Selected College Students' Knowledge and Perceptions of Biotechnology Issues Reported in the Mass Media

Gary J. Wingenbach
Tracy A. Rutherford
Deborah W. Dunsford

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Selected College Students' Knowledge and Perceptions of Biotechnology Issues Reported in the Mass Media

Abstract
The purpose of this study was to determine college students’ awareness of and attitudes toward biotechnology issues reported in the mass media. Future agricultural communicators (N = 330) representing 11 land-grant universities in 10 states recorded their knowledge and perceptions of biotechnology issues as reported in the mass media. Respondents were mostly seniors (46%), female (55%), and considered themselves "average students (60%). Students achieved only 30% correct responses (M = 3.05) in a knowledge assessment of biotechnology practices, illustrating a lack of knowledge. However, nearly 84% of the respondents perceived their level of knowledge as average to high (24% perceived they possessed above-average scientific knowledge). Future agricultural communicators were somewhat accepting of biotechnology practices for genetically modified organisms involving plant life (M = 3.28), but viewed these same practices as somewhat unacceptable for use on humans (M = 1.84). Significant, low positive relationships existed between respondents’ perceived and assessed levels of biotechnology knowledge (r = .17) and between their assessed knowledge and acceptance of biotechnology practices (r = .16). Selected college students in the agricultural sciences have much less knowledge about biotechnology practices than what they believed to possess. Although correctable through increased study of biotechnology, this finding may pose serious problems for students choosing to "communicate" the science of biotechnology issues in the mass media. Agricultural communications faculty nationwide should analyze their curricula to determine if students are being given the opportunity to study biotechnology issues while learning how to communicate it to a larger audience.

This research is available in Journal of Applied Communications: https://newprairiepress.org/jac/vol86/iss3/1
In further analysis, chi-square testing showed that there is no significant relationship between farmers’ perception of the informative role of a program and the program type ($X^2 = 0.043; P>0.05$). This implies that TV was perceived just as positively in terms of overall value as radio. Hence, either of the programs can be effectively used to disseminate agricultural information to farmers. Since the audience largely overlaps, and since radio as a medium is cheaper to produce, it should continue to receive emphasis. However, results show that many farmers are also watching the TV program.

Conclusions and Recommendations

The study was designed to investigate farmers’ perceptions of the informative roles of AgbeloBa radio and Ejekaroko TV programs transmitted by the Broadcasting Corporation of Oyo State. Results show that farmers do receive these programs on their radio and television, and that they perceive that both of the programs have substantial value in terms of relevant agricultural information. These positive results hold across demographic groups (age, marital status, etc.) although there is slightly less satisfaction by those in the lowest educational group. Therefore, it is suggested that the information and presentation components of the two programs be maintained.

Since audience members also rated advertising positively, more effort should be made to recruit additional advertising for the program. Advertising offers substantial opportunities for generating additional needed funding for the programs, and as long as it does not interfere with program benefits, it should be encouraged.

Finally, research should also continue to investigate or assess agricultural programs on various media channels in Nigeria and other developing countries to ensure that information dissemination is not hindered. Such assessment should be based on message content and farmers’ utilization for income generation and subsequent household food security and poverty reduction.

Abstract

The purpose of this study was to determine college students’ awareness of and attitudes toward biotechnology issues reported in the mass media. Future agricultural communicators (N = 330) representing 11 land-grant universities in 10 states recorded their knowledge and perceptions of biotechnology issues as reported in the mass media. Respondents were mostly seniors (46%), female (55%), and considered themselves "B" average students (60%). Students achieved only 30% correct responses (M = 3.05) in a knowledge assessment of biotechnology practices, illustrating a lack of knowledge. However, nearly 84% of the respondents perceived their level of knowledge as average to high (24% perceived they possessed above-average scientific knowledge). Future agricultural communicators were somewhat accepting of biotechnology practices for genetically modified organisms involving plant life (M = 3.28), but viewed these same practices as
somewhat unacceptable for use on humans (M = 1.84). Significant, low positive relationships existed between respondents’ perceived and assessed levels of biotechnology knowledge (r = .17) and between their assessed knowledge and acceptance of biotechnology practices (r = .16). Selected college students in the agricultural sciences have much less knowledge about biotechnology practices than what they believed to possess. Although correctable through increased study of biotechnology, this finding may pose serious problems for students choosing to “communicate” the science of biotechnology issues in the mass media. Agricultural communications faculty nationwide should analyze their curricula to determine if students are being given the opportunity to study biotechnology issues while learning how to communicate it to a larger audience.

Introduction

Biotechnology is a hot topic in the media. However, agricultural communicators often struggle to translate information from scientists about biotechnological breakthroughs into terms the public can understand. This struggle, which may be seen as an information and education gap, may be caused by communicators’ lack of understanding the “technical” science behind biotechnology issues, or the public’s lack of scientific knowledge in general. The results of this struggle are frequently disappointing for communicators and scientists. Communications researchers, media critics, communicators, and scientists encourage improved education in this area. But whom do we educate and when? College of agriculture students who will be future agricultural communicators and scientists are an obvious audience.

