

AGRICULTURAL LITERACY OF MISSOURI SECONDARY SCHOOL EDUCATORS

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Abstract

The purpose of this study was to assess secondary educators' knowledge of and attitude toward agriculture. The population consisted of teachers and administrators in 245 secondary schools in Missouri that offered an Agricultural Education program as part of the curriculum. The sample consisted of 200 randomly selected schools and a cohort group of educators representing: administrators, agriculture teachers, language arts teachers, mathematics teachers, science teachers, and social science teachers. Data collection instruments included 35 items to assess respondents' knowledge of agriculture and 35 items to assess their attitude toward agriculture. Usable responses were collected from 616 educators representing 146 schools. Data analysis revealed that agriculture teachers were the most knowledgeable and had the most positive attitude toward agriculture. Language arts and mathematics teachers were the least knowledgeable and had the least positive attitude toward agriculture. However, each of the educator groups surveyed were judged to be knowledgeable of and had a positive attitude toward the industry of agriculture. Based on the findings of this study, it was recommended that pre-service and in-service programs be conducted to promote strategies to integrate agricultural concepts and illustrations into other courses in the secondary school curriculum.

Agriculture has always been very important in the United States. United States agriculture has fed, clothed, and provided building materials for millions of Americans and many residents of other countries. Although America also has the lowest per capita food cost of any country in the world; much of the general public is unaware of where and how their food was produced (National Research Council, 1988). With each passing generation, this country has become one step further removed from direct ties to production agriculture (Flood & Elliot, 1994). This sociological shift has resulted in a modification of the policies which affect agriculture. Furthermore, there has been increased interest in developing policies related to the environment and resource use (e.g. land, water, fertilizer, fossil fuels, etc.) that may be detrimental to agriculture and food production in the future (Brown & Kane, 1994; Bracewell & Warner, 1994). For example, Erwin (1993, p. 66-67) noted that in the Environmental

Protection Agency "many fine, conscientious government employees were writing regulations for farmers while they themselves did not understand agriculture."

According to the National Research Council (1988), the consuming public lacks an understanding of the importance of agricultural policies including price supports, conservation programs, and export programs that affect the supply and cost of agricultural products. One factor that contributes to the lack of understanding is that agriculture has not been included as part of the total educational experience. The National Research Council (1988) reported that agriculture was not taught in elementary schools and has been segregated into vocational agriculture courses at the secondary level. Caulder (1991) also reported that agriculture was only being taught in public schools through secondary vocational agriculture courses.

Caulder noted that education about agriculture was too important and should be provided for all students, not only those enrolled in vocational agriculture courses. The National Research Council (1988) substantiated that view by suggesting that:

Beginning in kindergarten and continuing through twelfth grade, all students should receive some systematic instruction about agriculture. Much of this instruction should be incorporated into existing courses rather than taught in separate courses (p. 2).

Law (1990) suggested that secondary educators in history, social science, mathematics, language arts, and fine arts taught subjects which were linked to agriculture and could provide a context for infusing instruction about agriculture. Russell, et al., agreed that agricultural examples could be presented in the context of instruction in mathematics, reading, science, and social science. A review of literature revealed that educators judged to hold the most potential for integrating instruction about agriculture included: secondary building administrators; and teachers of agriculture, language arts, mathematics, science, and social science (Hammonds, 1950; Russell, McCracken, & Miller, 1990; Mabie & Baker, 1994; Leising & Helm, 1995)

In order to promote effective learning strategies however; educators must be knowledgeable of the subjects and concepts they teach (Holmes Group, 1986). Many educators draw heavily on their background and experience as a context for teaching. The experiences of educators directly influences the information that is taught and how it is presented to students (Humphrey, Stewart, & Linhardt, 1994).

Educators who lack a background in agriculture may be reluctant to incorporate instruction about agriculture into their curricula. In-service training

may be necessary to prepare educators who are willing to integrate instruction about agriculture. Before in-service training is prescribed, however; the knowledge and attitude levels of teachers regarding agriculture should be assessed (Terry, Herring, & Larke, 1992). Differences between and among educator groups may reveal differing needs for in-service training. Hoban and Kendall (1993) also suggested the need for research prior to designing educational programs and public policies related to the utilization of biotechnology in agriculture. They stated that "Public attitudes and knowledge must be researched, understood, and considered before developing educational programs" (p. 74).

