |
| 17 | "I have used hands-on projects in the past such as gardens and earth worm beds to teach my students, but I have found a new appreciation for ways to use these ideas to its full potential. I would have never considered myself an "Ag" teacher, much less someone who could call themselves "Ag literate" but attending the workshop and seeing exactly how to put everything together put it all into perspective. My perceptions of the use of agriculture as a teaching tool was only strengthened by the professional development I received and since I have implemented some of the very lessons I learned I have a new found appreciate for agriculture. I can't wait to attend more" (Teacher 17, personal communication, November 14, 2015). | Have used agriculture<br>Strengthened<br>Positive | Q. 2 |
| 21 | "I hate to admit, but I never considered incorporating agriculture into my Science lesson, any lesson at all. I was aware of all the agriculture in our area but never thought of the importance of incorporating into my classroom. After attending the workshop, I now see the importance of teaching it and making students aware of how important agriculture is to our lives. Ever since the workshop I try to make connections to agriculture in my lessons every day" (Teacher 21, personal communication, November 10, 2015). | Have used agriculture<br>Strengthened<br>Positive | Q. 2 |

(continued)

| Participant ID | Answer | Analysis | Next Step |
|---|---|---|---|
| 32 | "My perceptions have been changed because my eyes have been opened and I am constantly looking for ways to use agricultural concepts to teach in all content areas. Students have always been very engaged and interested in my fall units such as apples and pumpkins, but Dig Into Learning gave me ideas and inspired me to really make these units come alive. I began to look for ways to literally dig deeper into the possibilities for this unit. Kindergarten students learn best from sensory and hands on activities and using agriculture as an ongoing theme in my classroom has really helped me to keep my students motivated and engaged! For example, during our pumpkin unit we took our investigations further than ever before with science, math, reading, and writing activities" (Teacher 32, personal communication, November 19, 2015). | Have used agriculture<br>Strengthened<br>Positive | Q. 2 |
| 14 | "I need to add agriculture into my lessons, but have always strayed away because of my lack of knowledge. I am not really doing much with it right now, but I firmly understand the importance of integrating it into the classroom and want my students to know more. I have accessed the National Ag Literacy Outcomes and used several of the website resources to acclimate myself to know more about agriculture, I found the curriculum matrix extremely easy to use, all you do is search by grade level or subject and the work is done for you…its AWESOME. I guess my point is I feel totally supported in the use of agriculture in my teaching which is why I am certainly going to use it." (Teacher 14, personal communication, December 3, 2015). | Not yet begun<br>Positive<br>Excited | Q. 2 |

As participants responded to interview item 1, the researcher utilized the branching interview protocol to address the next item asked. The researcher then formatted a table to identify participants' LoU regarding the innovation. Table 35 demonstrates study classifications of the five participants who participated in individual interviews.

Table 35

*Participants' LoU*

| ID | Study Classification |
|---|---|
| 4 | Non-User |
| 17 | User |
| 21 | User |
| 32 | User |
| 14 | Non-User |

Evaluation of comments indicated that three participants (60%) were identified as users of the innovation, while two participants (40%) were identified as non-users. However, based on responses to interview items, the researcher identified that all participants either used or planned to use the innovation. Table 36 displays participant responses to interview item 2, "What are your beliefs of worth or effectiveness regarding the use of agriculture as a context for teaching and learning?"

Table 36

*Responses to Interview Item 2: What are your beliefs of worth or effectiveness regarding the use of agriculture as a context for teaching and learning? Do you have plans to make any changes?*

| ID | Answer | Analysis | Next Step |
|---|---|---|---|
| 4 | "I truly believe the integration of agriculture concepts will benefit students because it is something tangible. Even those that know very little about agriculture can relate to foods we eat. I have plans to begin use of this program soon and can't wait to see the impact it has on my students" (Teacher 4, personal communication, November 4, 2015). | Beneficial to students<br><br>Positive | Q. 3 |
| 17 | "My perceptions of agriculture have just strengthened as a result of PD (professional development) and it is so good to see others engaged/interested in Ag as well. Please continue to offer more workshops like this one" (Teacher 17, personal communication, November 14, 2015). | Beneficial to students<br><br>Positive | Q. 3<br><br>Q. 4 |
| 21 | "I now see the importance of teaching it and making students aware of how import agriculture is to our lives. I am trying to use agricultural examples and make connections within my class" (Teacher 21, personal communication, November 10, 2015). | Beneficial to students<br><br>Positive | Q. 3<br><br>Q. 4 |
| 32 | "My perceptions toward agriculture have always been positive because my husband has swine farms and also works in in the agricultural industry in a business position. However, "Dig Into Learning" gave me ideas and helped me begin to form new ideas about how deeply we can use agricultural themes and units to teach all of our content areas. My perceptions have been changed because my eyes have been opened and I am constantly looking for ways to use agricultural concepts to teach in all content areas. Students have always been very engaged and interested in my fall units such as apples and pumpkins, but Dig Into Learning gave me ideas and inspired me to really make these units come alive. I began to look for ways to literally dig deeper into the possibilities for this unit. Kindergarten students learn best from sensory and hands on activities and using agriculture as an ongoing theme in my classroom has really helped me to keep my students motivated and engaged! For example, during our pumpkin unit we took our investigations further than ever before with science, math, reading, and writing activities" (Teacher 32, personal communication, November 19, 2015). | Beneficial to students<br><br>Positive | Q. 3<br><br>Q. 4 |
| 14 | "Although I have never used agriculture in my classroom I have truly learned the benefit it can have on my instruction. I never realized how many standards could be integrated into something so basic and simple. I am so excited to think about my students' reactions. Initially I thought this would require a lot of extra work, but it seems very simple to integrate because a lot of what we need is right around us. I think I will begin use in the Spring, hopefully plant a garden and use the green house lesson that was shown in the 3rd grade session" (Teacher 14, personal communication, December 3, 2015). | Beneficial to students<br><br>Positive | Q. 3 |

All five participants, regardless of response to interview item 1, were instructed to answer item 2. Responses to item 2 determined the researcher's next steps in the interview process. If a participant responded no to this item the researcher asked item 3. However, if participants responded yes with an explanation, the researcher asked items 3 and 4. Table 37 provides participant responses to item 3.

Table 37

*Responses to Interview Item 3: Do you feel your needs were met in regards to the use of agriculture as a context for teaching and learning?*

| ID | Answer | Analysis | Next Step |
|---|---|---|---|
| 4 | "Oh yes, I would have never considered myself an agriculturally literate person, much less someone who would choose to teach agriculture in my lessons, but the resources provided and specific skills discussed to manage time were so helpful. It was a great way to network with other teachers across the county on ways they integrate lessons to save on time when there is so much to do in a day" (Teacher 4, personal communication, November 4, 2015). | Needs were met<br><br>Positive | STOP |
| 17 | "The Ag in the Classroom workshop was great and I feel like I need to use their website and resources more often...Hope we can have an Ag Day that will bring students, parents, teachers and the community on board for showing more agriculture appreciation especially since our county is so dependent on it. It was a fun workshop and enjoyed doing the activities in small groups. It helped us see how we could do these things with our students. I truly felt like my needs were met and my voice was heard in completing the needs assessment and Follow-up survey" (Teacher 17, personal communication, November 14, 2015). | Needs were met<br><br>Positive | Q. 4 |
| 21 | "I had very little experience before the training. I had done experiments using vegetables or fruits or animals but had never made the connection to Ag in our area. After attending the workshop I have a totally new understanding and consider myself an agriculturally literate person. I have never attended a workshop that I truly felt like my voice had been heard and applied to our learning, I wish more workshops asked what we wanted before we attended" (Teacher 21, personal communication, November 10, 2015). | Needs were met<br><br>Positive | Q. 4 |
| 32 | "The breakout session was very motivating to me! We had a great time with corn in our kindergarten classroom as part of our Thanksgiving unit. The examples she showed us, the materials she provided us with and the opportunity to actually engage in the activities was very motivating. Once I was back in my classroom I enjoyed looking at all of the materials provided for us on the flash drive and in the handouts" (Teacher 32, personal communication, November 19, 2015). | Needs were met<br><br>Positive | Q. 4 |
| 4 | "Yes, I did not have specific needs I was just curious about the idea of using agriculture. But I will say that this was the most effective workshop I have attended and I have since been very supported in my hopes to use agriculture in my classroom. I love going to a workshop that provides usable resources, you know the things that you can actually take back to your classroom and use. Not just papers that I am never going to read" (Teacher 14, personal communication, December 3, 2015). | Needs were met<br><br>Positive | STOP |

All five participants answered interview item 3, but two participants did not continue to item 4. Table 38 shows responses to interview item 4.

Table 38

*Responses to Interview Item 4: What kinds of changes are you making in your use of the innovation?*

| ID | Answer | Analysis | Next Step |
|---|---|---|---|
| 17 | "In Kindergarten, most all subject are integrated in weekly themes and I have decided the more you learn about STEM, the more you realize that is what kindergarten is all about. I plan to change my centers to be more STEM and agriculture focused. The higher level of questioning makes even the simplest task STEM" (Teacher 17, personal communication, November 14, 2015). | Have used agriculture<br><br>Strengthened<br><br>Positive Change | Q. 5 |
| 21 | "I would say that I have made drastic changes…I had never used agriculture much less the program in my classroom. As soon as I got to school after the workshop I worked in one of the lessons demonstrated at the workshop. Some changes I have made were simple just adding in daily facts about different commodities and other things related to our area that the kids could relate to" (Teacher 21, personal communication, November 10, 2015). | Have used agriculture<br><br>Strengthened<br><br>Positive Change | Q. 5 |
| 32 | "One of the activities we learned I added into my Thanksgiving unit "All About Corn" and have since added an agriculture/farming center into my center time. I wouldn't say that I had made any changes to the innovation itself" (Teacher 32, personal communication, November 19, 2015). | Have used agriculture<br><br>Strengthened | Q. 5 |

Interview item 4 addressed participants making a change within the innovation. Participant 4 did not continue to item 4 because response to item 2 indicated the participant had not yet begun use of the innovation. Table 39 shows responses to interview item 5.

Table 39

*Responses to Interview Item 5: Are you coordinating your use of the innovation with other colleagues utilizing the innovation?*

| ID | Answer | Analysis | Next Step |
|---|---|---|---|
| 17 | "I am coordinating this innovation with my grade level team members - Kindergarten teachers and have since shared this in a cross grade level planning between K-2 teachers" (Teacher 17, personal communication, November 14, 2015). | Collaboration | Q. 6<br>Q. 7 |
| 21 | "I have not yet shared this with any of my colleagues" (Teacher 21, personal communication, November 10, 2015). | No Collaboration | Q. 6 |
| 32 | "I have begun to use the NALOs as a guide during all of my units and teaching, and I am looking forward to delving into them deeper.  As grade level chair I have shared this knowledge and these resources with my colleagues" (Teacher 32, personal communication, November 19, 2015). | Collaboration | Q. 6<br>Q. 7 |

Interview item 5 addressed participant plans with coordinating the use of the innovation *Dig into Learning* with colleagues.  Participants who demonstrated they had begun use of the innovation and had made changes to their use of agriculture were then asked interview item 5.  Participant 17 demonstrated the process of coordinating with colleagues on the use of this innovation.  Participant 17 was asked interview item 6 and item 7.  Participant 21 had not shared or collaborated with colleagues regarding the innovation but was prompted to answer interview item 6.  Participant 32 was prompted to answer both interview items 6 and 7.  Table 40 demonstrates participant responses to interview item 6.

