

# Two Decades of Agricultural Literacy Research: A Synthesis of the Literature

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*The purpose of this investigation was to identify and synthesize research related to agricultural literacy since the publication of Understanding Agriculture—New Directions for Education (1988). The researchers sought to determine where agricultural literacy research was published, which populations were targeted, the purpose of the research, and the findings of agricultural literacy studies published between 1988 and 2011. Overall, a total of 49 studies were found - 17 studies in the Journal of Agricultural Education, seven studies in the NACTA Journal, three studies in the Journal of Extension, 18 studies in national or regional American Association for Agricultural Education (AAAE) conference proceedings, and four miscellaneous studies. The populations targeted in agricultural literacy research were teachers, students, and non-educator adults with elementary teachers and students being the most frequently targeted populations. The purposes of the respective studies were coded into three specific areas: (a) assess agricultural literacy; (b) test the effectiveness of an agricultural literacy program; or (c) develop a framework or guide used to assist educators. While the programs were found to be successful in increasing agricultural literacy, many populations assessed were found to be agriculturally illiterate. Further research is warranted to explain areas of deficiency in agricultural literacy.*

Keywords: agricultural literacy; research synthesis

“As our global population grows to a projected nine billion people by 2050, the non-agriculture population has little to no understanding of the complexities involved with sustaining a viable agriculture system” (Doerfert, 2011, p. 8). With a steady increase in the planet’s population, changes affecting agriculture are occurring such as increased production needs, widespread urbanization, and regulation and policy changes. The National Research Agenda for the American Association of Agricultural Education (AAAE) outlines six key research priority areas. Research priority one is “Public and Policy Maker Understanding of Agriculture and Natural Resources” (Doerfert, 2011). The emphasis placed on understanding agriculture in a modern world through research priority one communicates the need for an agriculturally literate society. Agricultural literacy is defined as an “understanding of the food and fiber system [that] includes its history and current economic, social, and environmental

significance to all Americans” (National Research Council (NRC), 1988, p. 1).

With fewer people directly involved in production agriculture and the complexity of agricultural issues presented to legislatures, the need for an agriculturally literate society is imperative so that informed individuals are able to make educated decisions regarding agriculture (Pope, 1990). The steady rise of urbanization has transferred the future of agriculture to a group of people with an overwhelming lack of support for agricultural issues. Agriculturally literate Americans are more likely to support policies affecting agriculture than those Americans lacking agricultural literacy (Ryan & Lockaby, 1996).

Controversy in agriculture has continued to increase over the years due to genetically modified crops, animal rights, and food safety issues (Leising, Igo, Heald, Hubert, Yamamoto, 1998). Organizations and special interest groups have attacked the agricultural industry using the guise of creating an “informed public.” An

agriculturally literate population is able to see beyond emotional pleas and make informed decisions on these issues. A society with an understanding of agriculture and current economic, social, and environmental impacts could lessen current challenges facing agriculture through good decision making along with providing the necessary support.

Research efforts in agricultural literacy began after a publication by The National Research Council in September of 1988 entitled *Understanding Agriculture—New Directions for Education* (1988). This report was the result of a study initiated in 1985 due to concerns about the diminishing profitability of American agriculture and the decrease of agricultural education enrollments in secondary schools. At the request of U.S. Secretaries of Agriculture and Education, the National Research Council established the Committee on Agricultural Education in Secondary Schools to assess the contributions of agricultural instruction on the economic impact of U.S. agricultural production (Frick, Kahler, & Miller, 1991). Upon publication of *Understanding Agriculture—New Directions for Education* (1988), research on the concept of agricultural literacy began and has continued throughout the last 23 years.

