Measuring the effectiveness of the Mississippi Agriculture in the Classroom Program on elementary students’ agricultural literacy levels

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Currently, the United States faces a time where the majority of the population is illiterate about the origins of their food. Thus, the population is considered to be agriculturally illiterate. Agricultural illiteracy allows skewed and misconceived agricultural information to infiltrate the populations’ beliefs about how their food is made. The United States Department of Agriculture along with the National Research Council have taken the initiative to start programs like the National Agriculture in the Classroom program to help combat low agricultural literacy levels. This study observes agricultural literacy levels in elementary students in Mississippi before and after new and existing Mississippi Agriculture in the Classroom treatments.
DEDICATION

This is dedicated to all of the little girls out there with curious minds and big dreams.
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First, I would like to acknowledge that none of this would have been possible without the unconditional love and blessings from my Lord and Savior, Jesus Christ. It is Him that I do all things for, and without Him, I am nothing. Next, I would like to thank Dr. Carley Morrison for all of her support, mentorship, and guidance through this whole process. To my committee members who provided me with feedback and advice when I was lost, and to everyone else in the School of Human Science for pushing me to be my best self.

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# TABLE OF CONTENTS

DEDICATION ........................................................................................................................ ii

ACKNOWLEDGEMENTS .................................................................................................. iii

LIST OF TABLES ........................................................................................................... vii

LIST OF FIGURES ........................................................................................................ viii

CHAPTER

I. INTRODUCTION .......................................................................................................... 1

  Statement of the Problem ............................................................................................ 2
  Purpose Statement ....................................................................................................... 2
  Research Objectives ................................................................................................... 3
  Significance of the Study ......................................................................................... 3
  Limitations ................................................................................................................. 4
  Assumptions .............................................................................................................. 5
  Definition of Terms .................................................................................................. 5

II. REVIEW OF LITERATURE .......................................................................................... 8

  Agricultural Literacy ................................................................................................. 8
  Conceptual Framework ............................................................................................ 16
    Agricultural Literacy Framework .......................................................................... 16
  Summary ................................................................................................................... 17

III. METHODOLOGY ........................................................................................................ 18

  Restatement of Problem .......................................................................................... 18
  Restatement of Research Objectives ....................................................................... 18
  Design of the Study ................................................................................................. 19
  Treatment .................................................................................................................. 20
  Population and Sample ............................................................................................ 23
  Instrumentation ......................................................................................................... 24
  Current Mississippi Agriculture in the Classroom Lesson Plans ......................... 25
  Soil ............................................................................................................................ 25
  Potatoes ..................................................................................................................... 26
  Dairy .......................................................................................................................... 26
National Agriculture in the Classroom Lesson Plans ........................................... 26
  Coding ........................................................................................................... 27
By-products ...................................................................................................... 28
Soil ..................................................................................................................... 29
Commodities .................................................................................................... 30
Assessment Instrument ................................................................................... 31
Teacher Interviews .......................................................................................... 34
  Group 1 ......................................................................................................... 35
  Group 2 ......................................................................................................... 35
  Group 3 ......................................................................................................... 35
Data Analysis (Quantitative) ........................................................................... 36
Data Analysis (Qualitative) ............................................................................. 37

IV. RESULTS & DISCUSSION .............................................................................. 39
  Objective One Results .................................................................................. 40
  Objective Two Results .................................................................................. 41
    Group 1, Group 2, Group 3 Scores .............................................................. 42
    Revised group means ............................................................................... 45
  Objective Three Results ............................................................................... 46
    Revised group means compared #2, #6, #8, #9, and #13 .......................... 49
  Objective Four Results ............................................................................... 52
Summary .......................................................................................................... 55

V. CONCLUSIONS AND RECOMMENDATIONS ............................................. 57
  Conclusions Related to Objective One ......................................................... 57
  Conclusions Related to Objective Two ......................................................... 58
  Conclusions Related to Objective Three ..................................................... 59
  Conclusions Related to Objective Four ....................................................... 60
  Recommendations ....................................................................................... 61
    Recommendations for Practitioners .......................................................... 61
    Recommendations for Researchers .......................................................... 62

REFERENCES .................................................................................................... 64

APPENDIX

A. LONGHURST MURRAY AGRILTURAL LITERACY INSTRUMENT ............ 71
B. PERSONAL CHARACTERISTICS ................................................................. 79
C. EXISTING LESSON: A SLICE OF SOIL .................................................. 81
D. EXISTING LESSON: POTATO FUN .......................................................... 83
E. EXISTING LESSON: ICECREAM IN AN INSTANT .................................. 86
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>REVISED LESSON: BY-PRODUCTS</td>
<td>90</td>
</tr>
<tr>
<td>G</td>
<td>REVISED LESSON: SOIL</td>
<td>109</td>
</tr>
<tr>
<td>H</td>
<td>REVISED LESSON: COMMODITIES</td>
<td>129</td>
</tr>
<tr>
<td>I</td>
<td>SUPERINTENDENT LETTER</td>
<td>156</td>
</tr>
<tr>
<td>J</td>
<td>SUPERINTENDENT PERMISSION LETTER</td>
<td>159</td>
</tr>
<tr>
<td>K</td>
<td>PRINCIPAL PERMISSION LETTER</td>
<td>161</td>
</tr>
<tr>
<td>L</td>
<td>IRB PERMISSION</td>
<td>163</td>
</tr>
<tr>
<td>M</td>
<td>GUARDIAN CONSENT FORM</td>
<td>165</td>
</tr>
<tr>
<td>N</td>
<td>STUDENT ASSENT FORM</td>
<td>168</td>
</tr>
<tr>
<td>O</td>
<td>TEACHER CONSENT FORM</td>
<td>170</td>
</tr>
<tr>
<td>P</td>
<td>TEACHER INTERVIEW QUESTIONS</td>
<td>172</td>
</tr>
<tr>
<td>Q</td>
<td>TEACHER RECRUITMENT EMAIL</td>
<td>174</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 1  Pretest, Posttest, Delayed Posttest Design.................................................................20
Table 2  Breakdown of revised By-product lesson .................................................................29
Table 3  Breakdown of revised Soil lesson ...............................................................................30
Table 4  Breakdown of revised Soil lesson ...............................................................................31
Table 5  Overall Demographics of School Wide Population .....................................................40
Table 6  Agricultural Literacy Factorial MANOVA .................................................................41
Table 7  Classification of Knowledge Based on Range of Scores ..............................................42
Table 8  Classification of Knowledge Based on Range of Scores ..............................................44
Table 9  Classification of Knowledge Based on Range of Scores ..............................................46
Table 10 Multiple Comparisons of Agricultural Knowledge (Pre-tests) Means by Group .......47
Table 11 Multiple Comparisons of Agricultural Knowledge (Post-Tests) Means by Group .........48
Table 12 Multiple Comparisons of Agricultural Knowledge (Delayed Post-Tests) Means by Group .........................................................................................................................48
Table 13 Multiple Comparisons of Agricultural Knowledge (Pre-tests) Means by Group: Revised ..........................................................................................................................50
Table 14 Multiple Comparisons of Agricultural Knowledge (Post-Tests) Means by Group: Revised ..........................................................................................................................51
Table 15 Multiple Comparisons of Agricultural Knowledge (Delayed Post-Tests) Means by Group: Revised ..........................................................................................................................51
Table 16 Interview Questions for Participating teachers in Groups 2 & 3 ...............................52
LIST OF FIGURES

Figure 1  Agricultural Literacy Framework (Elliot, 1999) ....................................................... 17
Figure 2  Explanatory Sequential Design (Creswel, 2014) ....................................................... 20
Since World War I, technological advancements in agriculture urbanized the majority of the United States’ population (Frick et al., 1991). According to the American Farm Bureau Foundation (2019a), increased urbanization of the population has led to today’s society as being roughly three generations removed from the farm (American Farm Bureau Foundation, 2019b). A result of the generation shift is a population lacking basic knowledge of where and how their food and fiber is produced (Kovar & Ball, 2013). The National Research Council did not acknowledge a gap in the public’s agricultural literacy until 1988. Previously, this had not been identified as an issue because most of the United States’ population had once been rural citizens producing their own food and fiber (A.U.C, 2019). Elliot (1999) stated “agricultural literacy or lack thereof is a direct result of the transition from a rural to an urban concentration in population” (p. 207).

The National Research Council (1988) published *Understanding Agriculture - New Directions for Education*, knowing that the prosperity of the United States depended on its food and fiber output system. This book called for the implementation of agriculturally related content and curriculum to be taught in schools across the country- from kindergarten through the twelfth grade (National Research Council, 1988). As a result, this book is attributed to the start of all agricultural literacy agendas (Anderson et al., 2014).
Statement of the Problem

According to Bellah, Dyer, and Casey (2004) and Kovar and Ball (2013), the majority of today’s society is agriculturally illiterate. In 2015, the United Nations stated that the world population will be 9.5 to 10 billion in 2050, causing farmers to have to produce more food and fiber for the growing population, with the same amount of resources they have had in previous years. Stanek (2015) states that farmers and producers across the world will have to produce more food within the next 40 years than they have in the last 10,000 combined. With the population not being exposed to agricultural career opportunities and knowledge, the division between the consumer and the farmer becomes ever more prevalent. With only 2% of the United States’ population directly involved in agriculture and farming, these numbers can be used as evidence showcasing that more individuals need to be exposed, get involved, and be literate about where and how their food gets from the farm to their table (American Farm Bureau Foundation, 2017).

Purpose Statement

Research conducted about agricultural literacy over the last decade provides evidence that today’s society and future generations should be literate in agriculture (Kovar & Ball, 2013). However, it can be concluded that the majority of the population in the United States is agriculturally illiterate (Bellah et al., 2004, Kovar & Ball, 2013). Molloy (2016) states that All citizens need to understand the economic, social, and environmental significance of agriculture. Food production is the basis of all civilization. We need a well-educated public to contribute to the success of a safe and affordable food system that will attempt to feed the expected nine billion people in this world by 2050 (para. 3).
Therefore this study is meant to determine if existing Mississippi Agriculture in the Classroom (AITC) curriculum compared to revised Mississippi AITC curriculum has a relationship with elementary students’ agricultural literacy levels.

**Research Objectives**

The following objectives guided this study:

**Objective 1:** Describe the demographics and personal characteristics of the population and their relationship with students’ agricultural literacy levels.

**Objective 2:** Determine the agricultural knowledge (National Agricultural Literacy Outcome standards) of Mississippi fourth grade students prior to and after exposure of an agricultural literacy program.

**Objective 3:** Compare agricultural knowledge change (National Agricultural Literacy Outcome standards) among Mississippi fourth grade students after treatment of new and existing Ag in the Classroom curriculum.

**Objective 4:** Describe the perceptions of the new and existing Agriculture in the Classroom curriculum among teachers.

**Significance of the Study**

In February of 2018, the United States Department of Agriculture’s National Institute of Food and Agriculture (USDA/NIFA) announced its continued support for K-12 agricultural literacy programs. The department set aside grant money for universities and Extension experiment stations, as well as organizations and individuals to conduct research about all facets of agricultural literacy (National Institute of Food and Agriculture, 2018). The USDA/NIFA grants are used to help students “gain a greater awareness of the role of agriculture in the
economy and society so they will become citizens who make wise decisions regarding agricultural challenges and opportunities in the 21st century” (NIFA, 2018, para. 2). Moreover, three decades later, since the National Research Council’s first call to action, the population still fails to be literate in agriculture, confirming that there is still a need for research and improvement (NRC, 1988).

**Limitations**

Limitations for this study include history, maturation, mortality, and selection. These are variables which might affect the internal validity of the study (Campbell & Ross, 1968). Also, this study was conducted using a small sample size \( (n = 63) \), so this cannot be generalized among the entire population. Due to location and time, this study could not be duplicated in other school systems. History is noted as the events that occur outside of the researchers control within the population between the pretest and posttest that might account for a change in the results (Campbell & Ross, 1968). Maturation refers to the passage of time within the population resulting in a more mature student population, referring to a process rather than an event (Campbell & Ross, 1968). Mortality is caused by students who move schools or drop out of the study and selection is a limitation due to the whole population not being represented (Campbell & Ross, 1968). Lastly, testing is considered a limitation for this study, this is due to the students being exposed to the same test three different times throughout this study.

As an attempt to reduce the limitations, students were not selected on an individual basis but through classroom placement. Students participated in this study through classroom lessons pertaining to math, science, and social studies, causing mortality to be low. Also, using nonrandomized control groups decreases threats to internal validity such as; regression, history, pretesting, instrumentation, and maturation (Ary, et al., 2006).
Assumptions

The following assumptions were made prior to, and during, the completion of this study:

1) Participants answered all questions to the best of their knowledge on the assessment instrument. 2) Participants participating in this study were representative of the general students’ population in the Starkville Oktibbeha School District 3) Teachers who chose to participate in teaching the agricultural literacy lessons taught them in their entirety and how the lessons instructed them to.

Definition of Terms

Agricultural Literacy, “can be defined as possessing knowledge and understanding of food and fiber systems” (Frick et al., 1991, p. 52).

Agricultural Knowledge consists of an individual’s level on how much they know about agricultural concepts

Experiential Learning is a learning experience where the learning space is multi-level and the learning cycle is carried by action/reflection, and experience/abstraction. (Kolb & Kolb, 2008)

National Agricultural Literacy Outcomes, “outline critical benchmarks for agricultural literacy. The National Agricultural Literacy Curriculum Matrix is the vehicle that can contextualize academic content and provide educators with high quality, relevant, meaningful, and engaging resources that lead to enduring understandings”(Spielemaker and Leising, 2013, p. 2).

National Agriculture in the Classroom (NAITC) program - Agriculture in the Classroom programs are implemented by state-operated programs. National Agriculture in the Classroom supports state programs by providing a network that seeks to improve agricultural literacy — awareness, knowledge, and appreciation — among PreK-12 teachers and their students. The mission of Agriculture in the Classroom is to "increase agricultural literacy through K-12
An agriculturally literate person is defined as "one who understands and can communicate the source and value of agriculture as it affects quality of life." Agriculture in the Classroom (AITC) programs seek to improve student achievement by applying authentic, agricultural-based content as the context to teach core curriculum concepts in science, social studies, language arts and nutrition. By encouraging teachers to embed agriculture into their classroom, AITC cultivates an understanding and appreciation of the food and fiber system that we all rely on every day. AITC is unique within the agricultural education community as the lead organization to serve the full spectrum of K-12 formal education. (National Agriculture in the Classroom, 2020, para. 1)

**Mississippi Agriculture in the Classroom program** Mississippi Ag in the Classroom is a school-based program helping students in grades K-12 acquire broader knowledge about agriculture and how it affects their world. The program’s objective is to encourage educators to teach more about food and fiber systems and the critical role of agriculture in our economy and society.

(Mississippi Farm Bureau Federation, 2018, para. 1)

**Existing Agriculture in the Classroom curriculum** this is the Ag in the Classroom curriculum that is currently available through the Mississippi Ag in the Classroom program operated by the Mississippi Farm Bureau Federation.

**Revised Agriculture in the Classroom curriculum** this is Ag in the Classroom curriculum that was selected from the National Agriculture in the Classroom’s curriculum matrix and modified to fit Mississippi’s College-and-Career readiness standards along with Mississippi commodities.

**Mississippi College-and-Career Readiness Standards** “Content standards outline the skills and knowledge expected of students from grade to grade and subject to subject” (MDE, 2020, para. 1).
Mississippi Commodities these are the 16 major commodities that the Mississippi Farm Bureau Federation recognizes for the state of Mississippi. These include: aquaculture, beef, food grains, cotton, dairy, equine, forage, forestry, honey, horticulture, peanuts, poultry, soybeans, sweet potatoes, swine, and rice (Mississippi Farm Bureau Federation, 2018).
CHAPTER II
REVIEW OF LITERATURE

This literature review focuses on defining agricultural literacy, and its importance. Additionally, this literature review overviews past and current research being conducted about agricultural literacy, along with emphasizing the importance between different levels of literacy. Finally, this literature review outlines the current standing of the Mississippi Agriculture in the classroom program, as well as teacher opinions on curriculum development.

Agricultural Literacy

When defining literacy, there are multiple definitions. In order to understand what it means to be agriculturally literate, it has to first be defined in order to create a standard understanding of what literacy is (Clemons et al., 2018). Defining literacy of any kind is important because it allows us to have more conscientious conversations, appraise situations, and make well informed decisions when approaching research and applications (Veerasamy, 2016). Wesley and Lapp’s (2017) content area literacy definition states, “broad subject areas such as science, technology, engineering, and mathematics, and include a person’s knowledge and understanding of associated principles and practices and ability to read, write, and communicate broadly” (p. 240), while Shanahan and Shanahan’s (2012) definition of disciplinary literacy notes that it is, “an emphasis on the knowledge and abilities possessed by those who create, communicate, and use knowledge within the disciplines” (para. 5). Possessing content area literacy implies that a person has the foundation of being able to read and write well enough to
explore a subject more in depth to produce disciplinary literacy within themselves (Shanahan & Shanahan, 2012). According to Shanahan and Shanahan’s (2008) Model of Literacy Progression, literacy develops from basic skills to more complex and less generalizable skills. The three basic levels are disciplinary literacy, intermediate, and basic literacy (Shanahan & Shanahan, 2012). Intermediate and basic literacy are both part of content area literacy. Students can be both in intermediate and disciplinary literacy together, due to the model not being a building progression (Shanahan & Shanahan, 2012).

Clemons et al. (2018) argued these definitions by identifying the differences between being literate in agricultural concepts and having literacy in those concepts. The argument was whether or not a person is considered to have “agricultural literacy” if they can only read the words and phrases associated with agricultural literacy rather than explain the concepts (Clemons et al., 2018).

Researchers have been defining what it means to be agriculturally literate since the National Research Council’s 1988 call to action. Frick et al. (1991) noted that agricultural literacy “can be defined as possessing knowledge and understanding of food and fiber systems” (p. 52). While the American Farm Bureau Foundation (2019a) describes being agriculturally literate, as a person who understands “all of the industries and processes involved in the production and delivery of food, fiber, and fuel that humans need to survive and thrive” (American Farm Bureau Foundation, para. 1, 2019). Lastly, the National Research Council (1988) proclaimed that “an agriculturally literate person would understand the food and fiber system and this would include its history and its current economic, social, and environmental significance to all Americans” (p.8). The National Agriculture in the Classroom programs (2014) accepted the definition of being agricultural literate as someone who understands and can
communicate the source and value of agriculture as it affects our quality of life. The National Agriculture in the Classroom’s definition helped to shape and develop the National Agricultural Literacy Outcomes (NALOs), and was also used as the definition for this study.

To follow these definitions and subject areas, Spielmaker and Leising (2013) created the National Agricultural Literacy Outcomes (NALOs). These benchmarks outline the critical aspects of agricultural knowledge that a person should possess an understanding of to be deemed literate in agriculture. These outcomes should be seen as “the vehicle that can contextualize academic content and provide educators with high quality, relevant, meaningful, and engaging resources that lead to enduring understandings” (Spielmaker & Leising, 2013, para. 8). In April 2013, the National Agricultural Logic Model, consisting of the foundation for the NALOs, (Spielmaker, Pastor & Stewardson, 2014) was developed by government officials, researchers, and practitioners in agricultural education. The NALOs focus on five subject areas:

1) Agriculture and the environment
2) Plants and animals for food, fiber, & energy
3) Food, Health, and Lifestyle
4) Science, Technology, Engineering, & Math
5) Culture, Society, Economy, & Geography

To assess this need of agricultural literacy implementation, assessments of the populations’ agricultural literacy have occurred in a variety of ways. However, Brandt (2016) noted that there was no clear way to assess agricultural literacy. Due to this, the Longhurst Murray Agricultural Literacy Instrument (LMALI) (APPENDIX A) was created and published in 2019 to assess agricultural literacy levels in students in Kindergarten through fifth grade by Utah State University (Brandt, 2016). The LMALI focuses on three different levels of
agricultural literacy, coinciding with Clemons et al. (2019) argument about literacy in general. The three levels are having limited or developing agricultural exposure, functional agricultural literacy, and practical and applicable agriculture proficiency, reflecting on what Clemons et al. (2018) found. The different levels also reflect Shanahan and Shanahan’s (2008) Model of Literacy Progression by starting with basic concepts and moving into more complex concepts.

A large majority of agricultural literacy efforts are focused in schools because according to Brandt (2016) “agriculture isn’t a focus in most elementary or high school classrooms throughout the nation” (p. 2). To go along with that, the National Research Council (1988) stated, “agricultural education in U.S. high schools usually does not extend beyond the offering of an agricultural education program [in a high school setting]” (p. 2), this is evidence that it is not common to have agricultural education in elementary schools.

Elementary students get exposed to science, technology, engineering, and mathematical concepts while in school, and these subjects can directly align with agricultural concepts (Brandt, 2016). In addition, Coenders et al. (2008) investigated what teachers wanted out of pre-developed science related curriculum. The researchers found that the teachers wanted the students to be able to affix newly exposed knowledge in a way that stimulated them in a familiar context through hands-on interaction to make what they were learning in science more relatable (Coenders et al., 2008).

Ricketts and Place (2005) found that students were more receptive to the material they were learning if they could be hands-on and actively participating in the lesson they were learning. All of the participants of Coenders et al., (2008) study also noted that there was an insufficient amount of time for them to create new learning materials for their students. It can be found that an increased teacher workload correlates with low job satisfaction, therefore making it
even more difficult for teachers to properly plan lesson implementation in their classroom (Timperley & Robinson, 2000). Pense, Leising, & Portillo (2011) recognized that the National Research Council (1988) determined that students in kindergarten through the twelfth grade should be exposed to agricultural concepts in order to become literate in agriculture. Due to there not being agricultural education programs in elementary schools and no set curriculum for agricultural education in elementary schools, there is a need for the development and integration of agricultural concepts to be used by teachers in elementary school settings.

When determining agricultural literacy levels, common methods and theories have been used including the Delphi method, knowledge gap theory, and constructivist theoretical perspectives. From 1988 to 2013, Kovar and Ball (2013) discovered that out of 49 agricultural literacy-based studies, only 23 assessed agricultural literacy, while the remaining 26 evaluated programs and assessed attitudes toward agriculture. Dale, Robinson, and Edwards (2017) determined the difference between scores on an agricultural literacy survey through demographics and colleges, while Hess and Trexler (2011) assessed elementary student agricultural literacy by having them explain what, where, and how each part of a hamburger was made, finding that the majority of the participants in both studies were not literate in agriculture. Bradford (2016) found that through an agricultural literacy treatment, participants had statistically significant increases in their agricultural knowledge, however, the majority of the participants were illiterate in agriculture to begin with. These studies individually showcase the many avenues and outcomes that researchers have found pertaining to agricultural literacy levels.