Theoretical Framework

The study of biotechnology and public perceptions is not new, nor is the controversy about biotechnology. As early as 1989, Hoban noted the potential importance of biotechnology, and the importance of communication channels in educating

| Item | Mean Score |
|------|-------------|
| 1 +  | Constant listening to Agbeloba (farmers are kings) on radio contributes to farm productivity. 4.89 |
| 2 +  | Watching Ejekaroko (let’s go farming) on television provides relevant and current farm information. 4.85 |
| 3 +  | Agricultural information content of the farm broadcasts Agbeloba and Ejekaroko are easy to utilize at the farm level. 4.92 |
| 4 -  | No new farming techniques are learned from either Agbeloba or Ejekaroko. 4.94 |
| 5 -  | Television farm broadcasts in the form of Ejekaroko are useful for only elite farmers. 4.56 |
| 6 -  | Agbeloba radio farm programs cannot lead to easy adoption of new practices by nonliterate farmers. 4.81 |
| 7 +  | A farmer’s religion does not influence listening to Agbeloba or Ejekaroko. 4.88 |
| 8 -  | Farmers’ social and economic attainment in the community determines which farm program they listen to or watch. 4.83 |
| 9 +  | Musical interludes in Agbeloba and Ejekaroko motivate the listening and viewing patterns of a farm and use of information obtained. 4.70 |
| 10 - | Advertisements and jingles played during Agbeloba and Ejekaroko farm programs interfere with the smooth running and understanding of the information content. 4.57 |
| 11 + | A farmer is easily convinced to adopt a recommended innovation in both livestock and crop enterprises from listening to Agbeloba or watching Ejekaroko. 4.95 |
| 12 - | To obtain relevant information from Agbeloba and Ejekaroko is expensive and time consuming. 4.83 |

Overall Mean Score for all 12 items 4.81

* Items were rated on a five-point Likert scale with “strongly agree” coded 5 and “strongly disagree” coded 1. Negatively phrased items were reversed so that higher mean scores represent favorable assessments across the 12 dimensions.
agricultural producers about these new technologies. Hoban stated "biotechnology has already generated controversy over ethical issues and environmental release of genetically altered organisms" (Conclusion section, para. 2). Reiners and Roth (1989) conducted a study of public perceptions, suggesting general public support for biotechnology practices, but with early signs of concern.

Public concern about the implications of food biotechnology may not necessarily be caused by a lack of information. A variety of research-based sources on biotechnology is readily available. Examples include the Comparative Environmental Impacts of Biotechnology-derived and Traditional Soybean, Corn, and Cotton Crops (Carpenter et. al., 2002) or Evaluation of the U.S. Regulatory Process for Crops Developed through Biotechnology (Chassy et. al., 2001), both available online through the Council for Agricultural Science and Technology. However, while easy to access, these documents, and most others on biotechnology, are not easily understood by the public. Also, these Internet sources would not serve members of the public who lack Internet access. Hagedorn and Allender-Hagedorn (1995) noted unsympathic scientific responses to public concerns about biotechnology. The authors found that the scientists' responses offered were “often incomprehensible to the majority of citizens” (Hagedorn & Allender-Hagedorn, 1995).

An incomprehensible response from scientists working in biotechnology leaves the mass media as most consumers’ major source of information on the subject (Hoban, 1999 & 2002). Hagedorn and Allender-Hagedorn (1995) point to the media as a key partner in developing public awareness and perceptions of biotechnology. The media tends to focus on sensational news stories, or to squeeze stories into a sound-bite format (Hoban, 2002). Thus, the public hears only part of the story and that part tends to arouse concern. However, even with the stories that are reported, studies indicate that many people feel they do not have sufficient information about biotechnology (Hoban, 2002; Einsiedel & Thorne, 1999).

The public's perceived lack of information complicates the National Academy of Science's desire for a public that understands the basics of biotechnology and its implications to personal and public health (Armstrong, 2000). Chappell and

Perceptions of the Informative Value of the Programs

Each farmer was asked to rate the two programs across 12 dimensions. Half of the items were negatively worded and the other half positively worded. As shown in Table 3, items 1 and 6 focused only on perceptions about the radio program Agbeloba. Items 2 and 5 focused only on perceptions about the TV program Ejekaroko. The other items asked farmers to provide perceptions about both programs. Results show that the two programs are highly valued across all 12 dimensions, with an overall mean of 4.81 (out of a maximum of 5.0) for the 12 items (with negative item scoring reversed). Advertising (Item 10) was least valued, but even it received a relatively high score. Almost 60 percent strongly disagreed that advertising interfered with program content and understanding. The use of musical interludes (Item 9), which is common across agricultural programs, was also positively evaluated. Item 7, which concerns religious differences, demonstrates that despite religious unrest in Nigeria, at least in farming it is perceived that a farmer of any religious orientation can benefit from these programs. Despite the fact that one quarter of farmers do not view the TV program regularly, they perceive that it is quite valuable as a source of information. Thus, it is likely that access to television, or other barriers not addressed in this study, may be restricting viewership rather than any negative judgment about content. Measures of perception of information quality and its ability to teach new farming techniques indicate high agreement that the programs are beneficial to farmers.