Publication of *Understanding Agriculture—New Directions for Education* (1988) sparked many changes in the management and operation of agricultural education programs in secondary schools. The publication stressed the establishment of programs in urban and suburban settings as well as a broadening of agricultural instruction. It also motivated a change in exclusivity by removing terms such as vocational, straying from traditional boundaries and attracting students of diverse interests. Aligning curriculum with science-based instruction methods and promoting a goal of increased program ethnic diversity was also encouraged (NRC, 1988).

Agriculture as a whole has changed drastically since the publication of *Understanding Agriculture—New Directions for Education* (1988). The agricultural industry went through extremely trying times and financial crises in the 1980s, as evident in the dramatic rise of interest rates peaking over 20 percent, as well as a high debt-to-asset ratio (Boehlje & Hurt, 2008). Financial issues are still a concern in current

times, but with agricultural loans at a much lower 4.5 percent and a significantly lower debt-to-asset ratio across the industry, agriculture is in a more secure position than it was in the 1980s. Another change is the rise of corporate farming resulting in fewer people involved in production agriculture. As agriculture changed drastically over the years, one would expect to see a change in how society understands agriculture as well.

Over the last two decades, the core concept of agricultural literacy, the understanding of agriculture, has stayed the same. However, understanding agriculture in 1988 and understanding agriculture in 2012 are two vastly different concepts. The change in technology alone warrants a new framework in which to examine agricultural literacy. Other changes include organic farming, ethanol production, international trade, buying local, environmental stewardship and climate, genetically modified organisms, as well as many other trends in agriculture. Agricultural educators designed programs to increase agricultural literacy prior to the publication of *Understanding Agriculture—New Directions for Education* (1988), but society is still considered agriculturally illiterate. If the concepts of agricultural literacy have evolved, but is being assessed through traditional methods, is the understanding of agriculture truly being evaluated?

### Purpose

As seen in the most recent AAAE National Research Agenda priority areas, agricultural literacy is still an concern in the agricultural education discipline. There is a need to summarize and synthesize agricultural literacy research to determine if the attempts made in creating agriculturally literate populations were successful and determine what has been learned about agricultural literacy in the last two decades. Synthesizing the findings of agricultural literacy research may highlight where the research has been and where it needs to go in the future.

The purpose of this investigation was to identify and synthesize research related to agricultural literacy since the publication of *Understanding Agriculture—New Directions for*

*Education* (1988). Based on this purpose, the following research questions were developed:

1. What studies were conducted in agricultural education regarding agricultural literacy?
2. What populations were targeted in agricultural literacy research?
3. What was the purpose of agricultural literacy research?
4. What findings and recommendations were suggested based on a summary of the agricultural literacy research?

### Methods/Procedures

The design for this study was a research synthesis. A synthesis of research is beneficial by gathering “trustworthy accounts that accumulate past research [which aids in] knowledge building” (Cooper, 2010, p.1). Building knowledge of the result of 23 years of agricultural literacy research is a needed task for the benefit of not only agricultural education, but the global industry of agriculture as well. The search and inclusion criteria utilized three essential strategies for rigor in research syntheses including search strategies, inclusion criteria, and coding (Cooper, 2010). Specific strategies incorporated an exhaustive search of library databases, such as ERIC and PsychINFO, along with Google Scholar and journal websites. Keywords and phrases included in the search were “agricult\* literacy” and “agricult\* education”. Articles containing agricultural literacy research were documented and saved for analysis.

The publication of *Understanding Agriculture—New Directions for Education* (1988) was selected as the parameter for this search given the focus placed on agricultural literacy, introducing the concept into agricultural education research. Establishing inclusion criteria prior to the literature search is necessary in maintaining rigorous synthesis methods (Cooper, 2010).

Inclusion criteria for this study were developed *a priori* and contained articles meeting the following specifications: (a) published in AAAE research conference proceedings (regional or national); (b) published in a peer-reviewed research journal; (c) included specific agricultural literacy terminology within the article; (d) available and accessible through search procedures; and (e) published between October 1988 and August 2011. Duplications of research, as well as studies not specifically using agricultural literacy terminology were excluded from the synthesis. Forty-nine studies met the inclusion criteria.