Table 40

*Responses to Interview Item 6: Do you feel the integration of agriculture as a context for teaching and learning is beneficial to your students?*

| ID | Answer | Analysis | Next Step |
|---|---|---|---|
| 17 | "Oh yes, I use agriculture in my classroom now and the kids love it. They learn so much and can apply so many life experiences" (Teacher 17, personal communication, November 14, 2015). | Integration of Agriculture is beneficial to students<br><br>Positive | Q. 7 |
| 21 | "When agriculture literacy becomes more of a focus, it seems to be able to tie in with many themes and lessons...so yes I think it is very beneficial to our students" (Teacher 21, personal communication, November 10, 2015). | Integration of Agriculture is beneficial to students<br><br>Positive | STOP |
| 32 | "The experiences that I have encountered have been that agriculture can be used to teach so many content areas. Also that the students truly enjoy the opportunity to engage with agriculture, nature and the environment, which makes it a very effective platform for teaching" (Teacher 32, personal communication, November 19, 2015). | Integration of Agriculture is beneficial to students<br><br>Positive | Q. 7 |

Interview item 6 focused on participant perceptions, asking how they felt about the integration of agriculture as a context for teaching and learning and its impact on their students. Three participants were asked this item regardless of answer interview item 5. Of the participants who continued in this process, all three had positive responses regarding the impact of agriculture on their students. This question was unique because in order to give an appropriate answer, the participants had to be using the innovation or have previous experience with the integration of agriculture into their classrooms. All three participant responses indicated their personal views on agriculture and their impact in their classroom. Table 41 provides the responses to item 7, the final item in the branching interview process, which asked participants, "What are your intentions on

continuing this innovation?"

Table 41

*Responses to Interview Item 7: What are your intentions of continuing this innovation?*

| ID | Answer | Analysis |
|---|---|---|
| 17 | "I have all intentions of continuing this innovation for many years to come" (Teacher 17, personal communication, November 14, 2015). | Continuation of the Innovation<br><br>Positive |
| 32 | "I have all intentions of continuing this innovation in my classroom and plan to use more things related to agriculture in my classroom the rest of the school year and next year. I am so excited about this innovation and really feel it is beneficial to my students and my school. I have plans to not only continue this innovation but have talked with my principal about conducting this similar professional development for my school before the next school year" (Teacher 32, personal communication, November 19, 2015). | Continuation of the Innovation<br><br>Positive |

Two participants were prompted to answer item 7 based on responses given to the researcher/interviewer for item 5 of the branching interview. Item 7 addressed participant plans to continue the use of the innovation. Participant 17 briefly described intentions to continue this innovation. The researcher viewed this as a positive response that proved this innovation did indeed have an impact on participant use of agriculture in the classroom. Participant 32 went a step further and described plans to offer a workshop of this nature at a different school site. In offering this workshop, more teachers from this elementary school could be exposed to what the world of agriculture can offer to the classroom. Table 42 demonstrates study classifications of the five participants who participated in LoU branching interviews.

Table 42

Participants' LoU

| ID | Study Classification |
|---|---|
| 4 | Non-User |
| 17 | User |
| 21 | User |
| 32 | User |
| 14 | Non-User |

In order to study the effects of the implementation process and participant perceptions, the researcher examined qualitative responses given from the survey assessment and individual interviews.

Of the five participants who agreed to participate in individual interviews, four participants answered yes to using the innovation. The researcher followed with questions that elaborated on ways of use and any changes that participants made to their use of *Dig into Learning*. One participant responded no to the use of the innovation.

> No, I have not begun use of program materials. I have been so caught up in progress monitoring that I have given little thought to anything else. But I am extremely excited about the things I learned and resources that were made available to me at the workshop. I have every intention of beginning several projects in the Spring and have sought other resources to use in addition to those I already have. The workshop provided me with the know how to navigate to find really cool and beneficial materials to use for my students. (Teacher 4, personal

communication, November 4, 2015)

In analyzing this response and following Hall and Hord's (2015) branching format for the LoU interview, the researcher deemed participant 4 as a level II user in the preparation phase of use. This participant has made every effort to prepare herself for proper implementation of this program. The participant even indicated a specific time to start using agriculture literacy integration.

The branching interview process indicated two of the participants (17 and 21) were currently at level III, mechanical use. Mechanical use refers to efforts being placed on use of an innovation from day to day.

> I have used hands-on projects in the past such as gardens and earth worm beds to teach my students, but I have found a new appreciation for ways to use these ideas to its full potential. I would have never considered myself an "Ag" teacher, much less someone who could call themselves "Ag literate" but attending the workshop and seeing exactly how to put everything together put it all into perspective. My perceptions of the use of agriculture as a teaching tool was only strengthened by the professional development I received and since I have implemented some of the very lessons I learned I have a new found appreciate for agriculture. I can't wait to attend more. (Teacher 17, personal communication, November 14, 2015)

> I hate to admit, but I never considered incorporating agriculture into my Science lesson, any lesson at all. I was aware of all the agriculture in our area but never thought of the importance of incorporating into my classroom. After attending the workshop, I now see the importance of teaching it and making students aware of how important agriculture is to our lives. Ever since the workshop I try to make connections to agriculture in my lessons every day. (Teacher 21, personal

communication, November 10, 2015)

The fourth participant (32) was a level IV B user, refinement level. Refinement refers to the use of an innovation to increase the impact. In discussing personal connections to this participant's life and class, the teacher uses agriculture as a context for learning to engage students in more productive conversation by teaching them to learn from all senses.

> My perceptions have been changed because my eyes have been opened and I am constantly looking for ways to use agricultural concepts to teach in all content areas. Students have always been very engaged and interested in my fall units such as apples and pumpkins, but Dig Into Learning gave me ideas and inspired me to really make these units come alive. I began to look for ways to literally dig deeper into the possibilities for this unit. Kindergarten students learn best from sensory and hands on activities and using agriculture as an ongoing theme in my classroom has really helped me to keep my students motivated and engaged! For example, during our pumpkin unit we took our investigations further than ever before with science, math, reading, and writing activities. (Teacher 32, personal communication, November 19, 2015)

The fifth and final participant (14) identified with level I, orientation. The orientation level refers to a person's desire to learn more. Statements made by this respondent were,

> I need to add agriculture into my lessons, but have always strayed away because of my lack of knowledge. I am not really doing much with it right now, but I firmly understand the importance of integrating it into the classroom and want my students to know more. I have accessed the National Ag Literacy Outcomes and

> used several of the website resources to acclimate myself to know more about agriculture, I found the curriculum matrix extremely easy to use, all you do is search by grade level or subject and the work is done for you . . . its AWESOME. I guess my point is I feel totally supported in the use of agriculture in my teaching, which is why I am certainly going to use it. (Teacher 14, personal communication, December 3, 2015)

Responses from needs assessment, follow-up assessment, and the individual interviews clearly pointed out the impact on teacher perceptions of the use of agriculture as a context for teaching and learning within the school district. As a whole, teacher attitudes were positive from the beginning, even though there were some concerns addressed during the implementation of the workshop. Again, these data accept the alternative hypothesis that elementary teacher perceptions were changed after attending the workshop *Dig into Learning*. Table 43 demonstrates participants' LoU as identified through the branching interview process. The researcher utilized Hall and Hord's (2015) explanation of each LoU. The researcher used these explanations to identify each participant based on responses given during the interview.

Table 43

*Identification of Participant LoU*

| ID | Q 1 Identifier | LoU Identifier |
|---|---|---|
| 4 | Non-User | Level II Preparation |
| 17 | User | Level III Mechanical |
| 21 | User | Level III Mechanical |
| 32 | User | Level IV B Refinement |
| 14 | Non-User | Level 1 Orientation |

Based on the explanation and identification of each participant's LoU, the researcher had the last piece to complete the evaluation of this program. The researcher interpreted responses to show interview participants' final LoU with regard to the implementation of the program *Dig into Learning*. Four of five interviewed participants had used or were currently using the innovation. This fact in itself was an implication of a positive impact on participant perceptions of the effectiveness of professional learning and initial implementation of the program *Dig into Learning*. It was evident through responses from branching interview items that there was a positive impact regarding this innovation.

**Summary**

Data were collected to answer the four research questions. Overall, 100% of participants viewed agriculture as context for teaching and learning to contextualize STEM education as a relevant teaching resource regardless of LoU. Based on the results of the paired samples *t* test conducted using scores from the control and treatment groups,

the differences in needs assessment and follow-up surveys were statistically significant for the total group, rejecting the null hypothesis that teacher participant perceptions were impacted after attending the workshop *Dig into Learning* (p=.011). Based on the qualitative and quantitative data, the researcher rejects the null hypothesis at this time. Further discussion of this interpretation is presented in Chapter 5. Chapter 5 also includes instructional recommendations based on these interpretations. The researcher further discusses the significance of the findings in Chapter 5 and proposes suggestions for future research.

# Chapter 5: Conclusion

## Introduction

The purpose of this mixed-methods program evaluation was to evaluate teacher perceptions of the use of agriculture as a context for teaching and learning through the implementation of *Dig into Learning: An Agricultural Literacy Innovation*. Quantitative data in the form of surveys and qualitative data in the form of open-ended response items and interviews were examined. At the beginning of this study, the focus was to evaluate the use of agriculture as a context for teaching and learning. However, the final research questions were refined to delve deeper into the perceptions and impact of professional learning and implementation of a newly adopted innovation. By utilizing Stufflebeam's (2003) CIPP model and Hall and Hord's (2015) CBAM, the evaluation indicated teacher perceptions were impacted through professional learning for the program *Dig into Learning*. The program evaluation utilized a process of describing, obtaining, reporting, and applying statistical analysis and qualitative analysis of data regarding the effectiveness and worth of the program *Dig into Learning*. Its goal was to guide decision making and support accountability as well as disseminate effective practices in the implementation of the program. The evaluation examined four specific components that included context, input, process, and products of the CIPP evaluation model in accordance with CBAM. In utilizing these two frameworks simultaneously, research was aligned with creating a program workshop that supported not only the implementation of the program but also the needs of participants who had intentions of using this program in their classrooms.

## Research Questions

This study asked the following research questions.

1. What needs for professional learning are expressed by elementary teachers with regard to STEM agricultural literacy curriculum integration?
2. How is professional learning developed and implemented based on elementary teachers' expressed needs with regard to STEM agricultural literacy curriculum innovation?
3. What are elementary teacher perceptions of the impact of professional learning of a STEM agricultural literacy curriculum innovation?
4. What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation?
    a. What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation as measured by the statistical analysis of the change in pre and posttest survey questions?
        i. Null Hypothesis 4a. Elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation remain unchanged from the pre and posttest survey questions.
        ii. Alternative Hypothesis 4a. Elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation change from the pre and posttest survey questions.
    b. What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation as measured by teacher interviews?

This chapter includes a review of the research design and a summary of the study, followed by interpretation and discussion of the findings, limitations to the study, and recommendations of the researcher. The findings are organized into sections that mirror the process of a program evaluation describing the review of literature, results, and recommendations regarding each process.