The studies that evaluated programs promoting agricultural literacy did so in several different ways. Studies analyzing perceptions and attitudes about agriculture were analyzed through media portrayals, exhibits, and the environment in which the population that was studied
lived in. Anderson et al., (2014) analyzed a program called the Summer Agriculture Institute (SAI) in which Oregon State University and Oregon Farm Bureau created and facilitated. Luckey, Murphrey, Cummins, and Edwards (2013) evaluated an exhibit called “AgVenture” hosted by the Houston Livestock Show. Sandlin and Perez (2017) gave out a survey to adults at an event called “Taste” which showcased locally grown food, asking them about the event. All had varying results when evaluating if the programs achieved their objectives and outcomes pertaining to influencing agricultural literacy levels and perception.

Determining and assessing perceptions and attitudes toward agriculture was another prevalent piece of literature in agricultural literacy studies. Estes, Edgar, and Johnson (2015) studied perceptions about the poultry industry in Arkansas. Pennisi, Lackey, Meendering, and Brandle (2018) observed perceptions of a proposed demonstration farm. Rumble and Buck (2013), Specht and Rutherford (2013), and Glaze, Edgar, Rhoades-Buck, and Rutherford (2013), all used agricultural imagery to observe the perceptions and attitudes toward agriculture. The outcomes of these studies were mixed with both positive and negative perceptions toward agriculture.

Rodriguez, Lamm, Owens, and Thompson (2015) recommended there should be studies conducted to determine if hands-on learning in gardening or the vegetable production process has an impact on children’s vegetable consumption at home, factoring in understanding and awareness. Clemons et al., (2018) noted there is a need for a study about how to bridge the gap between being literate in agriculture and being agriculturally literate. Pennisi et al., (2018) encourage and recommend Environmental Education Centers and Demonstration farms with the support of the community. Rumble and Buck (2013) suggest studies should be done analyzing the imagery and media portrayal consumers observe about agriculture. Through these results and
recommendations, it is evident that there is a need for research to be conducted to continuously assess the population’s agricultural literacy levels.

Due to the majority of the citizens in the United States being illiterate in agriculture and living in urban areas, the United States Department of Agriculture implemented the National Agricultural in the Classroom program (NIFA/USDA, 2011). The National Agriculture in the Classroom (NAITC) program is adopted and carried out individually by state programs (National Agriculture in the Classroom, 2020). The (2019) NAITC program provides “a network that seeks to improve agricultural literacy- awareness, knowledge, and appreciation- among PreK-12 teachers and their students” (para. 1). Currently, the Mississippi Agriculture in the Classroom (MAITC) program is housed by the Mississippi Farm Bureau Federation (MFBF), whom manages the state-wide MAITC curriculum and website. At the time of this study, the MAITC program consists of two-day workshops provided to Mississippi teachers about agriculture, had four lesson plans, and four activities available on the their website (Mississippi Farm Bureau Federation, 2018). The MAITC (2019) program objective is “to encourage educators to teach more about our food and fiber system and the critical role of agriculture to our economy and society” (para. 1). The current MAITC curriculum had not identified objectives, NALOs, or aligned with state standards.

According to the Urban and Rural Classifications as set forth by the United States government, an urban area is considered to have 2,500 or more inhabitants (Urban and Rural Classifications, 1949). Starkville, Mississippi, where this study was conducted, currently has a growing population of 25,352 citizens (City-Data, 2020). It can be noted that 96% of those individuals are considered to be urban residents, while the remaining four percent are rural (City-Data, 2020). This can be evidence that most of the elementary students in this study do not have
an agricultural background. This study was meant to provide information to researchers to conclude if aligning MAITC curriculum with objectives, state standards, and the NALOs would promote more implementation of the program in classrooms across Mississippi, as well as assessing agricultural literacy levels of elementary students who live in an urban area.
Conceptual Framework

The conceptual framework for this study was based on Elliot’s (1999) agricultural literacy framework model. This framework outlines the three main influences of a person’s agricultural literacy level: personal characteristics, education, and participation in agricultural activities. Elliot’s (1999) agricultural literacy framework states that these three categories of a person’s life, influence their agricultural literacy levels.

Agricultural Literacy Framework

According to Elliot’s (1999) Agricultural Literacy Framework, as seen in Figure 1, knowledge base of agriculture correlates with attitude and perception about agriculture. Moreover, three things affect an individual’s knowledge and perception starting with education (formal, non-formal, news), personal characteristics (gender, ethnicity, home location, family/friends), and participation in agricultural activities such as: FFA, 4-H, plants, and animals (Elliot, 1999).

Elliot (1999) also noted that education can be provided through both formal and non-formal settings, along with news and media avenues. Personal characteristics factor in demographics and if the individual has experience living on a farm. Participation in agricultural activities consist of being involved in an agriculturally related organization, or having direct experience in raising animals or growing plants. Furthermore, Specht, McKim, and Rutherford (2014) found that previous knowledge and agricultural literacy levels have an impact on an individual’s perception of production agricultural and related imagery.
Summary

Many individuals in today’s population lack a basic understanding of agriculture. Being agriculturally literate can help the population make well informed decisions when it comes to food safety, environmental concerns, and food and fiber policy. Kovar and Ball (2013) noted that technology in agriculture is evolving faster than ever before, therefore agricultural literacy levels of the population should be assessed and addressed as a result of that. Elliot’s (1999) Agricultural Literacy model has provided the framework for researching if an individual’s personal characteristics, participation in agricultural activities, and education affect students’ agricultural literacy levels. Diffusing curriculum and lessons pertaining to agriculture can have the potential of raising agricultural literacy levels in youths across the United States, while also being able to reevaluate existing and outdated agricultural literacy programs and efforts.
CHAPTER III

METHODOLOGY

Restatement of Problem

Research conducted over the last decade provides evidence that today’s society and future generations should be literate in agriculture. However, Bellah et al., (2004) and Kovar and Ball (2013) conclude that the majority of the population is agriculturally illiterate. Molloy (2016) states that all citizens need to understand the economic, social, and environmental significance of agriculture. Food production is the basis of all civilization. We need a well-educated public to contribute to the success of a safe and affordable food system that will attempt to feed the expected nine billion people in this world by 2050. Therefore, the purpose of this study is to determine if revised and existing MAITC curriculum changes elementary students’ level of agricultural literacy knowledge.

Restatement of Research Objectives

The purpose of this study is to determine if there is a statistically significant difference ($p < .05$) in agricultural literacy of students enrolled in the fourth grade who have participated in new Mississippi college-and-career readiness standards aligned MAITC curriculum compared with existing MAITC curriculum. The specific research objectives were:

Objective 1: Describe the demographics and personal characteristics of the population and their relationship with students’ agricultural literacy levels.
Objective 2: Determine the agricultural knowledge (National Agricultural Literacy Outcome standards) of Mississippi fourth grade students prior to and after exposure of an agricultural literacy program.

Objective 3: Compare agricultural knowledge change (National Agricultural Literacy Outcome standards) among Mississippi fourth grade students after treatment of new and existing Ag in the Classroom curriculum.

Objective 4: Describe the perceptions of the new and existing Agriculture in the Classroom curriculum among teachers.

**Design of the Study**

After IRB approval (IRB-19-244) (APPENDIX L), this study employed a mixed methods design using a paired t-test, descriptive statistics, a MANOVA, and semi-structured interviews. Mixed method research designs use both qualitative and quantitative data collection to paint a more descriptive picture in the findings by analyzing and investigating both types of data, comparatively, to draw conclusions and explain findings (Creswell, 2014).

Mixed methods research allows for comparing different perspectives and explanation of quantitative data through qualitative data (Creswell, 2014). Two nonrandomized treatment groups were used to compare with each other and a control group. Using a nonrandomized control group decreases threats to internal validity such as; regression, history, pretesting, instrumentation, and maturation (Ary, et al., 2006). Ary et al., (2006) also states that using a pretest for these groups ensures that the groups are equivalent on the dependent variable. For this study, all groups received a pre, post, and delayed posttest design, as shown in Table 1, and teacher interviews were held with educators teaching the new AITC lessons.
Table 1  Pretest, Posttest, Delayed Posttest Design

<table>
<thead>
<tr>
<th>Pretest</th>
<th>Lesson</th>
<th>Lesson</th>
<th>Lesson</th>
<th>Posttest</th>
<th>Delayed Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>X₁</td>
<td>X₂</td>
<td>X₃</td>
<td>O₁</td>
<td>O₂</td>
</tr>
</tbody>
</table>

Note. This is the order of the tests and lessons for the treatment groups.

The data collection design for this study is an Explanatory Sequential Mixed Methods design shown in Figure 2 (Creswell, 2014). Through this, quantitative data was collected through a pretest, posttest and delayed posttest using the *Longhurst Murray Agricultural Literacy Instrument* (LMALI K-5) (APPENDIX A). This was then used to formulate questions for the teacher interviews that would act as the qualitative data collection portion of the design (Cresswel, 2014).

![Explanatory Sequential Design](image)

Figure 2  Explanatory Sequential Design (Creswel, 2014)

**Treatment**

Due to Group 1 being the control group, they did not receive any type of treatment. Group 2 received the existing agriculture in the classroom curriculum. This consists of three lessons that the MAITC’s website already had available for teachers to use. Group 3 received the revised agriculture in the classroom lessons. These are three lessons chosen from the National
Agriculture in the Classrooms curriculum matrix and modified to fit the Mississippi College-and-Career readiness standards as well as pertain to commodities in Mississippi.
Treatment: Existing

For the classrooms that received the existing lessons as a treatment, the teacher was provided instructions on how to access three (3) different MAITC lessons that were 30-45 minutes each. I selected the lessons by similarity of the revised lessons, out of the eight lessons and activities that the MAITC program had available online at the time of the study. The teachers were asked to use and implement the lessons just as they would as if they were using and accessing the material “in-real-life”. The existing lessons could be accessed through the MAITC portal on the MFBF website. Teachers received all lesson supplies as well as copies of the pretest, posttest, and delayed posttest prior to implementation. Teachers were given directions on when to administer each test and a time frame to implement all three lessons.

Before the curriculum was implemented, each student in every participating classroom received a pretest. After the pretests, the lessons were taught throughout an 8-week time span. It was up to the teachers when to teach each of the lessons in the 2 months of the study. Posttests were given immediately after all three lessons had been implemented to check immediate knowledge gain. Two weeks later, delayed posttests were given to the students to check for retention of the information presented throughout the term (Colosi & Dunifon, 2006).

Treatment: Revised

For the classrooms that received the revised lessons as a treatment, the teacher was provided instructions on how to access three different NAITC lessons that were 45 minutes each. I selected these lessons from the curriculum matrix from the NAITC program, aligned with Mississippi College-and Career readiness standards, and made available online through the MAITC website via password protection, at the time of the study. The teachers were asked to use and implement the lessons just as they would as if they were using and accessing the material
“in-real-life”. Teachers received all lesson supplies as well as copies of the pretest, posttest, and delayed posttest prior to implementation. Teachers were given directions on when to administer each test, and a time frame to implement all three lessons.

Before the curriculum was implemented, each student in every participating classroom received a pretest. After the pretests, the lessons were taught throughout an 18-week semester. Posttests were given immediately after all three lessons had been implemented to check immediate knowledge change, and two weeks later, delayed posttests were given to the students to check for retention of the information presented throughout the treatments.

**Population and Sample**

The population of the quantitative portion of the study were students enrolled in fourth grade at Henderson Ward Stewart elementary school in the Starkville Oktibbeha School District. Overall there were $N = 62$ students that participated in the study. Fourth grade was chosen for participation in this study because the existing AITC curriculum in Mississippi catered to fourth grade only with available lesson plans. These students were split into three different groups. Group 1 had 36 students ($n = 36$), while Group 2 had 17 students ($n = 17$) and Group 3 had 14 students ($n = 14$).

The treatment groups were as follows:

- Control (Group 1) – pretest, no treatment, posttest, and delayed posttest
- Treatment Group 1 (Group 2) – pretest, existing curriculum, posttest, and delayed posttest teacher interview
- Treatment Group 2 (Group 3) – pretest, revised curriculum posttest, and delayed posttest, teacher interview
The population of the qualitative portion of the study were teachers who taught fourth grade at Henderson Ward Stewart Elementary School in Starkville, Mississippi. Samples of this population were selected through an inclusion criteria.

Inclusion criteria for the samples selected were:

1. Willing administration to allow for the study to take place.
2. Teachers willing to teach revised Ag in the Classroom curriculum.
3. Teachers willing to teach existing Ag in the Classroom curriculum.
4. Teachers willing to allow for interruptions into their classrooms for pre and post testing.

Teachers were recruited through Mississippi State University’s College of Education due to convenience. I contacted several superintendents across the state following recommendations from the College of Education at Mississippi State University. After recruitment and retention of a pool of teachers, all three groups were selected through random assignment. Each teacher was then contacted, and provided the lessons. Creswell (2014) notes that because the entire population is not represented, results cannot be generalized beyond this study due to the nature of it only describing one group of teachers. Overall, six teachers \((n = 6)\) participated in the study. However Group 1’s teachers were not contacted for interviews. Group 2 had only one teacher \((n = 1)\) agree to an interview and Group 3 had both teachers \((n = 2)\) agree to an interview. The teacher interviewed who taught the existing curriculum was coded at T1, while the teachers that taught the revised curriculum were coded as T2 and T3.

**Instrumentation**

The instruments used for the study were three existing lesson plans from Mississippi’s Agriculture in the Classroom program, three lessons from the National Agriculture in the
Curriculum

Curriculum for this study came from the current Mississippi Agriculture in the Classroom program and the National Agriculture in the Classroom curriculum matrix.

Current Mississippi Agriculture in the Classroom Lesson Plans

At the time of the start of the study there were four lesson plans and four activities listed on the Mississippi Agriculture in the Classrooms’ website, along with an order sheet for supplies that specifically identified fourth grade as the intended audience for the lessons. Three of these lessons were selected for teachers to teach (APPENDIX C-E). They included the following topics: Soil, Potatoes, and Dairy. These lessons were selected to mimic those selected for the revised lesson plans. The current lessons provided by the MAITC program include lesson objectives, but do not include any alignment to Mississippi College-and-Career readiness standards or the NALOs.

Soil

There were no definable objectives for the lesson “A Slice of Soil” (APPENDIX C). The lesson included two paragraphs of background information about soil, a materials list, and then procedure instructions. The lesson consisted of the teacher cutting an apple into four equal parts and explaining for three of the slices represented the oceans of the world while the fourth slice represented the land we have available. Then the fourth slice was cut down further to
represent deserts, swamps, Antarctica, the Artic, and mountain regions, along with areas of the world that are too rocky, wet, hot, or too poor for soils to grow crops and support humans. To end the lesson, the students were able to share apples amongst themselves.

**Potatoes**

The objective for the lesson “Potato Fun” (APPENDIX D) was stated as “To gain knowledge about potatoes” while the learner objective was “To name parts of a potato and identify different kinds of potatoes”. This then was followed by a supply list, procedure, and instructions. The instructions for this lesson plan were for the teacher to show five different potato varieties to students, identify the parts, and the use the potatoes to paint with and make a stamp. The review for the lesson was for the teacher to “review questions about the potato” and the “show everyone’s completed stamp”.

**Dairy**

The dairy lesson “Ice Cream in an Instant” (APPENDIX E) did not include any objectives. A materials list was followed by instructions and procedures on how students could make ice cream in a plastic bag.

**National Agriculture in the Classroom Lesson Plans**

The National Agriculture in the Classroom program has a curriculum matrix of lesson plans that are aligned with the National Agricultural Literacy Outcomes were used in this study. From this curriculum matrix, three were chosen that aligned with the existing lessons to be taught and then modified to fit Mississippi College-and-Career readiness standards as well as agriculture in Mississippi. These lesson plans are aligned with the NALOs, but do not identify
objectives. The research conducted in this study did this by conducting a constant comparative coding method.

**Coding**

Through a document analysis the Mississippi Department of Education College-and-Career readiness standards (Mississippi Department of Education, 2018), and lessons in the National Agriculture in the Classroom curriculum matrix were compared and aligned using a coding system. State science, social studies, and mathematics standards were used in conjunction with the agricultural literacy outcomes because Brandt, Forbes, and Keshwani (2017), believes that teachers will mostly likely be able to teach agriscience subjects through their curriculum.

Ary et al., (2006) states that a document analysis “focuses on analyzing and interpreting recorded material within its own context” (p. 32). Bowen (2009) states that the four reasons for a document analysis is: 1) Documents provide context with data, 2) Information in the documents can lead to important questions that need to be part of the study, 3) Documents provide supplementary data, and 4) Documents allow a way of tracking development and change. The documents analyzed were the lesson plans from the National Agricultural in the Classroom program and the Mississippi College-and-Career Readiness Standards (Mississippi Department of Education, 2018).

A constant comparative method of coding was used. First, a constant comparison of the NAITC lessons and Mississippi Department of Education elementary College-and-Career Readiness Standards for fourth grade (Mississippi Department of Education, 2018) were examined and compared to outline the theoretical properties of each objective (Glaser, 1965). Next, categories were integrated based on their purpose and alignment (Glaser, 1965). Then the coding theory was delaminated, assessed, reintegrated, and finally theorized into set aligned
categories and themes (Glaser, 1965). However, Morse (2015) notes “the researcher must be responsible for the analysis, and the most familiar with the research agenda and relevant theories, the researcher must be responsible for the research outcome” (p. 1215). Through coding and document analysis, I was able to gain empirical knowledge and understanding about both state science standards and National Agricultural Literacy Outcomes in order to align themes to lessons from the National Agriculture in the Classroom curriculum matrix (Bowen, 2009). After these themes and objectives were identified, lessons created by the NAITC program were aligned and used for the study. Lessons were then reviewed by experts in agricultural education and elementary education for content validity. The lessons were By-products, Soil, Commodities.

**By-products**

The by-products lesson (APPENDIX F) was meant to match the “Dairy” lesson. This lesson was laid out as overview and purpose, educational standards, objectives, materials needed, lesson set up, vocabulary, ag facts, background information for the teacher, and learning procedures. The objectives for this lesson plan were 1) Analyze what farmers have to manage in order to produce food and fiber, 2) Determine why farmers have to use science and inherited traits for their cattle, 3) Determine where protein comes from, 4) Discuss what would happen if farmers stop farming, 5) Discuss why people eat different foods around the world (Table 2). To start the lesson, students completed a K-W-L chart (What the students knew about the topic, what the students wanted to know about the topic, and then at the end of the lesson, what students learned about the topic.) Students were then separated into groups and given two sets of cards. The students had to solve mathematical equations that were aligned with their state standards in order to then match up the cards. Once the cards were matched, together they
created a statement about either beef or dairy. The students ended the lesson by having a
discussion and completing a reflection sheet.

Table 2   Breakdown of revised By-product lesson

<table>
<thead>
<tr>
<th>Title</th>
<th>Lesson Objectives</th>
<th>Standards</th>
<th>NALOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>By-Products</td>
<td>• Students will analyze what farmers manage in order to produce food and fiber</td>
<td>L.4.2.2</td>
<td>T1.3-5 e Recognize the natural resources used in agricultural practices to produce food, feed, clothing, landscaping plants, and fuel (e.g. soil, water, air, plants, animals, and minerals).</td>
</tr>
<tr>
<td></td>
<td>• Students will determine why farmers have to use science and inherited traits for their cows</td>
<td>4.NF.3 b</td>
<td>T2. 3-5 d Provide examples of specific ways farmers/ranchers meet the needs of animals.</td>
</tr>
<tr>
<td></td>
<td>• Students will determine where protein comes from</td>
<td>4.NF.3 c</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Students will discuss what would happen if farmers stop farming</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Students will discuss why people eat different foods around the world.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Standards are listed as abbreviated 2018 Mississippi College-and-Career readiness standards.

Soil

The soil lesson (APPENDIX G) was meant to match the “A Slice of Soil” lesson. This lesson was laid out as overview and purpose, educational standards, objectives, materials needed, lesson set up, vocabulary, ag facts, background information for the teacher, and learning procedures. The objectives for this lesson plan were 1. Analyze the components of soil, 2. Determine the silt, sand, and clay of the soils in the student’s surrounding areas, 3. Discuss the
resources needed to grow food and fiber, and 4. Examine why crop rotation is important to farmers (Table 3). In this lesson, students experimented with three different soil particles from their surrounding area. The students conducted a mason jar test to determine how much of each soil particles (sand, silt, clay) was prevalent in their sample. The students then measured and documented their findings. The lesson was followed up with a student reflection sheet.

Table 3  Breakdown of revised Soil lesson

<table>
<thead>
<tr>
<th>Title</th>
<th>Lesson Objectives</th>
<th>Standards</th>
<th>NALOs</th>
</tr>
</thead>
</table>
| Soil  | • Students will analyze the components of soil  
• Students will determine the silt, sand, and clay of soils in the student’s surrounding areas  
• Students will discuss the resources needed to grow food and fiber  
Students will examine why crop rotation is important to farmers | L.4.2.1  
4.MD.1 | T1.3-5 e Recognize the natural resources used in agricultural practices to produce food, feed, clothing, landscaping plants, and fuel (e.g. soil, water, air, plants, animals, and minerals).  
T2.3-5 e Understand the concept of specific ways farmers/ranchers care for soil, water, plants, and animals. |

*Note. Standards are listed as abbreviated 2018 Mississippi College-and-Career readiness standards.*

**Commodities**

The commodities lesson (APPENDIX H) was meant to match the “Potato Fun” lesson. This lesson was laid out as overview and purpose, educational standards, objectives, materials needed, lesson set up, vocabulary, ag facts, background information for the teacher, and learning procedures. The objectives for this lesson plan were 1) Determine where different commodities
come from and why, 2) Explain what commodities grow in Mississippi, 3) Determine where food comes from in the winter, and 4) Discuss the cost of food (Table 4). This lesson consisted of students identifying on a map of the United States, as well as map of Mississippi where certain types of commodities, including potatoes, come from along with reading and researching about six different types of commodities including: beef, potatoes, apples, corn, dairy, and citrus. The lesson was then followed up with a reflection sheet for the students.