The majority of the 49 resulting studies were retrieved from the following data sources: (a) AAAE research conference proceedings (regional and national), (b) *Journal of Agricultural Education*, (c) *Journal of Extension*, and (d) *NACTA Journal*. A final category of (e) other included additional studies retrieved through the online search of agricultural literacy resources. Cooper (2010) suggests the use of a coding guide when examining a large number of studies. From this, 49 articles were organized and summarized into a matrix identifying the following characteristics: (a) article title, author(s), and year; (b) participants and sample size; (c) purpose of the study; (d) specific objectives; and (e) findings and conclusions. The matrix was beneficial in coding the data into emergent themes.

A single coder was responsible for finding and coding all agricultural literacy research. Reliability of coding was established through peer debriefs. According to Creswell (2007), peer debriefing provides an external check of the research process and asks hard questions about methods, meanings, and interpretations. Debriefing occurred at multiple stages of the study, including the analysis of the findings. Every research study meeting the inclusion criteria was compared and categorized based on similarities which organized the data into logical groups. Findings then guided the development of conclusions, implications, and recommendations.

## Findings

### Research Question One: What studies were conducted in agricultural education regarding agricultural literacy?

For research question one, the researchers sought to determine the location of studies

within agricultural education research regarding agricultural literacy after the publication of *Understanding Agriculture—New Directions for Education* (1988). Forty-nine studies were identified through an exhaustive search that met the inclusion criteria (see Table 1).

Table 1

*Location of Agricultural Literacy Research Publication, 1988-2011 (n=49)\**

Year	JAE	NACTA	JOE	AAAE Conferences	Total
1988	0	0	0	0	0
1989	0	0	0	0	0
1990	0	0	0	2	2
1991	1	0	0	0	1
1992	1	1	0	0	2
1993	1	0	0	1	2
1994	0	1	0	3	4
1995	2	0	0	1	3
1996	1	0	1	1	3
1997	1	0	1	1	3
1998	1	0	0	0	1
1999	0	1	1	2	4
2000	0	0	0	1	1
2001	0	0	0	1	1
2002	1	0	0	0	1
2003	2	0	0	1	3
2004	1	0	0	0	1
2005	1	1	0	0	2
2006	0	1	0	0	1
2007	0	0	0	2	2
2008	1	0	0	1	2
2009	1	0	0	0	1
2010	0	2	0	1	3
2011	2	0	0	0	2
Total	17	7	3	18	45

\*Note: Four articles were found in miscellaneous journals. This category will be referred to as “other.”

Table 1 displays the number of studies published in the *Journal of Agricultural Education*, the *NACTA Journal*, *Journal of Extension*, or AAEE Conference Proceedings (national and regional). Beyond the four main categories, an “other” category was utilized to identify miscellaneous studies. There were no studies found on agricultural literacy in 1988 or 1989. All other years contained between one and four studies published within the year. The years 1994 and 1999 contained the highest number of studies

published, four in each year. Overall, a total of 17 studies were found in the *Journal of Agricultural Education*, seven studies in the *NACTA Journal*, three studies in the *Journal of Extension*, 18 studies in national or regional conference proceedings, and four miscellaneous studies were identified. Other sources offering agricultural literacy research included *California Agriculture*, the *Texas Journal of Agriculture and Natural Resources*, and *Water, Air, and Soil Pollution*.

### Research Question Two: What populations were targeted in agricultural literacy research?

For research question two, the researchers sought to identify the target populations in agricultural literacy research after the publication of *Understanding Agriculture—New Directions for Education* (1988). Initial examination of the research, included a designation of population, which led to three emergent themes for the types of research populations targeted. The populations were then coded based on the themes into (a) teachers, (b) students, and (c) non-educator adults (see Table 2).

