



## Journal of Applied Communications

Volume 98 | Issue 3

Article 6

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### Recommended Citation

Specht, Annie R.; McKim, Billy R.; and Rutherford, Tracy (2014) "A Little Learning in Dangerous: The Influence of Agricultural Literacy and Experience on Young People's Perceptions of Agricultural Imagery," *Journal of Applied Communications*: Vol. 98: Iss. 3. <https://doi.org/10.4148/1051-0834.1086>

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### Abstract

Agricultural knowledge gaps are forming between American agricultural producers and the consumers they feed and clothe. These divides in agricultural literacy and firsthand experience in the food and fiber industry may affect how consumers perceive images of modern production practices presented in the news media and, subsequently, the industry itself. In a quantitative study, researchers surveyed students at a large public university about their agricultural literacy – knowledge and awareness of and familiarity with agriculture-related issues – and agricultural experience, their firsthand interactions with agricultural production. The students also responded to images taken from a television news broadcast about antibiotic use in livestock production. Using these three variables, an analysis of variance was conducted that revealed significant differences between students experienced in agricultural production and those somewhat inexperienced, indicating that those with minimal exposure to agriculture may have done so in a context related to traditional, rather than modern, production. A regression analysis also revealed agricultural literacy was a significant predictor of reaction score. The researchers suggest, given the ability of agricultural literacy to influence perceptions, agricultural literacy initiatives should be promoted, while experiences with agriculture may be enhanced by hands-on learning at agritourism sites and agricultural fairs and expositions.

### Keywords

Television, agricultural literacy, knowledge gap theory, public perceptions

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## Abstract

*Agricultural knowledge gaps are forming between American agricultural producers and the consumers they feed and clothe. These divides in agricultural literacy and firsthand experience in the food and fiber industry may affect how consumers perceive images of modern production practices presented in the news media and, subsequently, the industry itself. In a quantitative study, researchers surveyed students at a large public university about their agricultural literacy — knowledge and awareness of and familiarity with agriculture-related issues — and agricultural experience, their firsthand interactions with agricultural production. The students also responded to images taken from a television news broadcast about antibiotic use in livestock production. Using these three variables, an analysis of variance was conducted that revealed significant differences between students experienced in agricultural production and those somewhat inexperienced, indicating that those with minimal exposure to agriculture may have done so in a context related to traditional, rather than modern, production. A regression analysis also revealed agricultural literacy was a significant predictor of reaction score. The researchers suggest, given the ability of agricultural literacy to influence perceptions, agricultural literacy initiatives should be promoted, while experiences with agriculture may be enhanced by hands-on learning at agritourism sites and agricultural fairs and expositions.*

## Key Words

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## Introduction

In the past decade, American audiences have consumed news stories focused on elements of modern agricultural production with which audiences are largely unfamiliar. In 2012, serious charges of livestock mistreatment, environmental degradation, and abuse of non-therapeutic antibiotics have been levied against the food industry: In August, federal officials shut down a Fresno, California, slaughterhouse after the release of a video showing visibly impaired cattle being stunned by “bungling” employees, raising fears that meat from sick animals entered the food supply (Cone, 2012). Meanwhile, a study conducted by the U.S. Government Accountability Office found the Environmental Protection Agency failed to regulate pollution caused by the nation's livestock operations, leading to the degradation of vital waterways like the Chesapeake Bay (Webber, 2012). Citing pressure from consumers “[focused] on where their food comes from and how it is raised,” the U.S. Food and Drug Administration (FDA) announced new guidelines for the use of antibiotics in food-animal produc-

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*This article is based on a manuscript presented at the 2013 meeting of the American Association for Agricultural Education in Columbus, Ohio.*

tion in May: The FDA called for a voluntary moratorium of antibiotic use for growth promotion and increased veterinary oversight (Miller, 2012; Jordahl, 2012).

Stories and related images of industrial farming and modern animal husbandry methods violate long-held stereotypes of agriculture as a tranquil, bucolic “lifestyle,” and the outcomes of this confusion may be exacerbated by a lack of agricultural awareness among members of the public. Agricultural literacy stands as one of the primary tenets of the American Association for Agricultural Education’s (AAAE) 2011-2015 National Research Agenda: “Arguably, an understanding of agriculture’s history and current economic, social, and environmental significance, both domestically and internationally, is important for all Americans” (Doerfert, 2011, p. 11).