**Review of Research Design**

This study utilized a mixed-methods design for a program evaluation in order to evaluate teacher perceptions of the impact of professional learning of a STEM agricultural literacy elementary curriculum innovation. The target population was comprised of elementary teachers who enrolled in and completed the program workshop *Dig into Learning* ($N$=49). After the initial needs assessment was returned by 35 participants (71.4% response rate), the accessible sample size was reduced to 35. The second instrument, a follow-up survey, was then administered 1 month after the workshop training to the 35 participants who completed the needs assessment. Fifteen participants (42.8% response rate) completed the follow-up assessment. The accessible sample size was then reduced to 15 ($N$=15). The researcher was able to track data sets by participant email addresses. Once the participant signed up for the program, a number was attached to his/her email based on registration. This number followed participants through the conclusion of the program workshop and after. The final research instrument was LoU branching interviews. A sample of five participants volunteered to complete LoU branching interviews based on self-reported data. Three participants indicated they used the program *Dig into Learning* and also used agriculture as a context for teaching and learning in their classrooms, and two participants indicated future plans to use agriculture as a context for teaching and learning.

Three instruments were used to assess participant attitudes, concerns, and LoU towards agriculture with respect to the innovation *Dig into Learning*. The first instrument was administered to the accessible population of participants who signed up to attend the program workshop, while the remaining two instruments were administered only to members who completed the needs assessment. The researcher utilized Hall and Hord's (2001) SoC Questionnaire as a guide to create needs assessment items. The needs assessment was the first instrument and analyzed participants' SoC and current LoU in regard to agriculture as a context for teaching and learning in STEM education. The instrument utilized a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). After the needs assessment data were gathered and analyzed, the researcher and North Carolina Ag in the Classroom curriculum specialists planned and implemented the workshop to support the innovation *Dig into Learning*. The follow-up survey was administered to participants who had completed the needs assessment to ensure pre/postresponse data. The follow-up survey evaluated participant attitudes, concerns, and LoU regarding agriculture as a context for teaching and learning after attending the program workshop. The final instrument was the LoU branching interviews. The branching interview process allowed the researcher to delve deeper into personal experiences of participants who completed the program workshop and determined participants' LoU with regard to agriculture as a context for teaching and learning after attending the program workshop. The researcher collected quantitative and qualitative data utilizing three instruments: the needs assessment, follow-up assessment data, and LoU branching interviews. This mixed-methods design allowed the researcher to gain a well-rounded understanding of the impact on professional learning and initial implementation of the innovation. In the next section, an overall summary of findings is

presented. Following this summary, an interpretation of the findings as well as their implications is discussed.

## Summary of the Study

**Context evaluation.** Initial data for this study were gathered from the use of a needs assessment. Emergent themes were noted, and the program workshop *Dig into Learning* was formatted and planned. Utilizing the CIPP model and Hall and Hord's (2015) CBAM, the researcher conducted an evaluation of this program and its effectiveness. This model was used to address the change in participant perceptions toward the use of agriculture as a context for teaching and learning after attending the program workshop. To address the context phase of this evaluation, initial data for the study were gathered from the needs assessment completed by participants prior to the workshop. Needs assessment items were concerned with establishing the occurrence of a problem, describing the problem, and making recommendations to reduce the problem within a program evaluation (Fitzpatrick et al., 2011).

Emergent themes were noted from the evaluation of the needs assessment to determine professional learning goals. Goals included defining agricultural literacy, providing access to resources and materials, tips on collaboration and time management, planning, teaching, and modeling of integrating agriculture into the general curriculum; i.e., planting seeds, commodities, corn, extracting strawberry DNA, and genetics. These goals were noted as the core goals associated with supporting participant needs throughout the workshop as a way to reduce or eliminate the problem that kept teachers from utilizing agriculture as a context for teaching and learning. The researcher and North Carolina Ag in the Classroom curriculum specialists addressed plans and interventions for this program through evaluation of the needs assessment. Professional

development was determined based on demonstrated need in the process of integrating agriculture as a context for teaching and learning. These data were utilized in the input process of this program evaluation.

**Input evaluation.** The input evaluation assessed strategies and work plans selected to address participant needs. Quantitative and qualitative data were utilized to assess participant needs addressed during the program workshop *Dig into Learning*. The researcher, along with North Carolina Farm Bureaus' Ag in the Classroom curriculum specialists, executed a 3½-hour program tailored to fit the needs of participants who attended the workshop *Dig into Learning*.

The workshop was tailored to the six grade levels present, kindergarten through fifth grade. The participants were split into subgroups based on grade level. A large part of the sample population were kindergarten and first-grade teachers. These groups were shown the same agriculture lesson on ways to integrate STEM and literacy. This lesson focused on commodities, specifically corn. This lesson tied literacy and STEM together. Utilizing the Gail Gibbons (2009) book *Corn*, the curriculum specialists modeled reading aloud, stopping to ask higher order questions, and explaining parts of the book and the importance of the farmer in growing crops. The curriculum specialist then passed around different ears of corn and discussed unique facts about corn. A science experiment with water and baking soda was demonstrated with corn kernels (Appendix H). Second-grade teachers were grouped together and shown a genetics lesson, specifically on inherited traits connected to STEM concepts appropriate to Common Core standards for this grade level. The curriculum specialist then showed participants the Gail Gibbons (2005) book *Chicks and Chickens* and discussed the genetic traits of different types of chickens. Third grade was shown lessons from these two content areas, plant life cycles and greenhouse

construction noting explicit STEM connections. The curriculum specialist demonstrated how easy it was to discuss Common Core standards connected to measurement when building greenhouses and the importance of planting plants the appropriate distance apart. In addition, participants were shown different life cycle activities to use during this lesson. Finally, fourth and fifth grades were combined and shown a lesson that could be interchangeable between either grade–strawberry DNA. This lesson connected STEM concepts to North Carolina state standards allowing participants to extract real DNA from strawberries. It was discussed that with this DNA, different types of strawberries could be grown; this is vitally important when discussing effects of crops and weather conditions.

Because the needs assessment showed that teachers had concerns relating to cost and time, the presenters of this program offered in-depth insight into ways to accommodate funding to integrate STEM agriculture literacy lessons into daily lessons and also ways to easily integrate these concepts into daily lessons without taking up extra time. The presenters used modeling as a way to demonstrate how to easily integrate agriculture into any lesson. Presenters utilized multiple resources including North Carolina Ag in the Classroom website and National Ag in the Classroom's NALOs to demonstrate the unlimited resources that were already created and ready to use for teachers in all elementary grade levels. The researcher sought to provide the most effective professional learning experience for participants based on their identified needs and concerns.

**Process evaluation.** The process evaluation assessed the implementation of the program. The process evaluation addressed participants' SoC that answered Research Question 3, "What are elementary teacher perceptions of the impact of professional

learning of a STEM agricultural literacy curriculum innovation?" After implementation of this program, participants completed follow-up assessments to evaluate the impact of professional learning on the use of agriculture as a context for teaching and learning. The process of this innovation trained teachers on ways to integrate agriculture into their daily lessons, incorporating standards supporting STEM agriculture literacy. The researcher evaluated data collected in the follow-up assessment to provide insight into participant perceptions of the impact of the program *Dig into Learning*.

In utilizing CBAM, the researcher was able to evaluate concerns utilizing Hall and Hord's (2015) SoC and LoU. In evaluating change, the researcher first identified that change is a process, not an event (Hall & Hord, 2015). The researcher evaluated participant processes of change by comparing participant initial concerns in utilizing agriculture as a context for teaching and learning and concerns after attending the workshop.

In conducting the initial needs assessment, the researcher identified the majority of participants within the *personal* stage of concern (Stage 2). Hall and Hord (2015) explained that change facilitators have to be very careful with persons who have personal concerns. The key to resolving personal concerns is to provide lots of information about the innovation (Hall & Hord, 2015). The researcher and curriculum specialists supported participant concerns by providing information and connecting participants to resources that could help them to become more agriculturally literate and support them in making it easier to integrate agriculture into their curriculum. Ag in the Classroom curriculum specialist provided participants with grade-level lesson plans that were differentiated and tied to 21st century learning and Common Core state standards. In addition, participants also received books about agriculture topics to support them in integrating STEM

agricultural literacy. Participants were shown resources and other supports such as grant opportunities to help lower participant concerns of cost. The researcher has since helped participants acquire funding to create opportunities to integrate agriculture into classrooms to support the concerns of participants.

There were also a number of participants identified in the *management* stage (Stage 3). Hall and Hord (2015) explained that an all-day, full-group training might not be the most effective way for this group. So the researcher and curriculum specialists formed small group short sessions during the workshop to cover different needs. Groups were divided into subgroups K-1, 2, 3, and 4-5 and then rotated through sessions that demonstrated lesson plan implementation, information on agricultural literacy, hands-on learning activities, connections to Common Core standards, NALOs, and resources to help utilize agriculture saving time and money.

Responses from the follow-up survey addressed the same concerns after participants attended the workshop. After teachers participated in the workshop, SoCs varied with the majority of participants identified in the *consequence* (Stage 4) and *collaboration* stages (Stage 5). Hall and Hord (2015) stated, “facilitators enjoy persons in the consequence stage . . . because individuals are targeted toward Impact and how quality of use of the innovation can be enhanced” (p. 329). This transition from the majority of participants identified in early stages of change to later stages of change indicated a positive impact. Even though there were still some concerns after the workshop, most concerns were related to time which fell under the *management* stage of concerns (Stage 3). As participants’ SoC were identified and compared, needs assessment responses and follow-up assessment responses seemed to indicate this workshop and the innovation of this program had a positive impact on participant

perceptions of the use of agriculture as a context for teaching and learning.

In addition, the researcher conducted individual interviews with participants following a branching interview format to identify participants' LoU regarding the integration of agriculture as a context for teaching and learning. Assessment and interview data provided the product of this evaluation. To further answer Research Question 3, the researcher evaluated responses given by participants to interview questions 1 and 3. For interview item 1, "Are you currently using or have you used the innovation," the researcher found that four of the five interview participants (80%) had indeed started using the innovation; and although one participant had not yet begun use, he/she had potential plans to begin the program within the next few months. As interviews continued, item 3 asked, "Do you feel your needs were met in regards to the use of agriculture as a context for teaching and learning?" From this item, five participants (100%) stated yes. The researcher then asked participants to elaborate on ways their needs had been met. Narrative statements alluded to positive perceptions and an overall positive impact with regard to the implementation of the program.

**Product evaluation.** The final phase of the program evaluation is the product evaluation. The product evaluation assessed the outcomes of the program. Research Question 4, "What are elementary teacher perceptions of the impact of initial implementation of agricultural literacy curriculum integration," was addressed in two parts: quantitative and qualitative. For Research Question 4a, "What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation as measured by the statistical analysis of the change in pre and posttest survey questions," the researcher assigned a null and alternative hypothesis.

**Null Hypothesis 4a**. Elementary teacher perceptions of the impact of initial

implementation of a STEM agricultural literacy curriculum innovation remain unchanged from the pre and posttest survey questions.

**Alternative Hypothesis 4a.** Elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation change from the pre and posttest survey questions.

The researcher evaluated the change in perceptions of participants by conducting a paired samples *t* test in order to determine if there was a significant difference in participant perceptions from the needs assessment and follow-up assessment scores. The test revealed a significant difference at the 95% confidence interval ($p=.01$), which indicated there was an impact on participant perceptions regarding the use of agriculture as a context for teaching and learning after attending the program workshop *Dig into Learning*. The researcher applied a coding system to identify the level of impact on teacher perceptions of professional learning. Data demonstrated a moderate to high level of impact. The evaluation of quantitative and qualitative data provided a well-rounded approach to determine the impact on professional learning and implementation of the program *Dig into Learning*.

In addition to quantitative analysis, the researcher dove deeper into teacher perceptions by assessing participants' LoU utilizing a branching interview process. Research Question 4b addressed the qualitative component of the LoU branching interviews: "What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation as measured by teacher interviews?"