Table 2  
*Participant Groups Included in Agricultural Literacy Research, 1988-2011 (n=49)*

Target population	Frequency
Teachers	
Elementary	4
High School	2
K-12	4
Students	
Elementary	15
Middle School	4
High School	5
K-12	2
College	3
4-H member	4
Non-educator adults	
Community members	6
Total	49

Table 2 displays the frequency of participant groups utilized in the targeted research population. Teachers were coded as elementary teachers, high school teachers, or K-12 teachers. The highest frequencies of teachers studied were elementary and K-12 teachers. Examples of agricultural literacy research with elementary teacher participant groups included Terry, Herring, and Larke (1992) and Bellah and Dyer (2007). Terry et al. assessed fourth grade teachers' understanding and use of agricultural concepts in their classroom to determine if assistance was needed to implement agricultural literacy programs. Bellah and Dyer (2007)

described elementary teachers' attitudes and perceptions of agriculture after completing a preservice agricultural literacy awareness course.

Students were coded as elementary students, middle school students, high school students, K-12 students, college students, or 4-H members/students. The highest frequency of studies targeted elementary students. One study involving an elementary student population was conducted by Meischen and Trexler (2003) in which they interviewed rural elementary students to determine students' understandings of agriculture specifically related to meat and livestock.

Non-educator adults were coded as community members and included parents, officials, administrators, or other community leaders. Examples of studies focused on assessing agricultural literacy of non-educator adults included Wearly, Frick and Shelhamer (1999) and Braverman and Rilla (1991). Wearly et al. assessed the agricultural knowledge of elected officials in Montana's 54<sup>th</sup> legislative session. Braverman and Rilla (1991) determined the agricultural views of three main stakeholder groups: county school superintendents, county career education directors, and school district superintendents.

### Research Question Three: What was the purpose of agricultural literacy research?

For research question three, the researchers sought to identify the purpose of the agricultural literacy research as indicated by the author(s) of the study. Studies were coded based on one of three themes: (a) assessing agricultural literacy, (b) testing a program or (c) the development of a framework or guide (see Figure 1). The studies assessing agricultural literacy were determining the agricultural knowledge of a specific population. The studies testing a program were determining the success of programs used to disseminate agricultural literacy. The studies developing a framework or guide were creating either a list of competencies or a conceptual model for the improvement of agricultural literacy in a population, typically as a guide for classroom teachers.

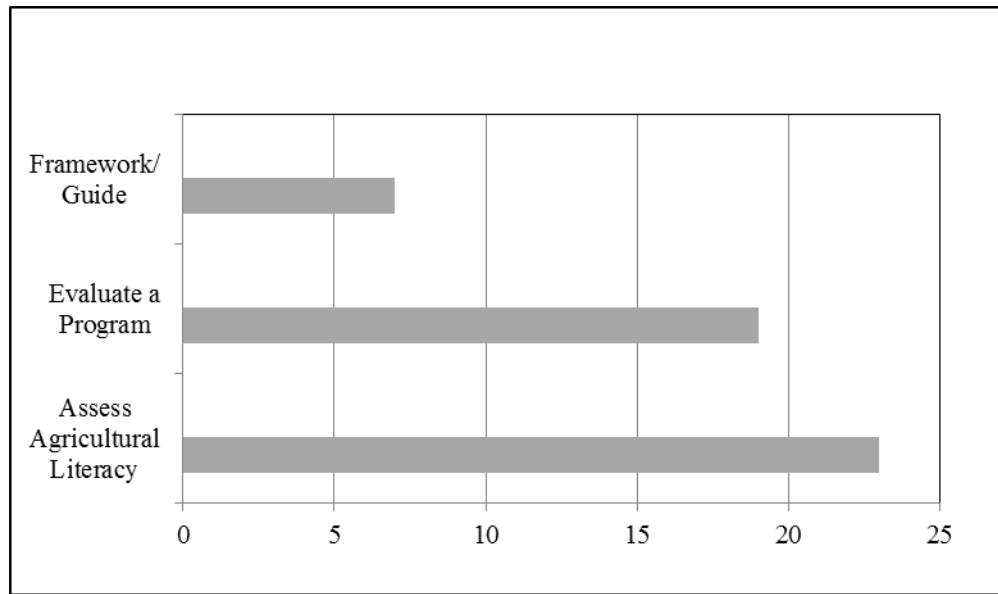


Figure 1. Bar graph of the number of studies found in each of the three distinct groups defined by their purpose.

