AGRICULTURAL LITERACY: AN ASSESSMENT OF RESEARCH STUDIES PUBLISHED WITHIN THE AGRICULTURAL EDUCATION PROFESSION

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Abstract

Spurred by the release of the 1988 report Understanding Agriculture: New Directions for Education, members of the agricultural education profession have been increasingly active in conducting research on agricultural literacy. The purpose of this study was to assess the research conducted in agricultural literacy through and review of the research designs, populations, research variables, and instrument design utilized. The results indicated that (1) non-experimental research methodology (both quantitative and qualitative) has been the dominate research typology utilized; (2) the majority of agricultural literacy research has examined populations in formal education settings including educators, students and administrators; (3) that knowledge of agriculture has been the variable most frequently measured; (4) that there is a lack of clarity as to how "perceptions," "opinions," and "concerns" are defined and measured: (5) changes in participant behavior as a result of agricultural literacy efforts are not a frequent measure; and (6) the majority of the research studies created a unique instrument to measure the variables examined. The researcher recommended (1) that more rigorous research designs be utilized future research efforts, (2) that the agricultural education profession should create a mechanism to facilitate agricultural literacy research collaboration, (3) that an agricultural literacy data collection instrument should be created through factor analysis procedures, (4) that more research is needed to examine changes in adult behavior that a result of agricultural literacy efforts, (5) that efforts to secure a multi-institutional national agricultural literacy research grant should be conducted, (6) that research is needed to determine if the current models of agricultural literacy are sufficient for individuals to understand the more complex issues, policies and technologies of today's agriculture industry, and (7) that agricultural literacy researchers should seek partnerships throughout the agriculture industry.

Introduction

With each successive generation removed from the agrarian environment, the general public's knowledge, attitudes and perceptions towards agriculture has seemingly degraded. The release of the 1988 report Understanding Agriculture: New Directions for Education (National Research Council) brought a great deal of clarity to the problem of agriculture illiteracy and the need for intervention throughout the educational system. The report also stated "achieving the goal of agricultural literacy will produce informed citizens able to participate in establishing the policies that will support a competitive agricultural industry in this country and abroad" (p. 2).

Since the release of the report Understanding Agriculture, agricultural education faculty and graduate students have been actively involved in a variety of research and intervention methods designed to close the literacy gap that exists between the agriculture industry and the general public. As recommended by the report, the majority of agricultural literacy efforts have focused on preparing teachers and infusing agricultural content throughout the public school educational curriculum. This approach is designed to utilize the American public education system to build an understanding of American agriculture through each successive year of education to the point where the efforts have resulted in an agriculturally-literate citizenry.

However, after 14 years of research and educational efforts, have we achieved the goal of agricultural literacy? A recent research report entitled *Sharing Knowledge* (Phillip Morris Companies, Inc., 1999) would seem to indicate that we have made very little progress in achieving an agriculturally-literate society. The report illustrated that the gap still exists between producers and consumers' understanding of production agriculture. Further, almost three-quarters of the consumers polled in this study rated agriculture's communications efforts as only fair or poor.

Concurrent to agricultural education's efforts in agricultural literacy, interest by the agriculture industry in risk communication to the general public has increased greatly in the past years. Ignited with the Alar controversy in the 1980s (which had a significant impact on apple producers and processors) and fueled with more recent controversies of BT corn and the Monarch butterfly, the use of genetically engineered corn (StarLink) in food items, and the mismanagement of research corn grown for pharmaceutical experiments have the media and the general public increasingly concerned about the safety of American agriculture products and the merits of further agricultural biotechnology development.

It is still important to understand the agricultural knowledge and opinions held by the general public (including educators) for a variety of reasons — voting and policy decisions; purchasing or non-purchasing decisions; education and career choices. It is also important for the agricultural education profession to reflect on the progress that has been made towards the goal of agricultural literacy, consider any "course corrections" that may be needed, and proceed towards the achievement of the goal with renewed vigor.

Purpose and Objectives

The purpose of this research was to examine the research conducted on agricultural literacy since the release of the report Understanding Agriculture: New Directions for Education (NRC, 1988).

The completion of this research would facilitate the achievement of the agricultural literacy goals of the agricultural education profession as well as the efforts of future agricultural literacy researchers. Specific objectives were:

1. Examine the research designs, populations, research variables, and instrument design utilized in research conducted since the release of the National Research Council report *Understanding Agriculture: New Directions for Education* (1988).