In answering Research Question 4b, the researcher conducted LoU branching interviews and transcribed participant responses in order to determine LoU. Loucks,

Newlove, and Hall (1998) believed transcript data should be used to indicate LoU for an innovation. The results from the branching interview protocol coincided with participant responses to survey questions. Four of the participants reported use of the innovation and believed agriculture was an important resource to integrate into STEM learning for the elementary curriculum. The remaining participant indicated no use of integrating agriculture as a context for teaching and learning; however, the participant expressed his/her plans to begin use of the innovation. Typical responses at each LoU were reviewed and narrative examples were evaluated as they emerged relative to the LoU.

**Interpretation of Findings**

Data associated with this topic indicated that prior to this program, the teachers in this school district did not have an understanding about how agriculture could be used as a context for teaching and learning in STEM education, despite the dominant role agriculture played in the area. After implementation of the innovation *Dig into Learning*, both with regard to the use of agriculture as a context for teaching and learning and the implementation of the innovation, more teachers were utilizing agricultural content to contextualize Common Core and state standards.

**Context evaluation.** Research Question 1 addressed, “What needs for professional learning are expressed by elementary teachers with regard to STEM agricultural literacy curriculum integration?” Teachers reported that before the workshop, they had concerns with the use of agriculture as a context for teaching and learning. In part, their concerns included the time it could potentially take, costs they would incur, and their lack of knowledge regarding agriculture as a context for teaching and learning. Despite obvious concerns, it was evident that participants had an interest in utilizing agriculture as a teaching context. One concern for the researcher was that

multiple participants agreed to the use of agriculture as a teaching context, but a high frequency of participants did not view themselves as agriculturally literate. Through evaluation, the researcher found that participants were knowledgeable enough to know agricultural literacy dealt with agriculture; however, based on survey responses, participants did not demonstrate a clear depiction of the meaning. Therefore, the researcher saw the need to educate participants on the meaning of agricultural literacy and how it is important to create a more agriculturally literate society. To address this need, the researcher and curriculum specialists addressed what it meant to be an agriculturally literate person and through presentation of materials provided participants with an understanding of what it meant to be agriculturally literate. According to NAITC (2011b), a person who considers him/herself agriculturally literate understands and can communicate the source and value of agriculture as it affects our quality of life. As individuals become agriculturally literate, issues of food demands, agriculture policy, and the demands of production agriculture will become more apparent. In addition to understanding agriculture and agriculture literacy, participants demonstrated needs in areas of utilizing agriculture concepts to teach STEM education. Teacher participants needed to understand the why and how factors associated with agriculture as a context for teaching and learning. In utilizing a needs assessment, the researcher was able to pinpoint areas of need and supports in order to initiate buy-in.

**Implications.** For the process of this innovation, the needs assessment data were used to answer Research Question 1, "What needs for professional learning are expressed by elementary teachers with regard to STEM agricultural literacy curriculum integration?" Addressing participant needs made the researcher aware of perceptions and concerns participant teachers held regarding agriculture as a context for teaching and

learning as well as agriculture and STEM education. Because the world is constantly changing and growing, educational practices have to be supported, as do the practices in professional learning. Analyzing participant perceptions and concerns was an effective strategy to assess their needs for professional learning. Once needs were identified, they were coded for themes. These themes included time, materials and resources, cost, and teaching and planning. In addition to utilizing the needs assessment to address areas of concern, it is vital in the identification of SoC.

In any change process, it takes more than just the change facilitator; it takes every stakeholder involved, most importantly those utilizing the innovation. The needs assessment served as a portal to initiate the change process. One of the major implications of this program evaluation was that the initial needs assessment served as the input framework.

The input section of the evaluation had the purpose of helping teacher participants better understand the use of agriculture to teach STEM while promoting the use of the innovation *Dig into Learning*. Assessing participant needs addressed concerns with the innovation. Addressing these concerns aided program developers in the implementation of this program. Without the identified concerns of participants, the workshop would have provided a vague, possibly unrelated professional learning opportunity that may have impeded the promotion of utilizing agriculture as a context for teaching and learning in relation to STEM education.

The use of a needs assessment provided needed insight that allowed the researcher to categorize participants' SoC that could then be addressed within the program workshop. It is not safe to assume that needs will be the same for all participant groups (Hall & Hord, 2015); however, program goals remain constant. It is important to meet

groups where they are in order to personalize learning. Doing so makes for a more effective professional development.

**Input evaluation.** Research Question 2 was, "How is professional learning developed and implemented, based on elementary teachers' expressed needs with regard to STEM agricultural literacy curriculum integration?" Overall, participants had positive attitudes and perceptions towards the use of agriculture as a context for teaching and learning STEM education. These findings paralleled the findings of attitudinal studies of preservice teachers with respect to the use of California Curriculum Guidelines for Agricultural Literacy Awareness (Bellah & Dyer, 2009). Although teachers had favorable attitudes towards the use of agriculture as a context for teaching and learning, needs assessment data identified over half (65.7%) had not used agriculture as a context for teaching and learning in their classroom in the past year. These data paralleled results of studies of agriculture education teachers who had obtained a master of arts in teaching at Oregon State University (Balschweid et al., 1998).

In utilizing data gathered from the needs assessment, the researcher identified areas of concern. The major concern for participants was time. The researcher could not provide participants with time, but the researcher and curriculum specialists provided participants with resources to help save time and make things easier in utilizing this innovation such as lesson plans and tips on integrating agriculture into Common Core standards. With the knowledge of agricultural literacy and support of managing time, the other focus was on teaching participants how to integrate agriculture into the daily curriculum. The researcher and curriculum specialists utilized professional learning strategies that allowed participants to take an active role in their own learning, including the involvement of teachers in workshop planning (needs assessment); the use of

professional curriculum specialists to ensure effective professional learning opportunities; sufficient time was given during regular workday; activities and models shown to allow time for questions and feedback; and participants were provided timely, targeted data that was applicable to the elementary classroom. The purpose of this professional development was to build a bridge between where participants were and where they needed to be to successfully utilize this innovation. The researcher and curriculum specialists formatted a program that addressed concerns of agricultural literacy by integrating lessons and supports that helped teachers themselves become agriculturally literate. The ultimate goal was to help the teachers help their students to become agriculturally literate as well.

**Implications.** The format of the workshop supported participant needs by addressing grade-level subgroups in an individualized way that best fit into the Common Core curriculum. Hall and Hord (2001) explained that change is a personal experience. Teachers need to feel supported in the use of a new program or process in order to feel successful in adopting the innovation (Hall & Hord, 2015). Addressing the common needs for professional learning allowed the researcher to offer support to participants during the program workshop and in the implementation of the program. Evaluation of participant needs provided the researcher with the foundation on which this program was formatted. The needs assessment allowed the researcher and curriculum specialists to be prepared for the why and how questions often asked when an innovation is introduced. The fact that this analysis method made the connections of personal needs to professional learning indicates the vital importance of addressing participant needs and concerns when initiating an innovation. Tailoring the professional development to participant stated needs is not always the paradigm in which planners operate; however, the research

supports this practice, and it proved effective in this situation.

**Process evaluation.** Research Question 3: What are elementary teacher perceptions of the impact of professional learning of a STEM agricultural literacy curriculum innovation? Based on analysis of the follow-up assessment given to participants 1 month after attending the *Dig into Learning* workshop, participants had fewer concerns. Of the participants who completed the follow-up assessment, 100% indicated they now understood agricultural literacy; and of these 15 participants, 14 participants (93.3%) now considered themselves agriculturally literate. In addition, 100% of participants who completed the follow-up assessment stated they would utilize agriculture as a context for teaching and learning during the remaining part of the 2015-2016 school year. Participant perceptions of agriculture were impacted in part because the workshop supported their identified needs. All 15 participants believed agriculture was a relevant resource to use in teaching core subjects. This study paralleled findings from other similar studies promoting agriculture as a context for teaching and learning in the elementary classroom. In those studies, teachers believed this strategy would bring a real-world context to science instruction (Trexler & Meischen, 2002). Participants reported that the integration of agriculture provided a new avenue of hands-on learning supporting multiple learning types within the classroom. These findings were backed by the Partnership for 21st Century Learning (2009) which stated that learners (teachers and students) needed a curriculum that employed instruction that integrated innovative, research-proven teaching strategies, modern learning technologies, and real-world resources and contexts. Although these findings cannot be generalized, for this school district, agriculture was a route that provided new innovative ways of learning; the only obstacle was initiating buy-in and providing interested participants with the tools they

needed to make it possible. In utilizing a needs assessment and follow-up assessment, the researcher compared SoC related to participant attitudes and perceptions of the use of agriculture as a teaching context. Studies conducted by Balschweid and Thompson (2000), Bellah (2006), and Bellah and Dyer (2009) have shown that after attending professional learning on the innovation, participants were much more likely to engage in the innovation. From this study, the researcher found that 66.7% of participants' SoC positively changed regarding the innovation. Overall, these data supported the belief that this professional learning experience impacted participant perceptions and attitudes toward agriculture as a context for teaching and learning and that the professional learning met the identified needs of participants.

**Implications**. For an innovation to take effect, participants have to feel supported, and implementers of the program have to be held accountable. In addition, it takes time for an innovation to be successful. Of course, how much time is determined by the population implementing the program. In relation to CBAM, participant concerns have to be relevant to the innovation. In the implementation of an innovation, there is always the chance that some participants are not interested in change (Hall & Hord, 2015). When this occurs, providing resources and support does not always change the minds of those who are unconcerned with the innovation. By evaluating participant concerns after attending the program workshop, the researcher was able to evaluate the effectiveness of the program and the implementation of *Dig into Learning*. Results from the follow-up survey supported the effectiveness of gearing professional development toward the needs of the participants and their students. The CBAM framework allowed participant needs to be met, which resulted in their satisfaction with the introduction to the innovation.

**Product evaluation.** Research Question 4: What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation?

Research Question 4 was split into two parts. Research Question 4a addressed the quantitative component of this program evaluation, analyzed by the researcher with a paired samples *t* test. Research Question 4b was, "What are elementary teacher perceptions of the impact of initial implementation of a STEM agricultural literacy curriculum innovation as measured by teacher interviews?"

An analysis of the quantitative data indicated there was a positive impact on teacher perceptions of agriculture as a context for teaching and learning to contextualize STEM education in the elementary classroom. Participant scores indicated increased SoC and LoU after the program workshop. A paired samples *t* test was administered in order to determine if there was a significant difference in participant perceptions from the needs assessment and follow-up assessment scores. The test revealed a significant difference at the 95% confidence interval ($p=.01$) which indicated there was an impact on participant perceptions regarding the use of agriculture as a context for teaching and learning after attending the program workshop *Dig into Learning*. The researcher applied a coding system to identify the level of impact on teacher perceptions of professional learning. Data demonstrated a moderate to high level of impact. The findings in this study were significant because they align with previous research that emphasized the importance of agricultural literacy.

The second part of Research Question 4 addressed the qualitative component of this program evaluation by conducting LoU branching interviews. Research Question 4b was, "What are elementary teacher perceptions of the impact of initial implementation of

a STEM agricultural literacy curriculum innovation as measured by teacher interviews?"

