

Spanning the Gap: The Confluence of Agricultural Literacy and Being Agriculturally Literate

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Abstract

The purpose of the study was to examine the confluence of agricultural literacy, what it means to be agriculturally literate, and if a gap between agricultural literacy and being agriculturally literate existed. Two primary research questions framed this study: 1) How do agriculture professionals define agricultural literacy? 2) What does it mean to be agriculturally literate? While the terms literacy and literate are often used synonymously they have important and different meanings. This study used the Delphi Study Technique for determining consensus. The Delphi panel consisted of engaged agricultural professionals from seven states. These professions represented a broad spectrum of agricultural careers and experience. Each panel member was recognized as a leader in his or her field. The findings indicated that participants did not discern a difference between agricultural literacy and being agriculturally literate in regards to reading, writing, and speaking about agriculture. This study supports the conclusion that the terms agriculturally literate and agricultural literacy are used interchangeably. Agricultural professional may not be aware of the inherent differences between possessing agricultural literacy and being agriculturally literate.

Keywords: agricultural literacy; literacy; literate; Delphi; disciplinary

Introduction

When we use disciplinary literacy to talk about agriculture we fail to effectively communicate with the public; our message is not understood (Clemons & Lindner, 2018). Disciplinary literacy is specialized “knowledge and abilities possessed by those who create, communication and use knowledge within the disciplines” (Shanahan & Shanahan, 2012, p. 8). Defining literacy is a challenge particularly in disciplines such as agriculture (McKenna & Robinson, 2014). Although the agricultural literacy movement began in the 1990’s, little has been done to investigate the gap between being literate in agriculture and agricultural literacy (Mars & Ball, 2016). While the terms literacy and literate are often used synonymously they have important and different meanings. Literacy focuses on knowledge and understanding while being literate is

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concerned with communication and learning through reading, writing and speaking (Harris, & Hodges, 1995).

In agricultural education we rely on two primary definitions of agricultural literacy. Frick, Kahler, and Miller (1991) wrote "agricultural literacy can be defined as possessing knowledge and understanding of food and fiber systems"(p. 52). Meischen and Trexler (2003), defined agricultural literacy as entailing "... knowledge and understanding of agriculturally related scientific and technologically based concepts and processes required for personal decision making, participating in civic and cultural affairs, and economic productivity..." (p. 44). Both these definitions are examples of disciplinary literacy. Frick, Kahler, and Miller (1992) further identified "concepts about agriculture that every citizen should know" (p. 1). Shanahan and Shanahan (2012) noted a difference between content literacy and disciplinary literacy. Content literacy focuses on broad subject areas such as science, technology, engineering, and mathematics (Wolsey & Lapp, 2017) and includes a person's knowledge and understanding of associated principles and practices and ability to read, write, and communicate broadly. Disciplinary literacy focuses on specialized content within subject areas (e.g. animal reproduction, genetically modified field crops, agricultural communications, and agriculture education) (Shanahan & Shanahan, 2012).

These definitions primarily rely on the attainment and possession of knowledge (literacy) yet do not address an individual's ability to write, read, and communicate (being literate) for learning about agriculture. The established literacy definitions in our field are similar to how Pense and Leising (2004) defined being literate in agriculture, "An agriculturally literate person would understand the food and fiber system in relation to its historical, economic, social, and environmental significance" (p. 86). Based on the established literacy definitions in our profession, agricultural education uses the terms literacy and literate interchangeably. The application of these definitions as a construct for defining our field is an opportunity for investigation of the gap that exists for agricultural professionals.