2. Utilize the results of this review of agricultural literacy research to propose future agricultural literacy research efforts by the agricultural education profession.

Procedures

Three primary data sources were used to examine agricultural literacy research conducted within the agricultural education profession. These included, (1) articles published in the *Journal of Agricultural Education (JAE)*, (2) papers presented at the *National Agricultural Education Research Conference (NAERC)* during 1989-2002, and (3) the *Summaries of Research and Development in Agricultural Literacy* (1999). JAE and NAERC were selected because they are the primary refereed outlets for published research by the members American Association for Agricultural Education (AAAE)[1]. The *Summaries of Research* was chosen as it represents AAAE's first attempt to identify all published works related to agricultural literacy.

Data was gathered from the *Journal of Agricultural Education* online on the AAAE website (http://aaaeonline.org) and verified through a manual search of print copies of JAE. All JAE articles published since 1988 (volumes 30-43) were included in the study. Data was gathered from NAERC proceedings from 1989-2002 (16^{th} – 29^{th} annual NAERC proceedings) and the *Summaries of Research and Development in Agricultural Literacy* manually. The search of all three data sources resulted in 473 possible research studies being identified. All possible research studies were reviewed in relation to the previously stated research objectives. Those articles that did not include a detailed description of the research designs, populations, research variables, and instrumentation utilized were not included in this study. In addition, the electronic search of *Journal of Agricultural Education* resulted in table of contents and volume indexes being "hits in the search and as such, were not included in this study.

Articles identified through the search procedures were also examined for possible publishing duplication of the same study in two different sources. When duplication was found, the study version that contained the most detailed research methodology was included for data analysis purposes. The data collection process resulted in 41 studies that were included for data analysis. Data were summarized using frequencies and percentages.

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[1] The American Association for Agricultural Education (AAAE) is an organization dedicated to the advancement of agricultural education in the United States. AAAE works toward improving the understanding of agricultural education by the American public and professional groups concerned with education. The Association maintains liaison and working relationships with such groups and provide support for programs designed to improve education in America.

Results

Research Designs

Utilizing Gall, Gall and Borg's research design descriptions (2003), the forty-one studies were sorted by research design. Over ninety percent (90.3%) of the studies conducted on agricultural literacy were non-experimental research designs (see Table 1). Within the non-experimental designs, quantitative research designs were utilized 89% of the time (n=33) with casual-comparative designs being reported in 17 of the studies or nearly 42% of all agricultural literacy studies. Three studies (7.3%) utilized quasi-experimental designs with two of the three studies utilizing a single group pre-test, post-test design. Only one study (2.4%) utilized an experimental design.

Table 1

Frequency of Research Designs Utilized in Agricultural Literacy Studies (n=41)

Research Design	Frequency	Percent
Experimental designs	1	2.4
Quasi-experimental designs	3	7.3
Non-experimental designs		
Quantitative		
Descriptive	11	26.8
Causal-Comparative	17	41.5
Correlational	5	12.2
Qualitative	3	7.3
Historical	1	2.4

Populations Studied

Of the populations included in agricultural literacy studies, non-agriculture teachers were most frequently examined. As shown in Table 2, fourteen studies (34.1%) included non-agriculture teachers who taught in either the elementary, middle or high schools. As for students, nine studies (22%) examined the agricultural literacy of elementary and middle school students. Populations not directly linked to formal educational settings were also studied including the media (7.3%) and other community adults (9.8%).

Further analysis of this data shows that the majority of the agricultural literacy research efforts have been focused on those involved in formal educational settings (see Figure 1). Twenty-four (59%) studies examined the agricultural literacy of educators while 21 studies (51%) examined students or youth (4-H). Seven studies (17%) examined the agricultural literacy of other adults not directly involved in formal education.

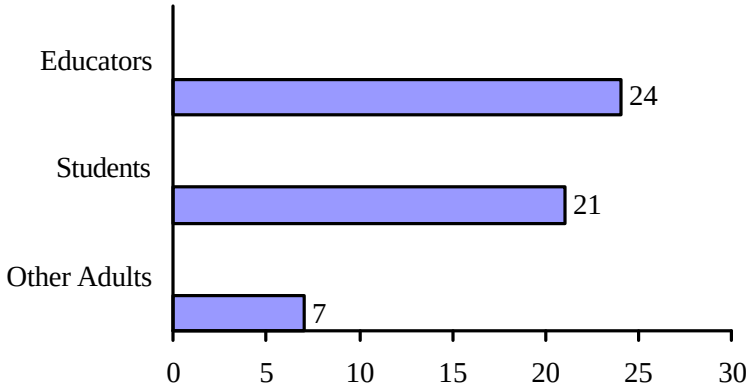
Table 2

Frequency of Populations Examined in Agricultural Literacy Studies (n=41)