Per Doerfert (2003), Americans are increasingly removed from the nation’s agricultural base, leading to potentially negative effects on how U.S. citizens view the food and fiber industry: “Limited knowledge ... makes [the public’s] views uncertain and malleable” (p. 12), opening the door for media portrayals of the industry to heavily influence public perceptions.

### **Purpose and Objectives**

The purpose of this study was to investigate the impact of agricultural literacy — operationalized here as knowledge and awareness of the U.S. food and fiber industry — and firsthand experience with agriculture on college students’ perceptions of television coverage of issues in modern livestock production. This study addresses AAAE’s National Research Agenda Priority 1: Public and policy maker understanding of agriculture and natural resources. Within this research area, special focus should be placed on “members of the agriculture industry [increasing] their understanding of various stakeholder group needs and/or behaviors” (Doerfert, 2011, p. 8), an attitude reflected in this study.

To fulfill the purpose explicated above, the researchers developed a series of objectives. The objectives of this study were to

- Describe college students’ reactions to images taken from agriculture-related television news stories;
- Describe college students’ perceived agricultural literacy and self-reported agricultural experience; and
- Identify possible explanations for college students’ reactions to agriculture-related television news stories.

### **Conceptual Framework**

#### **Knowledge Gap Theory**

Knowledge gap theory posits the infusion of mass-mediated information into a society causes certain groups to acquire knowledge at a faster rate than others, leading to “knowledge gaps” between informational haves and have-nots (Tichenor, Donohue, & Olien, 1970; Tran, 2013). Seminal work in knowledge gap theory positions socioeconomic status as the primary variable in the development of these (Ettema, Brown, & Luepker, 1983; Tichenor, Donohue, & Olien, 1970), but other factors, including audience motivation and perceived message usefulness, may contribute to the formation of informational divides among social groups (Ettema & Kline, 1977; Kwak, 1999). Ettema, Brown, and Kline (1983) contend motivation for attention is perhaps the most important element of unequal knowledge gains among social segments, noting that “gaps widen when there is a difference in motivation” (p. 519); Viswanath et al. (1994) agree, stating education-based knowledge gaps are exacerbated by a lack of perceived informational functionality. Audiences may limit their exposure to information they deem not useful (Knobloch, Carpentier, & Zillman, 2003) but will attend closely

when motivated by factors like perceived risk (Ho, 2012).

The agrarian information divide between farmers and consumers is growing: As more Americans move farther from the farm, both geographically and generationally, the necessity for and salience of agricultural knowledge decreases, leading to the potential development of an agricultural knowledge gap that could increase the incidence of negative or unrealistic perceptions of the industry taking hold in society (Rumble & Buck, 2013). To counter the division between agrarian-knowledge haves and have-nots, agricultural literacy has become an increasingly important initiative among agricultural educators and communicators alike.

### **Agricultural Literacy**

Before the agricultural industrial revolution of the post-World War II decades, the United States was a nation built upon — and reliant upon — a strong shared agrarian tradition: “A close identification with a common agrarian culture and heritage resulted in a shared sense of agricultural literacy, arising from intimate familiarity with the production, distribution, and use of agricultural products” (Powell, Agnew, & Trexler, 2008, p. 87). Increasing urbanization and the movement of the workforce toward white-collar employment gradually led to the decline of the agriculture industry as a focal point of American life, and the latter decades of the 20th Century ushered in growing concern regarding the U.S. population’s disconnect from the sources of its food and fiber (Brewster, 2012; Doerfert, 2003).

In 1988, the Committee on Agricultural Education in Secondary Schools released a series of recommendations related to agricultural literacy, noting that an agriculturally literate person should have a firm grasp of the industry’s “current economic, social, and environmental significance to all Americans” (National Research Council, 1988, p. 9). The committee concluded few Americans possessed a keen grasp of contemporary agricultural issues: Fewer than 30 percent of Kansas students at the elementary, junior, and senior school levels who were surveyed as part of the study were able to correctly answer basic questions about food and fiber production (Horn & Vining, 1986; National Research Council, 1988).

Many of the questions raised by the National Research Council Report remain unaddressed. Pense and Leising (2004) questioned the efficacy of agricultural literacy programs for K-12 students the following year, especially after discovering high-school students in an agricultural education track fared worse than their suburban and urban counterparts on an agricultural literacy instrument. How students performed on agricultural literacy instruments after high school remains largely unreported: In a 2003 study of the agricultural literacy research conducted since the 1988 report, Doerfert found only four studies investigated the agricultural literacy of university students.

