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Student Perceptions of Agriculture Messages Delivered Using Creative Media

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Abstract

The purpose of this study was to determine how communicating scientific GMO information, using an infographic, affected millennial and generation z students' perceptions of GMOs. Additionally, this study sought to determine the perceptions of infographics to convey agricultural messages. This study used a qualitative and quantitative approach in a questionnaire format through Qualtrics. The questionnaire was designed with five sections including a GMO pre-questionnaire, infographic content presentation, a GMO post-questionnaire, an infographic perception questionnaire, and demographic questions. All questions in the pre- and post-questionnaire were focused on the subjects found in the infographic presented in the content presentation. Overall, participants had increased accuracy in responses about GMOs and more positive perceptions of GMOs after viewing the infographic. The majority of participants found the infographic appealing and preferred the infographic to a research paper or paragraphs to present the same information. The recommendations based on this research is to utilize infographics to present scientific or technical agricultural messages and to create infographics that are well organized, aesthetically pleasing, and site sources.

Introduction

Background and Need

Agriculture has rapidly grown and evolved in the last century with changes in machinery, technology, and scientific ability. The separation of consumers and producers has occurred, allowing for a vast amount of misinformation to enter and create communication noise. Noise is created by differing information and a lack of direction that can impact how a message is received and interpreted. As this issue of miscommunication and separation of producers and consumers has developed, so has supportive advocacy for agriculture and agricultural communications. Agricultural communicators and agricultural supporters continue to struggle to properly inform the public on agricultural topics (Johnson and Hamernik, 2015). Using methods of teaching and communication, other than traditional agricultural education and extension, research, and organizational support, has the potential to improve reach and understandability of the content being presented. Infographics are commonly used to teach subjects and give information in a way that is easier to digest (Siricharoen, 2014). These ideas lead to an informed conclusion that infographics may create good media platforms for communicating agricultural related subjects.

Problem Statement

Many misconceptions exist about the industry of agriculture. Agriculturalists constantly work to combat these misconceptions about agriculture but continue to fall behind or do not effectively reach individuals (Tonsor, 2018). The issue of consumer misconception has become more noticeable as consumers and producers have become more separated. This biggest divide begins in younger generations. Urbanized millennials and Generation Z tend to have the largest disconnect with producers as they have the lowest exposure to production agriculture and are

most likely to explore alternate sources for information (Hembree, 2012). The average American in 2012 was three generations removed from connecting directly with agriculture meaning, the younger the generation the more removed they are (Hembree, 2012).

Purpose Statement

The purpose of this research was to evaluate millennial and Generation Z students' perceptions of genetically modified organisms (GMOs) based on how information was presented to them. Information was presented in graphic content to college-age students to evaluate their ability to understand the message. The focus was on the presentation of scientific content through at creative medium and determining if change occurred in their reported understanding of the topic and their preferences for infographics.

Research Questions

1. How does communicating scientific GMO information using an infographic affect millennial and Generation Z students' perceptions on the agriculture industry?
2. What are the perceptions of college students regarding the infographic used to convey agricultural messages?

Limitations

A possible limitation of this study is if the participant had already formed biases about GMOs.

Literature Review

The development of genetically modified foods, use of antibiotics in livestock production, and intensive agricultural production practices have resulted in consumer misconceptions about their food and about the agriculture industry (Tonsor, 2018). Deliberate communication from agricultural scientists about research findings often go unheard.

Agricultural communicators are essential to the dissemination of scientific information in a format that is understandable and desirable to the public. Misconceptions about the safety of foods, the commitment of farmers to land stewardship, the use of pesticides, and advanced breeding techniques must be conveyed through effective messaging and media. Much of today's research in agricultural communication and education focuses on teaching the next generation of farmers or agricultural education teachers. It is imperative to develop content not just for the college student, but for the public as well. Content must support and tell about agriculture effectively. The need for social sciences like agricultural communications in a hard science field can be overwhelming (Tonsor, 2018).

Agricultural Disconnect

Younger generations are more disconnected from agriculture, particularly in urban populations. Most urban Americans are three or more generations removed from the farm and agriculture. As a result, most Americans likely do not understand the need for and importance of agriculture or where their food comes from (Hembree, 2012). Science is quick to blame the public for being ignorant when it comes to misinformation and controversies (Tonsor, 2018).

Agriculture-related degrees have been perceived as the most useless with agriculture itself at number one (Hembree, 2012). Consumers often dictate the policies, regulations, and demand for products (Tonsor, 2018). This results in industry regulations that may not be scientifically sound or well accepted by the traditional producer (Tonsor, 2018). Forty-six percent of the time policies on food-safety and 15 percent of land use policies were not based on scientific research (Johnson and Hamernik, 2015). Policy makers and regulators tend to be politicians and lawyers with no direct connection to production agriculture.

While scientists often focus on research and fact, the public is often concerned with ethics and social aspects (Tonsor, 2018). Often the public would like to be more engaged in science and this requires transparency with the public. If transparency is allowed through information sharing this will improve interactions (Tonsor, 2018). A problem with transparency may become the difference in formative decisions made early on by scientists and the decision made by the public (Tonsor, 2018). This means that scientists may begin to work around what the public wants before making the best decisions based on science.