Population Examined	Frequency	Percent
<u>Educators</u>		
Agriculture Teachers	6	14.6
Non-Agriculture Teachers (non-college)	14	34.1
College/University Faculty	2	4.9
Guidance Counselors & School Administrators	2	4.9
<u>Students/Youth</u>		
Pre-High School Students	9	22.0
High School Students	7	17.1
College Students	4	9.8
Other Community Youth (4-H)	1	2.4
<u>Other Adults</u>		
Media	3	7.3
Other Community Adults	4	9.8

Note. Several studies examined more than one population. As a result, table percentages will not total 100.

Figure 1



Populations Examined in Agricultural Literacy Studies

Note. Several studies examined more than one population. As a result, total does not equal to 41 (number of studies examined).

Variables Measured

Of the variables examined in agricultural literacy studies, knowledge and perceptions were the two variables most frequently studied. As shown in Table 3, twenty-five studies (61%) measured the agricultural knowledge level of the research participants. Twenty studies (49%) examined the participants' perceptions of agriculture. Eight studies (19.5%) examined behavioral changes that occurred after some form of agricultural literacy treatment. What was not clear from the findings is the difference between "perceptions," "concerns," and "opinions." Without an examination of the instruments utilized in the research studies, this researcher could not determine if these are three unique variables or if the same variable is being measured but labeled differently.

Data Collection Instrument Utilized

The majority of the research studies utilized an instrument designed by the researcher (see Table 4). Of the 41 studies, 26 (63.4%) created a new instrument to achieve the research objectives. Seven studies (17.1%) developed an instrument based on the 11 agricultural literacy concepts identified by Frick, Kahler and Miller (1990) while five other studies (12.2%) utilized instruments already developed by another researcher. Three studies utilized a Delphi methodology which resulted in unique instruments created through the Delphi process.

Table 3

Frequency of Variables Measured in Agricultural Literacy Studies (n=41)

Variables Measured	Frequency	Percent
Knowledge	25	61.0
Attitudes	8	19.5
Perceptions	20	48.8
Opinions	6	14.6
Concerns	1	2.4
Behaviors	8	19.5

Note. Several studies examined more than one variable. As a result, percentages will not total 100.

Table 4

Frequency of Data Collection Instrument Utilized in Agricultural Literacy Studies (n=41)

Variables Measured	Frequency	Percent
Designed By Researcher — no model cited	26	63.4
Designed By Researcher —based on Frick, Kahler & Miller (1990)	7	17.1
Utilized Instrument Previously Designed by Another Researcher	5	12.2
Delphi Study Utilized	3	7.3

Conclusions

Based on the results of this study, several conclusions have been made by this researcher.

1. Descriptive research methods has been the dominate research typology utilized by agricultural education researchers.

2. The majority of agricultural literacy research has examined populations in formal education settings including educators, students and administrators. Research has also been conducted on other adult populations outside of the formal education setting.

3. Knowledge of agriculture has been the variable most frequently measured in agricultural literacy research.

4. It is unclear from the results as to what differentiates "perceptions," "opinions," and "concerns" as measured variables.

5. Changes in participant behavior as a result of agricultural literacy efforts are not a frequent measure of agricultural education researchers.

6. The majority of the research studies created a unique instrument to measure the independent variables examined.

Recommendations, Discussion and Implications

Recommendation #1. Agricultural education researchers need to consider more rigorous research designs for future agricultural literacy research efforts.

Based on the results of this study, agricultural education has done a good job of describing agricultural literacy present within a variety of populations. What the profession has not done adequately is determine what agricultural literacy interventions (materials, in-service activities, etc.) are more effective at increasing agricultural literacy than other possible interventions. To achieve this requires the more frequent use of quasi-experimental and experimental designs. While these designs are more challenging to complete, it is a necessary next step for agricultural literacy research and subsequent educational efforts.