Analysis was also conducted to assess whether perceptions of value for the two programs varied by gender, age, education or leadership status. Results showed that positive assessments of the two programs were not influenced by these demographic characteristics. In all of the demographic classifications considered (male/female; age less than 30/age greater than 30, etc.), more than 90 percent of the respondents gave an overall favorable rating for the two programs.
Hartz (1998) surveyed 2,000 journalists and 2,000 scientists to determine how the two groups felt about each other. Neither group believed the media was doing a good job of explaining science to the public. The authors suggested that both groups would benefit from more skills training—scientists need more communications skills, and journalists need more science skills (Chappell & Hartz, 1998). Helping college students acquire skills in communications and science is critical to educating the public on biotechnology.

Vestal and Briers' (1999) study of 88 journalists representing 65 of the nation’s largest metropolitan newspapers found that journalists’ knowledge of food biotechnology was relatively low. Of the study’s respondents, 92% indicated that they were “aware” or “somewhat aware” of how biotechnology affects their food, health, and environment. Respondents’ attitudes toward food biotechnology indicated that the group believed genetic modification of humans was the least acceptable use of biotechnology, followed by genetic modification of animals as “highly” or “somewhat unacceptable.” Statistically significant relationships existed between journalists’ beliefs about the effects of biotechnology, their family’s relationship to agriculture, and their perceived level of biotechnology knowledge. Journalists whose families owned agricultural land or who had a high perceived knowledge about biotechnology tended to believe that biotechnology would have more positive than negative effects. The study also identified a gap between the journalists’ actual knowledge (30% correct responses) about food biotechnology and their perceived knowledge (average to high knowledge). How do these relationships and lack of biotechnology knowledge among media professionals compare to the knowledge and perceptions of college of agriculture students?

Purpose and Objectives

The purpose was to determine college of agriculture students’ knowledge and perceptions of biotechnology issues reported in the mass media. The objectives guiding this inquiry were to:

1. Assess students’ knowledge of biotechnology issues reported in the mass media.

Listening and Viewing Patterns

As shown in Table 2, the majority of the farmers who listen to the radio program Agbeloba also watch the TV program Ejekearo (64%), while most of the remainder listen to Agbeloba alone (22%). Only 7.1 percent do not attend to either of the two programs (7.1%). Agbeloba enjoys a large regular audience, with 45 percent saying they listen every week and another 30 percent saying they listen every other week. The TV program Ejekearo has a smaller regular audience, with about 30 percent saying they watch every week and 21 percent every other week. These are still very substantial numbers when considering the total population of farmers in the region. Results show that almost 93 percent of farmers listen to or view one of these programs at least monthly.

Respondents were asked to select what program approach was most effective in generating their interest. Three choice areas were presented, as follows:

- Advertisement: Messages included in programs that call for farmer patronage e.g., agrochemical sales and efficacy
- Presentation format: Program formats such as discussion, question and answer, and field trips to show case studies of the issues under focus.
- Relevant information: Perceived relevancy of content. That is, respondents’ interests are maintained due to relevant information obtained from the two programs.
- Other: Program approaches that generate interest, other than those above.

Results showed that farmers responded most positively to relevant information that they could apply to their own farming (41%), while another third chose interviews and discussions to be most effective in generating their interest. Only 12 percent selected advertising. Twenty-two percent did not select any of the three as being effective in generating their interest.

Farmers also were asked to make an overall assessment of their perceived need for these programs to improve their farming enterprises. A large majority (96%) indicated a perceived need for the programs.
2. Determine students' attitudes toward biotechnology issues.

3. Determine if relationships exist between students' assessed and perceived levels of biotechnology knowledge and their perceptions toward biotechnology issues.

4. Determine if relationships exist between students' assessed and perceived levels of biotechnology knowledge and selected demographics.

Methods

Descriptive methodology and a correlational design were used to complete the study. Web-based survey data collection methods (Ladner, Wingenbach, & Raven, 2002) were used after obtaining approval to conduct the study through the Texas A&M University Institutional Review Board (#2002-381).

The self-selected population for this census study consisted of undergraduate students majoring in agricultural communications, enrolled in agricultural communications courses, and/or participating in the Agricultural Communicators of Tomorrow organization (N = 343). Total responses numbered 343; however, incomplete data reduced the usable number of respondents to 330 (96.21%). Valid responses were gathered from students at Clemson University, Oklahoma State University, Texas A&M University, Michigan State University, Western Illinois University, University of Arkansas, University of Florida, North Carolina State University, Kansas State University, Washington State University, and Texas Tech University. Results of this study should not be generalized beyond the confines of the respondent group.

