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A Case Study: Agricultural literacy proficiency in an Iowa elementary school

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Abstract

Planning theories suggest a stepwise structure for organizing programs; evaluate current status with a needs assessment, identify strengths, weaknesses or gaps, use tools such as a logic model to plan, then implement and evaluate programming (Kettner et al., 2017). The National Agriculture in the Classroom organization and its state affiliates have the responsibility of providing agricultural education content to school-aged children and teachers to increase agricultural literacy (NAITC, n.d.). The Longhurst Murray Agricultural Literacy Instrument (LMALI) is a modern, valid tool to assess proficiency level of students participating in such programming (Longhurst, et al., 2020). Tri-Center Elementary in Iowa administered the LMALI to kindergarten through fifth grade students in March 2021. The findings from this case study suggest recommendations to state and national program planners to improve effectiveness of agricultural literacy outreach programs.

Keywords: Agricultural Literacy, National Agriculture in the Classroom, Iowa, National Agricultural Literacy Outcomes

Introduction

Most Americans do not live on farms or work in agricultural occupations, however, make daily decisions about their food, clothing, and shelter impacting farming practices and the use of natural resources. Agriculture in the Classroom programs work to connect school-age students and teachers to increase agricultural literacy for future decision making (NAITC, n.d.). The mission of Agriculture in the Classroom programs is to "increase agricultural literacy through K-12 education" (NAITC, n.d., About section). Research Priority 1 of the American Association for Agricultural Education's (AAAE) Research Agenda focuses on methods, models, and programs in agricultural education for informing the public and policy makers about agricultural and natural resources issues (Roberts et al., 2016). Priority 1 emphasizes the importance of agricultural

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education across all age levels, not solely school-based Career and Technical Education courses. Guidance within the agenda suggests a need to evaluate all agricultural education programs. This agenda priority highlights the importance of agricultural literacy research and findings from such research has the potential to influence future agricultural literacy programming. In addition, this research aligns with the objectives of a multistate research committee supported by State Agricultural Experiment Stations from the Hatch Multistate Research Fund provided by the National Institute for Food and Agriculture. Specifically, this research supports objectives of this committee to assess the agricultural knowledge of diverse population segments and to evaluate programs to measure impacts, all in an effort to improve fundamental knowledge, critical thinking, and decision making of United States residents about agriculture and natural resources topics (W3006 Multistate Agricultural Literacy Research, 2019).

In 2020, research-based agricultural literacy assessments were developed and aligned with the National Agricultural Literacy Outcomes (NALOs) measuring students' proficiency level of agricultural concepts (NCAL, n.d.). These assessments are considered valid and reliable instruments (Longhurst et al., 2020). The assessments have been developed as a tool to determine student agricultural literacy knowledge based on the NALO themes in three levels and distributed to state AITC staff for use (NCAL, n.d.). A baseline regarding agricultural literacy is needed to develop programing to increase agricultural literacy (NAITC, n.d.).

Supported by national resources, each state AITC program is responsible for planning, executing, and evaluating their own programming (NAITC, n.d.). Iowa was the first state program to provide the assessments to kindergarten through fifth grade students at partnering elementary schools. The Iowa agricultural literacy program, home to the state's AITC program, engages approximately 6,000 students annually through school-based outreach. Staff and volunteers provided the agricultural literacy assessments to 684 students in grades kindergarten through fifth grade during the 2020-2021 school year. This case study focuses on 277 students at Tri-Center Elementary, the only Iowa school with a complete dataset representing students in kindergarten through fifth grade.

Theoretical Framework

Program planning methods are rooted in several planning theories cited throughout the last century (Kettner et al., 2017). In the 1950s Banfield and Meyerson indicated planning should be comprehensive in scope and based in analysis of current practices or needs (Kettner et al., 2017). Theorists went on to define three main types of planning including strategic planning, management planning, and program planning.

Program planning addresses a specific problem through specific inputs. Asset mapping or needs assessments commonly establish a baseline of where a specific population is at in relation to this specific need before implementing programming (Kettner et al., 2017). As indicated by Research Priority 1, there is a need to effectively inform the public about agriculture and natural resource topics (Roberts et al., 2016).

This basic research focused on one case of Iowa agricultural literacy outreach at Tri-Center Elementary by collecting baseline data to determine agricultural proficiency at this school as a first

step to inform program planners. Iowa AITC staff can use this data to take the next steps in program planning to modify or enhance programming. Research suggests the assessments be repeated after interventions have been modified, based on this baseline data, to continue measuring effectiveness of programming (Johnson & Christensen, 2014).