Figure 1 displays the frequency of studies in each category of purpose as identified by the study. Of the 49 total studies found, 23 were identified with the purpose of assessing agricultural literacy. Specifically, those studies that sought to assess agricultural literacy identified the purpose of “determining understanding.” An example of research with the purpose of assessing agricultural literacy was a study of Southeast Missouri State University students designed to determine their knowledge and perceptions of issues related to agriculture, food, and the environment (Birkenholtz, Harris, & Pry, 1994).

Nineteen studies were identified that tested the effectiveness of an agricultural literacy program. The studies testing a program typically compared a control and treatment group or gave pre- and post-tests to determine knowledge gained. Programs tested included Ag in the Classroom (Pense, Leising, Portillo & Igo, 2005), AgVenture Magazine (Swortzel, 1997), Food, Land, and People lessons (Powell & Agnew, 2011), and Summer Agricultural Institute (Balschweid, Thompson, & Cole, 1998).

Seven studies were identified with the purpose of developing a framework or guide. These studies typically had a goal of developing a tool to guide and assist educators in teaching agricul-

tural content (Frick, 1993; Hubert et al. 2000; Powell, Agnew, & Trexler, 2008). A study by Frick (1993) determined agricultural literacy subject areas to constitute a framework of a middle school agricultural education core curriculum. Hubert, Frank, and Igo (2000) sought to heighten awareness of a developed framework to improve food and fiber literacy in K-12 students. Powell et al. (2008) examined three approaches to agricultural literacy curriculum development, implementation, and assessment: inductive, deductive, and evaluative. They developed a conceptual model for agricultural literacy by examining multiple models.

#### **Research Question Four: What findings and recommendations were suggested based on a summary of the agricultural literacy research?**

For research question four, the researchers sought to examine the findings and recommendations of agricultural literacy research in order to guide or suggest directions for future research. Findings for the agricultural literacy research studies were in line with the specific purposes of the studies, which were to assess agricultural literacy of a population, test the effectiveness of an agricultural literacy program, or develop a framework or guide to assist

teachers in the dissemination of agricultural literacy content.

### **Agricultural literacy assessment**

Findings of the research studies in this synthesis focused on agricultural literacy assessment were coded as the populations being either agriculturally literate, possessing some agricultural knowledge, or agriculturally illiterate. A total of 23 studies had the goal of assessing agricultural literacy.

Six studies found participant groups (high school teachers, non-educator adults, and college students) to be agriculturally literate. For example, a study by Harris and Birkenholtz (1996) found that the secondary educator groups were knowledgeable about agriculture and had positive attitudes toward the agriculture industry. In another study, researchers found that elected officials in Montana's 54<sup>th</sup> legislative session had positive perceptions of agriculture (Wearly et al. 1999).

Ten studies found participant groups (elementary students, middle school students, high school students, and non-educator adults) possessed some knowledge of agriculture. A study by Pense and Leising (2004) found both Oklahoma high school agricultural education and general education students possessed some agricultural knowledge and that the two groups did not differ in their levels of overall knowledge of agriculture. They also found that students from rural schools were less knowledgeable about agriculture than students attending urban or suburban schools.