According to Mercier (2015) most of the U.S. population are not agriculturally literate while Chapman and Lindner (2018) noted "agricultural literacy is a growing issue across the United States as more individuals continue to become further removed from production agriculture" (p. 95). A growing global population, urbanization of populations, and aging farmers exacerbates the agricultural literacy problem. As the global population approaches ten billion people by 2050 the need for agricultural professionals to understand the differences between agricultural literacy and being agriculturally literate is vital to efforts promoting agricultural literacy. Sandlin and Perez (2017) highlighted this need when they found the public had the ability to read (literate) agricultural word and phrases, but did not accurately demonstrate knowledge (literacy) about the relationship between purchasing local products and the impact on the environment. Sandlin and Perez (2017) wrote "[i]n terms of knowledge about locally produced agricultural goods, attendees seemed to overestimate locally grown benefits" (p. 304). Viola, Bianchi, Croce, and Ceretti (2016) found that while consumers tended to read food labels, most struggled with knowledge and understanding. Deakin (2011) found that while most consumers read food labels less than half understood the nutritional information presented. According the National Center for Education Statistics (2016) the percentage of persons competent to understand and consume information decreases as the complexity and length of such information increases. As shown in Figure 1, to have disciplinary literacy in agriculture and to be disciplinary literate in agriculture a person must be generally literate and content literate, and possess general literacy and content literacy. Figure 1 also shows being literate may or may not be a prerequisite for having literacy. The likelihood of lack of being literate decreases a person engages in specific content or disciplinary information.

Generally Literate: Ability to read, write, & communicate using basic words and terms needed to function in life.	Content Literate: Ability to read, write, & communicate about broad fields of study such as science or math.	Disciplinary Literate: Ability to read, write, & communicate using specialized words and terms.
AI VI	→ AI VI	→ AI VI
General Literacy: Knowledge & understanding needed in everyday life.	Content Literacy: Knowledge & understanding of broad principles and practices	Disciplinary Literacy: Knowledge & understanding needed for advanced study.
Population	% Population ▼	% Population ▼

Figure 1. Relationship between **being** literate and **having** literacy in a population.

Mercier (2015) noted a lack of research on agricultural literacy prevents educational programs from expanding and recommends additional research to understand better this problem. Harris and Birkenholz (1996) reported that secondary school teachers were knowledgeable about and displayed positive attitudes toward agriculture. Harris and Birkenholz (1996) also noted that agriculture teachers had higher knowledge scores about agriculture and more positive attitudes about agriculture than did other secondary teachers. “Agriculture educators and agricultural industry leaders have called for a basic level of agricultural literacy for Americans of all ages” (Meishen & Trexler, 2003, p.43). Colbath and Morrish (2010) reported that a limited amount of research has been directed toward post-secondary and adult agriculturalists regarding being literate and possessing literacy skills. Stofer and Newberry (2017) noted that adults in the United States have demonstrated low levels of understanding regarding agriculture.

According to Kovar and Ball (2013) the core concept of agricultural literacy and the understanding of agriculture have remained relatively stagnant. Kovar and Ball (2013) wrote significant changes in the type of agriculture experienced in the 21st century supports further investigation and evaluation of the concepts and understanding of agricultural literacy. These suggestions for continued investigation and understanding of agricultural literacy present specific challenges at all levels of primary, middle, secondary, and adult education. In the field of agricultural education an opportunity exists to develop programs that teach the efficient use of disciplinary literacy through reading, writing, and speaking.

Conceptual Framework

Disciplinary literacy, content literacy, agricultural literacy, and the Pillars of Agricultural Literacy (American Farm Bureau, 2013; Frick et al., 1991; Meischen & Trexler, 2003; and Shanahan & Shanahan, 2012) bind the conceptual framework for this study. In addition to defining agricultural literacy, Frick et al., (1991) identified eleven concepts that encompass agricultural literacy: Environment, processing, policy, natural resources, animal production, societal significance, plant production, economic impact, marketing, distribution, and globalization. They further noted “an individual possessing such knowledge would be able to synthesize, analyze, and communicate basic information about agriculture.” (Frick et al., 1991, p.52). Based on this assumption of disciplinary literacy, a person would need to be literate and possess content literacy in order to learn through reading and writing in the discipline (Shanahan & Shanahan, 2008). Frick et al., recommended additional research to address what they described as broad concepts and how those concepts could be incorporated and communicated through educational materials (Frick et al., 1991).

Meischen and Trexler, (2003) wrote that “if a person were literate about agriculture, food, fiber, and natural resource systems, he or she would be able to: a) engage in social conversation, b) evaluate the validity of media, c) identify local, national, and international issues, and d) pose and evaluate arguments based on scientific evidence” (p. 44). Meischen and Trexler (2003) reported that while rural elementary students had a basic understanding of meat and livestock their literacy levels were below prescribed benchmarks. That is students understood the process but did not have the necessary disciplinary literacy skills. Trexler (2000) noted that while literacy is a moving target, it should be the goal of agricultural educators to ensure that all students can have informed conversations about agriculture.