Literature Review

Agricultural Literacy Frameworks

An agriculturally literate person "understands and can communicate the source and value of agriculture as it affects our quality of life." (Spielmaker et al., 2014, p. 2). This most recent definition is built on several previous iterations. In 1988, the National Research Council suggested "an agriculturally literate person's understanding of the food and fiber system would include its history and its current economic, social, and environmental significance to all Americans." (National Research Council, 1988, p. 8). Shortly following the publication of this definition, Frick, with the assistance of a panel representing 48 land-grant institutions, further contributed by adding the ability to "synthesize, analyze, and communicate basic information about agriculture" to the National Research Council definition. The panel also narrowed the purview of agricultural literacy outreach into 11 subject areas (Frick, 1990). In the mid 1990s the 11 categories were condensed further to five, creating the Food and Fiber Systems Literacy Standards (FFSLS) including: understanding of food and fiber systems; history, geography, and culture; science, technology, and environment; business and economics; food, nutrition, and health. These new standards aligned agricultural concepts with national education standards (Leising, 1994). This alignment with standards emphasized the relevance of the National Research Council's Committee on Agricultural Education in Secondary Schools (1988) recommendation that all students, kindergarten through 12th grade, should receive some agricultural instruction (National Research Council, 1988).

For many years, FFSLS were used to guide lesson and assessment creation. Previous research evaluated student knowledge of agriculture through use of treatment and control groups, pre and post intervention testing, and other assessment practices (Leising et al., 2000; Pense et al., 2005). These studies evaluated specific changes in student knowledge after interventions aligned to the five categories defined in FFSLS. The researchers found while most students did have knowledge gains as a result of agricultural education interventions, specific theme increases varied by grade level (Leising et al., 2000; Pense et al., 2005). Based on assessment results, it was recommended that kindergarten through third grade students needed more lessons in the Science, Technology & Environment, Business & Economics, and Food, Nutrition, & Health themes whereas 4-5th grades need increased emphasis on History, Geography, & Culture, Business & Economics, and Food, Nutrition, & Health themes (Pense et al., 2005).

Currently, the National Agricultural Literacy Outcomes (NALOs) provide updated guidance for K-12 agricultural education programs (Spielmaker & Leising, 2013). Constructed with influence from the FFSLS, these outcomes are also organized into five themes including: agriculture and the environment; plants and animals for food, fiber, and energy; food, health, and lifestyle; science, technology, engineering, and mathematics; and culture, society, economy, and geography. Each theme contains specific outcomes for four grade-level groups: K-2, 3-5, 6-8, and 9-12. Like the FFSLS, the NALOs connect agricultural content to current national educational

standards including Next Generation Science Standards and Common Core (Spielmaker & Leising, 2013).

Organizations Working Toward Agricultural Literacy

The *Logic Model for Agricultural Literacy* provides a framework for programs focused on increasing agricultural literacy. The model indicates financial and human capital are being leveraged to share agricultural education with students and educators at the pre-kindergarten through college levels, general public consumers, and policy makers (Spielmaker et al., 2014). Program planners can reply upon logic models to assist in effectively defining inputs, outputs, outcomes, and impacts to address a community need (Kettner et al., 2017). Led by the National Agriculture in the Classroom organization, state Agriculture in the Classroom programs put this logic model into action (NAITC, n.d.). These state AITC programs are housed within Extension, state departments of agriculture, Farm Bureaus, or private non-profit foundations.