Where are the longitudinal designs? How do we know that changes in knowledge led to behavior changes? Do we know that the high school students studied in the early 1990s have more positive agriculture behaviors (purchasing decisions, voting decisions) as adults than those fellow students who were not exposed to agricultural literacy interventions? Perhaps the agriculture instruction they received was only kept in short-term memory and never resulted in a behavioral change. Do we know that the elementary teachers who received in-service agricultural literacy training are still thinking positively about integrating agriculture into their instruction? Are they even still integrating agriculture content? We simply don't know the answers to these questions and many more because no one seems to have followed a population over an extended period of time.

Recommendation #2. The agricultural education profession should create a mechanism for researchers to collaborate on agricultural literacy research.

The agricultural education profession has benefited greatly from the work of the Western Region Coordinating Committee for Agricultural Literacy in creating the *Summaries of Research and Development in Agricultural Literacy* (1999). While this is a great start, collaboration does not need to end with the creation of this document. The American Association for Agricultural Education (AAAE) should create a section on their web site dedicated to creating collaborative research efforts around various programmatic areas – agricultural literacy being one of them Within this site, all published reports and papers should be posted, regardless of postings in other locations. Imagine finding all research related to agricultural education's most important research areas in one location. Even in this electronic age, it is still difficult to secure copies of all studies on a topic. To advance the knowledge base of a research problem quickly requires an understanding of previous research efforts. The members of the profession need to make a commitment to share what is known and not rely on our previous behavior of letting future researchers "find" our work.

Recommendation #3. Agricultural literary researchers should create an agricultural literacy data collection instrument for the profession.

This study illustrated that at least 28 different instruments have been created to measure agricultural literacy. Further, researchers are measuring "perceptions," "opinions," and "concerns" without clearly defining what it is that they are measuring. Why do we continue to conduct research in a vacuum – disconnected from other researchers in agricultural education? We could speculate reasons but let's focus on solutions instead. Drawing upon the AAAE Annual Meeting presession, *Using Principal Components Analysis and Common Factor Analysis in Agricultural Educatio*n (Warmbrod, 2000), agricultural literacy researchers should collaborate to create an agricultural literacy data collection instrument for the agricultural education profession. This instrumentation would allow future researchers to focus their resources (especially time) on other aspects of their research study instead of instrument development. Further, a single instrument utilized by all researchers would facilitate meaningful comparisons of results and further enhance progress towards the goal of agricultural literacy.

Recommendation #4. More research needs to be conducted that examines changes in behavior as a result of agricultural literacy efforts.

Donald Kirkpatrick in his book Evaluating Training Programs (1998) outlined four evaluation levels – *Reaction*, *Learning*, *Behavior* and *Results*. The *Reaction* evaluation level measures how those who participated in the program reacted to it. This measure of "customer satisfaction" often evaluates satisfaction with the program, content, presenter(s) and the logistics of the training. The *Learning* evaluation level can be defined as the extent to which participants change attitudes, improve knowledge, and/or increase skill as a result of attending the program. The *Behavior* evaluation level can be defined as the extent to which change in behavior has occurred because the participant attended the training. The fourth level, *Results*, can be defined as the final results that occurred because participants attended the program. In business, these results

can include increased production, improved quality, decreased costs, reduced turnover and higher profits.

The majority of research efforts to-date could be categorized as either *Reaction* (Level 1) or *Learning* (Level 2). To achieve the true essence of Understanding Agriculture's statement of "achieving the goal of agricultural literacy will produce informed citizens able to participate in establishing the policies that will support a competitive agricultural industry in this country and abroad" (p.2) requires research and evaluation efforts focused on positive changes in behavior (Level 3) and progress made towards the goal of national agricultural literacy (Level 4).

Recommendation #5. Agricultural literacy researchers should collaborate to secure a large research grant through national sources such as the National Science Foundation or USDA's National Research Initiative.

Recently, a group of university-level agricultural educators have collaborated to submit a multi-institutional proposal to the National Science Foundation to examine math and science achievement and agricultural education. This effort is a wonderful model for the profession to follow with other research areas including agricultural literacy.

Recommendation #6. Research is needed to determine if the current models of agricultural literacy are sufficient for individuals to understand more complex agriculture-related issues, policies and technologies.

The growth of agricultural biotechnologies has also come with problems, especially visible in genetically engineered foods. The controversy over genetically engineered food in Europe and more recently in the U.S. has prompted many agricultural educators and scientists to begin engaging in more open dialogue with the public in order to provide education as to the safety and benefits of this new technology (Lundy, Irani, Riscketts, Eubanks, Rudd, Gallo-Meagher and Fulford, 2002).