Therefore, the central problem of this study was to assess secondary educators' knowledge of and attitude toward the industry of agriculture. A secondary problem was related to the need to determine if differences existed among educator groups regarding their knowledge of and attitude toward the industry of agriculture.

Purpose

The central purpose of this study was to assess secondary educators' knowledge of and attitude toward agriculture. The following research questions were addressed:

1. What is the knowledge level of secondary educators about agriculture?
2. What is the attitude of secondary educators toward the industry of agriculture?
3. Is there a difference in the knowledge of agriculture among secondary administrators and teachers of language arts, mathematics, science, social studies, and agriculture
4. Is there a difference in the attitude toward agriculture among secondary administrators and

teachers of language arts, mathematics, science, social studies, and agriculture?

The independent variable used to classify respondent groups for this study was the position of the educators included in the sample. The dependent variables were the mean knowledge scores and mean attitude scores which were computed from responses to items included on the data collection instrument.

Two hypotheses were tested to determine if there were significant differences in the mean knowledge and attitude scores among the six educator groups. The null hypotheses were stated as follows:

HO₁: There is no significant difference in the mean agricultural knowledge scores among: (a) agriculture teachers; (b) language arts teachers; (c) mathematics teachers; (d) science teachers; (e) social science teachers; and (f) secondary school administrators.

HO₂: There is no significant difference in the mean attitude toward agriculture scores among: (a) agriculture teachers; (b) language arts teachers; (c) mathematics teachers; (d) science teachers; (e) social science teachers; and (f) secondary administrators in schools offering secondary agricultural education programs in Missouri.

Procedures

The target population for this study included educators employed by Missouri secondary schools offering an agricultural education program. The population included 245 schools listed in the 1991-1992 Missouri Vocational Agriculture Directory (Missouri Department of Elementary and Secondary

Education, 1991). Individual members of the population included all: (a) agriculture teachers; (b) language arts teachers; (c) mathematics teachers; (d) science teachers; (e) social science teachers; and (f) secondary school administrators.

The sample for this study included clusters of teachers from 200 randomly selected schools in Missouri. Cluster sampling, as described by McMillan and Schumacher (1989), was used for this study since it allowed for the selection of subjects from naturally occurring groups (i.e. schools). The head agriculture teacher at each school was asked to select the lead teacher/administrator from each of the five educator groups specified in the study.

The data collection instrument was designed by Agricultural Education faculty and graduate students at the University of Missouri-Columbia. The instrument was based upon the agricultural literacy concept areas identified by Frick (1991). The instrument consisted of three sections including knowledge statements, attitude statements, and demographic information about the respondents.

The knowledge section contained 35 statements which required respondents to record answers of True, False, or Don't Know. Correct responses (whether True or False) received a score of 1 and incorrect responses received a score of zero. A response of "Don't Know" also received a zero for scoring purposes. True/false items were used to assess respondent knowledge at the lowest cognitive level. The attitude section contained 35 statements which directed respondents to use a five point Likert-type agree/disagree scale to record their responses. There were 16 demographic questions included in the instrument. Instrument reliability was assessed by computing a Kuder-Richardson 20 for the knowledge section and a Cronbach's alpha coefficient for the attitude section. The face validity of the instrument was assessed by a panel of faculty with expertise in agricultural literacy from Lincoln

University, Michigan State University, Purdue University, and the University of Missouri.

The instrument was pilot tested in four sections of a college-level "World Food and Society" course at Southeast Missouri State University. The KR-20 coefficient for the knowledge section was .85 and for the attitude section a coefficient alpha of .90 was computed using the data collected in the pilot test.

The researcher mailed instruments and cover letters to the head agriculture teacher for distribution at each of the selected schools. Two follow-up contacts were conducted to increase the response rate. Data were collected on computer scored answer sheets and transferred to a data file by the Center for Educational Assessment at the University of Missouri-Columbia. Descriptive statistics were computed to summarize the data for research questions one and two.