### **Experience and Experiential Learning**

An element of agricultural literacy that is not well-studied in non-agricultural populations is first-hand experience with the food and fiber industry. The concept of experiential learning was developed by D. A. Kolb, an organizational scholar who applied the teachings of Dewey, Lewin, and other progressives in his education research (Battisti, Passmore, & Sipos, 2008). Piaget, a forerunner of Kolb and a powerful influence on his theories of experiential learning, believed that “an act of intellectual adaptation requires a balance or equilibrium between assimilation and accommodation. Intelligence is thus the result of the dialectic integration of internal cognitive organization, reflective abstraction, and external adaptation, involvement in experience” (Mainemelis, Boyatzis & Kolb, 2002, p. 7). Kolb’s model is based on the premise that people learn best by doing, rather than by rote memorization and regurgitation of facts (Kolb & Fry, 1975).

Learning in a real-world context deepens the educational experience, leading to improved understanding of material and the mechanisms of the real world. In a study of preservice music teachers, Haston and Russell (2011) found authentic context learning improved students' knowledge retention and performance and, more interestingly, diminished or erased preconceived notions the students held about teaching. In her testimony, one study participant expounded on this phenomenon, stating teaching in a real-world context better informed her understanding of "why some things happened in our classrooms that I never really liked. I can understand why they happened and what the problems were" (Haston & Russell, 2011, p. 383). Experience, therefore, may help mitigate the negative effects of misconceptions and establish new ways of thinking about previously unfamiliar topics.

## Methods

To investigate how agricultural literacy and industry experience influence young people's perceptions of agricultural production practices, students enrolled in two agricultural communications and journalism courses at a large southwestern public university were selected as a sample of the larger university population. Students in these courses traditionally represent a diversity of agricultural experiences.

These students were shown a series of screen captures, or still images, taken from a broadcast news story (Couric, 2010) about antibiotic-resistant bacteria and their possible link to nontherapeutic antibiotic use in livestock as part of a class exercise on visual communication and rhetoric (see Figure 1). The fifteen images were selected from an extensive collection of screen captures from the broadcast because they presented imagery related to livestock production and contained no textual evidence (i.e., captions or headlines) that directly revealed the topic of the story to the survey participants.



Figure 1. Images taken from broadcast news story on antibiotic use in livestock in the order shown to survey participants.

Based on the instrument developed by Specht (2010), an electronic questionnaire was created using Qualtrics online survey software and distributed in both paper and electronic format. To ensure every student was able to complete the questionnaire, students enrolled in a class held in a large lecture hall received the paper version, while those enrolled in a computer-lab-based course received the electronic version.

The questionnaire was used to gather demographic data and information pertaining to students'

agricultural knowledge, awareness, and experience. Each image was followed by a five-point Likert-type attitude scale participants used to indicate their affective response — or reactions — to the photo, with 1 indicating a “very negative” and 5 a “very positive” response. After viewing the series of images, the participants were asked to identify the subject of the news story based on what they had seen and to describe the visual cues that led them to choose those particular topics. Participants also explained their affective response to the topic they had chosen.

To measure participants’ agricultural awareness, respondents addressed statements along a numeric rating scale and were asked to rate their knowledge, experience, and beliefs related to agricultural and animal husbandry practices on a scale of 1-5. A score of “1” indicated no knowledge, awareness, or familiarity, and “5” indicated firsthand knowledge of the industry. The self-reported constructs of agricultural knowledge, agricultural awareness, and agricultural familiarity were collapsed into a single variable, agricultural literacy, while a grand mean of the four items related to agricultural experience — the participants’ level of involvement in the food and fiber industry — was calculated to provide an agricultural experience score for each respondent.

Specht (2010) reported reliability estimates (Cronbach’s  $\alpha$ ) that ranged from .71 to .98 ( $n = 66$ ). Because Specht’s (2010) study collected data in a similar manner, with a similar undergraduate student sample, using the same items and scales used in this study, a pilot test was not conducted. However, post hoc Cronbach’s alpha coefficients were calculated for the scales reaction, agricultural literacy, and agricultural experience, which yielded coefficients of .86, .94, and .90 respectively ( $n = 93$ ).

**Results**

Of the 122 students enrolled in both courses, 93 (76.2%) returned usable responses. The resulting data were analyzed using SPSS® version 20.0 for Windows™ computers. Using SPSS, new variables were created to represent the grand means of the reaction, agricultural literacy, and agricultural experience scores. The grand means of respondents’ agricultural literacy and agricultural experience scores were then re-coded into categorical variables with four levels (see Table 1).