In the agriculture industry, the importance of effectively communicating the benefits and risks of emerging biotechnologies is becoming a major priority. Recent national coverage of agriculture topics, such as BSE (mad cow disease) and emerging biotechnologies (such as bovine somatotropin or BST) has escalated concerns among consumers and media about the safety of the U.S. food supply. In a study by the International Food Information Council (IFIC, 2000), media reported more on the harms of biotechnology in 2001 than in 1999 by an increase of 20 percent. Biotechnology is only one field of agriculture that could benefit from additional agricultural literacy research efforts. Disposal of animal waste, pesticide residue, and water consumption for agricultural production practices are just a few other areas that are complex issues.

Recently Oregon voters decided against labeling their food for possible genetically engineered ingredients. While it would be easy to assume that the voters understood the negative impact this could have on agriculture and thus voted no, press reports of polls conducted indicate that the reason was more likely a "fear" of the cost to them personally to implement such a measure than it was an informed decision on the benefits and risks of genetic engineering. Political

scientists will add that this type of voter reaction is common in a down economy (vote "NO" on anything that cost me money).

The agriculture issues that are coming before legislators and the general public are complex and the decisions made will impact the future of the agriculture industry. While the agricultural education profession continues its efforts to create an agricultural literate society, we need to know if our intervention efforts are targeting too elementary of a level to impact these more complex issues.

In addition, we need to better understand how to create effective educational and informational messages that help the public understand these complex agriculture issues. Several risk communication models have been developed in recent years. One way of thinking about risk is to consider the relationship between potential hazard and the level of public outrage it might generate. Much of Sandman's (1993) work is anchored in the formula RISK = HAZARD + OUTRAGE. Do we know what aspects of today's agriculture industry upset the general consumer? How would knowing this alter our agricultural literacy efforts?

Hutcheson (1999) stated that there are additional factors creating increased interest in agriculture technologies, problems and issues. They are (1) the passage of right-to-know laws related to exposure to agricultural and environmental risk agents; (2) increased public fear and concern about exposure to these agents and the corresponding demand for risk information; (3) increased number of media reports focused on agricultural and environmental issues and (4) (underlies the first three) the loss of trust in government and industry as credible sources of information about agricultural and environmental risks. Within these four factors are variables such as learner motivation, affective or emotional behaviors and trust of the message source that have yet to be included in agricultural literacy efforts.

Recommendation #7. Agricultural literacy researchers need to seek partnerships with the agriculture industry.

There are many efforts related to the topic of agricultural literacy that are being conducted by groups outside of the agricultural education profession. Here are two examples.

Since 1994, Cotton Incorporated's advertising research effort called Lifestyle Monitor™ has conducted telephone research to gather consumer attitudinal information for targeted marketing and advertising. Interviewing over 4,000 U.S. consumers between the ages of 16 and 70, the program seeks to find which groups in America are 'most susceptible to the cotton message' (Reddick, 2002). One important finding from the Lifestyle Monitor program is the role of cotton and fabrics during "trigger events" in a person's life. This refers to series of important events in peoples' lives, such as moving away from home for the first time, doing the first load of laundry, getting married and having children. The examination of "trigger events" may be compared what in agricultural education has been called the "teachable moment."

The Pew Initiative on Food and Biotechnology was established in 2000 to be an independent and objective source of credible information on agricultural biotechnology for the public, media and policymakers. A recent telephone survey of 1001 American consumers conducted by the Mellman Group and Public Opinion Strategies for the Pew Initiative found that consumers are

concerned about the products produced by agricultural biotechnology, but limited knowledge about GM foods makes their views uncertain and malleable. The majority of Americans have heard very little about GM foods and are uncertain of what to think about its safety, despite (or perhaps due to) having received little information about genetic modification. The public's uncertainty is coupled by a desire to have more information available to them about GM foods and opposition to the introduction of GM foods to the U.S. food supply. However, they remain extremely supportive of continued research into GM foods and look toward the regulatory agencies (primarily FDA and EPA) to provide them with accurate and trustworthy information (Mellman Group, 2001). Research on a complex issue in agriculture, related to agricultural literacy research, and conducted by someone outside of the agricultural education profession.

Agricultural education has realized a "good start" on achieving the goal of an agricultural literate society. However, a good "pre-season" record does not ensure that a team wins the championship at the end of the year. Research efforts by agricultural educators on the topic of agricultural literacy must advance in both research design and collaboration if the goals of agricultural literacy are to be realized

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