Initiating the implementation of this innovation made all the difference. Data from individual interviews demonstrated that 5/5 participants (100%) felt their needs had been met and that the impact of the use of agriculture as a context for teaching and learning had impacted their way of thinking and their way of teaching. Making real-world issues relatable to learners follows 21st century learning standards; but for this learning to happen, those teaching it have to feel supported. With regard to the innovation *Dig into Learning*, teacher participants had to feel supported in the effort to implement an innovation of this magnitude for it to take effect. Furthermore, data from the needs assessment and follow-up assessment indicated that a change had occurred among the 15 participants involved in this evaluation; and their perceptions of the use of agriculture as a context for teaching and learning had become more positive. These results indicated that the overall goal of this program was met regarding the 15 participants involved with the initial implementation of the program *Dig into Learning*.

**Implications.** The product process of the program evaluation assessed the outcomes of the program and its intended impact. To evaluate this part of the program, the researcher compared quantitative data from the pretest and posttest, focusing on participants' SoC and LoU. This approach gave the researcher the ability to not only evaluate the effectiveness of professional learning strategies used but also participant desires to utilize agriculture as a context for teaching and learning in STEM education. This program was limited to the integration of STEM agricultural literacy within elementary grades within an eastern North Carolina school district. Findings show that participants' SoC and LoU were impacted after attending the program workshop and participant understanding of agricultural literacy had improved. The findings of this

study are significant because they align with previous research on agricultural literacy and evaluation methods of both CBAM and the CIPP model. This study provided the framework in which change facilitators can support teacher participants and encourage them to utilize agriculture as a context for teaching and learning to contextualize STEM education. The ultimate goal is to create opportunities to educate students on the many components of agriculture and its relevance to daily life.

Understanding that targeted professional development, based on specific needs of participants and created to support concerns and movement within the change process, is essential for effective design of learning opportunities for teachers. Making sure teachers feel supported in implementing any new innovation is an important aspect of professional development. In addition, providing teachers with the resources and tools needed to implement the innovation is imperative.

**Limitations**

The researcher recognized that limitations of this study existed because the instructional designer was also the researcher, with a bias towards the topic of agricultural literacy. In order to address this limitation, measures were taken to reduce bias. The researcher solicited outside observers to evaluate response data and individual interviews to gain additional insight during the evaluation.

Another limitation of this study was the format used to create the needs assessment and follow-up surveys. Some items of the needs assessment and follow-up assessment were worded differently to appropriately address specific themes to guide workshop format. Therefore, some responses from the items were not easily compared from initial assessment to postassessment; and some questions demonstrated no change in mean score, because participants felt agriculture was a good tool to integrate hands-on

learning in the classroom both before and after attending the workshop. The researcher carefully evaluated each item so this would not interfere with the final evaluation of survey data collected.

Another limitation of this study was the small sample size. The total population consisted of 35 teachers, and the final population for research included 15 teachers. This could be because of the short time frame participants had after the workshop. Due to this workshop being held as a district-wide professional development, results from this professional development were needed before the next district-wide professional development day. The district superintendent suggested a 1-month turnaround period for participants to complete the follow-up survey. In addition, the researcher did not utilize an instrument to address nonresponders because time was of the essence. Low postsurvey return and short turnaround for participant response data to the follow-up survey are linked; both situations may have impacted the results of this study.

In addition, the professional learning strategies utilized to address participant needs in this program cannot be generalized for participants outside of this district, because professional learning strategies were directly connected to the needs assessment completed prior to the workshop. A final limitation of this study was self-reported data. The researcher understood that data reported from participants may not have been completed whole-heartedly, and interview responses may have been more positive because of the researcher's presence. Some of the participants did not complete both the needs assessment and follow-up assessment, and not all participants answered every item on these assessments. This electronic method of data collection may have impacted results.

**Recommendations**

Based on the data collected for this study and the identified limitations, the researcher suggests recommendations for future research. One recommendation is to increase sample size to determine the impact on professional learning and initial impact of the innovation *Dig into Learning*. The sample size for this study was small, and the total population was not the same size as the treatment group.

Another recommendation is to continue the study in order to reevaluate participants' LoU after the completion of this school year. Many elementary teachers have seasonal themes where agricultural concepts tie better into their curriculum. Conducting a study of participants' LoU from the beginning of a school year to the end could be beneficial to accompany the findings of this study. Continuing the evaluation of participants' LoU of the next year could allow the researcher more time to go into classrooms and conduct observations of participants utilizing these practices. Hall and Hord (2011) noted that change facilitators should take a few moments out of the day to inquire about how a teacher is coping with a new innovation and offer assistance if needed in order to increase motivation for the change effort. Creating an IC map is also a way to support participants in the use of an innovation (Hall & Hord, 2001). Also, additional research is necessary to ensure that participants maintain the use of agriculture as a context for teaching and learning over the next several years and that participants are held accountable for maintaining knowledge of current agriculture issues and concepts to create learning opportunities that promote individual agricultural literacy.

Additionally, student perceptions and academic achievement on the use of agriculture as a context for teaching and learning should be evaluated. The first step was teaching teachers how to use agriculture in the curriculum, but the final step may be to

find out how this innovation influences student learning.

**Summary**

In the education world today, it is important to help innovators feel vested in the cause in order to help the change take place. The program *Dig into Learning* was facilitated to support the needs of teachers with the intent on integrating agriculture into the elementary curriculum. This was the first step in a growing innovation to support the knowledge and importance of agriculture.

This study found that teachers from this rural eastern North Carolina school district perceived that agriculture as a context for teaching and learning in the elementary classroom had a positive impact on STEM education. These positive feelings may have been facilitated through the professional learning workshop *Dig into Learning*, in which teachers were given support and resources that would aide in the implementation and use of this innovation. These positive feelings may have been facilitated through establishing the importance of integrating real-world, hands-on learning into the daily curriculum to promote success of 21st century learners; or it could simply be that participants from this school district believed in the importance of agriculture. The study results supported the idea that any of these scenarios were possible, because each one was evaluated through the analysis of SoC and LoU as it related to the CIPP evaluation of this program.

Professional learning should increase educator effectiveness by integrating theories, research, and models of human learning to achieve an intended outcome for student achievement. According to Learning Forward (2015), "the learners' backgrounds, experiences, beliefs, motivation, interests, cognitive processes, professional identity, and commitment to school and school goals affect how educators approach professional learning and the effectiveness of various learning designs" (para. 7). Many

participants, although willing to utilize agriculture as a context for teaching and learning, did not feel knowledgeable when it came to the many concepts of agriculture or its connection to the elementary curriculum. However, after attending the workshop, most participants who completed the follow-up survey indicated that they felt more knowledgeable about agriculture concepts and were excited about the integration to support STEM learning.

A growing body of research has consistently supported agriculture as a context for learning academic (STEM) content and developing 21st century learners. This supported the idea to use agricultural concepts within the elementary curriculum to context STEM learning. The resources provided during the workshop (support texts, lesson plans, resources/materials, and knowledge of access to Ag in the Classroom lesson plans) could be utilized to support 21st century learning. In doing so, participants may help foster agriculturally literate students who understand agriculture and its impact on the world and their daily lives.

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Appendix A

Letter for District Approval

May 12, 2015

Dr. Austin Obasohan, Superintendent of Duplin County Schools
P.O. Box 128
315 N. Main St.
Kenansville, NC 28349

RE: Permission to Conduct Research Study

Dear Dr. Obasohan,

As you know, I am currently enrolled in the Education Doctoral Curriculum and Instruction program at Gardner-Webb University, Boiling Springs, NC. I am requesting permission to conduct a research study at the elementary schools, kindergarten through grade five in the district. The research project is titled, *Dig into Learning: Program Evaluation of an Agricultural Literacy Innovation*

The purpose of the study is to explore teachers' experiences and beliefs of the impact an agriculture education innovation as a teaching context for the elementary curriculum would have in our district. Teachers who teach in kindergarten through grade five (k-5) who attend the Agriculture Education Professional Development Workshop would complete an initial survey to measure current levels of use and experiences with agriculture education as a context for teaching. Of these teacher participants, there will be teachers randomly selected to complete a Follow-up survey measuring teacher beliefs of agriculture education as a teaching context and the effectiveness of professional learning. Teachers will participate in a branching interview, of which questions will be formed based on the themes collected from the Follow-up survey. The answers to the questions would be coded and reported in the dissertation process for the study.

Teachers will be provided a consent form to be signed and returned prior to the beginning of research. Copies of the interview questions and consent forms are attached. Your approval to conduct this study will be greatly appreciated. I would be happy to answer any questions or concerns that you may have. You may contact me at 910-284-2073 or email eedwards2@gardnerwebb.edu or eredwards@duplinschools.net.

Sincerely,
Erica B. Edwards
Doctoral Candidate, Gardner-Webb University

# Duplin County Schools

*Office of the Superintendent*



**Austin Obasohan, Ed.D.**
*Superintendent*

**Carol Wimmer**
*Executive Administrative*
*Assistant to the Superintendent*

October 12, 2015

Ms. Erica Edwards
Duplin County Schools
(via email: eredwards@duplinschools.net)

Dear Ms. Edwards,

Thank you for your recent email regarding your dissertation work. You seem to be progressing right along – congratulations!

Your request has been approved to send out a follow-up survey to participants who attended the Dig into Learning Professional Development in September. You may also conduct face-to-face interviews with the understanding that data will only be used in accordance with your dissertation work and that participants will be aware of your study and remain anonymous. At the conclusion of your research project, I would appreciate it very much if you would please share the information you compiled with me.

Best wishes to you for successful completion of your research project. I look forward to reviewing your results.

Sincerely,

Austin Obasohan, Ed.D.
Superintendent

AO/cw

315 N. Main St. • Kenansville, NC 28349 • Phone: (910) 296-6615 • Email: cwimmer@duplinschools.net

# Appendix B

# National Agricultural Literacy Outcomes

Theme 1

Agriculture and the Environment

Agriculture has transformed and had to work with natural ecosystems to fulfill societal needs. Agro-ecosystems are now recognized as a major part of global ecosystems. To understand the processes and components, and the dependence and interactions of organisms and environment in natural systems, is to understand the dynamics of agricultural systems. Agriculture and natural resource management is a science-based human activity subject to divergence of opinions and public policies influencing the development and application of science and technology for the public good. Inputs and outputs of modern agriculture and food industries involve many technologies based on both public and private research and development. Theme 1 examines the relationship between agriculture and the environment. For more detail visit: http://www.agclassroom.org/get/doc/NALObooklet.pdf

Theme 2

Plants and Animals for Food, Fiber and Energy

Early humans developed agriculture as an alternative to hunting and gathering. This transition not only began to free up labor but also resulted in surpluses of various goods, which could, in turn, be traded. Since the domestication and cultivation of plants, and the domestication and raising of animals (agriculture), humans have been experimenting with genetics, types of soils, climate, production practices, and harvesting to meet the needs of a growing population.

Agriculture provides the food supply needed for survival, growth, and health for both humans and animals. The variety of year-round food choices has grown; foods not locally produced are available partly due to the transportation and distribution networks. The major factors in food and feed choices for people and their animals are cost, culture, convenience, and access and/or availability. Theme 2 focuses on the importance and stewardship of natural resources in sustainably delivering high quality food, fiber, and energy while at the same time maintaining a quality environment. For more detail visit: http://www.agclassroom.org/get/doc/NALObooklet.pdf

Theme 3

Food, Health and Lifestyle

Healthful eating means eating a variety of nutritious foods. Food contains six nutrients that people need for good health. These nutrients include carbohydrates, proteins, fats, minerals, vitamins, and water. The United States Department of Agriculture (USDA) makes general recommendations about what people should eat. The USDA's "My Plate" features a dinner plate divided into four sections: fruits, grains, vegetables, and protein, with dairy pictured as a glass alongside the plate. Vegetables and grains have the largest recommended daily serving size, and proteins and fruits are slightly smaller in serving size, along with dairy.