Six studies found participant groups (elementary students, elementary teachers, and college students) to be agriculturally illiterate. For example, Hess and Trexler (2011) found informants lacked essential sub-concepts of agriculture that prevented them from developing schema needed for understanding agricultural benchmarks. Terry et al. (1992) found that a majority of teachers in Texas taught agricultural concepts in their classrooms, but had inaccurate perceptions of and limited knowledge of agriculture.

The remaining study by Colbath and Morish (2010) compared agricultural literacy in two groups. The researchers found after assessing a

group of college freshmen that suburban students had the highest scores on agricultural literacy assessments when compared to rural and urban students. Comparing the agricultural literacy among groups allowed researchers to determine areas of weakness among populations and to identify where efforts should be focused in order to increase agricultural knowledge.

### **Program testing**

A total of 19 studies tested the effectiveness of agricultural literacy programs. All studies revealed increases in understanding of agriculture among participants, but with varying levels of effectiveness. Some studies reported a higher program impact on agricultural literacy than others.

Findings of agricultural literacy research focused on program testing indicated materials or program utilized were effective in increasing agricultural competency. In a study assessing the program *Ag in the Classroom* by Pense et al. (2005), findings indicated *Ag in the Classroom* programs made positive differences in the K-6 student acquisition of knowledge about agriculture. *California Agriculture* published a research article by Rilla, Desmond, Braverman, Ponzio, Lee, Sandlin, & Kaney (1991) that assessed several agricultural literacy programs across California. Their findings indicated that there were four key components in order to have a successful agricultural literacy program. They were a dedicated, visionary leader, high levels of commitment from staff and administrators, a strong link between agricultural literacy education and classroom-based learning and adequate (material) resources. Monk, Norwood, and Guthrie (2000) found that observing a live cow milking demonstration greatly improved fourth grade students' knowledge and understanding of the dairy industry. Finally, Mabie and Baker (1996) studied three groups of inner-city, minority, fifth- and sixth-grade students in Los Angeles, California. The groups were randomly assigned into the following treatments: (a) a ten-week garden project; (b) a ten-week series of in-class projects of bread baking, chick rearing, and seed germination; and (c) a control group that received no treatment. This study found that while the students had very little knowledge of

the food and fiber system prior to the treatments, their knowledge increased by participating in the activities.

### Development of framework or guide

Seven studies were conducted with the purpose of developing a framework or guide. Three of those studies developed a framework for the purpose of identifying competencies necessary for the attainment of agricultural literacy. Two studies developed a conceptual model for examining agricultural literacy. The remaining two studies developed a guide for teachers to use to educate students about agriculture. Specifically, one of these two studies identified topics that constituted the core curriculum for a middle school agriculture program (Frick, 1993).

Findings of agricultural literacy research focused on developing a framework or guide indicated creating this framework was beneficial in determining content for agricultural literacy instruction. An earlier study by Frick et al. (1991) established eleven agricultural subject areas needed to achieve agricultural literacy. The eleven areas were 1) relationship with the environment, 2) agricultural processing, 3) public policies, 4) relationship with natural resources, 5) animal products, 6) societal significance, 7) plant products, 8) economic impact, 9) agriculture marketing, 10) distribution, and 11) global significance. The researchers then recommended that the eleven broad areas should be used in agricultural education curricula reform to increase agricultural literacy in K12, elementary, middle, and high schools.

### Conclusions/Implications/Recommendations

Based on the findings in this study, it could be concluded that a majority of agricultural literacy studies have been published in the *Journal of Agricultural Education* and American Association for Agricultural Education conferences (national and regional) as compared to the *Journal of Extension*, the *NACTA Journal* and other sources. This implies that as a discipline, the field of agricultural education has mainly published within the field of agricultural education and has not ventured into other fields

and venues. It is important to note that the studies included in this synthesis are limited by terminology in that only articles explicating the agricultural literacy terminology were included. Perhaps disciplines outside of agricultural education use different terminology in their research of agricultural literacy. Without this exception, a larger quantity of studies outside the discipline of agricultural education would indicate an expansion on the focus of agricultural literacy to broader audiences. According to Williams, "Research is of limited value unless the findings are made available to other researchers and practitioners" (1991, p. 20). Therefore, it is recommended that agricultural education researchers place a high priority on publishing research utilizing specific agricultural literacy terminology in non-agricultural education venues to increase knowledge of agricultural literacy outside the field of agricultural education and to market their findings.