Table 4  Breakdown of revised Soil lesson

<table>
<thead>
<tr>
<th>Title</th>
<th>Lesson Objectives</th>
<th>Standards</th>
<th>NALOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commodities</td>
<td>• Students will analyze where different commodities come from and why</td>
<td>L.4.2</td>
<td>T1.3-5 e Recognize the natural resources used in agricultural practices to produce food, feed, clothing, landscaping plants, and fuel (e.g. soil, water, air, plants, animals, and minerals).</td>
</tr>
<tr>
<td></td>
<td>• Students explain what commodities grow in Mississippi</td>
<td>G.4.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Students will investigate where food comes from in the winter</td>
<td>G.4.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Students will discuss the cost of food</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Standards are listed as abbreviated 2018 Mississippi College-and-Career readiness standards.

Assessment Instrument

The LMALI (APPENDIX A) K-5 assessment instrument was used for the pretest, posttest and delayed posttests for all three groups. This instrument is an evidence-centered assessment design based on the National Agricultural Literacy Outcomes (NALOs) developed
through the University Nebraska-Lincoln (2016). This instrument measures three proficiency levels:

1.) Limited or developing agricultural *exposure*
2.) Functional agricultural *literacy*
3.) Practical and applicable agriculture *proficiency*

A modified Delphi Technique was used having a Teacher Advisory Committee cultivate assessment questions which were then validated by a sample spanning across seven states. This instrument was pilot tested through 400 students in the study and was followed up by student interviews (Brandt et al., 2017). The instrument consists of 15 questions consisting of multiple choice, matching, and true/false questions.

Reliability and validity of the scores on the test can only be measured when students have taken and responded to all 15 questions (Brandt, 2016). Partial credit can only be evaluated in order to assess classroom instruction (Brandt, 2016). Cronbach’s alpha coefficients were not calculated due to the fact that the instrument was developed using exploratory factor analyses (EFA), a confirmatory factor analysis (CFA), and a discriminant analysis (DA) to determine the validity of the proficiency levels of agricultural literacy. The reliability measures were grounded in the Delphi method using the National Agricultural Literacy Outcomes” (D. Spielmaker, Personal Communication, January 1st, 2020).

Prior to administration of the instrument, I conducted a Cronbach’s Alpha to measure instrument reliability. The Cronbach’s Alpha score for the instrument for this study was .651. According to Fields (2013), a Cronbach’s Alpha value of .7 to .8 is an acceptable value. However Nunnally (1978), states that early in research, values as low as .5 are a suitable.
At the beginning of the delayed posttest, I included eight questions for the students to answer about their personal characteristics, relating to agriculture. They were asked the following: 1) Are you a member of the 4-H club?, 2) Do you live on a farm?, 3) Do you have any family members who live on a farm?, 4) Do you or your family ever grow a garden?, 5) Do you or your family ever raise animals for food such as chickens, cows, or pigs?, 6) Does your family watch the news?, 7) Have you ever grown any kind of plant at school?, and 8) Have you ever raised any kind of animal at school?. Percentages and frequencies were calculated on if; students were members of the 4-H organization, students lived on a farm, if they had relatives that lived on a farm, had raised any type of plant or animal for food, if they or their family watched the news, or had ever grown any kind of plant or animal at school.

**Interview Protocol**

Teachers were emailed two weeks after the delayed posttests were collected to set up a time to be interviewed (APPENDIX Q). Interview questions were developed and check for content validity. Once teachers responded with an interview confirmation, they were then sent the interview questions to review (APPENDIX P). Before the interview began, teachers signed a consent form (APPENDIX O).

**Data Collection**

Before the study was conducted, the Office of Research Compliance granted IRB approval for research to be conducted with human subjects and approval of the instruments used in this study. Letters were provided to superintendents, principals, and then teachers explaining the study (APPENDIX I). Permission from all three groups and the teachers to participate in the study had to be granted before IRB completion (APPENDIX J-L). After permission and approval from the IRB and the administrators, I traveled to the participating school in late summer before
data was collected. Prior to administering any assessments or materials to the students and interviewing the teachers, I provided both students and teachers with consent forms and students with assent forms to be signed.

After consent from students’ guardians (APPENDIX M), student assent (APPENDIX N), and teacher consent (APPENDIX O) forms were returned, students were given a unique identification number and pretests were distributed. Starting in September 2019, lessons were taught as outlined in the cooperating teacher’s schedule. After the delayed posttests were administered, teachers were contacted to set up interviews. Teachers were interviewed in the two weeks that followed the distribution of the delayed posttest.

**Teacher Interviews**

Semi-structured interviews were held with the teachers in the study to obtain information on their beliefs, opinions, and feelings about the old and new MAITC lessons (Ary et al., 2006). After the MAITC lessons were taught to both test groups, pretests, posttest, and delayed posttests were taken, data was interpreted to formulate research questions about the teacher’s attitudes and opinions about the new lessons. These interviews were partially structured and each teacher was asked the same set of questions, but the interviewer modified the format of the questions to fit the teacher’s answers (Ary et al, 2006). To ensure that questions were not double-barreled, prior to the interviews, questions were reviewed by an expert in agricultural education (Litwak, 1956).

During the interviews, notes were taken for transcription and data analysis. Through this method of triangulation, validity and reliability of the data collected was increased (Fraenkel, Wallen, & Hyun, 2015). Additionally, this method provides a much more detailed account of an individual’s experiences than they would have provided through structured interview questions (Lune & Berg, 2017).
Group 1

Group one served as the designated control group, and therefore did not receive any experimental treatment. Group 1 received the pretest on September 30th, 2019 and was given the posttest and attitude instrument on November 7th, 2019. Two weeks after the posttest, students received the delayed posttest on November 21st, 2019. These assessments were conducted during regular class time. 37 students received the pretest, 36 received the posttest, and 37 received the delayed posttest. A total of 37 students were in Group 1.

Group 2

Group two was the designated group that received the existing MAITC lessons. Lessons were taught in pre-existing classroom populations. Each lesson lasted 45 minutes. Group 2 received the pretest on September 30th, 2019 and was given the posttest on November 7th, 2019. Two weeks after the posttest, students received the delayed posttest on November 21st, 2019. These assessments were conducted during regular class time. In Group 2, 20 students received the pretest, 17 received the posttest, and 18 received the delayed posttest. A total of 20 students were in Group 2. Teacher Interviews were conducted on December 10th, 2019.

Group 3

Group three was also a designated treatment group. New MAITC lessons were taught and these were based on lessons from the National Agriculture in the Classroom program. Lessons were taught in pre-existing classroom populations. Each lesson lasted 45 minutes. Group 2 received the pretest on September 30th, 2019 and was given the posttest on November 7th, 2019. Two weeks after the posttest, students received the delayed posttest on November 21st, 2019. These assessments were conducted during regular class time. In Group 3, 22 students received
the pretest, 16 received the posttest, and 16 received the delayed posttest. A total of 22 students were in Group 3. Teacher Interviews were conducted on December 4th, 2019.

**Data Analysis (Quantitative)**

Data were entered into Microsoft Excel spreadsheets and transferred into The Statistical Package for the Social Sciences (SPSS). Students who did not take all three tests (pretest, posttest, delayed posttest) were removed from data analysis. Student answered questions from the knowledge instrument were coded as 1 for correct and 0 for incorrect. Knowledge questions that students chose not to answer were coded as a 0.

Objective one collected data on the participant’s personal characteristics that described the relationship between those and the population’s agricultural literacy levels. This was conducted through a multivariate analysis of variance (MANOVA) to predict if the factors that Elliot (1999) identified had a statistically significant impact on the student’s agricultural literacy levels.

Objective two aimed to determine the agricultural knowledge (National Agricultural Literacy Outcome standards) change in Mississippi fourth grade students. According to the LMALI scoring guide, if the score on the instrument is < 50% then the student is considered to have exposure knowledge of agriculture, if the score on the instrument it ≥ 50% then the student is considered to be factually literate about agriculture, and if the score is ≥ 80% then the student is considered to be applicably proficient in agricultural literacy. To determine if the students were literate in agriculture prior to any type of exposure or treatment, pre-test scores from students were calculated by percentages taking the amount of correct answers the student scored on the assessment instrument and dividing it by 15 (the total amount of questions on the instrument).
Objective three assesses agricultural knowledge (National Agricultural Literacy Outcome standards) change among Mississippi fourth grade students prior to and after treatment of new and existing AITC curriculum. As determined by the 15 question assessment instrument based on results from the pre and posttests, scores were calculated and recorded as percentages out of 100 by dividing correct answers by 15 (the total number of questions on the instrument). Standard deviations and means were calculated for the overall pretests and posttests. A paired t-test compared the means of the pretest, posttest, and delayed posttest scores of all three groups and the mean difference was reported. Assumptions for a paired t-test are that the dependent variable must be continuous, the observations are independent of one another, the dependent variable should be approximately normally distributed, and the dependent variable should not contain any outliers (Statistic Solutions, 2020). Assumptions were not checked due the small sample size, and insignificant P-value ($p < .05$) (Statistic Solutions, 2020).

After a paired t-test was conducted that included all questions from the LMALI, I decided to select the questions that pertained to the specific NALOs addressed in the revised lessons. Questions 2, 6, 8, 9, and 13 were determined to be questions specifically addressed by the revised lessons. After individual means were calculated, paired t-tests were conducted comparing the pretest/posttest, pretest/delayed posttest, and posttest/delayed posttest of all three groups.

**Data Analysis (Qualitative)**

Objective four described the perceptions of the new and existing AITC curriculum among teachers. To do this, interviews were conducted amongst the teachers participating in the study. I conducted these at the participating school. Interviews were recorded and transcribed verbatim in Google Docs via transcription software Express Scribe. I then coded the responses via pattern into themes. This was done by contrasting and comparing the data collected from the interviews
until a theme through a pattern of thought emerged through a constant comparative method (Frankel, Wallen & Hyun, 2015).
CHAPTER IV
RESULTS & DISCUSSION

In an attempt to analyze the agricultural literacy levels and what personal characteristics had a relationship with agricultural literacy levels in this study, four objectives were established. Objective one was to describe the demographics of the sample size while analyzing the personal characteristics that Elliot (1999) outlines as having a relationship with agricultural literacy levels. Objective two was to determine the agricultural knowledge (National Agricultural Literacy Outcome standards) of Mississippi fourth grade students prior to and after exposure of an agricultural literacy program. To do this pretest, posttest, and delayed posttest scores were compared within groups to determine if there was a positive or negative change in agricultural literacy test scores. Objective three was to compare agricultural knowledge change (National Agricultural Literacy Outcome standards) among Mississippi fourth grade students prior to and after treatment of new and existing Ag in the Classroom curriculum. Pretest, posttest, and delayed posttest scores of all three groups were compared for objective three. Due to the statistical insignificance of the difference between the test score means, I isolated questions #2, #6, #8, #9, and #13 since those question objectives dealt directly with the NALOs covered in the revised lessons. Objective four was to describe the experiences of teaching the new and existing Ag in the Classroom curriculum among teachers. For this objective, qualitative data was obtained via open-ended interviews with Group 2 and Group 3 teachers.
**Objective One Results**

Objective one was to describe the demographics and personal characteristics of the population and their relationship with the students’ agricultural literacy levels. In total 63 students ($N = 63$) were able to complete the pretest, posttest, and delayed posttest. 0% ($n = 0$) of the students identified that they were a member or participated in the 4-H organization. 1.6% ($n = 1$) of students out of all three groups identified that they lived on a farm, while 25% ($n = 16$) students reported that they had family members who lived on farms. 71% ($n = 45$) students reported that they and their family had grown a garden, only 33% ($n = 21$) reported to have raised an animal such as a chicken, cow, or pig for food. 74% ($n = 47$) of students reported that their family watched the news. 63% ($n = 40$) students reported that they had grown a plant while at school, while 41% ($n = 26$) of students had reported to raising an animal at school. Due to the rules of the school district pertaining to keeping the identity of the students anonymous, primary demographic data was not collected by the researcher, however a secondary data source was used to survey the demographics of the population (National Center for Educational Statistics, 2020) (Table 5).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
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<td>581</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>587</td>
</tr>
<tr>
<td>Student #</td>
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<td>394</td>
</tr>
<tr>
<td></td>
<td>3rd</td>
<td>361</td>
</tr>
<tr>
<td></td>
<td>4th</td>
<td>397</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Caucasian</td>
<td>321</td>
</tr>
<tr>
<td></td>
<td>African-American</td>
<td>790</td>
</tr>
<tr>
<td></td>
<td>Hispanic</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>44</td>
</tr>
</tbody>
</table>

*Note: Data from the National Center for Educational Statistics (2020)*
There was not an overall statistical significance showcasing the relationship between personal characteristics and agricultural literacy means (Table 6). However, it can be seen that if students had family members that live on a farm, their means were higher. Table 6 showcases that mean differences if students indicated yes to the survey item.

Table 6   Agricultural Literacy Factorial MANOVA

<table>
<thead>
<tr>
<th>Item</th>
<th>Pretest</th>
<th>Posttest</th>
<th>Delayed Post test</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>M</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------</td>
<td>----------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Is a member of 4-H</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lives on a farm</td>
<td>1</td>
<td>47.00</td>
<td>47.00</td>
</tr>
<tr>
<td>Has family members that live on a farm</td>
<td>16</td>
<td>52.50</td>
<td>56.19</td>
</tr>
<tr>
<td>Grows a garden</td>
<td>45</td>
<td>47.16</td>
<td>49.98</td>
</tr>
<tr>
<td>Raises animals for food such as chickens, cows, and pigs</td>
<td>21</td>
<td>44.14</td>
<td>48.57</td>
</tr>
<tr>
<td>Family watches the news</td>
<td>47</td>
<td>44.72</td>
<td>47.40</td>
</tr>
<tr>
<td>Has grown a plant at school</td>
<td>40</td>
<td>47.70</td>
<td>50.00</td>
</tr>
<tr>
<td>Has raised an animal at school</td>
<td>26</td>
<td>49.23</td>
<td>51.23</td>
</tr>
</tbody>
</table>

Note. - represents missing data

**Objective Two Results**

Objective two was to determine the agricultural knowledge (National Agricultural Literacy Outcome standards) of Mississippi fourth grade students prior to and after exposure of an agricultural literacy program. The 15 question instrument was scored on a 100 point scale. Students that scored ≥ 80 % were placed in the *Applicable Proficiency* category, while students that scored ≥ 50 % were placed in the *Factual Literacy* category, and students who scored < 50 % were placed in the *Exposure* category (Table 7). Due to the statistical insignificance (*p < .05*)...
of the difference between the test score means, I isolated questions #2, #6, #8, #9, and #13 since those question objectives dealt with the NALOs covered in the revised and existing lessons.

Table 7  Classification of Knowledge Based on Range of Scores

<table>
<thead>
<tr>
<th>Score</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 ≥ 80 %</td>
<td>Applicable Proficiency</td>
</tr>
<tr>
<td>79 ≥ 50 %</td>
<td>Factual Literacy</td>
</tr>
<tr>
<td>&lt; 50 %</td>
<td>Exposure</td>
</tr>
</tbody>
</table>

*Note.* Range of scores as indicated by the scoring guide for the LMALI.

**Group 1, Group 2, Group 3 Scores**

Thirty-two students \(N = 32\) were able to complete the pretest in Group 1. Group 1 student’s scores on the pre-test ranged from 13% to 87%. Only 3.1% \((n = 1)\) students scored greater than or equal to 80% placing them as having applicable proficiency in agricultural knowledge. 38% \((n = 12)\) students scored greater than or equal to 50% placing them as having factual literacy about agricultural knowledge, and a large majority (59%, \(n = 19\)) students scored 50% or below, placing them as having exposure to agricultural knowledge. On average, group 1 showed very low agricultural knowledge \((M = 45.41, SD = 18.40)\) (Table 8) on the pretest.

For Group 1, posttest scores ranged from 0% to 87%. A portion of students (3%, \(n = 1\)) scored in the Applicable Proficiency category while 38% \((n = 12)\) scored in the Factual Literacy category. The remaining 59% \((n = 19)\) of the students scored in the Exposure category. On average, Group 1 showed little agricultural knowledge \((M = 44.63, SD = 20.82)\) on the posttest (Table 8).

Group 1 did not have an agricultural literacy treatment, delayed posttest scores ranged from 7% to 80%. None of the students (0%, \(n = 0\)) scored in the Applicable Proficiency category while 38% \((n = 12)\) scored in the Factual Literacy category. The remaining 63% \((n = 20)\) of the
students scored in the Exposure category. On average, Group 1 showed very low agricultural knowledge ($M = 42.13$, $SD = 20.05$) (Table 8) on the delayed posttest.

Seventeen students ($N = 17$) were able to complete the pre-test in Group 2. Group 2 students’ scores on the pretest ranged from 13% to 93%. % ($n = 17$). 12% ($n= 2$) of students in Group 2 scored in the applicable proficiency range, while 24% ($n = 4$) scored in the factual literacy range, and the majority of students (65%, $n = 11$) scored below 50% placing them in the exposure range of agricultural knowledge. On average, Group 2 show very low levels of knowledge about agriculture ($M = 46.24$, $SD = 24.90$) (Table 8) on the pretest.

After the agricultural literacy program treatment for Group 2, posttest scores ranged from 20% to 93%. A portion of students (18%, $n = 3$) scored in the Applicable Proficiency category while 35% ($n = 6$) scored in the Factual Literacy category. The remaining 47% ($n = 8$) of the students scored in the Exposure category. On average, Group 2 showed very low agricultural knowledge ($M = 56.88$, $SD = 20.70$) (Table 8) on the posttest.

After the agricultural literacy program treatment for Group 2, delayed posttest scores ranged from 27% to 100%. A portion of students (12%, $n =2$) scored in the Applicable Proficiency category while the 47% ($n =8$) scored in the Factual Literacy category. The remaining 41% ($n = 7$) of the students scored in the Exposure category. On average, Group 1 showed very low agricultural knowledge ($M = 57.71$, $SD = 20.60$) (Table 8) on the delayed posttest.

Fourteen students ($N= 14$) were able to complete the pretest in Group 3. Group 3 students’ scores on the pretest ranged from 27% to 87%. Seven percent ($n = 1$) students scored an 80% or higher on the pretest, placing them in the applicable proficiency category, while 21% ($n = 3$) scored between 80% and 50% on the pretest placing them in the factual literacy category,
and 50% (71%, n = 10) students scored below 50% on the pretest, placing them in the exposure to agricultural knowledge category. On average, Group 3 showed very low levels of agricultural knowledge on the pretest ($M = 43.43, SD = 19.06$) (Table 8).

After the agricultural literacy program treatment for Group 3, posttest scores ranged from 13% to 87%. A portion of students (7%, n = 1) scored in the Applicable Proficiency category while 21% (n = 3) scored in the Factual Literacy category. The remaining 71% (n = 10) of the students scored in the Exposure category. On average, Group 3 showed very low agricultural knowledge ($M = 48.93, SD = 24.50$) (Table 8) on the posttest.

After the agricultural literacy program treatment for Group 3, delayed posttest scores ranged from 13% to 100%. A portion of students (7%, n = 1) scored in the Applicable Proficiency category while 50% (n = 7) scored in the Factual Literacy category. The remaining 43% (n = 6) of the students scored in the Exposure category. On average, Group 3 showed very low agricultural knowledge ($M = 50.93, SD = 23.15$) (Table 8) on the delayed posttest.

Table 8    Classification of Knowledge Based on Range of Scores

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pre-test (%)</th>
<th>Post-test (%)</th>
<th>Delayed Post-test (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
</tr>
<tr>
<td>Control (Group 1)</td>
<td>45.41</td>
<td>18.39</td>
<td>44.63</td>
</tr>
<tr>
<td>Existing (Group 2)</td>
<td>46.24</td>
<td>24.86</td>
<td>56.88</td>
</tr>
<tr>
<td>Revised (Group 3)</td>
<td>43.43</td>
<td>19.06</td>
<td>48.93</td>
</tr>
</tbody>
</table>

*Note: Mean values for all 15 questions*
Revised group means

32 students ($N = 32$) were able to complete the pretest in Group 1. Group 1 student’s scores on the pre-test ranged from 13% to 87%. On average, Group 1 showed very low overall agricultural knowledge on the pretest, as well as for the revised questions ($M = 40.00, SD = 29.18$) (Table 9).

For Group 1, posttest scores ranged from 0% to 87%. On average, Group 1 showed very low overall agricultural knowledge on the posttest, as well as for the revised questions ($M = 38.12, SD = 27.05$) (Table 9).

Group 1 did not have an agricultural literacy treatment, delayed posttest scores ranged from 7% to 8. On average, Group 1 showed very low overall agricultural knowledge on the delayed posttest, as well as for the revised questions ($M = 38.12, SD = 26.08$) (Table 9).

Seventeen students ($N = 17$) were able to complete the pre-test in Group 2. Group 2 students’ scores on the pretest ranged from 13% to 93%. % ($n = 17$). On average, Group 2 showed overall very low levels of knowledge about agriculture on the pretest, as well as for the revised questions ($M = 45.88, SD = 28.08$) (Table 9).

After the agricultural literacy program treatment for Group 2, posttest scores ranged from 20% to 93%. On average, Group 2 showed very low overall agricultural on the posttest, as well as for the revised questions ($M = 51.76, SD = 24.56$) (Table 9).

After the agricultural literacy program treatment for Group 2, delayed posttest scores ranged from 27% to 100%. On average, Group 2 showed very low overall agricultural knowledge on the delayed posttest, as well as for the revised questions ($M = 51.76, SD = 25.56$) (Table 9).
14 students ($N=14$) were able to complete the pretest in Group 3. Group 3 students’ scores on the pretest ranged from 27% to 87%. On average, Group 3 showed very low overall levels of agricultural knowledge as well as for the revised questions ($M=32.86$, $SD=25.55$) (Table 9).

After the agricultural literacy program treatment for Group 3, posttest scores ranged from 13% to 87%. On average, Group 3 showed very low overall agricultural knowledge (on the posttest, as well as for the revised questions ($M=42.86$, $SD=23.35$) (Table 9).

After the agricultural literacy program treatment for Group 3, delayed posttest scores ranged from 13% to 100%. On average, Group 3 showed very low overall agricultural knowledge on the delayed posttest, as well as for the revised questions ($M=45.71$, $SD=27.66$) (Table 9).