Farmers and ranchers provide a variety of year-round food choices. Foods not locally produced are available partly due to the transportation and distribution networks. The major factors in food choices have been cost, culture, convenience, and access and/or availability. Advertisements are another form of information that guide food choices. Recently, Americans have become more interested in how food is produced, its nutritional value, agriculture's impact on the environment, and the contribution agriculture makes to the local economy and landscape. Consumer demand ultimately influences what is produced and how it is processed and marketed.

The U.S. food supply is considered the safest in the world. Still, food safety issues exist in the U.S. and abroad. According to food safety experts, improper storage, handling, and preparation of food—both at home and at food establishments—pose the top food safety problems today. Everyone who handles food in any form should know the basic safe food-handling practices. Safety concerns include microbiological contamination and non-living contaminates such as drug and pesticide residues and bone fragments. Contamination can occur during any step of food processing, storage, or handling of food products. The USDA regulates food processors and also provides consumer guidelines for safe handling, preparation, and storage of foods. Theme 3 explores the relationship between food production, storage, preparation, consumption, and health. For more detail visit: http://www.agclassroom.org/get/doc/NALObooklet.pdf

Theme 4

Science, Technology, Engineering and Mathematics

According to most historians, the development of agriculture resulted in the beginning of civilization. Agricultural development has relied on evolving scientific understandings, engineering processes, and the application of both to develop innovative technologies to save labor and increase yields. In the early 1900s, 50% of the U.S. population lived in rural areas, and 30% made their living on the farm (U.S. Department of Agriculture, 2014). Technological advancements of the last century have resulted in a nation where just over 1% (Central Intelligence Agency, 2013) of the population make their living on farms and ranches. It may seem that we no longer need to consider agricultural careers as important or relevant; however, it takes 21 million workers, or about 15% of the U.S. population, to support farm and ranch production, processing, and marketing (Goecker, Smith, Smith, and Goetz, 2010). The fact that 1% of the population produces for the other 99% is a real achievement! What has happened to cause this change in 100 years? Science, technology, engineering and mathematical understandings to address labor, and solve production and environmental problems.

The science and technologies applied to agriculture and food rival the science and technologies applied to medicine. Agriculture is the "other" major health science—applying science, engineering, technology, and mathematics to improve the health of plants and animals, of people, and our environment. The fields of mechanical engineering, microbiology, genetics, and chemistry have their origins intrinsically linked with agriculture and food, and while we have fewer people working on farms, the 21 million workers that support agricultural production include scientists, engineers, and

entrepreneurs.

Our quality of life is dependent upon the continued development and appropriate use of science and engineering to provide an abundance of safe, healthy, nutritious food, fibers, and the fuels necessary to sustain the needs of a growing world population. At the same time, we need to sustain the natural resource base of this planet—on which all life depends! While yields and labor-saving technologies remain important, future agricultural scientists and engineers will need to solve additional problems that will lead to a more sustainable agricultural system that feeds a growing population. Theme 4, understanding the science, engineering, technology, and mathematics of agriculture, food, and natural resources is crucial for the future of all humanity. For more detail visit: http://www.agclassroom.org/get/doc/NALObooklet.pdf

Theme 5

Culture, Society, Economy and Geography

Agriculture and natural resource systems have played a key role in the development of the United States and the sustainability of civilizations throughout the history of the world. Agriculture changed from hunting and gathering to forms of permanent agriculture, which in turn led the way for expansion of agricultural production and the integration of new technologies. Producing, processing, marketing, and distributing food, fuel, clothing, and shelter have been the work of most of humanity through the ages to ensure survival.

Largely, geographic location (longitude, latitude, elevation, soil type and precipitation) determines what plants and animals will grow and, therefore, determines what humans and animals will generally eat, what materials will be available for building shelters, making clothing, and providing fuel. As a result, distinct diets emerge for people living in different places in the world. Religion and other customs have further guided people's food choices, language, dress, festivals, and artistic expressions, which we often refer to as culture.

As productivity of agriculture increased through the application of science and technology, global trade of agricultural products expanded, which led to the development of more industrialized societies. Also, changes in the demand for agricultural workers from production (farming) to science, processing, and related agri-businesses resulted. Today, food, fiber, and fuel are traded globally, and often products travel thousands of miles from where they were produced to where they are consumed.

The global movement of agricultural products continues to be driven by economics, and consumer demand and preferences. Agriculture, food, and natural resource systems continue to play an integral role in the evolution of societies both in the United States and the world. For more detail visit: http://www.agclassroom.org/get/doc/NALObooklet.pdf

# Appendix C

## Needs Assessment

# Dig into Learning: An Agricultural Literacy Innovation - Needs Assessment

In an effort to understand your experiences about the use of agricultural content and concepts to contextualize STEM and North Carolina State Standards for teaching and learning please complete this survey prior to attending the Dig into Learning Professional Development session held on September 23, 2015. Your responses will be collected to better serve you during the professional development workshop and further training.

All K-5: Please answer the following questions to the best of your ability - based on the scale 1-Strongly Disagree, 2-Disagree, 3- Neutral, 4-Agree, 5-Strongly Agree

Your email address will be recorded but all responses are anonymous.

Needs Assessment

*Initial Survey to measure specific areas of need based on Agricultural Literacy and STEM learning.*

This survey will be created in GoogleForms as a Survey – directing teachers to answer based on specific grade level they teach connecting to NALOs, North Carolina Standards and STEM learning.

I am interested in understanding your experiences about the use of agricultural content and concepts to contextualize STEM and the North Carolina State Standards for teaching and learning.

**All K-5:** Please answer the following questions to the best of your ability – based on the scale 1 Strongly Disagree, 2 Disagree, 3 Neutral, 4 Agree, 5 Strongly Agree.

1. I have used agriculture in the past year to contextualize STEM concepts and the North Carolina State Standards.
2. I want to use agriculture as a context for learning in my elementary classroom.
3. I believe agriculture is a relevant resource to use for teaching core curriculum subjects such as science and math.
4. I understand the meaning of agricultural literacy.

5. I consider myself an agriculturally literate person.

6. I have integrated agricultural based projects or activities in my instruction within the last year.

7. I integrate small agricultural based projects or activities in my instruction.

8. I use STEM (Science, Technology, Engineering, and Math) activities in my daily lessons.

9. I am aware of the National Agricultural Literacy Outcomes.

10. I want to learn more about National Agricultural Literacy Outcomes connecting to my specific grade level standards.

11. I am interested in knowing more about how to use agricultural resources such as integrating books about agriculture into reading lessons, hands-on experiences, etc. to promote STEM learning.

12. I have access to agricultural resources (lesson plans, books, videos, science kits, etc.) to integrate agricultural content/concepts into my STEM instruction.

13. I have a solid grasp of agricultural concepts that could be part of my grade level STEM instruction.
14. I would like to know how integrating National Agricultural Literacy Outcomes and agriculture as a context for learning may be more effective in integrating instruction than resources I currently use.

Please only answer the following questions based on the grade level you currently teach kindergarten through second grade (k-2) and third through fifth grade (3-5).

**For K-2 Teachers:**

15. I understand National Agricultural Literacy Outcomes (NALOs) connect STEM focused learning to North Carolina Standards.

    a. I am confident in my ability to integrate agricultural literacy into STEM focused categorization of instruction.

    b. I would like professional learning focused on integrating agricultural literacy into STEM education emphasizing measurement and data instruction

    c. I would like professional learning focused on integrating agricultural literacy into STEM educational emphasizing categorization and classifying of objects.

d. I would like professional learning focused on integrating agricultural literacy into STEM education emphasizing forces and motion instruction.

e. I would like professional learning focused on integrating agricultural literacy into STEM education emphasizing life cycles instruction.

16. I would like to know how using agriculture as a context for teaching and learning will help my students to become agriculturally literate.

17. I would like to know how to use agriculture focused STEM lessons in my classroom.

18. I would like to know what other common core standards can be addressed by using agriculture as a context for teaching and learning.

**For 3-5 Teachers:**

19. I understand National Agricultural Literacy Outcomes connect STEM focused learning to North Carolina Standards.

    a. I am confident in my ability to integrate agricultural literacy into STEM focused categorization of instruction.

    b. I would like professional learning focused on integrating agricultural literacy into STEM education emphasizing measurement and data instruction

I would like professional learning focused on integrating agricultural literacy into STEM education emphasizing the change properties of objects.

I would like professional learning focused on integrating agricultural literacy into STEM education, emphasizing forces and motion instruction.

I would like professional learning on integrating agricultural literacy into STEM education, emphasizing the characteristics of organisms.

I would like professional learning on integrating agricultural literacy into STEM education emphasizing food and minerals instruction.

I would like professional learning focused on integrating agricultural literacy into STEM education emphasizing life cycles instruction.

I would like to know how using agriculture as a context for teaching and learning will help my students to become agriculturally literate.

I would like to know how to use agriculture focused STEM lessons in my classroom.

I would like to know what other common core standards can be addressed by using agriculture as a context for teaching and learning.

**All K-5:** The remaining questions are open-ended questions to gauge specific and relevant needs associated with the incorporation/integration of STEM activities and agriculture as a teaching context.

How do you define agricultural literacy?

If you have used agriculture to contextualize STEM and NCSS in the last year, please describe the agricultural topic(s), and the teaching method or approaches you have used.

Assuming you have the necessary resources, would you consider using agriculture as a context for teaching and learning STEM concepts? Why or why not?

What personal concerns, if any, do you have using agriculture as a teaching context?

Thank you for your time of completing this survey; your responses will tailor the instruction to better fit your needs at the upcoming Agricultural Innovation Professional Development Training.

# Appendix D

## Follow-up Assessment

# Dig into Learning: An Agricultural Literacy Innovation Follow-Up

In an effort to understand your experiences after attending Dig into Learning Workshop held on September 23, 2015 please complete the follow-up survey. Your responses will be collected to better serve you for future workshops relating to integration of creative learning for professional development and student learning. Thank you for your participation in this workshop.

Your email address will be recorded but all responses are anonymous.

If you would like to participate in a face-to-face interview regarding the innovation of agriculture as a context for learning please indicate this in the final question of this survey. Thank you again for your participation.

## All K-5 Teachers

Please answer the following questions to the best of your ability – based on the scale 1 Strongly Disagree, 2 Disagree, 3 Neutral, 4 Agree, 5 Strongly Agree.

Follow-up Survey

*Follow-up Survey to measure specific areas of need based on Agricultural Literacy and STEM learning.*

This survey will be created in GoogleForms as a Survey – directing teachers to answer based on specific grade level they teach connecting to NALOs, North Carolina Standards and STEM learning.

I am interested in understanding your experiences with the Dig into Learning workshop and use of agriculture to contextualize STEM and literacy regarding the North Carolina State Standards for teaching and learning after participation in Dig into Learning workshop.

**All K-5:** Please answer the following questions to the best of your ability – based on the scale 1 Strongly Disagree, 2 Disagree, 3 Neutral, 4 Agree, 5 Strongly Agree.

1. After attending, Dig into Learning workshop I will use agriculture now to contextualize STEM concepts and the North Carolina State Standards.

2. After attending Dig into Learning, I plan to use agriculture as a context for learning in my elementary classroom.

3. After attending Dig into Learning, I believe agriculture is a relevant resource to use for teaching core curriculum subjects such as science and math.