The American Farm Bureau Foundation (2013) developed the Pillars of Agricultural Literacy to help educational efforts aimed at increasing understanding of the relationship between agriculture and society. Six pillars are used to describe each relationship: Agriculture and the environment, agriculture and food, fiber, and energy, agriculture and animals, agriculture and lifestyle, agriculture and technology, and agriculture and the economy. The pillars were designed to aid in the implementation of agricultural learning activities in classrooms for the development of lessons that reflect the educational growth of learners. The model was developed to aid “people who are starting to look at their agricultural literacy efforts for a high level” (American Farm Bureau Foundation, 2013, p.1). The intent of the model aligns with the National Research Council’s 1998 directive that “beginning in kindergarten and continuing through twelfth grade, all students should receive some systematic instruction about agriculture” (National Research Council, 1998, p. 2). Wolsey and Lapp (2017) agreed with systematic instruction in literacy yet cautioned that the challenge for content area teachers is the type of thinking required by all students when reading, writing, composing, and speaking while developing literacy skills.

Shanahan, Shanahan, and Misischia (2011) noted secondary teaching often requires pre-service students to complete courses in content area reading and writing, while disciplinary specialization is often overlooked. Content area specialists teach subject matter information without consideration of the literacy skills required for reading, writing, speaking, and generating probing questions (Draper, 2002). According to Shanahan et.al., (2011) this oversight potentially develops teachers ill equipped to support their students’ disciplinary reading resulting in teachers providing the information they want students to have and avoiding text-based reading and discussions. They reinforce the need for all teachers to be teachers of literacy in their content area and extend their instruction beyond lecture and text-based reading.

To communicate better with the public and policy makers Enns, Martin, & Spielmaker (2016) noted that “...operationalization of what constitutes true agricultural literacy”...is needed (p. 14). Roberts and Ball (2009) highlight the important role agricultural education teachers have on influencing an agriculturally literate public. To meet the needs of educating the public and policy makers about agriculture and natural resources a need exists to understand better the distinction between agricultural literacy and being agricultural literate.

This research study addresses Research Priority 1, “What methods, models, and programs are effective for informing public opinions about agricultural and natural resources issues?” (Enns, Martin, & Spielmaker, 2016). Agriculturalists serve as the front line for educating the public regarding agriculture that will provide solutions for a growing population by acknowledging that a gap does exist between being agricultural literacy and being agriculturally literate.

Purpose

The purpose of the study was to examine the confluence of agricultural literacy and what it means to be agriculturally literate. Two primary research questions framed this study: 1) How do agriculture professionals define agricultural literacy? and 2) What does it mean to be agriculturally literate?

Methods

This study used a Delphi method for collecting data related to purpose and research questions of the study. The study consisted of four rounds of investigation with identified experts using predetermined selection criteria. Dalkey and Helmer (1963) of the RAND Corporation are general credited with the development of the Delphi technique. Hsu and Sandford (2007) noted it “is a widely used and accepted method for achieving convergence of opinion concerning real-world knowledge solicited from experts within certain topic areas” (p. 1). The Delphi technique is in reference to the Greek oracle, Delphi, from which prophecies were given (Yousuf, 2007). The use of the Delphi is similar to the Nominal Group Technique with the exception of requiring groups being surveyed in person; instead, an electronic delivery method is appropriate (Yousuf, 2007). This study is part of a larger study on agricultural literacy.