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pre-test (%)</th>
<th>Post-test (%)</th>
<th>Delayed Post-test (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (Group 1)</td>
<td>40.00 29.18</td>
<td>38.12 27.05</td>
<td>38.12 26.08</td>
</tr>
<tr>
<td>Existing (Group 2)</td>
<td>45.88 28.08</td>
<td>51.76 24.55</td>
<td>51.76 24.55</td>
</tr>
<tr>
<td>Revised (Group 3)</td>
<td>32.86 25.55</td>
<td>42.86 23.35</td>
<td>45.17 27.66</td>
</tr>
</tbody>
</table>

*Note:* Mean values for questions 2, 6, 8, 9, 13.

**Objective Three Results**

Objective three of this study was to compare agricultural knowledge change (National Agricultural Literacy Outcome standards) among Mississippi fourth grade students after treatment of new and existing Ag in the Classroom curriculum. Due to the statistical
insignificance of the difference of means between the groups ($p < .05$), the researcher isolated questions #2, #6, #8, #9, and #13 since these questions specifically covered the objectives of the NALOs addressed in the revised lessons.

For the pretest the mean difference between Group 1 (control) and Group 2 (existing) was $MD = -0.83$ while the mean difference between Group 1 (control) and Group 3 (revised) was $MD = 1.98$. In the existing group (Group 2) the mean difference compared to Group 1 (control) was $MD = 0.83$ and between Group 3 (revised) was $MD = 2.81$. Revised (Group 3) – Control (Group 1) = $MD = -1.98$ and the mean difference between Group 3 (Revised) and Group 2 (Existing) was $MD = -2.81$ (Table 10).

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Group</th>
<th>Treatment Group</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Test Scores</td>
<td>Control</td>
<td>Existing</td>
<td>-0.83</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Revised</td>
<td>1.98</td>
</tr>
<tr>
<td></td>
<td>Existing</td>
<td>Control</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Revised</td>
<td>2.81</td>
</tr>
<tr>
<td></td>
<td>Revised</td>
<td>Control</td>
<td>-1.98</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Existing</td>
<td>-2.81</td>
</tr>
</tbody>
</table>

*Note.* Mean differences for Pretests.

For the posttest the mean difference between Group 1 (control) and Group 2 (existing) was $MD = -12.25$, while the mean difference between Group 1 (control) and Group 3 (revised) was $MD = -4.30$. In the existing group (Group 2) the mean difference compared to Group 1 (control) was $MD = 12.25$, and between Group 3 (revised) was $MD = 7.95$. Revised (Group 3) – Control (Group 1) = $MD = 4.30$ and the mean difference between Group 3 (Revised) and Group 2 (Existing) was $MD = -7.95$ (Table 11).
Table 11  Multiple Comparisons of Agricultural Knowledge (Post-Tests) Means by Group

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Group</th>
<th>Treatment Group</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-Test Scores</td>
<td>Control</td>
<td>Existing</td>
<td>-12.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Revised</td>
<td>-4.30</td>
</tr>
<tr>
<td></td>
<td>Existing</td>
<td>Control</td>
<td>12.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Revised</td>
<td>7.95</td>
</tr>
<tr>
<td></td>
<td>Revised</td>
<td>Control</td>
<td>4.30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Existing</td>
<td>-7.95</td>
</tr>
</tbody>
</table>

*Note.* Mean differences for Post-tests.

For the delayed posttest the mean difference between Group 1 (control) and Group 2 (existing) was $MD = -15.58$, while the mean difference between Group 1 (control) and Group 3 (revised) was $MD = -8.80$. In the existing group (Group 2) the mean difference compared to Group 1 (control) was $MD = 15.58$, and between Group 3 (revised) was $MD = 6.78$. Revised (Group 3) – Control (Group 1) = $MD = 8.80$ and the mean difference between Group 3 (Revised) and Group 2 (Existing) was $MD = -6.78$ (Table 12).

Table 12  Multiple Comparisons of Agricultural Knowledge (Delayed Post-Tests) Means by Group

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Group</th>
<th>Treatment Group</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delayed Post-Test</td>
<td>Control</td>
<td>Existing</td>
<td>-15.58</td>
</tr>
<tr>
<td>Scores</td>
<td></td>
<td>Revised</td>
<td>-8.80</td>
</tr>
<tr>
<td></td>
<td>Existing</td>
<td>Control</td>
<td>15.58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Revised</td>
<td>6.78</td>
</tr>
<tr>
<td></td>
<td>Revised</td>
<td>Control</td>
<td>8.80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Existing</td>
<td>-6.78</td>
</tr>
</tbody>
</table>
Revised group means compared #2, #6, #8, #9, and #13

For the revised pretests the mean difference between Group 1 (control) and Group 2 (existing) was $MD = -5.88$, while the mean difference between Group 1 (control) and Group 3 (revised) was $MD = 7.14$. In the existing group (Group 2) the mean difference compared to Group 1 (control) was $MD = 5.88$, and between Group 3 (revised) was $MD = 13.02$. Revised (Group 3) – Control (Group 1) = $MD = -7.14$ and the mean difference between Group 3 (Revised) and Group 2 (Existing) was $MD = -13.02$ (Table 13).
Table 13  Multiple Comparisons of Agricultural Knowledge (Pre-tests) Means by Group: Revised

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Group</th>
<th>Treatment Group</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Existing</td>
<td>-5.88</td>
</tr>
<tr>
<td>Pre-Test Scores</td>
<td></td>
<td>Revised</td>
<td>7.14</td>
</tr>
<tr>
<td>Existing</td>
<td>Control</td>
<td></td>
<td>5.88</td>
</tr>
<tr>
<td></td>
<td>Revised</td>
<td></td>
<td>13.02</td>
</tr>
<tr>
<td>Revised</td>
<td>Control</td>
<td></td>
<td>-7.14</td>
</tr>
<tr>
<td></td>
<td>Existing</td>
<td></td>
<td>-13.02</td>
</tr>
</tbody>
</table>

For the revised posttest the mean difference between Group 1 (control) and Group 2 (existing) was $MD = -13.64$, while the mean difference between Group 1 (control) and Group 3 (revised) was $MD = -4.74$. In the existing group (Group 2) the mean difference compared to Group 1 (control) was $MD = 13.64$, and between Group 3 (revised) was $MD = 8.90$. Revised (Group 3) – Control (Group 1) = $MD = 4.74$ and the mean difference between Group 3 (Revised) and Group 2 (Existing) was $MD = -8.90$ (Table 14).
Table 14  Multiple Comparisons of Agricultural Knowledge (Post-Tests) Means by Group: Revised

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Group</th>
<th>Treatment Group</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-Test Scores</td>
<td>Control</td>
<td>Existing</td>
<td>-13.64</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Revised</td>
<td>-4.74</td>
</tr>
<tr>
<td></td>
<td>Existing</td>
<td>Control</td>
<td>13.64</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Revised</td>
<td>8.90</td>
</tr>
<tr>
<td></td>
<td>Revised</td>
<td>Control</td>
<td>4.74</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Existing</td>
<td>-8.90</td>
</tr>
</tbody>
</table>

For the revised delayed posttest the mean difference between Group 1 (control) and Group 2 (existing) was $MD = -13.64$, while the mean difference between Group 1 (control) and Group 3 (revised) was $MD = -7.59$. In the existing group (Group 2) the mean difference compared to Group 1 (control) was $MD = 13.64$, and between Group 3 (revised) was $MD = 6.05$.

Revised (Group 3) – Control (Group 1) = $MD = 7.59$ and the mean difference between Group 3 (Revised) and Group 2 (Existing) was $MD = -6.05$ (Table 15).

Table 15  Multiple Comparisons of Agricultural Knowledge (Delayed Post-Tests) Means by Group: Revised

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Group</th>
<th>Treatment Group</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delayed Post-Test</td>
<td>Control</td>
<td>Existing</td>
<td>-13.64</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Revised</td>
<td>-7.59</td>
</tr>
<tr>
<td>Scores</td>
<td>Existing</td>
<td>Control</td>
<td>13.64</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Revised</td>
<td>6.05</td>
</tr>
<tr>
<td></td>
<td>Revised</td>
<td>Control</td>
<td>7.59</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Existing</td>
<td>-6.05</td>
</tr>
</tbody>
</table>

*Note.* Mean differences for Delayed Post-tests.
Objective Four Results

Objective four was to describe the experiences of teaching the new and existing Ag in the Classroom curriculum among teachers. Three teachers were interviewed and coded as T1, T2, and T3. T1 taught the existing curriculum while T2 and T3 taught the revised curriculum. There were 14 interview questions asked to both sets of teachers (Table 16).

Table 16 Interview Questions for Participating teachers in Groups 2 & 3

<table>
<thead>
<tr>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do you currently incorporate Mississippi agriculture into your daily lesson plans? Why or why not?</td>
</tr>
<tr>
<td>2. Did the students enjoy learning about agriculture?</td>
</tr>
<tr>
<td>3. Did you enjoy teaching the lessons?</td>
</tr>
<tr>
<td>4. If yes, why?</td>
</tr>
<tr>
<td>5. If no, why?</td>
</tr>
<tr>
<td>6. Were the lessons easy to use? What made them easy/hard to use?</td>
</tr>
<tr>
<td>7. In your opinion, what is the best feature of these lesson plans?</td>
</tr>
<tr>
<td>8. Was there something that the lessons were missing that would have made them easier to use?</td>
</tr>
<tr>
<td>9. Was there something additional that the lessons had that was not needed?</td>
</tr>
<tr>
<td>10. Were you confident teaching this material? Why or why not?</td>
</tr>
<tr>
<td>11. What would have made you more confident in your ability to teach?</td>
</tr>
<tr>
<td>12. What are some recommended changes about the curriculum that you would suggest?</td>
</tr>
<tr>
<td>13. Do you plan to continue to use Mississippi Ag in the Classroom lessons in the future?</td>
</tr>
<tr>
<td>14. Why or why not?</td>
</tr>
</tbody>
</table>

Note. Questions meant for teachers who conducted the agricultural literacy treatments.

Seven themes emerged from the interviews.

**Theme#1:** Neither set of teachers were ever taught to incorporate agriculture into their everyday classroom. T1 had been teaching for 19 years while T2 and T3 had both been teaching for three years. When asked, neither sets of teachers had ever recalled being exposed to
agricultural concepts while in their teacher education programs. When asked, T1 stated “You mean in my college education? No, I don’t recall” while T2 responded “No, they wanted us to mainly integrate science and social studies to reading and math. We were not told very much about agriculture or health for that matter”, and T3 simply responding that she had not been exposed to agriculture in her degree program. However, teachers were taught how to incorporate life science into their curriculum, which could lead to covering some agricultural concepts.

**Theme #2: Teachers were not specifying Mississippi agriculture into their daily curriculum.** Teachers were asked if they ever purposely incorporated Mississippi agriculture into their day-to-day lessons. When asked if it had occurred to T1 to incorporate agricultural concepts related to Mississippi agriculture during their lessons they stated, “I said Vardaman, I’m pretty sure we looked at Idaho, but it wasn’t in Mississippi, but I garden myself so I probably reference my own, I have red potatoes so, something I probably said was sweet potatoes, we talked about how they just have them on the back of the truck and its really cool to have that many, so I referenced there. I don’t think I said anything about dealing with it.”, while T2 stated “I touch all of the reading and social studies standards for fourth grade social studies we are already teaching Mississippi studies, so we talk about soil, we talk about animals in our state, what our state is most widely known for, so we touch those things, but as far as going into depth about different types of cattle, and every single type of soil, maybe not so much. We do kind of touch that, so it’s kind of like a great way to enrich those standards”, with T3 following up with “Yeah, especially when it is really hard to find Mississippi stuff, and it’s really hard to find resources for Mississippi soils or animals”.

**Theme #3: Students enjoyed getting to interactively learn about agricultural concepts.** Overall, students enjoyed learning about agriculture. Through both sets of curriculum, the
lessons were very interactive and hands on. T1 stated, “They did [enjoy learning about agriculture], it was fun. They don’t have a lot of background knowledge [about agriculture]”, while T3 stated, “Oh yeah, and they definitely enjoyed the interactive pieces with the lessons, like we did with the soil testing, and they just really liked to get their hands in it and do it. That definitely helped this project for sure”.

**Theme #4:** The existing lessons would have been difficult for a novice teacher to use. T1 was asked if the existing lessons they received were easy to use. T1 replied with, “I mean it was easy for me, um, like I’m just saying I don’t think it would have been the easiest if I had not had experience with it. So, it needed some more information I would say.” They were also asked if they would have been confident with the existing lessons that were provided if they were a beginning teacher with T1 replying, “Yeah, no, I wouldn’t have been very confident with what was provided”. While T2 stated, “I think if [teachers] had something they could easily pick up and run with they would be more willing to [teach] it.” T2 followed up with having the standards already incorporated in their revised lessons was helpful.

**Theme #5:** Incorporation of the Mississippi College-and-Career readiness standards into the lessons are important. T1 said, “I’m not sure the standards were listed, so with my age of students to make sure their integrated with other standards because we need to mix those if we don’t have a lot of time, just making sure that they are something I’m supposed to be teaching in the classroom, because we don’t have a lot of extra time, so like if you had a science lab that would be outstanding and just make sure it hits the standards. [The standards] needed to be listed….they needed to know all of those”.

**Theme #6:** Teachers wanted more visual aids for students during the lessons. Both T2 and T3 emphasized the need for visuals to represent the agricultural concepts they were teaching
about in their lessons. T3 stated, “I would say the more visuals the better. A lot of our kids they
don’t know, we live in Mississippi and in a rural area, but if they haven’t driven by a cow field
and seen those things then they can’t relate”. While T3 followed with, “I did go back and add
pictures, and give them some visuals because some of these kids learn [better] with them”. T1
noted that she had physical potatoes to show her students for their “Potato Fun” lesson and that
“The most effective was probably teaching the different potatoes since I had them. I would say
that would be the visual for the kids that is most effective”.

Theme #7: Teachers enjoyed teaching agricultural concepts. Both teachers in the revised
curriculum group were positive about their teaching experience when teaching the agricultural
based lessons. T2 stated, “The [lessons] were really good incentives especially when we talked
we would say if you’re not behaving in here you won’t make ice cream Friday, but they don’t
understand like yes we are making ice cream but also learning at the same time. Looking at this
one I see that you had measurement standards, which measurements is really hard to explain in
class if you know they don’t know what a milliliter is so, it’s good they can go out there and see
the difference”, with T3 following up with, “[In one of the lessons], I would pull for information
text, especially the one about, I mean number one I would use this map of Mississippi for social
studies and I love how detailed it is”.

Summary
Overall, the majority of students scored low enough on the pretest, posttest, and delayed
posttest (> 50%) to only be considered to have Exposure in agricultural knowledge, in both the
treatment groups and the control group. Though there was an increase in knowledge shown from
the treatment groups, there was no statistically significant increase in scores among all three
groups. None of the students participated in an agricultural organization (4-H) and only one
participant lived directly on a farm. Through this it was seen that there was little to no relationship between the students’ personal characteristics and their agricultural literacy levels.

Lastly, students enjoyed the hands-on aspects of both sets of lessons, but teachers were more likely to teach the Mississippi Agriculture in the Classroom lesson plans if they were pre-aligned to the Mississippi College-and-Career readiness standards, had pre-determined objectives, and were more easily accessible. The teachers would have been uncomfortable to teach about their assigned agricultural concept had they not had the background information or the 20 plus years of experience. It was also seen that teachers had a difficult time finding resources about agriculture in Mississippi to use in their classrooms.
CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

The study aimed to gauge if personal characteristics had an effect on agricultural literacy levels, while evaluating agricultural literacy levels among fourth grade students at Henderson Ward Stewart elementary school. This study also evaluated what elementary teachers wanted out of premade agricultural literacy curriculum. The specific research objectives were:

Objective 1: Describe the demographics and personal characteristics of the population and their relationship with the students’ agricultural literacy levels.

Objective 2: Determine the agricultural knowledge (National Agricultural Literacy Outcome standards) of Mississippi fourth grade students prior to and after exposure of an agricultural literacy program.

Objective 3: Compare agricultural knowledge change (National Agricultural Literacy Outcome standards) among Mississippi fourth grade students prior to and after treatment of new and existing Ag in the Classroom curriculum.

Objective 4: Describe the perceptions of the new and existing Agriculture in the Classroom curriculum among teachers.

Conclusions Related to Objective One

Objective one attempted to collect data from participants related to their personal characteristics that could have a relationship with the students’ agricultural literacy levels. This was collected in the delayed posttest round of the assessment. Overall there was no statistically
significant characteristics and agricultural literacy within the participating fourth grade students in this study. These findings align with Elliot’s (1999) theory claiming that personal characteristics influences levels of agricultural literacy. However, it is important to note, that none of the participants had strong connections to agriculture prior to participating in the lessons for this study indicated by their responses. This is evidence as indicated by the National Research Council (1988) that due to being a mostly urbanized population, society has become agriculturally illiterate.

Through all three rounds of regression (pretest, posttest, and delayed posttest), there was no statistically significant evidence to justify the students demographic background having an impact on their agricultural knowledge or agricultural knowledge retention contrary to Elliot’s (1999) agricultural literacy framework. This aligns with evidence that Dale, Robinson, and Edwards (2017) found in their study with college aged students.

Conclusions Related to Objective Two

Objective two of this study was to determine the agricultural knowledge (National Agricultural Literacy Outcome standards) of Mississippi fourth grade students prior to and after exposure of an agricultural literacy program. Five percent of students out of all three groups were considered to have applicable proficiency in agriculturally related knowledge, deeming the majority of students’ illiterate in agriculture, much like Bellah, et al(2004) and Kovar and Ball (2013) found in their research. In all three of the groups tested, no groups displayed an average mean that identified them as having applicable proficiency in knowledge about agriculture, in all three rounds. Three decades since the National Research Council (1988) this study still found the population to be illiterate in agricultural. Through this, it can still be confirmed that there is a need for improvement and research in agricultural literacy efforts.
It was found that immediately after the agricultural literacy treatments, 10% of the students scored as being applicable proficient in agriculture, with the majority remaining illiterate in agriculture. However, the retention knowledge of students went from 10% being applicably proficient to only 8% of students being literate in agriculture in the span of two weeks after the initial posttest. There was an increase in test scores from the groups after their agricultural literacy treatment, however it was not significant ($p < .05$). After the students participated in the agricultural literacy treatments, their average mean did increase, but not in a statistically significant way contrary to what Bradford (2016) found.

**Conclusions Related to Objective Three**

Objective three was to compare agricultural knowledge change (National Agricultural Literacy Outcome standards) among Mississippi fourth grade students prior to and after treatment of new and existing Ag in the Classroom curriculum. For the pretest the individuals who reviewed the existing curriculum scored better than the control group as well as the group that received the revised curriculum. For the posttest the individuals who received the existing curriculum, scored nearly 8 points higher on average, than those who received the revised curriculum. However, when looking specifically at the questions #2, #6, #8, #9, and #13 that the revised lessons addressed through the NALOs, Group 2 that received the revised curriculum increased their tests scores by 10 points compared to Group 3 who received the existing curriculum that increased their test scores by six points.

This is evidence that when NALOs are specifically addressed in lessons, students have a higher level of agricultural literacy knowledge pertaining to the concepts that the NALOs specifically cover. Both groups 2 and 3 had an increase in knowledge, however it was not statistically significant. It can be see that exposure to agricultural literacy based curriculum in a
limited amount did result in an increase in agricultural literacy levels, however it did not produce a significant increase in agricultural literacy levels among the students contrary to Luckey et al., (2013) findings. This could have been due to small sample size of the study.

**Conclusions Related to Objective Four**

Objective four was to describe the perceptions of the new and existing Agriculture in the Classroom curriculum among teachers. It was brought forth that the teachers in this study were taught how to incorporate life science into their classrooms, but this training was never directly targeted at incorporating agriculture into their daily lessons in their teacher education programs. Due to this, neither set of teachers regularly incorporated Mississippi agriculture into their day-to-day curriculum much like Brandt (2016) recommended they do. To go along with that, both sets of teachers found it very difficult to find resources relating to agriculture in Mississippi that were classroom friendly. This caused the teachers in this study to not implement agriculturally related content in their classrooms like the National Research Council (1988) recommended. It was also apparent from the teachers that students did enjoy learning about agriculture through their science, social studies, and mathematics classes because it allowed them to apply the concepts they were learning through hands-on activities, finding what Ricketts and Place (2005) concluded to be true. This aligned with Coenders et al., (2008) discovery about teachers wanting curriculum that engaged their students in a familiar way.

Both sets of teachers that taught groups 2 and 3 did enjoy teaching about agriculture, however the teacher teaching the existing lessons noted that had she not had the prior experience with the subject matter, she would not have been comfortable, nor confident teaching about agriculture. The teacher who taught Group 2 (existing lessons) also noted that due to the lack of detail in the existing curriculum, they would not use the Mississippi Ag in the Classroom
program as a reoccurring source for lessons and information, whereas the teachers who taught the revised curriculum to Group 3 noted that they would continue to use the revised curriculum from the Mississippi Ag in the Classroom program. This could be due to the additional time that had to be taken to align the existing lessons in with the current classroom curriculum (Timperley & Robinson, 2000).

**Recommendations**

Through the findings of this study, there are a large amount of recommendations that can be made for future practitioners and researchers.

**Recommendations for Practitioners**

There are numerous misconceptions about today’s agricultural industry. Due to this, consumers are becoming less literate about where their food comes from, and how it is produced. Since perceptions of agriculture are a part of an individual’s agricultural literacy levels according to Elliot (1999), consumer perceptions of agriculture should be thoroughly studied throughout various age groups across Mississippi. Since the United Nations (2015) predicted that the world population will be around 10 billion by the year 2050, it is important for consumers to have a general understanding and positive perception about where their food and fiber comes from, in order to be more conscientious consumers. Additionally, students need to be exposed to career opportunities in agriculture, due the predicted increase in food and fiber production in the years to come.

It is apparent that students in Mississippi are illiterate about agriculture, coinciding with Kovar and Ball’s (2013) findings that the majority of the population is illiterate in agriculture. It was noted by National Research Council (1988) that most agricultural education courses are only
offered through career and technical programs. Due to this, teachers need to incorporate agricultural concepts into their everyday science, mathematics, and social studies lessons, starting in kindergarten. Through this study, teachers were able to combine these concepts together much like Brandt (2016) suggested.

In addition to these efforts, teachers should receive training on how to implement and incorporate agriculture into their daily classroom lessons. This could be done by incorporating agriculture into teacher education curriculum, summer workshops, or in-service training. Agricultural literacy programs should also offer trainings on how to utilize their materials and curriculum into classrooms, so that teachers would feel more comfortable implementing and discussing agricultural concepts.