A modified version of the instrument, Metro News Journalists' Perceptions of Food Biotechnology (Vestal & Briers, 1999) was derived from research based on the work of Duhé (1993), Barton (1992), and the North Carolina Nationwide Survey on Biotechnology (as cited in Vestal & Briers, 1999). Content validity was established by a panel of experts from the University of Arkansas, University of Florida, Kansas State University, Michigan State University, and the University of Kentucky. Face validity was established through a pilot study of students.
(Kansas State, Texas Tech, and Texas A&M) who were not part of this study.

The instrument contained 70 questions measuring students' knowledge, attitudes and perceptions toward biotechnology issues as reported in the mass media. These constructs were quantified through response sets in seven scales that included 1) knowledge of biotechnology; 2) acceptance of genetically modified organisms; 3) acceptance of biotechnology practices; 4) levels of importance placed on biotechnology research; 5) levels of importance placed on investigative reporting styles of biotechnology issues; 6) attitudes toward effects of biotechnology on selected issues; and 7) perceptions about the acceptance rates (consumers and agriculturists) of using government-approved biotechnology practices in food production.

Students' knowledge about biotechnology issues was measured using nine multiple-choice questions. Attitudes and perceptions were measured using four-point, modified Likert-type scales. Responses to the scale measuring acceptance of biotechnology practices could range from Highly Unacceptable (1) to Highly Acceptable (4). Vestal and Briers (1999) reported a Cronbach's alpha coefficient of .87 for the acceptance scale; Cronbach's alpha was .91 for the same scale in this study. Additional reliability analyses for scales not reported in the study by Vestal and Briers, but conducted in this study revealed Cronbach's alpha coefficients of .90 for the scales (1 = Not at all important, 4 = Extremely Important) measuring importance of investigative reporting and .85 for importance of biotechnology research. Scales measuring faith in biotechnology information sources (.73) and attitudes toward effects of biotechnology (.70) were deemed reliable. The researchers concluded that the scales used in this study provided reliable data for analyses and interpretation.

Pre-notice e-mail and listserv announcements describing the study were sent to land-grant university faculty members in early August 2002. Colleagues were asked to review the online instrument, provide clarification where necessary, and encourage undergraduates to participate in the study. Data collection began in mid-August with biweekly e-mail reminders to faculty members, and was completed in seven weeks. Respondents accessed the instrument through a closed Web address.

two thirds (68%) of the respondents consider themselves community or social leaders, while nearly one third (31.8%) are members of village council or associations. Their status in the community suggests that they might play an important role in diffusing information to others in their community. A majority (72%) of the respondents is married.

| Table 1. Distribution of respondents' social and personal characteristics (n = 198) |
|---------------------------------|--------|------------------|
| Characteristics                | Frequency | Percentages (%) |
| Gender:                        |         |                  |
| Males                          | 159     | 80.3             |
| Female                         | 39      | 19.7             |
| Age (Years):                   |         |                  |
| Young farmers (less than 30 years) | 31      | 15.7             |
| Older farmers (31 years and above) | 167     | 84.3             |
| Religion:                      |         |                  |
| Islam                          | 71      | 35.9             |
| Christianity                   | 85      | 42.9             |
| Traditional                    | 32      | 16.2             |
| Others                         | 10      | 5.0              |
| Educational status:            |         |                  |
| Informal                       | 72      | 36.4             |
| Primary                        | 52      | 26.6             |
| Secondary                      | 59      | 29.8             |
| Tertiary                       | 10      | 5.0              |
| None                           | 5       | 2.5              |
| Leadership status:             |         |                  |
| Community/social leader        | 135     | 68.2             |
| Council/Association member     | 63      | 31.8             |
| Marital status:                |         |                  |
| Single                         | 56      | 28.3             |
| Married                        | 142     | 71.7             |
Measurement of variables

Respondents were instructed to read and agree to an Informed Consent Form before entering the survey site.

Descriptive statistics were derived for each section and the instrument as a whole. Demographic data were analyzed using percentages and frequencies. Significant relationships between selected variables were established using bivariate analyses.

Results

Usable responses (N = 330) were gathered from college of agriculture students at 11 universities in 10 states and representing six programs of study. Specific areas of self-reported majors included those in agricultural education, other college of agriculture (poultry, forestry, and food sciences, and agribusiness/agricultural economics), agricultural communications, liberal arts (journalism, math, economics, education, and business) animal science, and health-related fields (nursing, pharmacy, and rehabilitation science). Respondents were mostly seniors (46%), female (55%), and considered themselves “B” average students (60%) from their self-reported overall grade point averages (Table 1).