Agricultural Literacy Assessment

Built upon the work of Leising et al. (2000) and Pense et al. (2005), four updated instruments have been created to assess agricultural literacy proficiency levels of students in grades K-12 (NCAL, n.d.). The Longhurst Murry Agricultural Literacy Instrument (LMALI) uses the NALOs as the guiding framework for content, aligning questions to each of the five themes within two of the NALO grade level bands: K-2 and 3-5. The other grade level bands, 6-8 and 9-12, do have assessment instruments developed in this fashion but are not within the scope of this case study. The LAMLI was created by researchers using framework from the Programme for International Student Assessment (PISA) (Longhurst et al., 2020). Within this framework, assessment questions were developed using a Delphi technique. Two committees were created; one panel was made up of national stakeholders in AITC programming representing four states. The second of expert teachers within the grade levels. Each committee followed an iterative process to determine the assessment questions. The questions were aligned with PISA proficiency stages which allows researchers to better understand a learner's level of understanding (OEDC: Programme for International Student Assessment, 2016). In addition to descriptive statistics, exploratory factor analysis, confirmatory factor analysis, and a discriminant analysis were conducted by the developers of the instruments to condense the Delphi panel's original set of 45 questions to the final 15-item instrument. These factor analyses combined with descriptive statistics and reliability measures in the Delphi method support the validity and reliability of the instruments. Instrument developers used this process along with the PISA conceptual framework to develop a sound process for summatively assessing knowledge and formatively supporting students' ability to apply agricultural knowledge and skills (Longhurst et al., 2020). There are three proficiency stages: exposure, literacy, and proficiency. Questions were written at the highest grade level of the band. For example, on the 3-5 instrument, questions were written to a fifth-grade level. Third-grade students should use this assessment, but it is anticipated most would only be able to answer the exposure level questions. The LMALI contains 15 items, one item per proficiency level for each of the NALO themes. Therefore, students' proficiency level could be evaluated on a by-question basis as well as on a total score basis. The ability to rate proficiency by question allows agricultural literacy practitioners to identify gaps in programming more clearly. The assessments were validated through testing in eight randomly selected states via their AITC programs (Longhurst et al., 2020).

Purpose and Objectives

The purpose of this instrumental case study is to understand the baseline proficiency of students at Tri-Center Elementary school in Neola, Iowa. Researchers who developed the LMALI suggest the instrument be further validated through use with student populations across the United States. This research also states the instrument can be used to evaluate AITC programming (Longhurst et al., 2020). This research was guided by two objectives:

1. To determine a baseline of the agricultural literacy proficiency knowledge of kindergarten through fifth grade students at Tri-Center Elementary.
2. To make recommendations to Iowa program leaders concerning the development of programming to increase agricultural literacy.

The purpose and objectives of this study work to address Priority 1 where the goal is to determine needs to develop methods and programs to effectively inform public opinions about agriculture, including those of school-age children (Roberts et al., 2016).

Methods

Research Design

Structured as an instrumental case study, this research study focuses on the agricultural literacy proficiency of Tri-Center Elementary students. In social science research, a case study is arranged around one bounded unit; a specific person, group, or institution within one sector or community (Hamilton & Corbett-Whittier, 2013). The case study should reflect interactions of this population with the wider world. Many types of case studies have been defined within educational research (Hamilton & Corbett-Whittier, 2013). Some structures seek to investigate all aspects of the case drawing conclusions about the larger picture of this community. An instrumental case study narrows the study's focus to just one aspect or issue of the case (Hamilton & Corbett-Whitter, 2013). Because this research seeks to understand only agricultural literacy proficiency within this one elementary school community it can be considered an instrumental case study. This study is also reflective in nature. The assessment is evaluating students' proficiency based on past experiences and interventions to establish baseline data for the Iowa AITC program at this school. Continuation of such research could contribute to longitudinal or cumulative case studies in the future.

National Agriculture in the Classroom organization has made the LAMLI assessments available to all state AITC program leaders. These state leaders were encouraged to administer assessments to partnering schools. Detailed instructions for how to accurately proctor these assessments were provided with the assessments. States could elect to return raw data to researchers for analysis. A case study is research arranged around one specific group, with two data collection methods (Hamilton & Corbett-Whittier, 2013). Therefore, one elementary school in Iowa was selected as the focus of this LMALI analysis. While NAITC has expressed goals of having statewide datasets reflective of the state's AITC program reach, because this was the first school with a full kindergarten through fifth grade dataset, we limited this study to a single case study. All kindergarten through fifth grade students at Tri-Center Elementary were provided the LMALI on March 23, 2021. The LMALI was the first means of data collection and a personal interview with AITC staff was the second. For this personal interview, we met with the Iowa AITC staff person responsible for interventions at Tri-Center Elementary via Zoom. This interview

sought to understand the format of and agricultural content conveyed during the interventions. This was conducted to help explain student knowledge prior to taking the LMALI.