**Recommendations for Researchers**

Specifically in Mississippi, agricultural literacy efforts need to be combined to ensure that students are being exposed, long term, to agricultural literacy curriculum. This is to ensure that students are grasping and maintaining agricultural concepts. It is suggested that students should be involved in agricultural literacy lessons that address the NALOs, for a longer period of time in order to re-test their knowledge gain about agricultural concepts. Also, with the ever changing agricultural industry and the ways that food and fiber are produced, agricultural literacy programs need to assess and update their efforts, material, and curriculum on a regular basis.

Lastly, Elliot’s (1999) model of agricultural literacy should be re-evaluated for younger students who do not have adequate experiences when dealing with agricultural concepts throughout their lives. With this lack of real-world experiences, elementary student’s agricultural literacy levels are influenced by other sources besides what is provided in the model. Through continuous efforts and research, the gap between the public’s agricultural literacy levels should
decrease as these efforts continue. Due to the population of this study living in a mostly urbanized area and having little to no background in agriculture, it is important that this study be replicated with a population that does have experience with agriculture, and potentially lives in a rural area. It is also recommended, due the population and sample of this study, that this research be replicated by having students complete one whole grade unit of Mississippi Agriculture in the Classroom curriculum and to conduct this study with a rural population.
REFERENCES


Anderson-McCoon, K., Cartmell, D., & Terry, R. Jr. (2016) “Fairgoers’ attitudes toward youth livestock exhibits at the California state fair,” Journal of Applied Communications: Vol. 100: Iss. 3. 10.4148/1051-0834.1227


Glaze, Catherine “Dru”; Edgar, Leslie; Rhoades-Buck, Emily; and Rutherford, Tracy (2013) “Visual communications: An analysis of university students’ perceptions of rural America based on selected photographs,” Journal of Applied Communications: Vol. 97: Iss. 1. 10.4148/1051-0834.1100


https://robeson.ces.ncsu.edu/2016/07/the-importance-of-agricultural-literacy/


http://www.ryerson.ca/content/dam/experiential/Penny,%20Frankel,%20Mothersill_IATED_paper_2012.pdf


Shanahan, T., & Shanahan, C. (2012). What is disciplinary literacy and why does it matter? Topics in Language Disorders, 32(1), 7-18.10.1097/tld.0b013e318244557a


68


Stanek, B. (2015). We'll need more food in the next 40 years than in the previous 10,000 combined. https://mic.com/articles/107808/we-ll-need-more-food-in-the-next-40-years-than-in-the-previous-10-000-combined#.Nm0rJUzVW


APPENDIX A

LONGHURST MURRAY AGRILULTURAL LITERACY INSTRUMENT
The Longhurst Murray Agricultural Literacy Instrument (LMALI) was developed (2019) by educators and agricultural experts to measure the National Agricultural Literacy Outcomes (NALOs) (Spielmaker & Liesing, 2014). The LMALI instrument was created using the method of domain analysis to measure three proficiency levels: 1) Limited or developing agricultural exposure, 2) Functional agricultural literacy, and 3) Practical & applicable agriculture proficiency.

Background Information for Users

Using a modified Delphi technique, a Teacher Advisory Committee developed multiple questions that were then validated by a sample of seven regionally stratified states. The NALOs are banded by grade level and each assessment is a cumulative outcome for the grade level band, meaning the K-2 instrument measures the agricultural literacy aligned to what a student should know at the conclusion of second grade, and the 3-5 instrument measures what a student should know about agriculture at the end of grade 5. Two valid 15-item instruments were developed for the K-2 grade band and one 15-item valid instrument was created for the 3-5 grade band. The LMALI assessments provide stakeholders and teachers with a reliable instrument to measure agricultural literacy related to the National Agricultural Literacy Outcomes for formative and summative assessment.

How to Administer the LMALI Instruments

Each of the 15 item instruments typically takes less than 15 minutes to complete. When particular items have multiple correct responses, the items are considered correct only when all the correct items are selected. Partially correct items can be evaluated to inform classroom instruction in formative ways. Validated and reliable scoring measures are only appropriate when a student completes all 15 items on the same assessment. The K-2 LMALI assessments are paper/pencil-based (attached). Two valid and reliable assessments were developed for this grade level band. Please note that the assessment questions should be read to these young students. The grade 3-5 assessment may be used in the paper/pencil format or students may take this assessment online using a Google form. The Google form can be accessed from the National Center for Agricultural Literacy Google Form site, [https://bit.ly/LMALI3-5](https://bit.ly/LMALI3-5) (students/teachers see the scores on the screen upon completion), or the shared form can be accessed and shared to an educator’s Google account for more direct contact with the student data.
Scoring

Scoring the proficiency levels should be done carefully. The proficiency level score is based on the total number of correct responses. The level of proficiency can be determined by using the proficiency scale. Educators can identify learner stages by identifying those with a score ≥ to 12 as proficient, those with a score ≥ 8 as factually literate, and those with a score ≤ 7 as exposure or developing level. Teachers and stakeholders can then use the average number of participants in each proficiency stage to evaluate student agricultural literacy based on the NA LO themes. Additionally, partial scoring techniques should be examined for formative classroom use. It is possible that some exposure or literacy-level students could be nearly proficient, if the additional concepts are explained.

Partial scoring has promise as a significant support for formative assessment of learning.

Assessment Key

Form K-2: 1 (NA LO Theme 1-5 & proficiency level)

1. B, C, E (NA LO: T1 - Exposure)
2. A, C, E (NA LO: T1 - Literacy)
3. B, C, D (NA LO: T1 - Proficient)
4. chicken-chick, horse-foul, goat-kid, pig-piglet, cow-calf, sheep-lamb (NA LO: T2 - Exposure)
5. grain-bread, chicken-eggs, pig-ham/bacon, strawberies-jam, cow-milk/cheese, lettuce-salad (NA LO: T2 - Literacy)
7. B (NA LO: T3 - Exposure)
8. A, C, D (NA LO: T3 - Literacy)
9. B, C, E, F (NA LO: T3 - Proficient)
10. A, B, D (NA LO: T4 - Exposure)
11. A (NA LO: T4 - Literacy)
12. A, B, D (NA LO: T4 - Proficient)
13. D (NA LO: T5 - Exposure)
14. B (NA LO: T5 - Literacy)
15. D (NA LO: T5 - Proficient)

LMALI Form K-2: 2

1. A (NA LO: T1- Exposure)
2. A (NA LO: T1- Literacy)
3. B, C, D (NA LO: T1 - Proficient)
4. chicken-chick, horse-foul, goat-kid, pig-piglet, cow-calf, sheep-lamb (NA LO: T2 - Exposure)
5. B (NA LO: T2 - Literacy)
6. A, C, D (NA LO: T2 - Proficient)
7. B, C, F (NA LO: T3 - Exposure)
8. A (NA LO: T3 - Literacy)
9. A, D, F, G (NA LO: T3 - Proficient)
10. A (NA LO: T4 - Exposure)
11. A, D, E (NA LO: T4 - Literacy)
12. A, B, D (NA LO: T4 - Proficient)
13. D (NA LO: T5 - Exposure)
14. B (NA LO: T5 - Literacy)
15. C (NA LO: T5 - Proficient)

LMALI Form 3-5: 1

1. B (NA LO: T1 - Exposure)
2. A, E, F, G (NA LO: T1 - Literacy)
3. E (NA LO: T1 - Proficient)
4. D (NA LO: T2 - Exposure)
5. renewable-B, nonrenewable-A, recyclable-C (NA LO: T2 - Literacy)
6. D (NA LO: T2 - Proficient)
7. C (NA LO: T3 - Exposure)
8. D (NA LO: T3 - Literacy)
9. A (NA LO: T3 - Proficient)
10. B (NA LO: T4 - Exposure)
11. A (NA LO: T4 - Literacy)
12. A (NA LO: T4 - Proficient)
13. C (NA LO: T5 - Exposure)
14. E (NA LO: T5 - Literacy)
15. A, C, E, (NA LO: T5 - Proficient)

While “nut” and “soil” are correct responses for farming outdoors, teachers using this questionnaire as a formative assessment should explain to students that the sun is a source of light and the soil is a source of nutrients anchoring plants. Farmers farming indoors may use artificial light sources and provide nutrients to plants without soil.

Citation Recommendation

1. Jill grows pumpkins, and the local water company had a canal break, which has caused her to reduce her watering. How does the decrease in water impact Jill’s pumpkin patch?
   
   a. the number of pumpkins grown will be the same as previous years
   b. some plants may die resulting in fewer pumpkins grown
   c. all the pumpkins grow bigger

2. Which of the following natural resources does a farmer need to grow crops? Circle all the correct choices.
   
   a. water
   b. cars
   c. trees
   d. rocks
   e. sunlight
   f. air
   g. soil

3. What do farmers manage in order to give us food, clothing, and shelter?
   
   a. irrigation
   b. animal waste
   c. soil nutrients
   d. animal life cycles
   e. all of the above
4. Why is it important for farmers to rotate the crops they grow in a field?
   a. plants will not grow in the same soil twice
   b. to make the field look nice
   c. farmers do not want other people to know what they are growing next
   d. to replenish nutrients in the soil

5. Match the definition to the term:
   renewable ____  nonrenewable ____  recyclable____
   a. available in limited supply, because it takes a long time to be replenished
   b. can be replenished naturally
   c. a product that is produced and can be broken down to make something new

6. Which of the following is not true?
   a. farmers grow plants in greenhouses so fresh fruits and vegetables are available to buy in the wintertime
   b. farmers ship fresh fruits and vegetables in the wintertime from other states or countries that have warmer weather
   c. farmers keep extra fruits and vegetables in warehouses to sell in the winter
   d. farmers heat the ground so they can grow fresh fruits and vegetables in the winter
7. What is the most important reason to practice safe food handling?
   a. to have a good reputation for your restaurant
   b. so you are not on the news
   c. to avoid sickness
   d. so you don’t have to buy extra food

8. Which type of food provides the most protein for your body?
   a. grains
   b. vegetables
   c. fruits
   d. meat or beans

9. Samantha is making a list of reasons that food might cost more at the store. Select the item below that will not be on her list.
   a. kids do not want to eat fruits and vegetables
   b. weather conditions damage crops
   c. increased fuel costs for farmers
   d. not enough workers to harvest food
10. Why should scientists continue to study agriculture?

   a. to reduce the number of farmers
   b. to improve the quality and safety of farm products
   c. to reduce the number of farm workers
   d. scientists do not need to study agriculture because we already know how to grow food

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11. Science and technology helps farmers grow healthier plants and animals.

   a. true
   b. false

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12. Farmers use the science of inherited traits to determine what kinds of plants and animals they will grow on their farm.

   a. true
   b. false

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13. When you drink a glass of orange juice for breakfast, the oranges most likely came from which state?

   a. Nebraska
   b. Washington
   c. Florida
   d. New York
14. Select the **one** choice that is **not** a reason people eat different foods around the world.

a. people have different religions  
b. people celebrate different holidays  
c. people live in different climates  
d. people have different types of soil  
e. people speak different languages  

15. What would happen if farmers in a community stopped doing their job? **Circle all** the correct choices.

a. food prices would increase  
b. food prices would decrease  
c. people would demand changes  
d. nothing would change  
e. food would be imported from other places  
f. food would be exported from the community
APPENDIX B

PERSONAL CHARACTERISTICS
Circle yes or no for the following questions:

Are you a member of the 4-H club?   Yes  No

Do you live on a farm?   Yes  No

Do you have any family members who live on a farm?   Yes  No

Do you or your family ever grow a garden?   Yes  No

Do you or your family ever raise animals for food such as chickens, cows, pigs?   Yes  No

Does your family watch the news?   Yes  No

Have you ever grown any kind of plant at school?   Yes  No

Have you ever raised any kind of animal at school?   Yes  No
APPENDIX C

EXISTING LESSON: A SLICE OF SOIL
A Slice of Soil

One of the most important natural resources on the earth’s surface is soil. Many living things depend on it as a source of food, either directly or indirectly.

Our food producing land remains the same and yet the world population continues to grow. Consequently, each person’s food portion becomes smaller and smaller. It is the responsibility of each generation to use the soil wisely to insure the future. You can conduct the following demonstration to show how little of the earth’s surface is actually used for food production as compared to growing populations.

Materials

- Large apple
- Paring knife

Procedure

- Cut the apple into 4 equal parts. Three parts represent the oceans of the world. The fourth part represents the land area.
- Cut the land section in half lengthwise. Now you have two 1/8 pieces. One section represents land such as deserts, swamps, Antarctic, Arctic, and mountain regions. The other 1/8 section represents land where man can live and may be able to grow food.
- Slice this 1/8 section crosswise into 4 equal parts. Three of these 1/32 sections represent areas of the world which are too rocky, too wet, too hot, or where soils are too poor for production, as well as areas developed by man.
- Carefully peel the last 1/32 section. This small bit of peeling represents the soil of the earth on which mankind depends for food production.
- Share the juicy apple with a friend!
APPENDIX D

EXISTING LESSON: POTATO FUN
Potato Fun

Objective: To gain knowledge about potatoes

Learner Objective: To name parts of a potato and identify different kinds of potatoes

Supplies:
- 3 potatoes for show – White, Red, and Sweet
- 1 large white potato for each participant
- Pairing knives
- 1 small paper plate per every 3 participants
- Tempera paint
- 1 sponge for each plate
- 1 pencil for each participant
- Paper towels
- Newspapers to cover tables
- Paper for stamping
- Optional: art brushes and stencils

Procedure:
Show each kind of potato and talk about the different ways of preparing each kind:
- Russet (white) – baking
- Long white – baking and frying
- Round white – boiling and frying
- Round red – boiling and frying
- Sweet – baking

Identify the parts of the potato:
- Eye – bud, sprouts to make a plant
- Eyebrow – ridge above eye – protects bud
- Skin – protects the flesh of the potato

Potatoes grow underground and are about 80% water. It is the most popular vegetable and is available year-round.
Making a potato stamp
   Give each student a potato
   Cut each potato in half crosswise
   Trace a design from stencil or freehand in the flesh of the potato
   Cut around the design about ¼" leaving the design raised
   Dip potato in paint
   Stamp on the paper
       Be careful not to press to hard – it will mash the design
   Repeat stamping – potato should be re-dipped before each stamp

Evaluate:
   Review questions about the potato
   Show everyone’s completed stamp
APPENDIX E

EXISTING LESSON: ICECREAM IN AN INSTANT
Ice Cream in an Instant

Looking for a good and tasty way to teach students about the dairy industry, nutrition and even a bit of chemistry? Here are a few quick and easy ways to make ice cream right in the classroom.

Ice Cream in a Baggie

1/2 cup of milk or half and half
1 tablespoon of sugar
1/4 teaspoon of vanilla

Put ingredients in a sandwich size Zip-Lock bag and “zip” closed.

The filled and closed sandwich bag from above
2 tablespoons of rock salt
crushed ice cubes

Put these ingredients into a gallon size Zip-Lock bag. Shake and roll until frozen (about 15 – 20 minutes)

Ice Cream in a Coffee Can

Ingredients

1 small (12 oz.) coffee can with tight fitting lid
1 large (39 oz.) coffee can with tight fitting lid
1 cup whole milk
1 cup heavy whipping cream
1/2 cup sugar
1/2 teaspoon vanilla
pinch of salt
rock salt
crushed ice cubes
Directions

Pour the whole milk and cream into a large bowl and stir.
Add sugar, salt and vanilla to the mixture and mix well.
Add any optional ingredients.
Pour mixture into the small coffee can, fill until 2” from top.
Snap on lid, seal with tape to reduce leaks.
Put the small can inside the large can.
Surround the small can with about 1 ½ cups of crushed ice.
Add a couple of handfuls of rock salt to the ice.
Fill the can, alternating ice and rock salt.
Place the lid on the large can. Seal with tape to prevent leaks.
Tell the kids to keep the can rolling, pushing the can to each other on the sidewalk for about 20 minutes.

Ice Cream using Liquid Nitrogen

This method makes good ice cream for two reasons: 1) The mix freezes very quickly, so you get small crystals and a very creamy texture and 2) the evaporating LN2 aerates the mixture so it doesn’t end up as a frozen lump.

Recipe for ½ gallon of strawberry ice cream

Cream base
4 cups of heavy cream
1 ½ cups half and half
1 ¾ cups sugar

Berry mixture
1 quart fresh strawberries, mashed
½ cup sugar
Directions

Keep all ingredients cold! Make sure the sugar is dissolved in the cream base. Pour the cream base into a large metal bowl. Add one or two liters of liquid nitrogen and stir vigorously. When the cream has thickened, add the berry mix and more nitrogen, if necessary. Continue to stir until the nitrogen has evaporated (the fog has disappeared).

This recipe does not keep well and is best consumed immediately (oh, darn). If it begins to melt, add more nitrogen and stir.
APPENDIX F

REVISED LESSON: BY-PRODUCTS
BY-PRODUCTS

Lesson Plan for Grade 4, Science
Prepared by Alyssa Hutcherson

OVERVIEW & PURPOSE

Students will identify the differences between beef and dairy cattle and determine the by-products produced by each type of cattle while practicing reducing fractions and multiplication.

EDUCATION STANDARDS

Mississippi College-and-Career Readiness Standards:
L.4.2.2 Develop and use models to explain the unique and diverse life cycles of organisms other than humans (e.g., flowering plants, frogs, or butterflies) including commonalities (e.g., birth, growth, reproduction, or death).

4.NF.3 b. Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model (including, but not limited to: concrete models, illustrations, tape diagram, number line, area model, etc.). Examples: 3/8 = 1/8 + 1/8 + 1/8; 3/8 = 1/8 + 2/8; 2 1/8 = 1 + 1 + 1/8 = 8/8 + 8/8 + 1/8.

c. Add and subtract mixed numbers with like denominators, e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction.

NALOs
T1.3-5 e. Recognize the natural resources used in agricultural practices to produce food, feed, clothing, landscaping plants, and fuel (e.g., soil, water, air, plants, animals, and minerals)

T2. 3-5 d. Provide examples of specific ways farmers/ranchers meet the needs of animals.

OBJECTIVES

1
- Analyze what farmers have to manage in order to produce food and fiber.
- Determine why farmers have to use science and inherited traits for their cows.
- Determine where protein comes from.
- Discuss what would happen if farmers stop farming.
- Discuss why people eat different foods around the world.

MATERIALS NEEDED

Activity 1:
- Beef and Dairy KWL chart
- Flip Chart paper (optional)
- Cows on the Farm written by Marc C. Schuh
- Beef and Dairy Commodity Fact Cards
- Beef and Dairy Quiz
- Glue or tape
- Scissors
- Plain white paper (two sheets per group)
- Reflection sheet

Activity 2:
- Milk (1 cup per student)
- Small sized ziploc bags (1 per student)
- Large sized ziploc bags (1 per student)
- Ice (Enough to fill a large Ziploc baggie)
- Rock Salt (1 box per 20 students)
- Vanilla extract (1/2 tsp per student)
- Measuring cup

Lesson Set Up:

Activity 1:
1. The teacher will need to make a KWL chart (the K stands for what the students already know, the W stands for what the students want to know, and the L is what students ultimately want to learn), before the class starts and display it in an easy to access
location in the classroom. To do this the teacher will need to either on the board or on a large piece of flip chart paper create three columns and label them separately as K, W, L.

2. Before the lesson the teacher will need to separate students into groups of 3-4 students.
3. The teacher will need to print the sets of Beef & Dairy Commodity Cards, (enough for one set for every group, or 3-4 students).
4. The teacher will also need 2 sheets of plain white paper per group, as well as enough glue or tape, and scissors for each group to share. You can have these items ready to pass out or already have them separated into groups on each desk.
5. The teacher will also need to print the Beef and Dairy Quiz, one for every student.

Activity 2:

1. Before class the teacher will need to obtain a bucket of ice, and the rest of the ice cream ingredients.
2. The teacher will then need to set up an assembly line of the ice cream ingredients.
3. The order should be the following: Small Ziploc baggies, milk, sugar, vanilla extract, large Ziploc baggies, ice, rock salt.
4. The teacher will need to set up a hand washing station
5. The teacher will also need to print one copy

Vocabulary

**beef cattle**: cattle, both female and male, with muscular bodies primarily raised for meat

**cattle**: bovine animals consisting of different breeds, domesticated for producing beef and milk

**dairy cattle**: cattle bred for the ability to produce large quantities of milk (females only), from which dairy products are made

**milking parlor**: building where dairy cows are milked

Ag Facts:

- One beef cow can produce about 475 pounds of beef, which is almost equal to 2000 hamburgers.
- Beef is a good source of ZIP (zinc, iron, and protein) along with other vitamins and minerals that we need to be strong and healthy.
Did you know it takes 3,000 cow hides to supply the NFL enough footballs for 1 year?

- One dairy cow's daily milk production (about 70 pounds) can produce 8 gallons of milk or 3.3 pounds of butter or 7 pounds of cheese.
- A Holstein's spots are like a snowflake or human fingerprint; no two cows have exactly the same pattern of spots.
- With today's technology, some dairy farms have robots that operate their milking machines.
- Mississippi is home to around 10,000 milk cows.
- The top milk producing counties in Mississippi are: 1) Marion 2) Tate 3) Webster 4) Pike 5) Copiah

Background Information for Teacher:

In the United States, cattle are typically raised to produce beef and milk for our food supply. The term cattle can refer to any breed or gender of the bovine species. All breeds of cattle produce meat and all female cattle produce milk after they give birth. However, within the cattle industry, specific breeds of cattle are classified as either "beef" or "dairy" cattle due to their efficiency in producing either meat or milk.

Female cattle, or cows, produce milk. They begin producing milk after giving birth to their first baby, which is called a calf. Cows that are able to produce large quantities of milk are called dairy cows. Such breeds of dairy cows raised in the United States include the Holstein, Ayrshire, Brown Swiss, Guernsey, Jersey, and Milking Shorthorn. Can any breed or type of male cow be used for milk production? No, male cows do not produce milk.

Cattle breeds that are more muscular are raised as beef cattle. There are many different breeds of beef cattle raised in the United States such as Angus, the most popular, along with other common breeds such as Hereford, Shorthorn, Charolais, Simmental, and Limousin. Female beef cows produce milk after giving birth, but in much smaller quantities than a typical dairy cow. Female beef cows produce enough milk to raise their own calf.