Table 1  
*Category Labels for Recoded Categorical Variables*

Variable	Score Range	Label
Agricultural literacy level	1.00-2.00	Illiterate
	2.01-3.00	Somewhat illiterate
	3.01-4.00	Somewhat literate
	4.01-5.00	Literate
Agricultural experience level	1.00-2.00	Inexperienced
	2.01-3.00	Somewhat inexperienced
	3.01-4.00	Somewhat experienced
	4.01-5.00	Experienced

### Descriptive Statistics

Descriptive statistics were calculated on the continuous variables reaction score, agricultural literacy score, and agricultural experience score. The respondents reported an overall moderately negative reaction to the images presented in the survey instrument ( $M = 2.52$ ,  $SD = .55$ ). The grand mean of agricultural literacy scores indicated students considered themselves neither strongly literate nor illiterate ( $M = 3.38$ ,  $SD = 1.05$ ), with similar findings for agricultural experience ( $M = 3.35$ ,  $SD = 1.12$ ).

Frequencies were calculated for the categorical variables agricultural literacy level and agricultural experience level (see Tables 2 and 3). Self-assessed agricultural literacy was relatively evenly distributed among the four categories, though more than half (57.00%) rated themselves as at least somewhat knowledgeable about and aware of agricultural issues.

Table 2

*Frequency of Agricultural Literacy Scores by Literacy Level*

Category	Frequency	Percent	Cumulative Percent
Illiterate	21	22.60	22.60
Somewhat illiterate	19	20.40	43.00
Somewhat literate	27	29.00	72.00
Literate	26	28.00	100.00

The respondents were slightly more positive in their self-assessment of agricultural experience, with one-third of survey participants rating themselves as experienced in the agriculture sector, though a significant portion also reported that they were somewhat inexperienced.

Table 3

*Frequency of Agricultural Experience Scores by Experience Level*

Category	Frequency	Percent	Cumulative Percent
Inexperienced	15	16.10	16.10
Somewhat inexperienced	26	28.00	44.10
Somewhat experienced	21	22.60	66.70
Experienced	31	33.30	100.00

### Analysis of Variance (ANOVA)

Using the continuous variable reaction score and the categorical agricultural literacy and agricultural experience variables, the researchers conducted an analysis of variance to determine if differences existed among the levels of the categorical variables. The result of the Levene's test was not significant (.22), indicating that the assumptions of homogeneity were not violated. The results from the one-way ANOVAs are presented in Table 4.

Pairwise comparisons of reaction score resulted in no significant differences between the levels of agricultural literacy. For agricultural experience, however, pairwise comparisons discovered significant differences between respondents who rated themselves as "somewhat inexperienced" ( $M = 2.31$ ;  $SD = 0.42$ ) and those who rated themselves as "experienced" ( $M = 2.82$ ;  $SD = .62$ ). This slight but significant difference, nonetheless, failed to reach the 0.80 threshold for statistical power (.69), indicating that significant results could have been due to chance or error.



Table 4  
*One-Way Analysis of Variance for the Effects of Students' Self-Perceived Level of Agricultural Literacy and Agricultural Experience on Students' Reactions to News Images of Agriculture*

Scale	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>	$\eta^2$	1 - $\beta$
Level of Agricultural Literacy							
Between	3	6.64	2.12	8.80	< .001	.23	.99
Within	89	21.46	0.24				
Total	92	27.82					
Level of Agricultural Experience							
Between	3	5.33	1.78	7.03	< .001	.19	.98
Within	89	22.45	0.25				
Total	92						

**Regression Analysis**

To determine if either construct was a significant predictor of students' reaction scores, the grand mean for students' agricultural literacy score and the grand mean for students' agriculture experience score were used as independent variables in a stepwise regression analysis, where the primary variables of interest were regressed on the variable students' reaction score. The results indicated students' agricultural literacy score was a significant ( $p < .001$ ) predictor of students' reaction score ( $B = .251$ ;  $SE B = .048$ ;  $\beta = .477$ ;  $R^2 = .219$ ;  $\Delta R^2 = .227$ ).

**Conclusions**

The first research objective — to describe young people's reactions to images from agriculture-related television news stories — produced relatively predictable results. Overall, the 93 respondents reported largely negative responses to the images taken from the CBS Evening News broadcast about antibiotic use in livestock production agriculture. Whether intentional or not, the program's choice of visuals reflected negatively on animal production methods, even among those students who reported higher levels of agricultural literacy and experience in the food and fiber industry. This finding coincides with the results of framing and visual rhetoric studies that focus on the news media's tendency to shock audiences into belief or action (Allen, 1996; Finnegan, 2004; Olson, 2007).