4. After attending Dig into Learning, I understand the meaning of agricultural literacy.

5. After attending Dig into Learning, I consider myself an agriculturally literate person.

6. After attending Dig into Learning, I have and/or plan to integrate agricultural based projects or activities in my instruction within the 2015-2016 year.

7. After attending Dig into Learning, I plan to integrate small agricultural based projects or activities in my instruction.

8. After attending Dig into Learning, I plan use STEM (Science, Technology, Engineering, and Math) activities in my daily lessons.

9. After attending Dig into Learning, I am aware of the National Agricultural Literacy Outcomes.

10. After attending Dig into Learning, I feel more knowledgeable about National Agricultural Literacy Outcomes connecting to my specific grade level standards.

11. After attending Dig into Learning, I feel supported in using agricultural resources such as integrating books about agriculture into reading lessons, hands-on experiences, etc. to promote STEM learning.

12. After attending Dig into Learning, I know how to access agricultural resources (lesson plans, books, videos, science kits, etc.) to integrate agricultural content/concepts into my STEM instruction.

13. After attending Dig into Learning, I have a solid grasp of agricultural concepts that could be part of my grade level STEM instruction.

14. After attending Dig into Learning, I know how integrating National Agricultural Literacy Outcomes and agriculture as a context for learning may be more effective in integrating instruction than resources I currently use.

Please only answer the following questions based on the grade level you currently teach kindergarten through second grade (k-2) and third through fifth grade (3-5).

**For K-2 Teachers:**

15. After attending Dig into Learning, I now understand how National Agricultural Literacy Outcomes (NALOs) connect STEM focused learning to North Carolina

Standards.

a. I am confident in my ability to integrate agricultural literacy into STEM focused categorization of instruction.

b. I was supported in learning focused on integrating agricultural literacy into STEM education emphasizing measurement and data instruction.

c. I was supported in learning focused on integrating agricultural literacy into STEM educational emphasizing categorization and classifying of objects.

d. I was supported in learning focused on integrating agricultural literacy into STEM education emphasizing forces and motion instruction.

e. I was supported in learning focused on integrating agricultural literacy into STEM education emphasizing life cycles instruction.

16. After attending Dig into Learning, I now know how using agriculture as a context for teaching and learning will help my students to become agriculturally literate.

17. After attending Dig into Learning, I now know how to use agriculture focused STEM lessons in my classroom.

18. After attending Dig into Learning, I now know what other common core standards can be addressed by using agriculture as a context for teaching and learning.

**For 3-5 Teachers:**

19. After attending Dig into Learning, I now understand National Agricultural Literacy Outcomes connect STEM focused learning to North Carolina Standards.

a. I am confident in my ability to integrate agricultural literacy into STEM focused categorization of instruction.

b. I feel supported in learning focused on integrating agricultural literacy into STEM education emphasizing measurement and data instruction.

c. I feel supported in learning focused on integrating agricultural literacy into STEM education emphasizing the change properties of objects.

d. I feel supported in learning focused on integrating agricultural literacy into STEM education, emphasizing forces and motion instruction.

e. I feel supported in learning on integrating agricultural literacy into STEM education, emphasizing the characteristics of organisms.

f. I feel supported in learning on integrating agricultural literacy into STEM education emphasizing food and minerals instruction.

g. I feel supported in learning focused on integrating agricultural literacy into STEM education emphasizing life cycles instruction.

20. After attending Dig into Learning, I now know how using agriculture as a context for teaching and learning will help my students to become agriculturally literate.

21. After attending Dig into Learning, I now know how to use agriculture focused STEM lessons in my classroom.

22. After attending Dig into Learning, I now know what other common core standards can be addressed by using agriculture as a context for teaching and learning.

**All K-5:** The remaining questions are open-ended questions to gauge participants' feelings after attending Dig into Learning, associated with the incorporation/integration of STEM activities and agriculture as a teaching context based on identified needs.

After attending Dig into Learning workshop:

23. How do you define agricultural literacy?

24. Will you use agriculture to contextualize STEM and NCSS in the 2015-2016 school year, please describe the agricultural topic(s), and the teaching method or approaches you have used.

25. Did you receive resources to use agriculture as a context for teaching and learning STEM and literacy concepts? Why or why not?

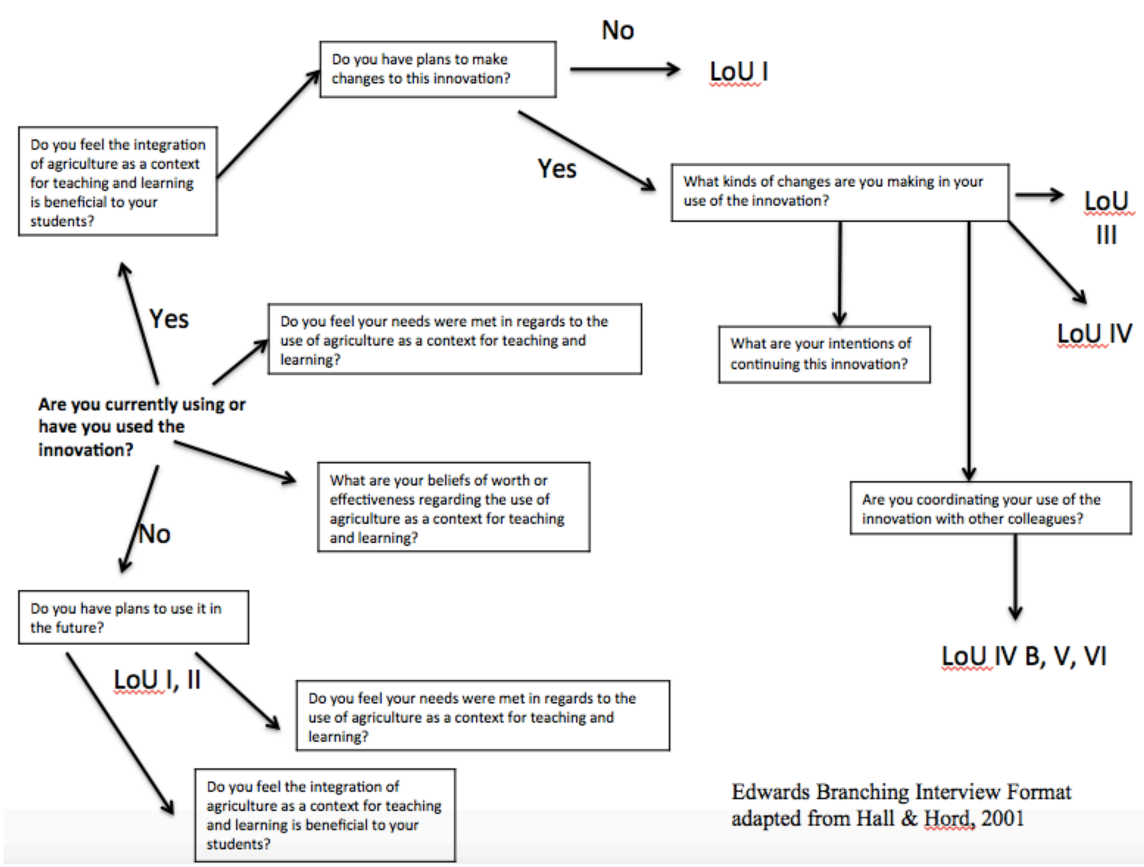
26. What personal concerns, if any, do you still have using agriculture as a teaching context?

Final Question:

I would like to participate in a face-to-face regarding my experiences and levels of use of agriculture as a context for teaching and learning? Type name in response box below indicating yes, if you are NOT interested just submit completed survey leaving area blank.

# Appendix E

## LoU Branching Interview




Edwards Branching Interview Format adapted from Hall & Hord, 2001

# Appendix F

## Consent Form for Interview Participants

**Consent Form**
Gardner-Webb University

Dear Teacher,

You are invited to participate in a research study entitled, "Dig into Learning: An agricultural literacy innovation. The purpose of the study is to better understand the beliefs and experiences, levels of use and stages of concern elementary teachers have in regards to agriculture as a context for teaching.

As a selected research participant, you will have attended the Dig into Learning: An agricultural literacy innovation for Duplin County Schools and completed an initial survey. You have been selected to participate in a research study regarding teacher beliefs and experiences, levels of use, and stages of concern elementary teachers have regarding agriculture as a teacher context for elementary teachers. As a participant, you have completed a needs assessment survey for baseline data and will complete a Follow-up survey. If you have received this consent you will have indicated on the Follow-up survey you are interested in participating in a face-to-face interview. All information collected will be kept completely anonymous. All survey and interview responses will be reviewed by the researcher for data analysis. No teacher names or information will be collected or used for this study other than to have your consent to participate.

Please respond to this letter by signing one of the follow options.

By signing this consent form I:

1. Voluntarily agree to participate in the research study.
2. May not personally benefit from this study, but acknowledge the information obtained may benefit others.
3. Am free to refuse participation and to withdraw from the research at any time without prejudice towards me.
4. Understand my participation and all documents gained from the study will not be use in an evaluative way.
5. Acknowledge that records from this study will be kept confidential and, if applicable, pseudonyms will be used in the final document.
6. Agree to participate in ***two*** one-on-one interviews with the researcher.

____ I agree to participate in this research study.
____ I do not agree to participate in this research study.

Thank you for your time. If you have any questions regarding this study, you may contact Erica Brown Edwards by phone XXXXXXXX or by email XXXXXXX.

________________________________
Printed Name of Participant

Signature of Participant | Date

Signature of Researcher | Date

# Appendix G

## Dig into Learning Explanation of CIPP

# DIG into Learning

## An Agricultural Literacy Innovation

Dig into learning is a program that promotes the integration of agriculture as a context for teaching and learning in STEM education for elementary grades.

### Program Evaluation

Context – Needs Assessment sent out to participants to address needs regarding agriculture as a context for teaching and learning. The results were then utilized to format the plan for professional learning.

Input – Participant needs were addressed through professional learning opportunities – professional learning included: small group sessions specific to grade level, knowledge of agricultural literacy, connection of NALOs and Common Core standards, integrating hands on learning into the daily curriculum. Participants were provided with materials including: books, materials, access to lesson plans and knowledge of use of curriculum matrix from National Ag in the Classroom and NC Farm Bureau grade level specific lesson plans.

Process – After participants attended the program workshop, a Follow Up survey was sent to evaluate participants perceptions and impact of professional learning, as well as participants use of agriculture concepts to contextualize STEM agricultural literacy.

Product – The process of the program workshop was evaluated using both quantitative and qualitative methods. Participant responses of the Needs Assessment and Follow Up survey were compared to demonstrate change and acceptance of the innovation. Interviews were conducted with some participants to verify responses and delve deeper into participant perceptions of the impact of initial implementation of the program Dig into Learning.

### Continuing the Innovation

Offering support to participants in collaboration of agriculture integration – participants need to be supported by administration and encouraged to collaborate with colleagues on the use of this innovation.

Additional professional learning opportunities will be offered to provide more learning experiences for participants.

Hands on workshop offered during summer for teacher participants.

# Appendix H

## All About Corn and Activity

FARM BUREAU NORTH CAROLINA
Ag in the Classroom | Going Local
Post Office Box 27766 | Raleigh, NC 27611 | (919) 719-7282

# Corn – First Grade

**Purpose**

Students will gain information from the text, *Corn* written by Gail Gibbons to understand how corn is grown, and composed into a variety of products for people to eat.