Fifteen purposively chosen panelists participated in the study using established Delphi techniques as reported by Rayfield and Croom (2010) and supported by Conner and Roberts (2013). Panel members were recruited and selected based on their leadership roles and experience in agriculture. Participants were employed in the agriculture industry and served in a leadership capacity that provided opportunity for interacting with the public. The composition of the expert panel included participants from seven states. Participants possessed at minimum a bachelor’s degree in an agricultural area of study and predominately employed in rural settings. Participants represented a wide range of agricultural careers including political and policy, education, for profit advocacy centers, agribusiness/industry, agriculture communications, and FFA/Professional Organizations. Delbecq, Van de Ven, and Gustafson (1975) suggested that ten to fifteen subjects are sufficient if the background of the respondents is homogenous. To ensure validity of results selection of expert participants is critical (Hsu & Sandford, 2007). Delphi participants according to Pill (1971) and Oh (1974) need to have expertise in the area being studied and must be willing to share their expertise. Delbecq et al., (1975) identified three groups qualified to be participants of a Delphi study: “top management decision makers who will utilize the outcomes of the Delphi study, professional staff members together with their support team and respondents to the Delphi questionnaire whose judgments are being sought” (p. 85). Fifteen agricultural professionals indicated their desire to participate in the study. All fifteen expert participants completed the first round of the study and eleven expert participants ultimately completed the second, third, and fourth round. While the loss of panel members may decrease the reliability of the findings, a final panel of 11 experts is consistent with the Delbecq et al. recommendation of ten to fifteen participants.

The Delphi process consisted of four rounds and data was collected using open-ended and closed-ended response questions during the Spring of 2017. The first-round instrument consisted of two open-ended questions: How do you define the term agricultural literacy?; and what does it mean to be agriculturally literate? NVivo software was used to categorize and analyze the data. Agreement levels of 80% (Dalkey, 1969) were used to determine consensus for each question in each of the four rounds. Consistent with Rayfield and Croom (2010) items receiving 80% agree or strongly agree indicated consensus. Round two statements included closed-ended questions using the following scale: 5=*strongly agree*, 4=*agree*, 3=*neither agree/disagree*, 2=*disagree*, and 1=*strongly disagree*. The third-round instrument consisted of 19 new statements that participants

indicated their level of agreement using a two-point scale: 2=*agree* or 1=*disagree*. The fourth-round closed-ended instrument asked participants whether they agreed or disagreed with the final definitions provided.

Findings

The findings of the study are presented by Delphi round. In round one the first question asked participants “how do you define the phrase agricultural literacy?” Participants ($N = 15$) provided definitions that were analyzed, parsed and reconstituted into statements representing themes that emerged from the information provided. Statements and sentences within the definitions that were repetitive and closely related were paired to avoid repetition in questioning for round two. As a result of this analysis, eleven items/themes were development for further analysis. These items/themes are shown in Table 1 and provided the basis for defining agricultural literacy.

Table 1

Round One Participant (N= 15) Responses: How do Agriculture Professionals Define the Phrase Agricultural Literacy?

Participant Generated Responses and Emerging Themes
A person’s ability to understand the source of food.
Acquisition of knowledge that allows a person to read, write, and communicate about agriculture.
Agriculture is the production of food, fiber, fuel, and natural resources.
Awareness of the food, fiber, and natural resource industries.
Educating the public about the aspects of agriculture.
Knowledge of the role agriculture plays in a person’s life.
Recognizing that crops are used for more than food.
The ability to describe to others where sources of food originate.
The understanding of agriculture (plants, animals, technology, business, natural resources, food, and mechanics) and its overall relationship with the environment.
Understanding agricultural processes including economics of planting crops, financing fields and equipment, transportation of goods, and the process of turning the agricultural products into a consumable good.
Understanding that animal welfare is a top priority for farmers.

The second question asked participants what does it mean to be agriculturally literate? Similarly, participants ($N = 15$) provided definitions that were analyzed and parsed and reconstituted into statements representing themes that emerged from the information provided. Information that was repetitive or closely related were paired to avoid repetition in questioning for round two. As a result of this analysis, thirteen items/themes were development for further analysis. These items/themes are shown in Table 2 and provided the basis for describing what it means to be agriculturally literate.

Table 2

Round One Participant Responses (N = 15): What does it mean to be Agriculturally Literate?

Participant Generated Responses and Emerging Themes
Applying agricultural knowledge to real world problems.
Being agriculturally literate means you possess more knowledge in agriculture than in other areas.
Having a basic awareness and understanding of where our food, clothes, fuel, etc. comes from is grown and how it is grown, produced, processed, and transported.
Having an understanding of agricultural terminology.
Knowing agriculture relates to everything we do on a daily basis.
Knowing basic agricultural facts incorporated into daily education instruction in school systems.
Knowing the source of food is from farms (not grocery stores).
Knowing we cannot live without agriculture.
Knowing animals provide products for consumers.
Open-mindedness and willingness to hear about different production methods: not calling one type of farming the "right" way.
Possessing an understanding of agriculture, not necessarily the application of agricultural processes.
Possessing knowledge of the impact farmers, ranchers, and the agriculture industry have on the world.
Understanding that not all food grown is for human consumption (used for animal feed, bio-fuels, etc.).