Instrumentation

The Longhurst Murray Agricultural Literacy Instrument (LMALI) was developed by researchers for the purpose of assessing kindergarten through fifth grade students' agricultural proficiency based upon the National Agricultural Literacy Outcomes (Longhurst et al., 2020). Each assessment was 15 questions in length with all questions being multiple choice. There were two forms of the K-2 assessment, with similar type questions in a different order on each form. Most K-2 questions provided black and white images with one- or two-word labels as response options whereas more 3-5 grade responses were offered in sentence form. The instruments were previously validated by the original researchers for the purpose of continued use to assess agricultural literacy. Reliability and validity were confirmed using a series of factor analyses supported by the PISA conceptual framework (Longhurst et al., 2020). Assessments in Iowa were taken in paper and pencil format then scanned into a digital file to send to researchers. Excel was used by the researcher to score assessments and analyze the data. For the personal interview, researchers asked the Iowa AITC staff to list agricultural education interventions that the K-5 grade students at Tri-Center Elementary had participated prior to taking the assessment. This list included which NALO theme aligned with the lesson content and reflected all content provided from 2018 to the time of the assessment. This timeframe reflected the tenure of the employee interviewed.

Population

The Iowa agricultural literacy program engages nearly 6,000 students each year. Iowa AITC staff randomly selected classrooms to participate in the LMALI based on relationships with teachers and administrators with a willingness to participate. Nearly 300 students at Tri-Center Elementary participated in this case study. The school is the only elementary school in the district which employs 100 staff servicing 700 students in total (Tri-Center Community School District, 2021). This district is located in Pottawattamie County with a population of more than 93,200 people where the main industries by occupation are education, health care, and social assistance, retail, manufacturing (U.S. Census Bureau, 2019).

To provide context for this case study, Iowa AITC program staff have partnered with teachers at Tri-Center since 2018 to provide agricultural literacy outreach. In that timeframe, 33 instances of AITC interventions took place in grades pre-kindergarten through fifth grade; 16 pre-kindergarten, 6 kindergarten, 2 first grade, 1 second grade, 1 third grade, 3 fourth grade, 1 fifth grade, and 3 interventions where all grades participated. Four events were hosted in partnership with local FFA Chapters, two events involved farmers reading to students as a part of the lesson, two were conducted virtually, and all others were taught by the staff person. Each school year this AITC staff person presents to the elementary school staff offering options for programming and showcasing lessons teachers could use on their own. The 33 instances of intervention by the AITC staff person are a result of being invited in by the classroom teacher. No state or administrative requirement direct teachers to use AITC programming; it is a completely voluntary offering (M. Bruck, personal communication, January 11, 2022).

Lessons used were retrieved from Iowa AITC's lesson database or the National Agricultural Curriculum Matrix on the National Agriculture in the Classroom website. Both sites

had previously matched lesson content to NALO themes. Lesson content addressed one or two NALO themes therefore instances of themes add up to more than the number of interventions. Most content taught connected to Theme Two Plants and Animals for Food, Fiber, and Energy (n = 23). Theme Five Culture, Society, Economy, and Geography (n = 15) was the next most frequently taught followed by Theme Three Food, Health, and Lifestyle (n = 7); and Theme One Agriculture and the Environment (n = 5). Only one intervention connected to Theme Four Science, Technology, Engineering, and Math.

While this research is not structured as a pre and posttest, it is important to understand the history of interventions at Tri-Center Elementary as a part of establishing a baseline for agricultural proficiency at this school. This context combined with the findings from the newly available LMALI will provide insight for program planners to make decisions about next steps with Iowa agricultural literacy outreach at this school.

Analysis

We were provided a scanned PDF of the completed LMALIs. Responses were organized into Microsoft Excel by coding for each multiple-choice response option as well as correct or incorrect by question. This granular coding allowed for most specific analysis of student responses by NALO theme. Excel was used to calculate descriptive statistics.

Findings

Tri-Center Elementary in Iowa returned a complete kindergarten through fifth-grade data set with 277 student responses representing: 46 kindergarten, 50 first grade, 41 second grade, 36 third grade, 49 fourth grade, and 46 fifth grade students. Most kindergarten students (n = 31) total test score fell into the Exposure proficiency level meaning most students received a score of less than 50% on the assessment (Table 1). As the grade level increased, so did the students' proficiency level with more first grade students scoring within the factual literacy level (n = 28). More second grade students did score within the applicable proficiency level (n = 9) than kindergarten (n = 1) and first grade (n = 4) however most second grade students ranked within the factual literacy level (n = 29*)*. Kindergarten through second grade students scored highest on questions related to NALO Theme One: Agriculture and the Environment with mean scores ranking as the factually proficient for this theme. Questions in this theme asked students to identify pictures of animals raised on a farm where sheep, cattle and chickens were the correct responses, whales and tigers were incorrect. The second question asked about plant needs offering rain, soil, and sun images as correct responses. The final question in Theme One addressed problematic weather for farms where correct responses included no rain, tornado, and hail.