Students’ knowledge of biotechnology issues reported in the mass media was assessed using nine multiple-choice questions. The research design did not preclude students from using the Internet to search for answers they did not know, and one could expect unknowledgeable respondents to score 25% correct for questions with four possible choices. However, respondents in this study achieved only 30% correct responses (M = 3.05, SD = 1.51). This lack of knowledge about biotechnology practices mirrors the findings of Vestal and Briers (1999) and Bruhn (as cited in Vestal & Briers, 1999). Nearly 84% of the respondents perceived their level of scientific knowledge as average to high (M = 3.07, SD = .74). Of those respondents, 24% believed they had “above-average” scientific knowledge. Again, these findings match those found by Vestal and Briers, where metro news journalists perceived a higher level of scientific knowledge than they actually possessed.

College of agriculture students responded to 28 questions designed to assess their attitudes toward biotechnology issues. These questions were contained in scales measuring acceptance of biotechnology practices, importance of biotechnology, faith in biotechnology information sources, potential barriers to
Table 1. Demographic Frequencies of Respondents
(N = 330)

| Variables                          | f  | Percent |
|------------------------------------|----|---------|
| University:                        |    |         |
| Clemson University                 | 81 | 24.5    |
| Oklahoma State University          | 73 | 22.1    |
| Texas A&M University               | 61 | 18.5    |
| Michigan State University          | 41 | 12.4    |
| Western Illinois University        | 23 | 7.0     |
| University of Arkansas             | 16 | 4.8     |
| University of Florida              | 12 | 3.6     |
| North Carolina State University    | 11 | 3.3     |
| Kansas State University            | 5  | 1.5     |
| Washington State University        | 5  | 1.5     |
| Texas Tech University              | 2  | 0.6     |
| Major:                             |    |         |
| Agricultural Education             | 79 | 23.9    |
| Other College of Agriculture       | 78 | 23.6    |
| Agricultural Communications        | 6  | 20.0    |
| Liberal Arts                       | 52 | 15.8    |
| Animal Science                     | 29 | 8.8     |
| Health-related Fields              | 18 | 5.5     |
| Undecided                          | 3  | 0.9     |
| Class Status:                      |    |         |
| Senior                             | 152| 46.1    |
| Freshman                           | 79 | 23.9    |
| Junior                             | 56 | 17.0    |
| Sophomore                          | 25 | 7.6     |
| Other                              | 10 | 3.0     |
| Gender:                            |    |         |
| Female                             | 181| 54.8    |
| Male                               | 140| 42.4    |
| Overall Grade Point Average:       |    |         |
| 3.00-3.99                          | 198| 60.0    |
| 2.00-2.99                          | 105| 31.8    |
| 4.00                               | 16 | 4.8     |
| 1.00-1.99                          | 3  | 0.9     |
| < 1.00                             | 1  | 0.3     |

Method

The study was conducted in two local government areas of Oyo State in Southwest Nigeria. The area is made up of Akinfele and Ibadan South West Local Government Areas. The choice of Akinfele and Ibadan South West Local Government Areas was made because it has a typical representation of the region as a whole, including both urban and rural settlements. In addition, this area has excellent reception of programs of Broadcasting Corporation of Oyo State (BCOS).

The target population consisted of all farmers in the two local government areas identified above. A random sampling procedure was adopted during the selection of 200 respondents from the entire study area. This is about 15 percent of the farmers on the list of the Extension Officers in the Agricultural Development Project sampled cells. Extension agents compile these lists as a part of their duties, and determine who are primarily farmers. In this study, the list of farmers in sampled villages/wards was obtained from the Extension agent, and then a random sample of these individuals was selected. Questionnaires were administered to the respondents in their homes in person after the day’s work between June and August 2001.

One hundred ninety-eight of the 200 farmers selected completed usable questionnaires. This high response rate was achieved because the interviews were conducted by a team of postgraduate research assistants and this author, who personally sat with the farmers and asked questions directly from the questionnaire, filling out answers directly to avoid misinterpretation and inaccurate responses. Twelve farmers, whose educational attainment was sufficient to permit them to read and complete the questionnaires on their own, were permitted to read and respond to the questions on their own. Two of these 12 did not return their questionnaires, leading to the response rate of 198 out of 200.
cost and to areas previously not accessible to extension agents on a regular basis. While prior studies have confirmed that these radio programs have large audiences, there has been less attention to the perceptions farmers hold about the specific benefits these programs provide.

This study examined how farmers perceive the information benefits of two long-running agricultural programs on two electronic media channels (radio and television) in selected communities in Southwest Nigeria. The radio program is Agbeloba (Farmers Are Kings), and the TV program is Ejekaroko (Let's Go Farming). These two programs are transmitted by Broadcasting Corporation of Oyo State (BCOS) radio and television stations. Both programs are broadcast weekly in the Yoruba Language on Thursdays from 6:35 p.m. to 7 p.m. (Agbeloba) and on Tuesdays between 5:30 p.m. and 6 p.m. (Ejekarok). The two programs have been part of the corporation’s programs since its inception. The forerunner of Agbeloba was Agbe Mase (I Will Take to Farming), which was broadcast by the Western Nigeria Broadcasting Corporation (WNBC) in 1957. Some 23 years later in 1979, the television broadcast of Ere Agbe (The Gains of Farming) was broadcast on Western Nigeria Television Station (WNTV) (WNTV, 1979). This program would later be named Ejekaroko. In addition to carrying agricultural advertising, the two programs convey directly research-based agricultural recommendations using researchers, extension personnel and farmers themselves.