In round two participants were provided the items/themes developed in round one and asked to indicate their level of agreement with those items/themes. Data related to defining agricultural literacy are provided in Table 3. Participants strongly agreed that educating the public about the aspects of agriculture ($M = 4.7$, $SD = .48$) should be included in defining agricultural literacy. Participants tended to agree with the other ten items/themes. The next two items that participants tended to agree with most where: "Agriculture is the production of food, fiber, fuel, and natural resources" ($M = 4.5$, $SD = .93$), and "awareness of the food, fiber, and natural resource industries" ($M = 4.5$, $SD = .53$). The two items with the lowest mean scores were: "A person's ability to understand the source of food" ($M = 4.2$, $SD = .92$), and "understanding that animal welfare is a top priority for farmers" ($M = 4.0$, $SD = 1.25$). The response rate for round two and subsequent rounds was eleven participants and is congruent with Delbecq, Van de Ven, and Gustafson (1975) in regards to appropriate size of a Delphi panel. Data related to what it means to be agriculturally literate are provided in Table 4. Participants strongly agreed with eight of the thirteen items/themes. The item/theme with the highest level of agreement was "having a basic awareness & understanding of where food, clothes, fuel, etc. comes from is grown, produced, processed, and transported" ($M = 4.75$, $SD = .87$). Participants tended to agree with five of the thirteen items/themes.

Table 3

Round Two Participant Consensus (n = 11): How do Agriculture Professionals Define the Phrase Agricultural Literacy?

Instrument Statement	<i>M^a</i>	<i>SD</i>
Educating the public about the aspects of agriculture.	4.70	.48
Agriculture is the production of food, fiber, fuel, and natural resources.	4.50	.93
Awareness of the food, fiber, and natural resource industries.	4.50	.53
Recognizing that crops are used for more than food.	4.40	.97
Knowledge of the role agriculture plays in a person's life.	4.40	.52
The understanding of agriculture (plants, animals, technology, business, natural resources, food, and mechanics) and its overall relationship with the environment.	4.40	.52
Understanding agricultural processes include the economics of planting crops, financing fields and equipment, transportation of goods, & the process of turning the agricultural products into a consumable good.	4.40	.52
The ability to describe to others where sources of food originate.	4.30	.68
Acquisition of knowledge that allows a person to read, write, and communicate about agriculture.	4.30	.68
A person's ability to understand the source of food.	4.20	.92
Understanding that animal welfare is a top priority for farmers.	4.00	1.25

Note: M^a 5=strongly agree, 4=agree, 3=neither agree/disagree, 2=disagree, 1=strongly disagree

Table 4

Round Two Participant Consensus (n = 11): What does it mean to be Agriculturally Literate”

Instrument Statement	<i>M^a</i>	<i>SD</i>
Having a basic awareness and understanding of where food, clothes, fuel, etc. comes from is grown, produced, processed, & transported.	4.75	.87
Possessing knowledge of the impact farmers, ranchers, and the agriculture industry have on the world.	4.70	.85
Possessing an understanding of agriculture. Not necessarily the application of agricultural products.	4.70	.89
Knowing the source of food is from farms (not grocery stores).	4.70	.89
Knowing which animals provide products for consumers.	4.70	.89
Understanding that not all food grown is for human consumption (used for animal feed, bio-fuels, etc.).	4.70	.89
Applying agricultural knowledge to real world problems	4.70	.89
Open-mindedness and willingness to hear about different production methods: not calling of type of farming the “right” way.	4.70	.89
Having an understanding of agricultural terminology.	4.40	1.16
Knowing agriculture relates to everything we do on a daily basis.	4.40	1.16
Knowing we cannot live without agriculture.	4.40	1.16
Knowing basic agricultural facts incorporated into daily educational instruction in school systems.	4.40	1.16
Possessing more knowledge in agriculture than in other areas.	4.40	1.16