Beef and dairy cow production in the United States are two distinct industries because of
the trait differences mentioned above; milk production in large quantities vs. more muscular cattle raised for meat. As of January 1, 2015 the beef cattle inventory was up by 1% from the previous year at 89.9 million. The top five states that raise all cattle both beef and dairy include Texas, Nebraska, Kansas, California, and Oklahoma. In 2012, there were 915,000 cattle and calf operations to include 29.7 million beef cows and 9.3 million milk cows. The total beef consumed in the United States was 25.5 billion pounds for 2014. Milk production was calculated in 2014 to be 206,046 million pounds. Those stats prove that both beef and dairy are a large component of the human diet.

The cow that produced 1,500 quarts of milk per year a hundred years ago can produce 7,812 quarts per year today. One first grade student would have to drink 85 plus cartons of milk a day for an entire year to equal this amount. The dairy cows are normally milked twice a day, depending on the farm in a building called a milking parlor. Automatic milking machines are used today and help the dairy farmer keep accurate records regarding milk production from each cow.

LESSON PROCEDURES

Day 1:

1. Interest Approach - Engagement

Print the KWL chart provided or make your own similar to the one linked. This should be kept on chart paper or on the board so that it can be used and posted throughout the entire lesson. Ask students the following questions and place their answers in the first two columns. The third column will be filled in at the conclusion of the lesson.

What I Know (K)

What do you know about beef cattle?

What do you know about dairy cattle?

Do beef and dairy cattle look the same or different?

Which group of cattle produce milk? beef? ice cream? hamburger?

What I Want to Know (W)
What do you want to learn about beef cattle?

What do you want to learn about dairy cattle?

What foods do I eat that are produced by beef cattle?

What foods do I eat or drink that are produced by dairy cattle?

Next, read the book, Cows on the Farm, written by Mari C. Schuh and point out the differences indicated in the book between beef and dairy cattle. Tell the students they will be learning about the products that both beef and dairy cattle produce that are included in their diets.

2. Activity 1:

1. The teacher should lead the following discussion:

"By a show of hands, ask students if they like milk, cheese, ice cream, hamburgers, and steaks."

"Where do you think these products come from?"

Answer: These products come from cows.

"Do these products come from the same type of cows or different?" (Students might say the same type of cows)

Answer: There are two types of cows. One specifically produces meat. These are known as beef cows. The other type of cow is a dairy cow. Through science and inherited traits (like those you get from your mom and dad), farmers make their cows the best they can be at their jobs whether its producing beef or milk.

"What do our bodies get from beef and dairy products?" (Students might say vitamins)

Answer: Beef and dairy products provide our bodies with the essential nutrients, vitamins and minerals we need. One of those nutrients is called protein. We get protein from many different foods like beans and dairy, however we get the most from meat like beef from a cow.

"Which products are produced by a dairy cow?" (Students might say milk)

Answer: A female dairy cow will produce milk over her lifetime. From this milk, cheese, butter, ice cream, yogurt, and many more things will be made. However, if a male type of cow is born, he cannot produce milk, so he will be used to produce beef.

"Which products are produced by a beef cow?" (Students might say steak)

Answer: Steaks, hamburgers, and roasts are some products produced by a beef cow.
Allow students time to explore their positions. Refer back to the KWL chart and remind students of their previous responses. Add any changes or different responses not mentioned prior to the beginning of the lesson.

“In which ways are cows different than one another?” (Students might say they look different)

Answer: Coat color, gender, weight, size.

If needed, prompt by asking them to consider some of the physical differences noticed between themselves and their classmates. Explain to students that just like we get different traits from our parents, so do cows.

3. Next, divide students into groups of 3 - 4 students. Distribute one set of the Beef & Dairy Commodity Cards per group, glue or tape, and 2 pieces of plain white paper per group.

Give students the following instructions:

“First, in your groups label 1 sheet of paper Dairy Cattle and the other sheet of paper Beef Cattle. Then, as a group, you should solve all of the addition problems and write the answer directly behind the “=” sign. Next, students will pair the cards with the same sum. For example, a card with the equation 4+1=5 will match with the card 3+2=5. Last, tape or glue matching boxes together to form a complete sentence strip. Keep like colors together, red with red and blue with blue.”

“Note that the 2nd line of the cards is in black text and will be matched to make a fact statement. The third line of the cards lists a commodity that is produced by cattle. Blue text indicates a dairy product. Red text indicates a beef product.

“As a group should glue or tape the fact strips in chronological order to the sheets of paper they labeled in step 4. All of the blue sentence strips should be taped to the paper labeled Dairy Cattle. All of the red sentence strips should be taped to the paper labeled Beef Cattle. All 8 strips for each the beef and dairy cows should fit on one piece of paper. When finished, students will have two fact sheets, one for beef cows and the other for dairy cows.”

4. Ask each group of students to stand and read out sentence strip from both beef and dairy fact sheets.

5. Ask and discuss with students the following questions after they have read their beef and dairy fact:

"Why do you think it's important for farmers to care for their cows?” (Students might say so that they stay alive)

Answer: So that they are happy and healthy for us to eat.
“What would happen if farmers didn’t raise beef or dairy cows?” (Students might say there would not be any food)

Answer: Food prices would increase because there was not enough to go around. People would demand changes, because they would want beef and dairy products, and beef or dairy products might have to be imported from other countries so that we would have them.

“What products that come from beef and dairy cows do you think are the most important?” (Students might say all of them)

Answer: They are all important. Every part of the cow is used to make something. We eat hamburgers and drink milk, but we also get leather from their hide (skin) and many more other products.

“Do farmers raise food like crops only to feed their beef and dairy cows?” (Students might say they raise enough to feed everyone)

Answer: Most of the time farmers raise enough crops to feed their beef and dairy cows, but also enough to sell to feed us too.

“Are some crops grown for both humans and animals to eat?” (Students might say no)

Answer: Yes. Cows and humans can both eat the same thing, however we eat them in different forms. As an example, cows might eat soybean hulls (the outside shell of a soybean) in their feed, while we as humans can drink soy milk made from soybeans.

“What do farmers have to manage in order to give us food, clothing and shelter?” (Students might say water and soil)

Answer: Farmers have to manage irrigating (watering) crops and managing soil nutrients so that their crops are getting everything they need to grow. With cows they have to manage animal waste, and their life cycles to make sure the cows are clean and comfortable and growing and producing the way they should.

6. Next, have each group work collaboratively to read and answer the 10 questions on the Beef and Dairy Quiz. Discuss responses once each group has completed the quiz.

7. Conclude this day by saying to the students:

“Today we learned the difference between a dairy cow and a beef cow. In the next class session we will be discussing different products that come from each.”
Day 2:
8. Activity Two:

1. The teacher should lead with the following discussion:

“By a show of hands, who in this class likes ice cream?”

Answer: (Give students enough time to raise their hands)

“Did you know that some people cannot eat ice cream or beef from cows, what would be some
reasons why do you think?”

Answer: People around the world have different religions. In some religions, eating beef is not allowed.
Another reason because of religious reasons is on certain holidays, some people cannot eat certain foods
like beef. Also, there are some people that live in places with different climates and soils than we have, so
they grow and produce different types of animals and crops to eat. Another reason would be that some
people are allergic to certain foods like beef or dairy.

Instruct students:

“Today, we will be making ice-cream today out of milk. Yesterday, we talked about by-products
from beef and dairy cows. Ice Cream is a by-product of milk from dairy cows. You will need to
wash your hands or use hand sanitizer when instructed”

2. Have the class wash their hands or distribute hand sanitizer. Once they are done, have a class
discussion about food handling safety.

“Class, why did we make sure that our hands were clean before we started making our ice cream?”
(Students might say so that they get rid of all of the germs)

Answer: So that the class would not spread germs from their hands to their food. Germs in your food can
make you sick.

3. Next, read the following instructions to the students.

“Students, first you will receive a plastic Ziploc bag. You will get in line with your Ziploc bags, and
go through the line to get all of your ingredients. First, you will get one cup of milk in your first
Ziploc bag. You will then put your sugar and vanilla in the same bag as your milk. After you get
these three ingredients in your first bag, I want you to seal it up so that no milk is leaking out of it.
You will then get another Ziploc bag filled with ice and rock salt. You will place your first sealed up
Ziploc bag into the second bag with ice and salt. Once you get your first bag into your second, you
will them seal your second one up so that there are no leaks. You will then shake your bags from side to side until your ice cream starts to make. If you hands start to get cold, you can use a paper towel to cover your bag, or put your bag down until your hands start to warm up again. What questions are there?"

INGREDIENTS
1 c. milk
2 tsp. granulated sugar
1/2 tsp. pure vanilla extract
3 c. ice
1/3 c. rock salt
Toppings of your choice

9. Concept Elaboration and Evaluation

1. After completing activity 1 and 2, complete the (L) portion of the KWL chart. Ask the students what they learned and compare that with what they knew and wanted to learn. Make sure all questions on the (W) portion of the chart have been answered.

2. Lastly, have students complete the reflection worksheet. Once students have turned in their worksheet, go over the correct answers.
1. Circle the correct answer.  
   Male cows produce milk.  
   True or False

2. Circle the correct answer.  
   Silage is chopped up corn as feed.  
   True or False

3. Circle the word that complete the sentence.  
   Dairy cows produce large quantities of __.  
   steaks milk ice cream corn

4. Circle the word that completes the sentence.  
   Beef cows are more __ than dairy cows.  
   colorful taller muscular

5. Complete the sentence.  
   ____ cows are milked 2 times a day.

6. Circle the word that completes the sentence.  
   Beef and dairy cows like to ____ in the pasture.  
   sleep play graze swim
7. Circle all beef products.

8. Circle all dairy products.

9. Circle the correct answer: Veterinarians help keep cows healthy?
   True or False

10. Complete the sentence: Cows live on a ___.
1/5
large amounts of milk.
hamburger.

1/3
Silage is made by chopping up
Beef cows make

2/12
graze in the pasture.
steak.

8/5
We get many products
Beef cows make

6/9
cows when it is cold outside.
ribs.

1/6
In the summer, cows
Beef cows make

6/16
The farmer feeds the cows silage.
pot roast.

2/3
The farmer must provide shelter for
Beef cows make

10/25
heavily muscled.
cubed steak.

3/8
When the weather is cold,
Beef cows make

10/14
to nurture their young.
prime rib.

5/10
They do not produce
Beef cows make

2/6
Immature corn (ears, leaves, & stalk).
Hamburger.
2/5
Beef cows are
Beef cows make

5 x 5
They eat silage, grass, alfalfa,
Dairy cows make

6 x 7
Their bodies start making milk after
Dairy cows make

9 x 8
Silage is made by chopping up the
Dairy cows make

4 x 12
Cows like to
Dairy cows make

6 x 6
Dairy cows use food to produce
Dairy cows make

3 x 11
The milk is made in a sack
Dairy cows make

16/10
from beef cows.
Roast beef.

48
graze in pasture.
cheese.

42
they have a baby calf.
butter.

25
clover, wheat, and hay.
yogurt.

56
dairy cow is milked twice a day.
chocolate ice cream.

33
under their bellies called an udder.
whipping cream.

7 x 8
When the udder is full of milk, the
Dairy cows make
36
About 100 glasses of milk a day.
buttermilk.

72
Immature ears, leaves, & corn stalk.
sour cream.
Reflection Sheet: By-Products

Name: ___________________________ Date: ____________

1. What do you think would happen if farmers stopped raising dairy cows?

2. Do you think that everyone around the world eats meat or drinks milk? Why or why not?
Discussion Key
Reflection Sheet: By-Products

Name: ________________________ Date: ______________

3. What do you think would happen if farmers stopped raising dairy cows?

Answer: The price of milk would increase because there would not be enough to go around. Milk would have to be imported from other countries. People would demand something be done about the problem of not having enough milk.

4. Do you think that everyone around the world eats meat or drinks milk? Why or why not?

Answer: Some people have different religions that restricts them from eating beef. The same goes for certain religious holidays. Some people around the world live in areas where they do not grow cows so they have a different diet. Some people choose not to eat meat for health reasons too.
APPENDIX G

REVISED LESSON: SOIL
SOIL
Lesson Plan for Grade 4, Science
Prepared by Alyssa Hutcheson

OVERVIEW & PURPOSE

Students examine different types of soil that have been mixed with water and allowed to settle. They will investigate soils components (sand, silt, and clay), while also graphing and taking measurements of each. Students will discuss and recognize what natural resources are and why they are important to the life cycle of plants and animals.

EDUCATIONAL STANDARDS

Mississippi College-and-Career Readiness Standards:
L.4.2.1 Compare and Contrast the life cycles of familiar plants and animals.

4.MD.1 Know relative sizes of measurement units within one system of units including km, m, cm, mm; kg, g, mg; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36),...

NAROs:
T1.3-5 e. Recognize the natural resources used in agricultural practices to produce food, feed, clothing, landscaping plants, and fuel (e.g. soil, water, air, plants, animals, and minerals)

T2.3-5 e. Understand the concept of specific ways farmers/ranchers care for soil, water, plants, and animals.

OBJECTIVES
- Analyze the components of soil.
- Determine the silt, sand, and clay of soils in the student’s surrounding areas.
- Discuss the resources needed to grow food and fiber.
- Examine why crop rotation is important to farmers.

MATERIALS NEEDED

Day 1
Activity 1:

For each group:

- Flour
- Sugar
- Water
- Glass jar with lid (one for every two students)
- Three different buckets of soil. (This should not be from a flower bed or purchased in a store. This is not true soil. This has to come from a garden, or yard etc.)
- Permanent marker
- Ruler
- Paper towels

Day 2

Activity 2:

For the teacher:

- Soil samples from a variety of locations (about three different samples) (Have enough for each group to get a sample.
- Paper cups

For each group:

- Three paper cups per group with a different soil sample in each
• Permanent marker
• Jars made the day before with soil samples in them
• Rulers for each student
• What's Soil Made of? Handout (1 per student)
• Reflection Sheet (1 per student)

Lesson Set Up:

Day 1:

1. The teacher will need to obtain 3 large buckets of soil from 3 different locations. (Note: this should not be purchased or obtained out of flower beds. This is a soil medium and not considered "soil"). Make sure to label these #1, #2, and #3 soil to keep them separated.
2. The teacher will need to fill enough cups (1 per group of students) with sugar and one cup (1 per group of students) with flour.
3. The teacher will also need to fill one cup (1 per group of students) with water.
4. Have one cup of each placed at each group before the lesson begins, or have them set aside.
5. Next, the teacher should have set aside one mason jar (1 per every two students).
6. The teacher should also have a source of water (from bottles or a sink), for the students.

Day 2:

1. The teacher should have a "What is soil made out of?" worksheet and a reflection sheet printed for each student.
2. There should also be markers and rulers available for each pair of students.

VOCABULARY

Clay: fine granular material composed of closely packed particles.

Loam: ideal garden soil that has a well-balanced mixture of sand, silt, and clay.

Sediment: coarse granular material composed of finely divided rock and mineral particles.
Silt: sedimentary material composed of fine mineral particles in size between sand and clay.

inorganic: not consisting of or derived from living matter

organic: a substance of, relating to, or derived from living matter

Ag Facts:

- The process by which minerals move down through soil is called leaching.
- In a teaspoon of good soil there will typically be several hundred million bacteria.
- The average acre of good cropland will be home to over 1 million earthworms.
- Soil is mostly made of the elements oxygen, silicon, aluminum, iron, and carbon.
- It is possible to over-farm soil and remove so much of its nutrients and organic matter that plants will no longer be able to grow in it.

Background Information for Teacher:

What is soil?

Soil is the loose upper layer of the Earth's surface where plants grow. Soil consists of a mix of organic material (decayed plants and animals) and broken bits of rocks and minerals.

How is soil formed?

Soil is formed over a long period of time by a number of factors. It can take up to 1000 years for just an inch of soil to form. Besides time, other factors that help soil to form include:

- Living organisms - This includes organisms such as plants, fungi, animals, and bacteria.
- Topography - This is the relief or slope of the surface of land where the soil is forming.
- Climate - The overall climate and weather where the soil is forming.
- Parent material - The parent material is the minerals and rocks that are slowly broken down. At first you may think of soil as just dirt. Something you want to get rid of. However, soil plays a very important role in supporting life on Earth.
- Plants - Many plants need soil to grow. Plants use soil not only for nutrients, but also as a way to anchor themselves into the ground using their roots.
- Atmosphere - Soil impacts our atmosphere releasing gasses such as carbon dioxide into the air.
Living organisms - Many animals, fungi, and bacteria rely on soil as a place to live.
Nutrient cycles - Soil plays an important role in cycling nutrients including the carbon and nitrogen cycles.
Water - The soil helps to filter and clean our water.

Properties of Soil

Soil is often described using several characteristics including texture, structure, density, temperature, color, consistency, and porosity. One of the most important properties of soil is the texture. Texture is a measure of whether the soil is more like sand, silt, or clay. The more like sand a soil is, the less water it can hold. On the other hand, the more like clay soil is, the more water it can hold.

Soil Horizons

- Soil is made up of many layers. These layers are often called horizons. Depending on the type of soil there may be several layers. There are three main horizons (called A, B, and C) which are present in all soil disintegrating to form the soil.

LEARNING PROCEDURES

Day 1:
1. The teacher should start out by reading the following to the class:

“The Earth’s soil is a very important resource. Without healthy soil we would not be able to grow the plants we need for food, fiber, and shelter. There are many different types of soil and each is made up of different components, not just dirt! Soil is composed of three different types of particles that are classified as sand, silt, or clay.

The rock material in soil has been broken down over a very long time into smaller and smaller pieces by “weathering,” which happens when rock and soil are exposed to wind, water, and changing temperatures. Water and air are also found in soil. Water, air, and rock particles are the inorganic components of soil, which means these components are not living and never were living. The organic components in soil are living, or were once living, organisms. Examples of organic soil materials include decayed plant and animal
waste, worms, insects, bacteria, and more. Healthy soil is a mixture of a variety of inorganic and organic materials.

In this activity you will carefully dissect a soil sample to find out what it is made of. Farmers carry out soil tests like this on a regular basis. Farmers want to know the properties of their soil because it plays a role in the amount of nutrients that are available for plants to use."

2. The teacher should then emphasis the following points about the lesson to the class:

- Soil is a natural resource that farmers use to provide our food.
- Soil is necessary to grow the plants which provide food for humans and animals. Soil is also used to grow plants which provide clothing (cotton) and fuel.
- Soil contains mineral matter and organic matter. It also contains water and air.

3. Interest Approach – Engagement

1. The teacher should lead the following discussion:

"What is a natural resource?" (students may say something that comes from the ground).

Answer: Examples of natural resources such as minerals in the ground, forests, water, and fertile land and soil. Natural Resources occur naturally. We do not have to make them because nature does. Natural resources can be renewed so they can also be known as renewable resources. A forest is renewable because it can be replanted.

“What is a nonrenewable resource?” (students may say something about it cannot be grown or made)

Answer: A nonrenewable resource is something that is only available in limited supply, because it takes a long time to be replenished. Like gas that we put in our cars took millions of years to form and we cannot make gas so it is a nonrenewable resource.
“What is a recyclable resource?” (students may answer something that can be made into something else)
Answer: A recyclable resource or a product that is produced and can be broken down to make something new. Like we can recycle plastic water bottles to be turned into ink pens.

"Where does our food come from?" (Students might say the grocery store)
Answer: give specific examples of food such as apples, lettuce, corn, etc. Point out that each of these foods grow from plants in the soil.

"Is soil a natural resource?” (Hopefully students will say yes)
Answer: Yes!

4. Inform students that they are going to be learning about the importance of soil, a natural resource and how important it is to farmers in order to grow and produce the food we eat.

5. The teacher should lead the following discussion:

“What do we as humans need in order to survive? (students may say food, clothing, shelter)
Answer: We need food, water, clothing, and shelter.

“What do plants need in order to survive?” (students may say water, sunlight, etc.)
Answer: Plants need water, sunlight, nutrients, air, and soil.

“We know that the sun shines down on plants to help them grow and they are planted in the soil and surrounded by air, but how do plants get water?” (students may say from the sky or that we water them.)
Answer: Plants do get watered when it rains, and we may water them with a watering hose, but think about a big pumpkin patch, if we watered it by hand it would take us a very long time. That’s why farmers who grow big fields of plants water their plants through something called irrigation. Irrigation is just a fancy word for watering plants, however farmers use big machines to irrigate their plants. Some farmers use wells and flood their fields, some use big
sprayers that travel across their fields and spray water down on their plants, and some farmers use big hoses that have holes in them that drip water into the soil around the plants.

“Where do you think farmers in Mississippi get their water from?”
Answer: Underneath the ground there is something called a water reservoir that holds water in it. Many farmers dig wells into the group to pump that water out onto the surface. But some farmers get their water from water reserves that spill over from the Mississippi River. They have these huge levees that they built up to keep that water from spilling over and flooding the towns and cities below them.

“What do you think would happen if we did not have food clothing water or shelter?” (students may answer with we would freeze or be hungry)
Answer: It would be very difficult for us to survive without them.

“What do you think would happen to plants if they did not get the soil, water, sunlight, nutrients, or air they needed?” (students may say they would not survive)
Answer: Plants would not grow properly and would not produce the fruit and vegetables we need.

“Today we are going to be looking at one of those components that plants need in order to survive and that is soil.”

6. Activity 1: Shake, Rattle, and Roll

1. Explain to the class that soil is made of three different types of particles: sand, silt and clay. The perfect soil will contain an even mixture of all three. This is called a loam soil.

2. Give each student a small sample of sugar, representing sandy soil. Explain that this soil does not usually grow plants well, as it dries out quickly and does not let the roots get enough water. Have the students describe the texture. Inform them that this is the way that sand feels. Very gritty. Next, allow students to feel a small sample of dry flour and rub it between their fingers. This is the powdery, silky texture of silt. Finally, add a small amount of water to the flour. This is the texture of clay. Clay particles clump together and compact when dry and drain poorly when wet. Have the students describe the texture.

3. Break students into pairs in their groups. Give each pair of students one mason jar, and cap and lid, some water. Have students in pairs fill their jar halfway with one of the soil samples from the buckets, and the rest of the jar should be
filled with water. Make sure to instruct the students to label the jars according to their soil sample number, as well as their names on the top. Have the students take turns vigorously shaking the jar until the larger clumps are broken apart. (Make sure to warn your students to be careful when shaking the jars, as to not break them). Have students place their jars in a safe place and allow at least 24 hours for the soil to settle completely (You can make one ahead of time).