It is further concluded that the populations most frequently targeted in agricultural literacy research are elementary teachers and students. The reasoning behind this may be traced back to an important statement extensively cited from *Understanding Agriculture—New Directions for Education* (1988). It states, "Agriculture-broadly defined- is too important a topic to be taught only to the relatively small percentage of students considering careers in agriculture and pursuing vocational agriculture studies" (NRC, 1988, p. 8). After the publication of *Understanding Agriculture—New Directions for Education* (1988), there was an increase in educating elementary students about agriculture, as well as focusing on elementary education participants in agricultural literacy studies. The major issue with targeting young audiences is to do so potentially excludes older audiences capable of directly impacting complex issues and policy decisions. According to Igo and Frick (1999), a well-informed, agriculturally literate society is needed for the continued success of the U. S. agriculture industry. Recommendations of the synthesis include expanding the focus of agricultural literacy research beyond elementary teachers and students. Examining high school teachers and students, as well as community members and leaders on a more frequent basis would better

indicate the number of agriculturally literate individuals making impactful decisions.

Further, it is concluded that the two main purposes for agricultural literacy research are to assess the agricultural literacy of a population or test an agricultural literacy program for effectiveness. These conclusions imply that assessing the agricultural literacy of a population and determining the effectiveness of a program are important goals in order to determine the next steps in agricultural literacy education. Together, the findings and recommendations of studies assessing literacy programs, as well as the agricultural competency of populations indicate the programs were successful in disseminating agricultural literacy, but many populations are still agriculturally illiterate. Perhaps, the agriculturally illiterate populations are simply not being reached by the efforts of agricultural literacy programs. Baseline data are needed to ascertain what students are learning about agriculture to provide key indicators of progress being made toward the achievement of program goals (Pense et al. 2005). It is recommended that researchers continue assessing the understanding of agriculture in all populations to determine weak areas in need of further intervention. Researchers should also continue testing programs for agricultural literacy effectiveness while also expanding the types of programs tested and the populations included in the programs.

Finally, it is concluded that when assessing populations, people are either agriculturally literate, possessing some knowledge of agriculture, or agriculturally illiterate. While assessing agricultural literacy, populations were also compared to determine areas of weakness. When

testing a program, the findings indicate the materials or program were successful in increasing agricultural literacy. These findings may point to a disconnect between successful agricultural literacy programs and an agriculturally illiterate society. This could be due to programs not reaching a majority of people, or it could be that these programs are mostly operated on small scales in a specific states, towns, or even classrooms. According to Jepsen, Pastor, and Elliot (2007), most efforts to increase agricultural literacy through specific programs are intermittent, at best. If more programs were national in scope, such as Ag in the Classroom, more people across the country could be included in the program. These findings indicate researchers are assessing populations' knowledge of agriculture, as well as assessing the materials and programs used to increase agricultural literacy in a variety of populations, but that the programs are not reaching a large portion of the population. It is recommended that researchers continue to assess populations and programs while increasing the variety of populations and programs assessed. Researchers should also identify areas of deficiency in research related to agricultural literacy efforts and continue these efforts in the future.

Agricultural literacy is a current issue, not only in American society, but globally. Knowledge and understanding of agriculture is necessary as the global population expands creating compounding issues of feeding the world, while establishing and maintaining a sustainable, viable agriculture system.

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**Notice of Correction**

Anna L. Ball was originally listed as Anna L. Henry in the author's line on this manuscript. This correction has been made in all online references to this paper as of March 27, 2013.