Table 1

Kindergarten through second grade students LAMLI total score

Proficiency Level	Kindergarten	First Grade	Second Grade
Exposure (<50%)	31	18	3
Factual Literacy (³50%)	14	28	29
Applicable Proficiency (³80%)	1	4	9
	46	50	41

Kindergarten through second grade students proved weakest in NALO Theme Four: Science, Technology, Engineering and Math with mean scores falling in the exposure proficiency level. These questions asked students to identify tools used by farmers. Consistently students did not select the image of a computer a tool that could help a farmer do their job (n = 7%). However, when presented with a fan, tractor, shovel, and light bulb, most students (n = 96%) did select that a fan would help farmers keep chickens housed in a building cool during hot weather.

Similar to the younger subset, as grade level increased from third through fifth grade, the number of students at higher proficiency levels also increased (Table 2). Third grade had the most students scoring at an Exposure level (n = 24) than the other two grades. While the number of students at the Factual Literacy and Applicable Proficiency levels fluctuate between grades, overall, there is an increase in students scoring at higher proficiency levels from each grade to the next.

Table 2

Third through fifth grade students LAMLI total score

Proficiency Level	Third Grade	Fourth Grade	Fifth Grade
Exposure (<50%)	24	15	7
Factual Literacy (³50%)	19	18	24
Applicable Proficiency (³80%)	2	16	15
	45	49	46

Grades three and five were strongest in NALO Theme Four: Science Technology Engineering and Math. These questions asked students to select reasons scientists should study agriculture, if science and technology helps farmers grow healthier plants and animals, and a question about farmers using inherited traits to determine the kinds of plants and animals grown on their farms. Third and fifth grade students also had the same lowest scoring NALO Theme Five: Culture, Society, Economy, and Geography. Questions in this theme addressed locations of foods grown throughout the United States, reasons people eat different foods around the world, and the effects to a community if farmers quit farming.

Fourth grade did not follow the same pattern as third and fifth grade. Fourth grade students were strongest in responses associated with NALO Theme Two: Plants and Animals for Food, Fiber, and Energy. These questions asked students to identify reasons a farmer might rotate crops,

define renewable, nonrenewable, and recyclable, and identify ways farmers provide fruits and vegetables in the winter. The weakest theme for fourth grade was Theme One: Agriculture and the Environment. Students were asked questions related to the effects a decrease in water might have on plants, natural resources needed to support plant growth, and types of resources farmers manage to provide food, clothing, and shelter. Questions two and three of this theme offered either circle all that apply or circle all of the above. Routinely students selected some of the correct responses but did not fully answer the question.

Based on mean score per question, Theme Two had the highest level of proficiency for fourth grade. However, one of the questions addressing Theme Two was routinely answered incorrectly across all three grades. The question asked students to match the appropriate definition to the words renewable, nonrenewable, and recyclable. Often, students only selected one of the multiple-choice responses rather than writing letters on each line to link the words and definitions. While not the lowest scoring theme for each grade, Theme Three: Food, Health, and Lifestyle was a commonly lower scoring theme across the three grades. Questions in this theme addressed safe food handling, the role of protein for the human body, and reasons food costs might increase.

Conclusions and Discussion

The LMALI developers indicated as grade level increases so should a students' level of proficiency in agriculture as measured by assessment score (Longhurst et al., 2020). This phenomenon is demonstrated in the instrumental case study of Tri-Center Elementary. In both the kindergarten through second and third through fifth grade bands, students are moving within the continuum from the Exposure level to Factual Proficiency to Applicable Proficiency as grade level increases. Longhurst and collaborators indicate scoring below the Exposure level is nearly impossible as even without formal learning humans have some interaction with agricultural content. The Tri-Center Elementary data supports this statement.

The LMALI was administered at Tri-Center Elementary as part of a statewide initiative by the Iowa AITC program. Given the recent publication of the LMALI, this data provides support to the validity of the instrument as a measure of student proficiency based on previous experiences as the students represented in this data had participated in agricultural literacy interventions prior to administration of the instrument. With the information shared by the Iowa AITC staff, we can draw some conclusions about the agricultural content taught to improve Iowa AITC offerings. This alignment is best illustrated by the fourth-grade students. These students would have participated in AITC interventions during the 2018-2019 (second grade), 2019-2020 (third grade), and 2020-2021 (fourth grade) school years prior to taking the assessment. This grade level scored highest on NALO Theme Two. Iowa AITC staff indicated most content taught aligned with Theme Two more than other NALO Themes.