4. Say to the class: "Today we got to see some examples of the way silt, sand, and clay feel. In the next class session, we will see what the soil in our jars are made out of, and you will be able to see the different layers of silt, sand, and clay". Display the following image to students on the board by drawing it and labeling each layer.
5. Explain each layer to the students and inform them that they will get to see these layers the next class session in their jars.

6. Have students complete Soil reflection sheet #1

**Day 2:**
Interest Approach: Hold up one of the jars made the day before in front of the class. Show students that the soil inside has settled into the three layers of sand, silt, and clay. Use a permanent marker to draw a line to mark each layer.
1. Pass out the "What is soil made out of?" worksheet, one to each student.
2. As a class, read the top of the worksheet, and the instructions to the class.
3. Have students obtain their jars in partners and instruct them to mark each layer they see with their markers.
4. Have students graph their layers and label them by inches or centimeters on the top of their worksheets.
5. Instruct students to hold on to their worksheets for the next part of their lesson.

6. Activity 2: What's Soil Made Of?

1. In each group, place each soil sample (should be 3 in plastic cups) in the middle of each group of students. Make sure they are labeled by the soil number according to the outside of the bucket.
2. Have students go through each soil sample in groups and answer the remaining questions on the worksheet.
3. Have students turn in worksheets how they normally would.

7. The teacher should lead the following discussion:

"What do you think farmers do when soil runs out of nutrients because the plants he planted used up all of them?" (Students might say they do not use that soil anymore)
Answer: Different plants produce and use different nutrients. Because of science, farmers know what those nutrients are. They plant different crops in their fields each year to make sure that their soil not losing all of its nutrients and this is called crop rotation.

"What do you think farmers do when it has not rained in a long time and their soil is starting to dry out?" (Students might say they water it)
Answer: Farmers use different techniques to water their crops called irrigation. If farmers could not get water to their crops, many of them would die.

8. Concept Elaboration and Evaluation
After conducting these activities, review and summarize key concepts by having students complete the reflection sheet. After students turn this in, review and discuss the correct answers.
What’s Soil Made of?

The Earth’s soil is a very important resource. Without healthy soil we would not be able to grow the plants we need for food, fiber, and shelter. There are many different types of soil and each is made up of different components, not just dirt!

The rock material in soil has been broken down over a long time into smaller and smaller pieces by “weathering”, which happens when rock and soil are exposed to wind, water, and changing temperatures. Water and air are also found in soil. Water, air, and rock particles are the inorganic components of soil, which means these components are not living and never were living. The organic components in soil are living, or were once living, organisms. Examples of organic soil materials include decayed plant and animal waste, worms, insects, bacteria, and more. Healthy soil is a mixture of a variety of inorganic and organic materials.

In this activity you will carefully dissect a soil sample to find out what it is made of. Farmers carry out soil tests like this on a regular basis. Farmers want to know the properties of their soil because it plays a role in the amount of nutrients that are available for plants to use. If their plants do not have the proper nutrients then their plants cannot thrive and grow. Farmers have learned that rotating their crops (this means not planting the same thing in the same spot year after year), they can conserve the nutrients in their soil because some plants make and leave behind nutrients that other plants can use. However, they need to know what nutrients are in their soil first before they decide what crops to plant.

Instructions:
1. On the pictures provided below, graph your soil as shown on your jar. Make sure the measure each layer and label it as sand, silt, or clay. You can draw lines and color in each layer. The teacher should have shown you a picture of how this looks.
2. After you label and graph your jar and soil type, switch with other people in your group to graph the other two jar types.
3. After you have graphed your jars, answer the questions below each jar.
Soil Type #1

Measurements:
Silt: _______
Sand: _______
Clay: _______

What color is the soil sample? (dark brown, light brown, reddish brown, gray, orange, etc.)

__________________________

Is there more silt, sand, or clay in your sample? If so how much?

__________________________

What kinds of things can you see in the sample? (leaves, twigs, sand, worms, insects, etc.)

__________________________
Soil Type #2

Measurements:
Silt: 
Sand: 
Clay: 

What color is the soil sample? (dark brown, light brown, reddish brown, gray, orange, etc.)

Is there more silt, sand, or clay in your sample? If so how much?

What kinds of things can you see in the sample? (leaves, twigs, sand, worms, insects, etc.)
Soil Type #3

Measurements:
Silt: 
Sand: 
Clay: 

What color is the soil sample? (dark brown, light brown, reddish brown, gray, orange, etc.)

________________________________________

Is there more silt, sand, or clay in your sample? If so how much?

________________________________________

What kinds of things can you see in the sample? (leaves, twigs, sand, worms, insects, etc.)

________________________________________
Reflection Sheet: Soil #1

Name: ____________________________       Date: __________

1.) Jill grows pumpkins, and the local water company had a levee break, which has caused her to reduce her watering. How does the decrease in water impact Jill’s pumpkin patch?
Reflection Sheet: Soil #2

Name: ___________________________ Date: ___________

2.) Why is it important for farmers to rotate crops they grow in a field?
Discussion Key
Reflection Sheet: Soil #1

Name: ___________________________ Date: ____________

3.) Jill grows pumpkins, and the local water company had a levee break, which has caused her to reduce her watering. How does the decrease in water impact Jill’s pumpkin patch?

Answer: Some of the plants may die due to lack of water, resulting in fewer pumpkins grown.

Reflection Sheet: Soil #2

Name: ___________________________ Date: ____________

4.) Why is it important for farmers to rotate crops they grow in a field?

Answer: To replenish the nutrients in the soil.
APPENDIX H

REVISED LESSON: COMMODITIES
COMMODITIES

Lesson Plan for Grade 4, Social Studies
Prepared by Alyssa Hutcherson

OVERVIEW & PURPOSE

Students will be able to analyze where different crops and commodities are produced and grown in the United States and Mississippi. Students will be able to discuss where certain crops are grown due to weather, and what determines the price of food.

EDUCATIONAL STANDARDS

Mississippi College-and-Career Readiness Standards:

L.4.2 Students will demonstrate an understanding of life cycles, including familiar plants and animals (e.g., reptiles, amphibians, or birds.)

G.4.1 Describe the physical geography of Mississippi. 1. Compare and contrast the ten geographical regions of Mississippi in terms of soil, landforms, etc. 2. Illustrate major natural resources and deposits throughout Mississippi on a map, ex. Oil, agricultural, etc.

G.4.2. Understand how geographic and environmental factors influence life and work. 1. Compare the resources and scarcity of resources in a local region to other regions of Mississippi (e.g., Delta’s rich soil vs. coastal waters).

NALOs:

T1.3-5 c. Recognize the natural resources used in agricultural practices to produce food, feed, clothing, landscaping plants, and fuel (e.g. soil, water, air, plants, animals, and minerals)

OBJECTIVES

- Determine where different commodities come from and why.
- Explain what commodities grow in Mississippi.
- Determine where food comes from in the winter.
- Discuss the cost of food.
MATERIALS NEEDED

- 1 small bags of corn chips (to represent corn)
- 1 small bags of potato chips (potatoes)
- 1 small bags of apple chips or individual container of applesauce (apples)
- 1 small packages of beef jerky (beef)
- 1 bottle of orange juice
- 1 small packages of string cheese (milk)
  - If you cannot obtain the actual food items listed above, use images
- Large paper bag
- Where Does it Come From? activity sheet, 1 per student
- Background Information and Data handouts (beef, potatoes, apples, citrus, corn, milk), 1 topic per group
- United States Map, 1 per group
- Classroom map of the United States
- Markers or colored pencils for each group
- Reflection Sheet, 1 per student

Lesson Set Up:

1. The teacher will need to print each commodity background document (1 per commodity/group), the "Where does it come from?" activity sheet (1 per student), United States Map (1 per group), and the reflection sheet (1 per student).
2. Next the teacher will need to display the snack items in the front of the room and get a paper or plastic bag ready to place them in.
3. The teacher will need to make sure that students are separated into groups (6) before class starts.
4. The teacher can also pull up the Mississippi Ag Map on the board or overhead projector before class starts.

VOCABULARY

2
**bushel**: a unit of measurement used in US agriculture that is equivalent to a volume of 64 pints, but is generally standardized by weight for different products; a bushel of wheat weighs 60 lb, a bushel of corn weighs 56 lb

**by-product**: something produced in an industrial or biological process in addition to the principal product

**commodity**: a raw material or primary agricultural product that is bought and sold on a large scale

**data**: information in numerical form

**end product**: the final product after processing that is sold to the consumer

**hundredweight (cwt)**: a unit of weight equal to 100 pounds

**Ag Facts:**
- Farm and ranch families comprise just 2 percent of the US population.
- Today's farmers produce 262 percent more food with 2 percent fewer inputs (labor, seeds, feed, fertilizer, etc.), compared with 1950.
- One in three US farm acres is planted for export.
- In 2014 US farmers produced more than 11 billion pounds of apples, 14 billion bushels of corn, and 200 trillion pounds of milk.

**Background Information for Teacher:**
The variety of climates and soils found across the United States makes different parts of our country better suited for raising different agricultural commodities. Many of the fresh fruits and vegetables that we eat are grown in temperate regions like California, Florida, and parts of Texas. These areas have longer growing seasons than other parts of the country. Wheat, barley, corn, and other grain crops grow well in our country's midsection, which was once grassland. In some parts of the country, the land is not suitable for growing crops but provides good grazing for cattle and other livestock. Potatoes grow best in cooler climates, so they are a good crop for mountainous regions where it stays cool longer in the spring. Some crops require a great deal of rain, and some
need plenty of sunshine. Because our country has so many different climates and soil types, we are able to produce many different kinds of agricultural products.

The United States produces and sells a wide variety of agricultural products across the Nation. In terms of sales value, California leads the country as the largest producer of agricultural products (crops and livestock), accounting for almost 11 percent of the national total, based on the 2012 Census of Agriculture. Iowa, Texas, Nebraska, and Minnesota round out the top five agricultural-producing States, with those five representing more than a third of U.S. agricultural-output value. (USDA)

The value of agricultural production in the United States rose over most of the last decade due to increases in production as well as higher prices. Yield gains for crops were particularly important, although acreage also rose in response to elevated prices from 2008 to 2012. Falling prices in the last two years, accompanied by some reduction in acreage, have led to a 15-percent decline in the value of crop production since 2012. While livestock production increased over the decade, high feed costs and drought led to slower growth in recent years. Cattle herd rebuilding combined with Porcine Epidemic Diarrhea Virus (PEDv) to reduce red meat production by almost 4 percent in 2014, pushing overall red meat and poultry production down more than 1 percent. Higher prices more than compensated for lower production, resulting in a 17-percent increase in the value of livestock production last year.

LEARNING PROCEDURES

Day 1:

1. Interest Approach – Engagement (10 minutes)
Display food products to the class.
The teacher should lead the following discussion:
“By looking at these food products, do you know what we will be learning about today?”
(Students might say they will be learning about food)

After hearing answers from the students (Anticipated answers could be about food, we are getting to eat, snacks, etc.) explain to the students:


Today we will be learning where our food comes from, from around the United States. All across the state of Mississippi and the country farmers are growing crops and livestock to make the food you see in the grocery store and up here displayed today. First, we will be learning about what our food is made out of and then we will be learning where our food is grown.

"Do you know what ingredients are used in the displayed foods?" (Answers will vary)

Answer: (Anticipated answers could be potatoes or apples but expect some random answers) Explain to students what each food is made out of (listed beside the food in the list). For example, if they list pizza as a favorite food, the ingredients would include flour, pizza sauce, cheese, pepperoni, etc.

"What plants/animals do these ingredients come from?" (Students might say cows and corn)

Answer: Wheat, tomatoes, dairy cattle, pigs, oranges, etc.

"Where are they produced?" (Students might say in gardens)

Answer: On farms

"Are any of them grown in your state?" (Students might say yes in gardens)

Answer: Yes. As a matter of fact Mississippi produces a lot of things you can buy in the grocery store. We will be looking at a map to see where each item is grown.

2. Explain that these ingredients are agricultural commodities.

"The word commodity just means something that the United States makes that they can use or sell to other countries. In this case we grow a lot of food. The food we grow are plants and animals and these can also be called commodities. Beef cows are a commodity, sweet potatoes are a commodity, almost every fruit and vegetable you see in the grocery store is considered to be a commodity. This is how we will be learning how geography and the production of their food is related."

3. Share the information contained in the Background, and explore the meanings of the words end product, and by-product. To illustrate, bring to class some examples of end products and agricultural commodities from which they were made (e.g., cotton ball—or raw cotton boll, if available—and cotton shirt, dry beans and bean dip, tomato and tomato sauce, apple and apple cider). Ask students to differentiate between the commodity and the end.
product. “A commodity is a food we get directly from the ground or the animal it came from such as beef or milk or apples. An end product is what we turn it into like beef turns into beef jerky, milk turns into cheese, and apples turn into apple sauce” A by-product is what is left over from the plant or animal that we use to turn into something else. So a cow that was raised to produce hamburger will also have its hide/ skin turned in to a leather purse or shoes”.

4. Activity 1:

Pass out a copy of “Where does it come from to each student”. Instruct students to not get started on their worksheet until provided with further instruction.

Place each snack into one large paper bag. Divide students into groups of “6 stations” (if this is already predetermined in class then use the predetermined groups). Designate a leader for each group. The leader of each group will reach into the bag and draw out a snack. Once all snacks have been drawn have students discuss what they think the commodity of their snack is (e.g. Corn Chips will be corn.

Once the students feel that they have it figured out, instruct the leader of the group receive a copy of the Background Information and Data handout about the specific agricultural commodity the group will be studying and a copy of the attached map of the United States.

Instruct students to read the background information and examine the data to answer the remaining questions on the activity sheet. Then they should locate the top five states where their snacks grow on their United States maps and color those states. (20 minutes)

Have each group report on its findings and mark on a classroom map the states where the designated food grows. Students should also report on the growing conditions necessary for each product.
5. The teacher should then lead the following discussion in which students are asked to think about what factors determine what is grown in which states (climate, availability of land, transportation, storage capacities) and how much is produced (climate, the size of state, soil type).

"Think about the weather in Florida. Florida is nice and sunny and warm. Oranges and cuties like sunny and warm climates so they like to grow in places like Florida and California. Think about up north in states like Oregon and Washington where there is snow and gets really cold. Apple likes to grow in nice damp and cool places to they grow really well in those places. If the weather is not perfect for the type of plants or animals a farmer is growing, he could lose some of his crop, which could then make food prices higher because there is not enough to go around."

"Think of other places where food is grown. Farmers have to have a lot of land to grow plants and animals. They also have to have good roads so that they can transport what they grow so that it can end up in the grocery store. Also, since farmers have to make sure their crops get to the grocery store, they also have to pay for things like gas and people to work on their farms. Do you think this could affect the price of those crops? Why or why not?" (Answers will vary)

Answer: Gas prices go up and down all of the time so the farmer is never certain on what he is going to have to pay for gas. A farmer has to add this on to the cost of his crops. Also, many farmers have a hard time finding workers to work on their farms usually because it's pretty hard work and some farms can be very far out in the country. This can also make your food more expensive because farmers might have to offer to pay workers more money to get them to come work for them.

6. Handout or display a map of Mississippi agriculture (provided by the Mississippi Department of Agriculture)
Lead a discussion about the county the school is located in, its climate, in relation to what is displayed on the map. Go over all state areas and commodities on the map for students to understand what commodities are produced in Mississippi and where. After this, ask the following:

**Ask students:**

"Do you know how food is grown when it gets cold where we live? (Students might say that food is not grown when it's cold) Display a picture of a greenhouse to students.

Answer: Some farms grow food in greenhouses like this one shown. These greenhouses have sprinklers to water the plants and have heaters in them to keep them warm and protected. What is another way we get food in the grocery store when it is cold? "In many other countries around the world, while we are experiencing winter, they are experiencing summer and are growing many crops. Just like we sell our commodities to other countries to buy, we buy a lot of commodities from other countries as well. Like during the winter we buy tomatoes and avocados from Mexico and oranges and citrus from places in Africa." "Also, farmers can sometimes store food that they grow in warehouses and keep it to sell during the winter".

7. **Concept Elaboration and Evaluation**

After conducting these activities, review and summarize key concepts by having students complete the reflection sheet.
United States Map

Different regions of the country specialize in producing different agricultural products based on what crops are most suited to their climate and soil and what products the market demands. Locate and color the top five states that produce the commodity used to make your snack.
Where Does It Come From?

1. My snack is __________________________

2. The main agricultural commodity used to make this snack is ________________

3. Name some states where you think this commodity might be grown.
   __________________________ _______________ _______________

4. After reading the background information, make a check mark next to the growing condition that comes closest to describing what your agricultural commodity needs.
   a. Cool conditions.
   b. Not too wet.
   c. Sunny mild days when in bloom; plenty of rain mid summer.
   d. Sometimes raised on land that cannot be used for other purposes.
   e. Plenty of pasture and plenty of water.
   f. Plenty of water.

5. Look at the data provided for your commodity. Find the top five states where the main ingredient in your snack is produced.
   1. __________________________  2. __________________________
   3. __________________________  4. __________________________
   5. __________________________

6. Count the states listed. _____ Are all 50 states represented?  yes  no

7. Is the state where you live on the list?  yes  no
   If so, write the number showing how much of this agricultural product was produced in 2014 or 2015 in your state.

8. List some products this agricultural commodity is used to make.
   __________________________ _______________ _______________
Where Does It Come From?
(answers)

Beef
1. Beef jerky; 2. beef; 3. student determined; 4. d; 5. Texas, Nebraska, Kansas, California, Oklahoma; 6. 50 states; 7. specific to your state; 8. makeup, crayons, steaks, roasts, hamburgers, ball gloves, footballs, shoes, belts, ice cream, yogurt, chewing gum, detergent, toothpaste, floor wax, Medicine.

Potatoes
1. Potato chips; 2. potatoes; 3. student determined; 4. a; 5. Idaho, Washington, Wisconsin, North Dakota, Colorado; 6. 28 states; 7. specific to your state; 8. French fries, mashed potatoes, potato Chips.

Apples
1. Apple chips or applesauce; 2. apples; 3. student determined; 4. c; 5. Washington, New York, Michigan, Pennsylvania, California; 6. 29 states; 7. specific to your state; 8. applesauce, apple pie and other desserts, fresh apples for eating, apple cider, apple juice.

Corn
1. Corn chips; 2. corn; 3. student determined; 4. f; 5. Iowa, Illinois, Nebraska, Minnesota, Indiana; 6. 41 states; 7. specific to your state; 8. oil, syrup, cereal, starch, soda pop, bakery goods, cornstarch, fructose, ethanol, packaging materials.

Dairy
1. String cheese; 2. milk; 3. student determined; 4. c; 5. California, Wisconsin, New York, Idaho, Pennsylvania; 6. 50 states; 7. specific to your state; 8. butter, chocolate milk, ice cream, yogurt, cheese and more.

Citrus
1. Orange Juice; 2. Oranges/Citrus fruits; 3. Student determined 4. C.f; 5. Arizona, California, Florida, Texas; 6. 4 states, no 7. Specific to your state; 8. Orange juice, lemonade, cosmetics
Where Does It Come From?

Beef Background

We get meat from beef cattle and milk from dairy cattle. Although females from all cattle breeds produce milk and meat, some cattle are better at giving milk, and some are better at providing meat.

The first step in beef production is raising the calves that will become meat. In a cow/calf operation, the farmer keeps cows for the calves that they will produce. After she is bred, the mother cow carries the developing baby calf for 9 months, a little longer than one school year. At birth, the average calf will weigh 60-100 pounds. Newborn calves grow by drinking milk from their mothers, and soon they begin eating green grass from pastures. Calves are weaned off of milk when they are six to ten months old and weigh between 450 and 700 pounds.

During the winter, beef cattle stay in feedlots and eat hay and grain. Sometimes they graze on wheat fields before it is time to let the wheat grow tall.

When the calves are big enough (about 800 pounds) they are sold to feedlots, where they are fed a special diet to gain weight quickly. This is often called the finishing phase of beef production. Most cattle spend four to six months in a feedlot before they reach market weight, which is typically 1200 to 1400 pounds, reached around 18 to 22 months of age.

From beef cattle we get steaks and roasts and hamburgers. We also get by-products like leather for shoes, belts, baseball gloves, and footballs. Gelatin in products such as ice cream and yogurt are made from the bones of cattle. Even chewing gum has an ingredient that comes from a cow. Here are some other products we get just from the fats and proteins produced by cattle:

- makeup
- detergent
- floor wax
- crayons
- toothpaste
- perfume

Cattle and calves for beef are produced in every state in the nation. They can be raised in many different climates and on many different kinds of land. In the West, cattle are often grazed on land that cannot be used for other purposes. This is land that erodes easily or is too rocky or dry for growing crops. As long as the beef producer doesn’t keep the animals too long on one section of land, grazing animals help keep this land healthy. They fertilize the land with their manure while their hooves break up the surface of the soil so tender grass can poke through.
<table>
<thead>
<tr>
<th>State</th>
<th>Cattle (1,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>1,220</td>
</tr>
<tr>
<td>Alaska</td>
<td>10</td>
</tr>
<tr>
<td>Arizona</td>
<td>880</td>
</tr>
<tr>
<td>Arkansas</td>
<td>1,640</td>
</tr>
<tr>
<td>California</td>
<td>5,150</td>
</tr>
<tr>
<td>Colorado</td>
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</tr>
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<td>Connecticut</td>
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<tr>
<td>Delaware</td>
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<tr>
<td>Florida</td>
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<tr>
<td>Georgia</td>
<td>1,040</td>
</tr>
<tr>
<td>Hawaii</td>
<td>135</td>
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<tr>
<td>Idaho</td>
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<tr>
<td>Illinois</td>
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<tr>
<td>Indiana</td>
<td>870</td>
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<tr>
<td>Washington</td>
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<td>West Virginia</td>
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<tr>
<td>Wisconsin</td>
<td>3,500</td>
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<tr>
<td>Wyoming</td>
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<tr>
<td><strong>US (Total)</strong></td>
<td><strong>89,800</strong></td>
</tr>
</tbody>
</table>

Where Does It Come From?

Potatoes Background

The potato is not a root but a part of the underground stem that stores food reserves for the plant. The roots collect more water and nutrients than the growing potato plant can use at one time. The plant stores the excess food in oval packages, called tubers (the potatoes). When the greenery starts to wither and turn brown, the potatoes are ready to harvest. Potatoes grow best in cool weather and are an important crop in mountainous parts of the country, where the growing season is short.