**Purpose and objectives**

The purpose of this study was to investigate farmers’ perceptions of the informative values of Agbeloba and Ejekaroko agricultural programs broadcast on radio and television. The specific objectives of the study were as follows:

1. To determine if the two programs actually reach the farmers in the study location where the reception of two media channels is excellent;
2. To examine farmers’ perceptions of the informative roles of the two programs across 12 dimensions (discussed later);
3. To determine the relationship between farmers’ demographic characteristics (age, gender, educational

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**Table 2. Descriptive Statistics for Attitudes toward Biotechnology Issues**

| Variables                                                      | M    | SD  |
|----------------------------------------------------------------|------|-----|
| **Acceptance levels for genetically modified organisms involving** |      |     |
| Forests/landscape plants                                      | 3.28 | .79 |
| Food Crops                                                     | 3.28 | .78 |
| Microorganisms                                                 | 3.07 | .79 |
| Animals                                                        | 2.60 | .90 |
| Humans                                                         | 1.84 | .98 |
| **Acceptance levels of biotechnology practices involving**     |      |     |
| Insect-resistant cotton                                        | 3.41 | .74 |
| Insect-resistant corn                                          | 3.36 | .77 |
| Slow vine-ripening tomatoes                                   | 3.34 | .76 |
| Herbicide-resistant soybeans                                   | 3.33 | .77 |
| **Importance levels placed on biotechnology research to**      |      |     |
| Benefits to the environment                                   | 3.53 | .64 |
| Harming the environment                                       | 3.47 | .73 |
| Safer food                                                     | 3.44 | .69 |
| Risk compared to pesticides                                   | 3.23 | .74 |
| Reduction of pesticides                                        | 3.13 | .78 |
| Added nutritional value                                        | 3.10 | .73 |
| Control of released genes                                      | 3.02 | .82 |
| **Importance levels for journalists to**                       |      |     |
| Investigate claims and statements made by government agencies  | 3.33 | .76 |
| Investigate claims and statements made by food companies       | 3.28 | .74 |
| Investigate claims and statements made by biotech companies    | 3.24 | .75 |
| Provide analysis and interpretation about the undesirable consequences of biotechnology | 3.23 | .84 |
| Provide analysis and interpretation about the desirable consequences of biotechnology | 3.18 | .83 |
| Investigate claims and statements made by university scientists | 3.17 | .77 |
| Investigate claims and statements made by activist groups      | 2.94 | .98 |
| **What effect will biotechnology practices have on**           |      |     |
| World hunger                                                   | 3.34 | .58 |
| Healthful foods                                                | 3.07 | .64 |
| Family farms                                                   | 2.78 | .85 |
| Fish and wildlife                                              | 2.74 | .67 |

Note. Four-point, Likert-type scales were used throughout each section measuring students' attitudes. " 1 = Highly Unacceptable, 2 = Somewhat Unacceptable, 3 = Somewhat Acceptable, 4 = Highly Acceptable. a 1 = Not at all Important, 2 = Somewhat Important, 3 = Important, 4 = Extremely Important. b 1 = Very Negative, 2 = Negative, 3 = Positive, 4 = Very Positive.
using biotechnology in food production, and effects of biotechnology (Table 2).

Future agricultural communicators were somewhat accepting of biotechnology practices for genetically modified organisms involving plant life ($M = 3.28$), but viewed these same practices as somewhat unacceptable for human use ($M = 1.84$). Respondents believed it was important to continue biotechnology research ($M = 3.02-3.53$) and important for journalists to use investigative reporting styles ($M = 2.91-3.33$). In general, students believed that biotechnology practices will have positive effects on fish/wildlife, family farms, healthful foods, and world hunger (Table 2). Respondents estimated the time required for consumers and agriculturists to accept using government approved biotechnology in food production. Students estimated agriculturists will take 3 to 5 years to accept government-approved biotechnology practices, but consumers will take twice as long (6 to 10 years) (Table 3).