Research questions three and four were restated into null hypotheses for statistical analysis. The null hypotheses were tested using an a priori alpha level of .05. HO_1 and HO_2 were tested using multivariate analysis of variance (MANOVA), followed by analysis of variance (ANOVA). ANOVA was used to determine if mean differences existed among the respondent groups. Fisher's Least Significant Difference post hoc test was employed to determine where differences occurred among the respondent groups.

Non-respondent error was a factor that the researcher was unable to control or to measure in this study. Therefore, the results and conclusions must be limited to the respondents who provided the data for analysis and should not be generalized to the target population.

Findings

Data collection instruments were received from educators representing 146 (73%) of the 200 schools included in the sample. Six hundred and sixteen (of the 1200 possible educators) returned usable responses which were included in the data set for analysis. The respondents were predominately white (96.8%) and male (59.2%).

Descriptive statistics revealed (see Table 1) that mean knowledge scores ranged from a high of 31.59 (93%) for the agriculture teacher group to a low of 28.04 (82%) for the language arts teacher group. The maximum possible score was 34 (note: one item was omitted from the original 35 knowledge items). Mean attitude scores ranged from a high of 142.41 (average scale value of 4.07) for agriculture teachers, to a low of 128.72 (average scale value of 3.68) for language arts and mathematics teachers. Higher scores were indicative of more positive attitudes with a maximum possible score of 170. Attitude scores were computed as summed responses of 34 items (one item was omitted from the original 35 attitude items) to reflect the cumulative nature of the construct.

The use of MANOVA followed by ANOVA revealed statistically significant differences in the mean agricultural knowledge scores among the educator groups (see Table 2). Therefore the first null hypothesis was rejected. The Fisher's LSD test (see Table 3) revealed that agriculture teachers produced higher mean knowledge scores than each of the other educator groups. Mathematics and language arts teachers scored lower than each of the other educator groups, but did not differ from each other.

The second MANOVA procedure (also followed by ANOVA) revealed statistically significant differences among the educator groups' attitude toward agriculture mean scores (see Table 4). Therefore, the second null hypothesis was

Table 1. Mean Knowledge and Attitude Scores of Secondary Educators

Educator group	n	Knowledge ^a		Attitude ^b	
		Mean	SD	Mean	SD
Administrators	91	<u>29.659</u>	2.705	<u>131.736</u>	10.561
Agriculture	83	<u>31.590</u>	1.848	<u>142.410</u>	9.300
Language Arts	120	<u>28.042</u>	3.339	<u>128.717</u>	11.270
Mathematics	113	<u>28.212</u>	3.619	<u>128.717</u>	10.577
Science	107	<u>29.673</u>	2.218	<u>129.879</u>	9.422
Social Science	102	<u>29.225</u>	2.978	<u>131.451</u>	9.729
Total	616	<u>29.269</u>	3.107	<u>131.662</u>	11.094

^aThe maximum score on the knowledge portion was 34 and the minimum score was 0.

^bThe most positive attitude score possible was 170, and the most negative attitude score possible was 34.*

rejected. The Fisher's LSD post hoc test (see Table 5) revealed the agriculture teacher group had a more positive attitude score than the other educator groups in the study. Language arts teachers were less positive about agriculture than social science teachers. Language arts and mathematics teachers were also less positive about agriculture than the administrator group.

After analyzing the data collected in this study, the following major findings were observed:

1. Each educator group scored over 80 percent on the knowledge instrument.
2. Agriculture teachers were more knowledgeable about agriculture and had a more positive

attitude toward the industry of agriculture than other educator groups.

3. Language arts and mathematics teachers were less knowledgeable and had a less positive attitude toward the industry of agriculture than the other educator groups.

Conclusions/Implications

The educator groups in this study were knowledgeable of and had a positive attitude toward the industry of agriculture. Although there were statistically significant differences observed among the educator groups; the differences were not of practical significance. These educators are

Table 2. ANOVA for Knowledge Scores by Respondent Group

Source	df	F	p
Main effect (group)	5	18.61	.0001*
Error	610		
Total	615		

MANOVA test result for H_{01} : No group effect, Pillai's Trace = 0.216, $F = 14.77$, $p < .0001$.

potential candidates for integrating agricultural concepts and illustrations into the lessons they teach. Since their agricultural knowledge and their attitude toward the industry of agriculture did not appear to be a major barrier, secondary educators should be encouraged to incorporate agricultural concepts and illustrations to increase the level of agricultural literacy among the next generation of citizens in this country.