For kindergarten through second grade, the weakest theme was Theme Four Science, Technology, Engineering, and Math. Only one intervention aligned with this NALO theme therefore the students may not have had appropriate knowledge to adequately answer these questions. While this result could be directly tied to minimal Theme Four intervention by AITC staff, NALO researchers indicate these outcomes connect to science education standards such as Next Generation Science Standards (Spielmaker & Leising, 2013). The National Science Teaching

Association indicates in these early elementary years science education often receives less lesson time than reading and math (NSTA, 2022). Therefore, students could have less background knowledge to bring forward, however further research would be needed to validate this explanation.

It is concerning that third and fifth grade students scored lowest on questions related to Theme Five, yet this theme was the second most prevalent in lessons taught. A possible explanation for this could be that the lessons taught focus on Iowa specific content as it relates to Culture, Society, Economy, and Geography whereas the assessment is based in more broad terms. Further research would have to be done to investigate this content. Also, these grade levels were most proficient in Theme Four, however, only one intervention aligned with this theme.

Program planning theories suggest needs assessments or baseline data be used to create or improve program offerings (Kettner et al., 2017). The results of this study can inform Iowa AITC leaders as to program strengths and deficiencies at Tri-Center Elementary. Based on the overall proficiency levels of kindergarten through fifth grade there is growth in proficiency as grade level increases, supporting the work of this agricultural literacy outreach program. However, analyzing each theme's proficiency can provide recommendations for future program content. To address weaknesses demonstrated in Theme Four at the kindergarten through second grade level, Theme Five for third and fifth grade and Theme One for fourth grade, Iowa AITC staff should evaluate the strength of content taught in these lesson plans. Program staff indicated lessons taught to these grade levels addressed Themes Four, Five, and One, however students demonstrated low proficiency. This suggests the lessons are either inaccurately associated with these themes or need additional content to adequately address the themes. It is recommended Iowa AITC staff reevaluate this content and its alignment to these themes.

In addition, Iowa AITC staff indicated most lessons taught across all grades aligned with either Themes Two (n = 23) or Five (n = 15). Such a heavy imbalance in content could skew student proficiency levels. It is recommended AITC program staff evaluate their program of work by theme then adjust offerings as necessary to balance content by theme more evenly.

While the results of this case study cannot be generalized across all state Agriculture in the Classroom programs, it can be used as a model. Gathering baseline data provides a solid platform for effectiveness-based program planning (Kettner et al., 2017). With the addition of the newly published Longhurst Murray Agricultural Literacy Instrument, AITC programs now have a more modern, validated tool to assess student proficiency (Longhurst et al., 2020). The Logic Model for Agricultural Literacy and the National Agricultural Literacy Outcomes are theory-based tools to assist program planners in building effective outreach. The LMALI provides the last piece to this puzzle, the evaluation tool. It is recommended other state AITC staff leverage existing relationships with schools and administrators to measure agricultural literacy proficiency using the LMALI. Like with the Tri-Center Elementary, this could provide a baseline to evaluate the current status of agricultural literacy outreach, identify gaps, and plan for future programming.

Future research recommendations related to this dataset could follow a few paths to further support AITC program development. First, Iowa ATIC program should continue this type of work repeatedly at Tri-Center Elementary and other partnering schools to build on this data. Once

baseline data is established and program plans are in order, organizations need to continue to evaluate programming for effectiveness and relevancy (Kettner et al., 2017).

Second, Iowa AITC staff indicated interventions at Tri-Center Elementary were primarily led by one staff person visiting classrooms in the school building to teach agricultural lessons. Many other modalities of agricultural education outreach exist (NAITC, n.d.). This data could be compared with similar populations who participated in a different modality of AITC outreach to assist program planners in evaluating effectiveness of methods. Factors such as planning logistics, staffing, budgets, travel, and infrastructure all influence program planner decision making (Kettner et al., 2017). By using this research in comparison to other similar studies, across different modalities, program planners could make informed decisions about the direction of new offerings.

Finally, as more state AITC programs use the LMALI and return data to researchers, the Tri-Center Elementary data can contribute to a nationwide dataset. Further analysis of this data could be stratified to evaluate just one grade level's proficiency across the nation, one full state program's proficiency, or other subsets within this possible larger dataset. The National Agriculture in the Classroom organization should consider continued encouragement of state programs to use the LMALI to increase this dataset.

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