Note: *M^a* 5=*strongly agree*, 4=*agree*, 3=*neither agree/disagree*, 2=*disagree*, 1=*strongly disagree*

In round three participants were asked to reach consensus on the items/themes related to defining agricultural literacy. Participants were asked if they agreed or disagreed that the item/theme belonged in the definition. Consensus (80% of participants) was achieved on eight of the eleven items related to defining agricultural literacy. Items/themes that had unanimous consensus included: “A person’s ability to understand and describe the course of food;” “recognizing that crops are used for more than food;” “the understanding of agriculture (plants, animals, technology, business, natural resources, food, and mechanics) and its overall relationship with the environment; and “a person’s ability to understand and describe the course of food.” Items/themes that did not achieve consensus included: “Awareness of the food, fiber, and natural resource industries;” “knowledge of the role agriculture plays in a person’s life;” and “the ability to describe to others where sources of food originate.”

Table 5

Round Three Participant Consensus (n = 11): How do agriculture professionals define the phrase agricultural literacy?

Consensus Items/Themes to be Included in Definition of Agricultural Literacy
Agriculture involves production of food, fiber, and natural resource.
Recognizing that crops are used for more than food.
The understanding of agriculture (plants, animals, technology, business, natural resources, food, and mechanics) and its overall relationship with the environment.
A person's ability to understand the source of food.
Understanding that animal welfare is a top priority for farmers.
Understanding agricultural processes include: economics of planting crops, financing fields and equipment, transportation of goods, & the process of turning the agricultural products into a consumable good.
Educating the public about the aspects of agriculture.
Acquisition of knowledge that allows a person to read, write, and communicate about agriculture.

Similarly, in round three participants were asked to reach consensus on the items/themes related to describing what it means to be agriculturally literate. Participants were asked if they agreed or disagreed that the item/theme belonged in the description of what it meant to be agriculturally literate. Consensus (80% of participants) was achieved on twelve of the thirteen items/themes. Items/themes that had unanimous consensus included: "Possessing knowledge of the impact farmers, ranchers, and the agriculture industry have on the world;" "possessing an understanding of agriculture, not necessarily the application of agricultural products;" "knowing we cannot live without agriculture;" "knowing the source of food is from farms (not grocery stores);" "knowing which animals provide products for consumers;" "understanding that not all food grown is for human consumption (used for animal feed, bio-fuels, etc.);" and "having a basic awareness & understanding of where food, clothes, fuel, etc. comes from is grown, produced, processed, & transported." The only item/theme that did not achieve consensus was "being agriculturally literate means that you possess more knowledge in agriculture than other areas."

Table 6

Round Three Participant Consensus (n = 11): What does it mean to be Agriculturally Literate?

Consensus Items/Themes that Describe what it means to be Agriculturally Literate
Possessing knowledge of the impact farmers, ranchers, and the agriculture industry have on the world.
Possessing an understanding of agriculture, not necessarily the application of agricultural products.
Knowing we cannot live without agriculture.
Knowing the source of food is from farms (not grocery stores).
Knowing which animals provide products for consumers.
Understanding that not all food grown is for human consumption (used for animal feed, bio-fuels, etc.).
Having a basic awareness and understanding of where food, clothes, fuel, etc. comes from is grown, produced, processed, & transported.
Open-mindedness and willingness to hear about different production methods. Not calling one type of farming the "right" way.
Applying agricultural knowledge to real world problems.
Having an understanding of agricultural terminology.
Knowing basic agricultural facts incorporated into daily educational instruction within school systems.
Knowing agriculture relates to everything we do on a daily basis.

Round four invited panelists to indicate their level of agreement related to a final definition of agriculture literacy and what is meant to be agriculturally literate derived from round three. Panelists reviewed the statements using a two-point scale as either agree or disagree. Participants reached consensus on the definition that "Agricultural literacy is the awareness and understanding food, fiber, natural resources, and animal health and its relationship to the public and the environment." Participants reached consensus that "Being agriculturally literate means knowing and understanding how agriculture, as a basis for human life, affects people."