Results for the second objective supported the use of the convenience sample of students in two agricultural communications and journalism courses. Students' self-reported agricultural literacy and agricultural experience scores trended toward the middle, and further investigation into the breakdown of students' self-assessments revealed they were relatively evenly distributed among the four levels of agricultural literacy and industry experience. This distribution allowed the researchers to investigate differences among these categorical groups, though a relatively small cell size may be a confounding factor necessitating further analysis with a larger sample of participants.

Objective 3 — identifying possible explanations for young people's reactions to agriculture-related television news stories — may be explicated by the results of the ANOVA and regression us-

ing the categorical variables level of agricultural literacy and level of agricultural experience and the continuous variable reaction score. The ANOVA demonstrated differences exist between reactions from students who assessed themselves as somewhat inexperienced and those who considered themselves experienced in the food and fiber industry. This finding may give credence to Alexander Pope's (1709) idiom that "a little learning is a dangerous thing," meaning those who lack substantial information about a subject may feel qualified to make judgments on that subject. In this case, students who have minimal experience in agriculture may make critical judgments about modern livestock production due to their limited exposure to that type of agricultural activity and preconceived attitudes and beliefs related to more traditional conceptualizations of agriculture, such as county fairs and small family farms.

The regression analysis, on the other hand, indicated a predictive linear relationship between students' perceived agricultural literacy and their reaction to the images from the broadcast news story. Based on the regression results, students who report higher levels of agricultural knowledge and awareness of and familiarity with agricultural issues will, on the whole, report more positive scores than those with lower levels of agricultural literacy. This finding supports the supposition that agricultural literacy influences individuals' perceptions of the U.S. food and fiber system (Hess & Trexler, 2011a).

### **Implications and Recommendations**

Based on the results of this study, agricultural literacy and experience have the potential to impact young people's reactions to negatively skewed visual material related to modern production agriculture. Within the context of this study, agricultural literacy was shown to be a successful predictor of respondent reaction, indicating increased literacy lessens the likelihood of audiences reacting with knee-jerk negativity toward news stories and images related to the food and fiber industry. This outcome corroborates the agriculture sector's belief in the power of agricultural literacy programs, such as Agriculture in the Classroom, being undertaken across the country (Lieszkovszky, 2012; Schulte, 2012). Given the plethora of information regarding the lack of agricultural literacy among the nation's youth (Balschweid, Thompson, & Cole, 1998; Hess & Trexler, 2011a; Hess & Trexler, 2011b; National Research Council, 1988; Terry, 2013), these programs should be continued and, when possible, expanded.

The study also revealed hands-on experience may influence students' reactions to pictorial news content associated with agriculture. Agricultural experience's association with reaction is somewhat problematic, eliciting the widest contrast of responses between those who believe themselves to be experienced and those who rank themselves as somewhat inexperienced. This dichotomy suggests those who have minimal experience with agriculture may be gaining their agrarian understanding from contexts that present agriculture in a more traditional manner, such as county fairs and livestock shows, and reveal little about the practices of large-scale modern production. These environments, therefore, should consider incorporating digital tours of production facilities and other educational visual aids to better familiarize visitors with the realities of today's agricultural methods. Agritourism may offer another solution: The United States Department of Agriculture (USDA) offers agritourism as a method of sustaining family farms while bringing in additional income with the added benefit of building relationships with consumers (Mahoney, Spotts, & Edwards, 1999). The agritourism model has been adopted by producers across the continent in efforts to boost profits and educate consumers (Brooks, 2012; Knill, 2012).

Because this study was limited in scope and scale, further research should be conducted to elucidate the impacts of agricultural literacy and experience on consumer perceptions of and attitudes toward agriculture. The researchers relied on student self-assessment to develop the independent variable agricultural literacy; a more comprehensive study could employ a knowledge-based test of agricultural topics and issues to determine respondents' literacy level. Survey items related to agricultural experience were broad and could be narrowed to better describe the types of industry-related activities in which respondents engage. Finally, the research should be expanded to other populations beyond the scope of this particular study to gauge the far-reaching effects of literacy and experience on consumer perceptions.

Though the study results are not generalizable beyond the population sampled, they provide additional evidence that audiences' knowledge of and familiarity with the food and fiber industry influences their perceptions of industry-related information in mass-mediated news contexts. For agricultural communicators, educators, and producers, this research may serve as a call to action to better inform the U.S. populace about its food and fiber system through formal education programs, industry-based communications efforts, and agritourism.

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