Potatoes produce more pounds of protein per acre than rice or wheat, and they are a good source of potassium and B vitamins. The average American eats about 125 pounds of potatoes and potato products each year.

Potatoes were domesticated by ancient tribes living in the Andes Mountains of Bolivia and Peru between 10,000 and 7,000 years ago. Archaeologists have found pictures of potato plants in designs on ancient pottery. Ancient tribes preserved potatoes by trampling and drying them.

Even though potatoes were first grown in South America, people in North America did not start eating them until after they became a popular food in Europe. European explorers carried potatoes from South America to Europe in 1570. About 150 years later, the rulers of several European countries ordered their people to start growing potatoes. In Ireland, potatoes became the main food for the people. In the 1840s, disease wiped out the potato crop in Ireland for two years in a row. The resulting famine caused many Irish people to move to America.

Today, most of the world’s potatoes today are grown in Asia. Potatoes are grown in all 50 of the United States and are a common truck crop. A truck crop is grown on a farm and taken to the market by truck.

Before they go to market, potatoes are graded according to size and quality. The price of the potato depends on how it looks and how much it weighs.

From potatoes we get some of our favorite foods – French fries, mashed potatoes, potato chips and more.
# POTATOES DATA

Production, 2014

1,000 cwt*

<table>
<thead>
<tr>
<th>State</th>
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<td><strong>US Total</strong></td>
<td><strong>446,693</strong></td>
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</tbody>
</table>

* A unit of weight in the US Customary System that is equal to 100 pounds (cwt)

Where Does It Come From?

**Apples Background**

Scientists say apples have been around for 750,000 years. The first apple orchard in North America was planted in Boston, Massachusetts in 1625. As our country was settled, nearly every farm grew some apples. Most of the early varieties would be considered poor quality today. Of nearly 8,000 varieties known around the world, about 2500 are grown in the United States. However, only about 100 varieties are grown commercially, meaning you can buy them at a grocery store or find them in processed products like juice or apple sauce.

Apples come in lots of colors and shapes. Each apple is loaded with minerals, vitamins, and fiber. Apples are classified as pome fruits because they have leathery seeds embedded in the core of the fruit similar to pears, another pome. The average apple tree will bear fruit in three years, with full production coming in eight to ten years. A standard apple tree lives an average of 100 years.

Growing an apple crop takes all year. In the winter, while the trees are dormant, apple growers begin pruning—clipping off limbs and branches to let the sunshine in. Pruning helps the tree produce better fruit.

About the time that frost ends in spring, the buds begin to swell. With the opening of the “King” blossom (the largest and centermost of the five blossom clusters), it is time to pollinate to begin. Bee colonies rented from beekeepers must be moved in quickly. Sunny mild days are needed during bloom to encourage strong bee activity. Apples need more than one variety of pollen for the cross-pollination that ensures good fruit set.

Fruit size and firmness are affected by the amount of moisture apple trees receive in mid-summer. If the weather is too dry, producers must irrigate.

August is the last growing month before the apples begin to ripen. Red apples need cool nights during harvest to trigger production of an enzyme that increases the amount of color or “blush.” Apples bruise easily and must be picked by hand. Picking begins around the end of August and ends in October.

Besides fresh apples for eating, apples give us applesauce, apple cider, apple juice, apple pie, and other delicious baked treats.
**APPLES DATA**

*Total Production, 2014*

<table>
<thead>
<tr>
<th>State</th>
<th>Million Pounds</th>
</tr>
</thead>
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<td>7.1</td>
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<tr>
<td>California</td>
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</tr>
<tr>
<td>Colorado</td>
<td>7.3</td>
</tr>
<tr>
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<td>17.6</td>
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<tr>
<td>Idaho</td>
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<td>Illinois</td>
<td>20.6</td>
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<tr>
<td>Indiana</td>
<td>17.0</td>
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<td>Iowa</td>
<td>3.2</td>
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<td>Maine</td>
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<td>Maryland</td>
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<td>Minnesota</td>
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<td>Missouri</td>
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<td>Ohio</td>
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<td>Oregon</td>
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<td>Wisconsin</td>
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<tr>
<td><strong>US Total</strong></td>
<td><strong>11,251.2</strong></td>
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</table>

Where Does It Come From?

Corn Background

The corn plant is an American native. It was first grown by farmers in Mexico around 7,000 years ago.

Corn is an annual plant that grows seven to ten feet tall. It is actually a type of grass. Strong roots called prop roots help support the cornstalk. A tassel grows at the top and contains hundreds of small flowers that produce pollen.

The different types of corn include dent corn, flint corn, sweet corn, popcorn, and flour corn. Dent corn is commonly called “field corn.” This is the most widely grown type of corn in the United States, and it is the type that is processed into thousands of different products and used as animal feed. Producers use a large part of the dent corn crop to feed cattle, hogs, sheep, and poultry. Sweet corn, popcorn, and flour corn are used for human food. The number of bushels of corn produced in the United States measures more than double that of any grain crop, and the United States produces more corn than any other country.

Corn is planted in the early spring using a corn planter. The machine drops the kernels into rows and then presses the soil around each kernel. Before planting, the planter places fertilizer in the soil. The rest is up to the weather. Rain is extremely important because the corn plant needs a lot of water to grow.

Sometime between late September and November the corn will be ready to harvest. Corn is harvested by a large combine. The machine cuts off the corn plant, removes the ear of corn, and separates the kernels from the corn cob. Parts of the corn plant are left in the field to protect the soil for the next year.

There are more than 3,500 different uses for corn products, and more uses are being found each day. Corn makes oil, syrup, cereal, starch and more than 1,000 other products you can buy in the grocery store. Corn kernels are used to make fructose, a liquid sugar used to sweeten soda pop and baked goods. Cornstarch is also made from corn. Corn can be used to produce biodegradable plastic and packaging materials, reducing the amount of waste added to landfills. Ethanol is also made from corn and used as fuel for cars, trucks, and buses.
<table>
<thead>
<tr>
<th>State</th>
<th>Thousand Bushels</th>
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</table>

*A unit of measurement in the US Customary System that is equal to 64 pints or the equivalent weight. A bushel of corn equals 56 pounds.

Where Does It Come From?

Milk Background

Just as beef cattle are raised mostly for their meat, dairy cattle are raised for their milk. The main breeds of dairy cows in the United States are Holstein, Jersey, Guernsey, Brown Swiss, and Ayrshire. Some breeds produce more milk than others, and some produce richer milk than others. Holsteins are the most common. They produce large quantities of milk, and their distinct black and white coloring makes them easy to recognize.

A dairy cow weighs about 1,500 pounds. The average cow spends 6–10 hours a day eating, and consumes about 90 pounds of food. She may eat pasture plants, hay (dried grass or alfalfa), or silage (chopped green grasses or other plants), and some grain (corn, barley, oats, etc.). She drinks 25–50 gallons of water each day. That’s nearly a bathtub full. Cows that eat only pasture plants produce less milk than those supplemented with more concentrated and high-energy foods like grains. A high-producing cow can give more than 100 glasses of milk a day.

Cows make milk to feed their calves, but they are such big animals that they make much more milk than a calf needs. A dairy cow must have one calf a year, or she will stop producing milk. The cows must be milked twice a day and are sometimes milked three times a day.

Dairy farmers are careful to keep the milk clean and avoid exposing it to the open air, which would contaminate it. The cow’s udder is washed before she is milked to keep the milk clean.

Before modern milk delivery, people had to take their cows with them when they traveled if they wanted milk. Today a refrigerated tanker truck picks up milk from the dairy and delivers it to the milk processing plant. At the dairy plant, the milk is pasteurized to kill any disease-causing bacteria before it is sold.

Milk can be processed into many different foods and dairy products, including butter, chocolate milk, ice cream, yogurt, cheese, and more.
<table>
<thead>
<tr>
<th>State</th>
<th>Total Production, 2014 (Million Pounds)</th>
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<tbody>
<tr>
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<td>Wyoming</td>
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US Total: 201,231

Where Does It Come From?

Citrus Background

Oranges, grapefruit, lemons, and limes are all types of citrus fruit. Citrus fruits have a juicy pulp inside a leathery skin. They grow on trees, bushes, or shrubs.

Throughout the ages, the fruit of citrus trees has been a symbol of eternal love, happiness, and even holiness. Kings and queens built entire indoor gardens around citrus. Hercules so valued it, he stole the golden fruit from Hesperides, who protected it as the primary food of the ancient Roman and Greek gods.

The history of citrus stretches farther back into time. The earliest references to oranges are to be found in ancient Chinese documents, with one such notation appearing in a written record dated about 2200 B.C.

The citron was the first citrus fruit to attract the attention of Europeans, who were seeking trade routes to the Far East and its fabulous wealth. The citron became established in Europe about 310 B.C., and was followed thereafter by the sour orange, the lemon, the sweet orange.

But nowhere on earth, or perhaps even the heavens, has the "golden fruit" held more importance than in Florida, where citrus growing and processing has become a multi-billion dollar industry.

Christopher Columbus brought the first citrus to the New World in 1493. The early Spanish explorers, planted the first orange trees around St. Augustine, Florida, sometime between 1513 and 1565.
**Citrus Data Total Production, 2015-2016**

**Thousand Acres**

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<th>Acres</th>
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<td>435,300</td>
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<tr>
<td>Texas</td>
<td>24,500</td>
</tr>
</tbody>
</table>
Reflection Sheet: Commodities

Name: ___________________________ Date: ____________

1. What would be some reasons that food might cost more at the store?

2. How do you think farmers grow food when it's winter time in the United States?
Discussion Key
Reflection Sheet: Commodities

Name: ___________________________ Date: ____________

3.) What would be some reasons that food might cost more at the store?

Answer: Weather conditions could damage crops. As gas prices increase it would cost more to transport crops from their farms to the store. Sometimes there is not enough workers to help on farms.

4.) How do you think farmers grow food when it's winter time in the United States?

Answer: Farmers grow plants in greenhouses so fresh fruits and vegetables are available to buy in the winter, some states and countries have warmer weather when it's cold in the United States or Mississippi so we import food from them. Farmers also keep extra fruit and vegetables in warehouses to sell in the winter.
APPENDIX I

SUPERINTENDENT LETTER
(Insert Name here),

My name is Alyssa Hutcheson and I am a Graduate student at Mississippi State University in the School of Human Sciences. I would like to briefly introduce myself and then inform you about my thesis research in which I am recruiting teachers for.

I earned my Bachelor's in Agricultural Education, Leadership, and Communications with a concentration in teaching from Mississippi State University in December 2018, having student taught that previous semester. While student teaching grades 9-12, it came to my attention that many of my students did not possess a good understanding of where their food, clothing, and shelter comes from. Through this experience I become passionate about educating the population about agriculture.

I am working to revise existing Mississippi Farm Bureau Ag in the Classroom curriculum to align with Mississippi's College-and-Career Readiness standards so that teachers can conveniently and easily tie agricultural concepts into their lessons. My thesis research aims to compare the existing curriculum to the revised curriculum to determine its effectiveness at increasing ag literacy in students while determining the teachers perceptions of integrating agricultural concepts and lessons into their existing curriculum.

The design for this study will involve 4th grade teachers and students during the Fall 2019 semester. Dr. Stephanie Lemley is serving on my thesis committee, she suggested I reach out to you for your help with identifying teachers to participate in this study. One group of teachers will teach three lessons from the existing curriculum, one group will teach three lessons from the new curriculum, and then there will be one control group that will not be exposed to either. I would like to be able to have at least three classrooms/teachers per group. All student groups will receive a pre-test, post-test, and a delayed-posttest. There will be no known risks to the teachers or participating students, and all identifiers for the participants will be removed or coded. Also, all supplies will be provided to the teachers for the lessons so that there is no expense for participating in this study.
If you chose to participate or are interested in learning more about this study, please let us know at your earliest convenience. If you have any questions or concerns about this study please feel free to reach out to myself or my academic advisor Dr. Carley Morrison at any time.

Again, thank you for taking the time to consider being a part of a study.

Sincerely,

Alyssa L. Hutcheson
Graduate Research Assistant
Agricultural Education, Leadership, and Communications
alh948@msstate.edu

Carley C. Morrison
Assistant Professor
Agricultural Education, Leadership, and Communications
662.325.0749
carley.c.morrison@msstate.edu
APPENDIX J

SUPERINTENDENT PERMISSION LETTER
August 14th, 2019

To Whom It May Concern:

The Starkville Oktibbeha Consolidated School District has approved research to be conducted with Mississippi State University’s School of Human Sciences and we anticipate the Ag in the Classroom (AITC) Project will provide continued opportunities for all of our elementary teachers to engage in teaching agricultural concepts in their classrooms, through science, social science and mathematics, starting in the Fall of 2019. The goals of the project are to provide teachers with standards based agricultural lessons that can easily be implemented within everyday curriculum.

We agree to encourage teachers to participate in AITC by disseminating information about the study.

The AITC Project will provide support for our elementary teachers as researchers work to develop high-quality instruction for our students. Therefore we endorse this project, and look forward to this partnership with Mississippi State University and its implementation in our schools.

Sincerely,

Eddie Peasant, Ed.D.
Superintendent
Starkville Oktibbeha Consolidated School District

Expect Excellence Every Day
APPENDIX K

PRINCIPAL PERMISSION LETTER
September 10th, 2019

To Whom It May Concern:

Henderson Ward Stewart Elementary school has approved research to be conducted with Mississippi State University’s School of Human Sciences and we anticipate the Ag in the Classroom (AITC) Project will provide continued opportunities for all of our elementary teachers to engage in teaching agricultural concepts in their classrooms, through science, social science and mathematics, starting in the Fall of 2019. The goals of the project are to provide teachers with standards based agricultural lessons that can easily be implemented within everyday curriculum.

We agree to encourage teachers to participate in AITC by disseminating information about the study.

The AITC Project will provide support for our elementary teachers as researchers work to develop high-quality instruction for our students. Therefore we endorse this project, and look forward to this partnership with Mississippi State University and its implementation in our schools.

Sincerely,

[Signature]
Julie Fancher
Principal, Henderson Ward Stewart Elementary School

Expect Excellence Every Day
APPENDIX L

IRB PERMISSION
From: nn54@msstate.edu
Sent Date: Monday, December 02, 2019 08:52:43 AM
To: cpc215@msstate.edu, alh948@msstate.edu, cbj170@msstate.edu, mls15@msstate.edu, snb748@msstate.edu
Cc: 
Bcc: 
Subject: Do Not Reply: Approval Notice for Study # IRB-19-244, Ag in the Classroom

Message:
Protocol ID: IRB-19-244
Principal Investigator: Carley Morrison
Protocol Title: Ag in the Classroom
Review Type: EXPEDITED
Approval Date: December 02, 2019
Expiration Date: September 16, 2024

**This is a system-generated email. Please DO NOT REPLY to this email. If you have questions, please contact your HRPP administrator directly.**

The above referenced study has been approved. *For Expedited and Full Board approved studies, you are REQUIRED to use the current, stamped versions of your approved consent, assent, parental permission and recruitment documents.*

To access your approval documents, log into myProtocol and click on the protocol number to open the approved study. Your official approval letter can be found under the Event History section. All stamped documents (e.g., consent, recruitment) can be found in the Attachment section and are labeled accordingly.

If you have any questions that the HRPP can assist you in answering, please do not hesitate to contact us at irb@research.msstate.edu or 662.325.3994.
APPENDIX M

GUARDIAN CONSENT FORM
Mississippi State University
Informed Consent Form for Participation in Research

IRB Approval Number: IRB-19-244

Title of Research Study: Mississippi Ag in the Classroom

Study Site: Starkville Oktibbeha County School District

Researchers: Alyssa Hutcheson, Mississippi State University, School of Human Sciences
Dr. Carley Morrison, Mississippi State University, School of Human Sciences

Purpose
This study is meant to further Ag in the Classroom Curriculum development and assess agricultural literacy levels in 4th graders in Mississippi.

Procedures
If your student participates in this study, they will be taught three interactive lessons about agriculture throughout the fall 2019 school semester that will take 30-45 minutes each to complete by their in class teacher. They will also take three tests consisting of a pre-test, post-test, and a delayed post-test that has 15 questions and this should take them no longer than 15-30 minutes to complete each time. The results of this test will be used by the researchers for the results of this study. The students will not face any negative consequences by taking these tests. This will all be completed in the students’ normal class time, and will not interfere with their day-to-day school activities.

Risks or Discomforts
There are no risks or discomforts associated with participating in this study.

Benefits
Benefits of participating in this study include getting to learn valuable information about agriculture and the food and fiber industry while getting to participate in hands-on learning activities.

Confidentiality
All identifiers for student documents will be removed and coded so that there will be no link back to the student and their work. All documents will be held in a secure location that only the researchers and their academic advisor has access to.

Please note that these records will be held by a state entity and therefore are subject to disclosure if required by law. Research information may be shared with the MSU Institutional Review Board (IRB) and the Office for Human Research Protections (OHRP) and others who are responsible for ensuring compliance with laws and regulations related to research, including people on behalf of Mississippi State.
The information from the research may be published for scientific purposes; however, your identity will not be given out.

Your name and identifying information will not be connected in any way to your responses by separately submitting your PRP Identity Code back to the system while your responses are sent to a different database for retrieval by the researcher.

Questions
If you have any questions about this research project or want to provide input, please feel free to contact Alyssa Hutcheson or Dr. Carley Morrison at (662-325-2950).

For questions regarding your rights as a research participant or to request information, please feel free to contact the MSU Human Research Protection Program (HRPP) by e-mail at hrp@research.mst.edu, or visit our participant page on the website at http://orc.mst.edu/humanparticipants/participant/.

To report problems, concerns, or complaints pertaining to your involvement in this research study, you may do so anonymously by contacting the MSU Ethics Line at http://www.mst.edu/ethicsline/.

Voluntary Participation
Please understand that your participation is voluntary. Your refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may discontinue your participation at any time without penalty or loss of benefits.

Please take all the time you need to read through this document and decide whether you would like to participate in this research study.

If you agree to participate in this research study, please sign below. You will be given a copy of this form for your records.

Participant Signature Date

Investigator Signature Date

Research Participant Satisfaction Survey

In an effort to ensure ongoing protections of human subjects participating in research, the MSU HRPP would like for research participants to complete this anonymous survey to let us know about your experience. Your opinion is important, and your responses will help us evaluate the process for participation in research studies. https://www.surveymonkey.com/r/M5M95YF
APPENDIX N

STUDENT ASSENT FORM
IRB Approval Number:  
Project Title:  
Investigator:  

Your parent knows that we are going to ask you to participate in this project. We want to know about kid's knowledge about farming and agriculture. Your teacher will teach you three lessons about farming and agriculture. You will take a test three different times to test your knowledge about farming and agriculture. It will take 30 minutes to take the test, and several weeks for your teacher to teach the lessons. Your name will not be written anywhere on your tests and these will not be taken for a grade by the researchers. No one will know these answers came from you.

If you don't want to participate, you can stop at any time. There will be no bad feelings if you don't want to do this. You can ask questions if you do not understand any part of this study.

Do you understand? Is this OK?

Participant's Name (Please Print): ________________________________________________

Signature ___________________________ Date ______________

Investigator's Signature ___________________________ Date ______________

Research Participant Satisfaction Survey

To make sure that your rights as a research participant have been protected, the MSU HRPP would like for you to complete this survey to let us know about your feelings of this study. Your answers will help us make sure that research participants are protected.  
https://www.surveymonkey.com/r/M5M95YF
APPENDIX O

TEACHER CONSENT FORM
Mississippi State University
Informed Consent Form for Participation in Research

IRB Approval Number: IRB-19-244

Title of Research Study: Mississippi Ag in the Classroom

Study Site: Starkville Oktibbeha County School District

Researchers: Alyssa Hutcheson, Mississippi State University, School of Human Sciences
Dr. Carley Morrison, Mississippi State University, School of Human Sciences

Purpose
This study is meant to evaluate updated Mississippi Ag in the Classroom curriculum.

Procedures
If you participate in this study, you will be interviewed about your experiences using the updated Ag in the Classroom curriculum.

Risks or Discomforts
There are no risks or discomforts associated with participating in this study.

Benefits
Benefits of participating in this study include getting to learn valuable information about agriculture and the food and fiber industry while getting to inform curriculum creators about changes that need to be made to the curriculum.

Confidentiality
All identifiers for student documents will be removed and coded so that there will be no link back to the student and their work. All documents will be held in a secure location that only the researchers and their academic advisor has access to.

Please note that these records will be held by a state entity and therefore are subject to disclosure if required by law. Research information may be shared with the MSU Institutional Review Board (IRB) and the Office for Human Research Protections (OHRP) and others who are responsible for ensuring compliance with laws and regulations related to research, including people on behalf of Mississippi State University’s School of Human Science. The information from the research may be published for scientific purposes; however, your identity will not be given out.

Your name and identifying information will not be connected in any way to your responses by separately submitting your PRP Identity Code back to the system while your responses are sent to a different database for retrieval by the researcher.

Questions
APPENDIX P

TEACHER INTERVIEW QUESTIONS
1. Do you currently incorporate Mississippi agriculture into your daily lesson plans? Why or why not?
2. Did the students enjoy learning about agriculture?
3. Did you enjoy teaching the lessons?
4. If yes, why?
5. If no, why?
6. Were the lesson easy to use? What made them easy/hard to use?
7. In your opinion, what is the best feature of these lesson plans?
8. Was there something that the lessons were missing that would have made them easier to use?
9. Was there something additional that the lessons had that was not needed?
10. Were you confident teaching this material? Why or why not?
11. What would have made you more confident in your ability to teach?
12. What are some recommended changes about the curriculum that you would suggest?
13. Do you plan to continue to use Mississippi Ag in the Classroom lessons in the future?
14. Why or why not?
APPENDIX Q

TEACHER RECRUITMENT EMAIL
All,

First, I want to thank each of you again for participating in this research study. It has been an absolute joy working with you and we want to make sure that each of you know how truly thankful we are for your participation. To finish up this study, we would like to sit down and discuss with you your recommendations for the curriculum. These interviews/discussion should not take any longer than 30 minutes. We would like to talk with Mrs. Reed and Mrs. Napier together, and Mrs. Wilson individually. Please just let us know a time and place that works the best for each of you between now (12/2/2019) and December the 12th (12/12/2019). Just let me know at your earliest convenience. Let me know if you have any questions!

Thanks again,

Alyssa Hutcheson