**Table 3. Frequencies for Acceptance of Government-approved Biotechnology Practices ($n = 324$)**

| Item                                                                 | $f$ | Percent |
|----------------------------------------------------------------------|-----|---------|
| Estimated time it will take the average farmer to accept U.S. Government (EPA, FDA, and USDA) approved biotechnology as an acceptable farm practice. |     |         |
| 3-5 years                                                           | 96  | 29.1    |
| 6-10 years                                                          | 95  | 28.8    |
| > 10 years                                                          | 65  | 19.7    |
| 0-2 years                                                          | 56  | 17.0    |
| Never                                                               | 12  | 3.6     |

| Item                                                                 | $f$ | Percent |
|----------------------------------------------------------------------|-----|---------|
| Estimated time it will take the average consumer to accept U.S. Government (EPA, FDA, and USDA) approved biotechnology as an acceptable farm practice. |     |         |
| 6-10 years                                                          | 111 | 33.6    |
| 3-5 years                                                          | 102 | 30.9    |
| > 10 years                                                          | 56  | 17.0    |
| 0-2 years                                                          | 39  | 11.8    |
| Never                                                               | 16  | 4.8     |

Nearly two thirds of the respondents listen to both programs. Even though radio is currently utilized more than television by most farmers, they perceive that the television program is providing very useful content.

**Background and Introduction**

In Nigeria, as in many other countries, limited numbers of extension agents (one to 4,000 farmers) make it impossible to reach all farmers by interpersonal means. Thus, although there have been a number of documented project successes in which extension agents have personally delivered useful research-based information (Akinpelu, 1987), mass media alternatives to reaching large numbers of farmers are an essential supplement.

Both radio and television have been successfully used in agricultural extension in many countries (Ogunmilade, 1984). Evidence from previous research indicates that people's attitudes and perceptions may be influenced by their media use (Anigwe, 1990; Olowu, 1993; Yahaya and Akinboye, 1999; and Yahaya and Omokhaye, 2001). In an earlier study conducted in Southwest Nigeria, Patel and Ekpere (1978) reported that 83 percent of the farmers listen to radio farm programs. Similarly, Olowu and Igdan (1989) reported that farmers generally obtain information from the radio, and of about 34 percent of the farmers who sought information from the radio, 31 percent actually obtained useful information from it. These researchers also discovered that farmers' educational level was significantly related to the media from which they sought specific information, particularly information on marketing, pesticides and herbicides. Age of farmers also was significantly related to the media that farmers used to find information on improved technologies. In another study, Olowu (1991) found that the viewing of agricultural television programs is significantly and positively related to knowledge of improved farm practices.

Because of their popularity and ability to reach farmers, radio and, more recently, television have been used by agricultural organizations in Nigeria to disseminate relevant agricultural information to larger numbers of farm families at minimal
Table 4. Pearson Correlations between Respondents' Assessed and Perceived Biotechnology Knowledge and Selected Demographics (n = 320)

| Variables | Assessed Knowledge of Biotechnology Issues | Perceived Knowledge of Biotechnology Issues | Assessed and Perceived Biotechnology Knowledge  |
|-----------|------------------------------------------|--------------------------------------------|---------------------------------------------|
| Family owns agricultural production property | Family owns agricultural production property | Family owns agricultural production property | Family owns agricultural production property |
| Have lived on a farm or ranch | Have lived on a farm or ranch | Have lived on a farm or ranch | Have lived on a farm or ranch |
| Have worked on a farm or ranch | Have worked on a farm or ranch | Have worked on a farm or ranch | Have worked on a farm or ranch |
| Accepted | Accepted | Accepted | Accepted |
| Sig. | Sig. | Sig. | Sig. |
| .06 | .05 | .01 | .00 |
| .02 | .25 | .25 | .00 |
| .01 | .00 | .02 | .00 |
| .00 | .00 | .00 | .00 |

Note: Four-point, Likert-type scales for each section were summated to determine students' overall attitudes toward biotechnology practices. *p < 0.05. **p < 0.01.
To fulfill the third objective, respondents' attitude scores were summated using their acceptance ($M = 27.38$, $SD = 5.75$), importance ($M = 47.95$, $SD = 7.86$), and biotechnology effects ($M = 11.84$, $SD = 2.14$) scores, and analyzed with their knowledge scores. Also, selected demographics (family-owned agricultural production property, have lived on a farm/ranch, and have worked on a farm/ranch) were analyzed with their knowledge scores to determine if a significant relationship existed (Table 4). Significant, but low positive relationships existed between respondents' assessed and perceived levels of biotechnology knowledge ($r = .17$), and between assessed knowledge and their acceptance of biotechnology practices ($r = .16$). Interestingly, a stronger positive relationship, albeit low, occurred between perceived level of knowledge and acceptance of biotechnology practices.

A significant (low) positive relationship existed between respondents' assessed knowledge of biotechnology and farm or ranch work experience ($r = .11$) (Table 4). An interesting outcome of the analyses revealed significant, but low positive relationships between respondents' perceived level of biotechnology knowledge and all selected demographic variables. Those relationships were for family-owned agricultural production property ($r = .18$), have lived on a farm or ranch ($r = .16$), and have worked on a farm or ranch ($r = .23$).