Conclusions, Implications, and Recommendations

This study examined the confluence of agricultural literacy and being agriculturally literate. Expert panelists' perceptions of the research questions were surveyed through four rounds using the Delphi technique. The participants in this investigation possessed expert knowledge of agriculture in a variety of professional fields including: understanding of agriculture when explaining advocacy for producers, teachers, and other professional fields, displaying appreciation for the cultivation of livestock and crops, sharing information regarding production and scientific agriculture as related to defining agricultural literacy. The findings indicated that participants did not discern a difference between agricultural literacy and being agriculturally literate in regards to reading, writing, and speaking about agriculture. This finding supports the conclusion that agriculturalists are either not aware of the inherent differences between being agriculturally literate and possessing agricultural literacy or do not have the prior training to bridge the gap that inhibits effective communication outside of agriculture. Participants defined what it means to be agriculturally literate similarly to agricultural literacy and were not able bridge the gap between the operational definitions of being literate and literacy. As discussed in Figure 1 and expanded on in the examples below the ability for agriculturists to communicate effectively with the public is diminished when content and disciplinary words and terms are used and when the public lacks

content and disciplinary literacy. It is important for agricultural educators to discern and understand the difference between the terms literate and literacy if we are going to help improve the public's understanding of agriculture.

Findings of this study support the disciplinary definitions of agricultural literacy offered by Frick, et al. (1991) and Meischen and Trexler (2003). Findings also highlight that "experts and professionals [in agriculture] think in specific ways about their field[]" (Wolsey & Lapp, 2017). The findings of this study indicated a gap does exist between agricultural literacy and being literate in agriculture. An implication exists that understanding what it means to be agriculturally literate is illusive and not fully understood within the limitations of the participants of this study. Agriculturalists read and write in specialized ways, and those who would acquire agricultural literacy must learn to read and write like the experts. Those who would learn in the discipline of agriculture today need specialized reading and writing skills, the skills employed by expert agriculturalists in learning from agricultural texts. The implication of this observation is that there is a gap in understanding being literate and possessing agricultural literacy. Agriculturalists are the front line of explaining the industry, science, and social aspects of agriculture.

An implication of this study is that there is a need for a closer analysis of the gap between being agricultural literacy and being agriculturally literate. This study did not address the general literacy abilities of non-agriculturalists and therefore, further studies should be investigated to complement the findings of this study. Further exploration of the gap between being agriculturally literate and agricultural literacy should focus on how agriculturalists communicate with the public. The manner in which our profession explains and communicates with non-agriculturalists is not effective. For example, the phrase genetically modified organisms is a disciplinary phrase that requires advanced knowledge (disciplinary literacy), while the words individually are a combination of being generally literate (modified) and content literate (genetically and organisms). Those without advanced training likely can read the phrase, but may ascribe inaccurate meaning. In another example, the word biotechnology presents a different challenge for non-agriculturalists. The accurate use and knowledge of the word likely requires both being disciplinary literate and having disciplinary literacy. Just as a medical doctor must use general words and terms to communicate effectively with patients, so too must agriculturalists use general terms to communicate effectively with the public.

The results of this study indicated a gap between agricultural literacy and being agriculturally literate is elusive and potentially misunderstood by agricultural professionals. This gap and the consequences associated with not understanding the connection between reading, writing, and communicating out of our field have profound limitations. It is recommended and in agreement with Mercier (2015) that future studies investigate the public perception of modern methods agriculturalists use to educate students of agriculture the way we communicate with the public. Investigations should be undertaken to determine the benefits of being agriculturally literate and possessing agricultural literacy to effectively discuss the science of agriculture with non-agriculturalists. The findings of this study reinforce the gap between being literate and agricultural literacy. In an age where non-agriculturalists need to discuss and debate literacy in the public lyceum, we are ultimately missing a vital component of developing a literate global populace.

To increase agricultural literacy it may be necessary to use basic words and terms of which the public has a higher percentage of ability to read, write, and communicate. While it is a laudable goal to teach disciplinary specific words and terms, using such does not necessarily result in greater agricultural literacy. Understanding the differences between literate and literacy may help agricultural educators develop teaching materials targeted at increasing the public's agricultural literacy. Professional development and outreach for those promoting agricultural literacy is

recommended. Additional research on such efforts is warranted to discern impacts of recommended training.

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