The relatively high knowledge scores and positive attitude scores might be explained by the homogenous nature of the respondents. It should be noted that schools included in this study were predominately rural schools that offered an Agricultural Education programs as part of the curriculum. Wright, Stewart and Birkenholz (1994) reported that eleventh grade students from schools with Agricultural Education programs were more knowledgeable about agriculture than students from schools that did not offer Agricultural Education.

Therefore the educators' knowledge about agriculture may have been a function of the local agricultural education program, the rural location of the school (Frick, Birkenholz, & Machtmes, 1995), or the educational background of the respondents.

Another plausible explanation why respondents may have produced relatively high scores on the knowledge instrument could be that the questions on the survey were not sufficiently difficult to discriminate among respondent groups. Although the instrument appeared to have sufficient discriminating power with the pilot test of college students from heterogenous backgrounds; the more homogeneous and highly-educated respondents in this study may have produced a "ceiling effect" associated with the knowledge section of the instrument. Additional and more difficult questions may be needed to enhance the discriminating power of the instrument. Also, the use of true/false questions limited the instrument to a measure of respondent knowledge at the lowest level of cognition. Higher levels of cognition should be assessed in future studies.

The finding that agriculture teachers had higher knowledge scores and more positive attitude scores was not surprising. It was expected that agriculture teachers should perform better on agricultural knowledge and attitude assessment surveys due to their educational background and interest in the

Table 3. Fisher's Least Significant Difference Test Among Respondent Groups for Knowledge Scores

Educator group		<u>M</u>	Groups				
			B	C	D	E	F
A.	Agriculture	31.590	.0001*	.0001*	.0001*	.0001*	.0001*
B.	Lang. Arts	28.042		.6541	.0001*	.0026*	.0001*
C.	Math	28.212			.0002*	.0109*	.0004*
D.	Science	29.673				.2663	.9739
E.	Soc. Sci.	29.225					.3008
F.	Admin.	29.659					

*Significant at the .05 level.

Table 4. ANOVA for Attitude Scores by Respondent Group

Source	df	F	p
Main effect (group)	5	22.88	.0001*
Error	610		
Total	615		

MANOVA test result for H_0 : No group effect, Pillai's Trace = 0.216, $F = 14.77$, $p < .0001$.

subject. Their higher knowledge levels and more positive attitude levels support the use of agriculture teachers as consultants, to aid in the integration of agriculture concepts and illustrations in other areas of secondary school curriculum (Birkenholz, et al., 1992).

This study revealed that language arts and mathematics teachers were significantly different from the other educator groups regarding their knowledge of agriculture. Although the difference was statistically significant, there appeared to be little difference on a practical basis. Although technical agriculture courses are not recommended as a part of the pre-service teacher education curriculum; participation in a course focusing on the integration of agricultural concepts in language arts and mathematics may be beneficial. Promoting the integration of agricultural examples may provide these educators with the incentive to incorporate practical applications involving agriculture into their instructional programs.

Educator groups surveyed in this study were knowledgeable about agriculture and had a positive attitude toward agriculture. This finding provides evidence of the potential for expanding the agricultural literacy initiative throughout other courses in the secondary school curriculum. Although these teachers revealed a positive attitude toward the industry of agriculture; that feeling may not have translated into a felt need to adjust their curriculum to incorporate the teaching of agricultural concepts in their lessons. Additional

research is needed to assess the receptivity of teachers regarding the integration of agricultural concepts and examples in their teaching.

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Table 5. Fisher's Least Significant Difference Test Among Respondent Groups for Attitude Scores

Educator group	M	Groups				
		B	C	D	E	F
A. Agriculture	142.410	.0001*	.0001*	.0001*	.0001*	.0001*
B. Lang. Arts	128.717		.9999	.3930	.0475*	.0340*
C. Math	128.717			.3999	.0506	.0364*
D. Science	129.879				.2667	.2030
E. Soc. Sci.	131.451					.8466
F. Admin.	131.736					

*Significant at the .05 level.

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