**Recommendations and Implications**

Undergraduate students majoring in agricultural communications, enrolled in agricultural communications courses, and/or participating in the Agricultural Communicators of Tomorrow student organization will inevitably become communicators for the agriculture industry. To some extent, their expected future success and effectiveness as communicators may be affected by their understanding and knowledge of issues within agriculture. Biotechnology practices affecting production agriculture, food, health, and the environment are major issues now, and will continue to be major issues in the future (Casey, 2002). The impact biotechnology has on food and fiber production, consumption, and the sale and trade of agricultural products worldwide will no doubt have a political consequence, as has occurred already in Zambia ("Opinion: Better," 2002).

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Vestal, T. A. & Briers, G. E. (1999) Metro news journalists critique food biotechnology. *Journal of Applied Communications, 83*(2), 23-34.
Future agricultural communicators (84%) in this study believed their level of scientific knowledge was average to high, and 24% of those respondents believed they had “above-average” scientific knowledge. Conversely, respondents averaged only 30% correct responses in the knowledge assessment questions. A logical deduction from this study indicates that average knowledge would yield 4.5 correct responses in the biotechnology assessment. However, a substantial discrepancy exists between the respondents perceived and assessed knowledge. These results are consistent with the attitudes and beliefs of professional journalists surveyed by Vestal and Briers (1999). If current college students are no more knowledgeable about biotechnology than are professional journalists who have been out of school for more than 15 years (Vestal & Briers, 1999), then the future of knowledgeable, accurate communications about biotechnology may be at risk. Agricultural communications educators are encouraged to examine their curricula to determine if students are being given an opportunity to increase their understanding of science, especially biotechnology. Educators must ensure future agricultural communicators are adequately prepared to investigate, understand, and communicate the science of biotechnology, basing their communications on knowledge and/or experience, rather than on already-present global attitudes perpetuated by an uninformed populace.

Experience in agriculture and respondents' knowledge of biotechnology was related. A low but significant correlation existed between students who have worked on a farm or ranch and their assessed biotechnology knowledge. Low but significant relationships also existed between respondents’ “perceived knowledge” and agricultural backgrounds such as those who have family-owned agricultural production property, or have lived or worked on a farm or ranch. Therefore, as was revealed by Vestal and Briers (1999), experience influences the agricultural communicator’s perceptions of biotechnology. The difference between perception and reality may be debatable, but what is not debatable is perceived and actual biotechnology knowledge possessed by each agricultural communicator. If students, and the professional journalists studied by Vestal and Briers, lack sufficient knowledge about biotechnology, how will they know what is truth when investigating a future story? Future agricultural communicators should be...
given opportunities to interact with people involved in science and biotechnology enterprises. The possibilities include student internships, field experience, and visits to biotechnology firms and agencies like the USDA, NRCS or Farm Services Agency, who are in the business of communicating the science of biotechnology to others.

Low positive relationships existed between respondents' assessed and perceived levels of biotechnology knowledge. The more confidence respondents indicated in their perceived knowledge, the more correct responses were given in the knowledge assessment. Educators can use this relationship to expand upon the limited knowledge of agricultural communicators. Understanding the science of biotechnology will increase students' confidence in communicating these issues in future careers. If the perceptions reported in this study were developed from knowledge gained in science classes, labs, and interactions with biotechnology scientists, then students may not have a clear understanding of the "knowledge" learned through these events since they perceive themselves as more knowledgeable about scientific information than what is reality. Educators need to evaluate the clarity of their science teaching to ensure that true understanding and knowledge transfer have been acquired by students.

Mirroring the results from Vestal and Briers (1999), there was a positive relationship between the acceptance of biotechnology practices and both perceived knowledge and assessed knowledge. This contributes to the current literature surrounding knowledge and perceptions. As an individual's knowledge of biotechnology increases (perceived or assessed), the individual is more likely to view biotechnology positively. Continuing to develop the knowledge base among agricultural communicators will allow them to share information factually and clearly with agricultural and nonagricultural audiences. Future agricultural communicators indicated that biotechnology practices were acceptable when involving plant life, but unacceptable for human use. Respondents believed that farmers would accept government-approved biotechnology practices in 3 to 5 years, while consumers would take longer, 6 to 10 years.

Agricultural communicators at the collegiate level maintain similar beliefs and knowledge bases to professional journalists (Vestal & Briers, 1999) and to the public (Hossain, Benjamin, Adelaja, Schillig, & Hallman, 2002; NSF, 2000). The challenge for educators is to develop methods, both in and out of the classroom, to help students and professionals expand their knowledge and experience with biotechnology. To do less is to ignore the warning from Ryan-Harshman (1999).

Only a small percentage of what is read or heard is truly well balanced. Sometimes, in biotechnology reporting, this is true because the intent is to present the topic negatively; but more often, this is true because a low level of scientific knowledge combined with a wariness of technology and business lends a negative bias to reports. (p. 2)

Keywords

College students, biotechnology perceptions, mass media.
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