**Subject Area(s)**

English Language Arts, Math, Science, and Social Studies

**Common Core/Essential Standards**

**ELA**

- **CCSS.ELA - Writing: W 1.5**
  Write informative/explanatory texts in which they name a topic, supply facts, and provide a sense of closure.
- **CCSS.ELA Speaking and Listening: 1.5**
  Presentation of Knowledge and Ideas – Add drawings or visual displays.
- **CCSS.ELA-Reading: Literature RL 1.1**
  Ask and answer questions about key details in a text.
- **CCSS.ELA-Reading: Foundational Skills RF 1.3**
  Phonics and Word Recognition: Know and apply grade level phonics in decoding skills.

**Math**

- **CCSS.MATH.CONTENT.1.MD.1**
  Order three objects by length; compare the lengths of two digits indirectly by using a third object.
- **CCSS.MATH.CONTENT.1MD.2**
  Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (length unit) end to end.

**Agricultural Literacy Outcomes**

**Culture, Society, Economy & Geography**

- Trace the sources of agricultural products (plant or animal) used daily.
- Identify plants and animals grown or raised locally that are used for food, clothing, shelter and landscapes.
- Explain why farming is important to communities.
- Identify the people and careers involved from production to consumption of agricultural products.

**Food, Health, and Lifestyle**

- Recognize that agriculture provides our most basic necessities: food, fiber (fabric or clothing), energy, and shelter.

**Plants and Animals for Food, Fiber & Energy**

- Identify animals involved in agricultural production and their uses (i.e., work, meat, dairy, eggs).
- Identify the types of plants and animals found on farms and compare with plants and animals found in wild landscapes.

**Essential Questions**

1. Why is corn such an important food source?
2. Make a list of things that are products or by-products of corn.
3. What makes a kernel of corn pop?
4. What would happen if we did not have farmers to produce food for us?
5. What are the different types of corn?
6. List several items you eat each day that contain corn.

**Vocabulary**

**Corn:** a grain that was cultivated thousands of years ago used as food for humans and animals.
**Tassel**: the male flower on a corn plant, they contain millions of grains of pollen.
**Ear:** corn kernels develop along a cob and is referrect to as the 'ear.'
**Stalk:** the stem of the corn plant.
**Husk:** the outer shell or coating of the corn seed that covers the cobs.
**Kernel:** corn seeds.
**Hull:** the skin that covers a kernel.

**Student Motivator**

Start off by showing the students a handful of corn kernels. Begin a discussion with students about corn. *What kinds of seeds are these? Have you ever eaten them? How do they grow? What makes popcorn pop?* (Each kernel of corn contains moisture. When a kernel is heated, the moisture expands. Pop! The hull bursts open. Now the popcorn is ready to eat).

Pop some popcorn for the studetns to eat while they learn all about corn!

**Background Knowledge**

There are two kinds of corn in the US. Field corn is by far the most common, which is grown on more than 99% of all corn acres. While only a small amount is processed for use as corn cereal, cornstarch, corn oil, and corn syrup for human consumption, it is primarily used for livestock feed, ethanol

production and other manufactured goods. It is considered a grain. Sweet corn is what people purchase fresh, frozen or canned for eating. It's consumed as a vegetable and sweet corn is picked when immature. Field corn is harvested when the kernels are dry and fully mature.
Corn is a grain that was cultivated thousands of years ago in what is now called Mexico and Central America. It was the major crop for the great Mayan civilization. The Axtecs also had a great civilization and used corn in many ways to feed themselves and their animals. The native people in what is now Canada and the United States also grew corn. When the pilgrims sailed from England to the Americas they had very little to eat. The Native American Indians tuaght the Pilgrims how to grow corn.

Sweet corn is the most common corn people eat. Flint corn is used in many foods we eat and is also used to feed animals. Dent corn is also used for many different kinds of foods.

Each ear of corn has many corn silks. At the end of each corn silk is an egg that is attached to the cob. Pollen moves down the corn silk. When a grain of pollen and an egg join together, the egg is fertilized, and the kernel begins to grow. There is one corn silk and one egg for each kernel.

Three to four months after the corn has been planted, the corn silks begin to turn brown. This means the kernels are ripe and the corn is ready to be harvested. The average corn plant is about 8 feet tall and about 8 inches long.

**Procedures**

**Activity 1**

1. Begin by showing students different kinds of corn. (Popcorn, raw corn, corn on the cob, corn still in the husk, and Indian corn)
2. Show students the vocabulary (included with lesson) and introduce each word.
3. Ask students *what do you know about the different types of corn shown*? Tell students to for those items as you read the book *Corn* by Gail Gibbons.
4. Read and discuss the book *Corn* by Gail Gibbons. On a chart, brainstorm or list important facts learned from reading the story about different types of corn and the many uses of corn. This may be used later for students to refer to when completing writing activities.

**Activity 2**

**Hopping Corn, A Popping Science Experiment:**

1. Brainstorm with students why popcorn pops. *Will all corn pop*? Discuss answers.
2. Refer to pages 16-17 in the book. Explain to the students what makes corn pop.
3. Complete the following experiment with the students: Following this experiment will make corn hop and pop around.

**Materials needed:**

- a clear glass container, popping corn,
- 2 ½ - 3 cups of water
- 2 Tbsp. of baking soda
- 6 Tbsp. of white vinegar
- food coloring (optional)

**Instructions:**
1. Fill your jar with water and add a couple drops of food coloring.
2. Add baking soda and stir until it dissolves.
3. Add a small handful of popping corn.
4. Add vinegar and watch corn start to hop up and down. This should work for over an hour.

4. Incorporate math by having students measure out ingredients.
5. After the experiment, students can write about the experiment in a science notebook. .
6. Students may also use a variety of types of corn to experiment with: which one pops the longest, fastest, moves around the most, or least.

**Activity 3**

**Corn Measurement**

**Materials needed:**
- green bulletin board paper
- copies of ears of corn
- corn kernels
- yellow yarn
- yellow paint (optional)

1. Review the book *Corn* by Gail Gibbons. Tell students they will create a stalk of corn that represents *All About Me* to use for measuring objects in the classroom. It will be nonstandard unit for measuring.
2. Have students use *All About Me* Cornstalk instructions to create their individual cornstalk
3. When students finish, have each student use their stalk of corn as a nonstandard unit of measurement to find an object longer than the stalk of corn, an object shorter than the stalk of corn, and an object the same length as the stalk of corn.

**Activity 4**

**Corn Vocabulary in a Bottle:**

**Materials Needed:**
- plastic water/drink bottles (cleaned out)

- dried corn kernels
- story paper
- markers/crayons
- variety of parts of corn if available (cob, kernels, silk, husk, stalk)

1. Introduce key *vocabulary terms* and place on the word wall or writing center.
2. Ask students what they know about corn. Make a list/brainstorm their ideas and make a list.
3. Read and discuss *Corn* by Gail Gibbons. Point out on each page the key *vocabulary words* that were introduced earlier. If possible, have real parts of the corn to show the students.
4. Have students use story paper to story paper to write important facts about what they learned about corn and how it grows from the book.
5. When students finish, have students use premade corn kernel bottles with the *vocabulary words* mixed inside the kernels. Have students find the words and write them on paper.

**Extension Activity:**

1. Have students create their own corn kernel bottles using words they learned from the story.
2. Have students put the words in ABC order or write sentences using the words they found in the bottles.
3. Have students watch this video about planting, harvesting and the many uses of corn.

**Activity 5**

**Who Grows Corn?**

**Materials Needed:**

- *Corn* by Gail Gibbons
- markers
- chart paper
- writing paper

1. Review the book *Corn* by Gail Gibbons.
2. Ask students what kinds of products come from corn. Record answers on chart paper.
3. *Who grows the corn?*
4. *What do farmers do with the corn after it is harvested?*
5. After discussing these questions, have students choose his/her favorite corn product and write an opinion piece stating why he/she believes it's the best corn product to buy.

**Extension Activity:**

1. Growing with corn on the cob. Place an ear of Indian corn in a pan filled with ½ inch of water. Have students observe what happens! You can also try this with regular corn on the cob. Have students compare and make predictions on what will happen with each type of corn.
2. Have students pretend they are trying to sell their favorite corn product. Have the students create an ad or flyer highlighting his/her favorite product. The picture should be appealing to the

consumer so they will buy the product.

**Materials**

- Materials needed are listed with each activity.

**Suggested Companion Resources**

- A Tale of Two Corns
  **http://www.youtube.com/watch?v=jFVIIZ_VYEU**
- Fresh for Kids
  http://www.freshforkids.com.au/veg_pages/corn/corn.html
- Kids Corn(er)
  http://www.freshforkids.com.au/veg_pages/corn/corn.html

**Essential Files**

- *Corn PowerPoint*
  - *All About Me Instructions*
  - *Vocabulary flash cards*
  - *Water bottle cards and recording sheet*
  - *Corn Measurement Instructions*

**Essential Links**

- Planting, harvesting and the many uses of corn
  **http://www.youtube.com/watch?v=jFVIIZ_VYEU**

**Ag Facts**

- Corn is called maize by most countries, this comes from the Spanish word 'maiz'.
- Corn is a cereal crop that is part of the grass family.
- An ear or cob of corn is actually part of the flower and an individual kernel is a seed.
- On average an ear of corn has 800 kernels in 16 rows.
- Corn will always have an even number of rows on each cob.
- A bushel is a unit of measure for volumes of dry commodities such as shelled corn kernels. One bushel of corn is equal to 8 gallons.
- With the exception of Antarctica, corn is produced on every continent in the world.
- There are over 3,500 different uses for corn products.
- As well as being eaten by the cob, corn is also processed and used as a major component in many food items like cereals, peanut butter, potato chips, soups, marshmallows, ice cream, baby food, cooking oil, margarine, mayonnaise, salad dressing, and chewing gum.

- Juices and soft drinks like Coca-Cola and Pepsi contain corn sweeteners. A bushel of corn can sweeten 400 cans of soft drink.

**Extension Activities**

Allow students to sample different types of foods from corn. Ex. Corn flakes, corn pudding, popcorn, corn on the cob, canned corn, cream corn, etc. Create a graph and have students record their favorite 'corn' food.

Have students share what they think is inside an ear of corn. Then allow students to work in small groups to 'dissect' and ear of corn. Have them identify the kernels, husks corn silk, and the cob. Give students a plastic knife and let them cut inside the kernels. *How does it feel? Taste? Smell?*

Have students create a corn stalk (or draw) and label the parts of the plant.

**Sources & Credits**

- http://onetimethrough.com/hopping-corn-science-activity/
- http://www.iowacorn.org/en/corn_use_education/fun_for_kids/
- http://www.iowacorn.org/documents/filelibrary/education/fun_for_kids/Growing_Corn_Experiment_90CAA2E20E8EC.pdf

“All About Me” Cornstalk
Math and Measurement

1. Stalk: Get with a partner. Have your partner lay down on the strip of green paper (corn stalk) and draw a line at the head and foot of your partner. Cut the paper showing the length of your partner . Now switch and measure your partner.

2. Corn: (Husk and Cob) Choose a piece of corn for the number of people living in your house.

3. Kernels: Put yellow dots or glue kernels of corn on your corn based on how old you are. If you are 6 put 6 dots, if you are 7 put 7 dots, etc.

4. Silks – Add silks to the top of your corn based on how many letters are in your name. If you have 5 letter in your name you need 5 strings of silk on each piece of corn.

5. Find objects in your classroom that are longer and shorter than your cornstalk. You can have students arrange them from shortest to tallest, tallest to shortest, etc. Students may also write about the data findings.

corn

plant

harvest