Consumer Perception

Consumer perception of the agriculture industry can be both positive and negative. People interpret words and phrases depending on their own life experiences (Rumble et al., 2014). Words are considered the most basic form of communication that will often bring an image, positive, negative, or neutral, to a person's mind (Rumble et al., 2014). Ideas like genetically modified organisms (GMOs), organic farming, pesticides, food security, farmers, agribusiness, animal welfare, family owned, and food safety are common topics surrounding the agricultural industry among the general public (Wightman, 2017 & Rumble et al., 2014). Consumers often associate different feelings and meanings to certain words or phrases than those associated by the producer or scientist (Rumble et al., 2014). Much of the communication about agriculture relies on dissemination of information about controversial topics and products that to farmers and producers do not seem to be an issue. Communicators in the science community often provide just the facts without providing the rich context and/or science in terms that are easy to understand. The focus of this information is often on the most misunderstood terms and phrases (Wightman, 2017). Using simple facts or ideas that may challenge an opposing view in a non-threatening way is common (Wightman, 2017).

According to Rumble et al. (2014), consumers often perceive ideas like GMOs and pesticides negatively while they perceive organic and animal welfare to be positive. Farmers often evaluate GMOs and pesticides as positive for the industry while organics are not always perceived as positive to producers. GMOs and pesticides help produce the necessary products to meet food demands of 8-12 billion people (Rumble et al., 2014).

Communication Techniques

To effectively bridge the gap between consumers and producers it is necessary to understand different communication techniques. Communication often deals with persuasion as well as informing. This communication requires appropriate audience analysis and understanding of behavior when face-to-face (Grantham, 2009). Interpersonal communication, activity between multiple people, is important when informing and persuading. Interpersonal communication is centered around non-verbal communication like eye contact and body language (Grantham, 2009). Communicating science is complex and scientific research requires focused and simplified communication efforts. A message appropriate for the audience is also vital (Johnson & Hamernik, 2015). A clear message that has sound support from credible sources is particularly important and can effectively help educate an audience (Grantham, 2009).

Media and Fine Arts in Communication and Education

A concept explored in education and communication practices is the adoption media, art, music, and film. The Elaboration Likelihood Model (ELM) explains the two methods of human persuasion using the central route and the peripheral route. The central route is when an individual has a high level of motivation and involvement and analyzes a message using logic. The peripheral route is when individuals have lower levels of involvement and are influenced by surface characteristics. ELM can be used to understand how information may be perceived by

the public and how to appeal to an audience (Geddes, 2016). When the ELM is correlated with infographics it is shown that infographics serve as a peripheral cue and interactive infographics bring in more elaboration from the receiving party. Utilizing graphics would bring about an attitude change in the peripheral route (Burnett et al., 2019). Infographics are growing in popularity and tend to make content easier to share (Siricharoen, 2014)

In conclusion, the use of infographics in communication to enhance agricultural knowledge and understanding may alleviate common misconceptions. Understanding where the disconnect is, what the misconceptions are, how producers and consumers can relate, and what communication practices to use are all critical to effectively communicate about agriculture.

Methodology

This section reviews the overall design of the study as well as rigor, population, sampling, and instrumentation used. It also reviews order and presentation of surveys and intervention. A mixed method questionnaire was used to obtain qualitative and quantitative data to evaluate the perceptions of respondents. Approval for this study was granted by the Institutional Review Board (protocol number 2201383813) as presented in Appendix A.

Research Design

To answer the research questions, the researcher used a mixed methods sample survey approach. A sample survey is an approach that takes a small portion of a larger population to represent the generalized views of the larger population. A sample survey requires a design that represents the desired population (Lynn, 2011). This approach used a smaller group of students selected from a larger population of students who attend the University of Arkansas in Fayetteville. Correct, scientific method selection of participants is required to later be able to estimate population variables from the statistics (Kish, 2001b). For the purpose of this research,

the mixed methods approach combined quantitative and qualitative questions in a survey format. The purpose of using mixed methods was to be able to evaluate questions in a numerical format while still being able to utilize the more in-depth insights of qualitative questioning. Quantitative survey questions were be used for questions that were easier to evaluate using a numerical scale and did not benefit from elaborate answers. Qualitative open-ended responses were used for questions where elaboration was useful and beneficial. Mixed methods were appropriate for this survey as there were many questions that were easily and better evaluated on the numerical scale of quantitative research, but the elaboration of qualitative research questions was vital in understanding the experiences and opinions of participants.

The survey consisted of close-ended and open-ended questions to assess perceptions of GMOs. Respondents completed section one of the instrument, viewed a researcher developed GMO infographic, and then responded to the same questions from section one after viewing the infographic. The next section included questions about infographics. The questionnaire allowed the researcher to determine if the content influenced the participants' beliefs about GMOs as well as how their preferences for infographics. Surveys help analyze judgment and ability to recall information (Kish, 2001a). This makes surveys appropriate to the research as judgment and recall can be pertinent to perception. This survey consists of a pre-questionnaire, timed infographic, post-questionnaire of the same questions, infographic preference questions, and a demographic section.

Rigor

Internal. Internal validity evaluates the design and trustworthiness of the study (Andrade, 2018) As the data collection involved three distinct stages, a survey followed by an intervention followed by another survey, there could were potential internal validity threats from

historical events or maturation. However, data was collected from each participant and time taken to complete the survey can be reviewed. In order to avoid instrumentation issues, all materials and the survey were constructed prior to the start of testing, were reviewed by experts in agricultural communications and research, and remained the same for all participants. All questions in the survey were clearly worded and clarified through the use of cognitive interviews. The quantitative questions were designed so data could be analyzed and reported consistently. Open-ended questions were evaluated based on a rubric to separate responses into thematic categories.

External. External validity examines the ability of the findings to be generalized and trusted due to outside factors (Andrade, 2018). All questions related directly to the study and did not stray from the direct topic at hand. This helped strengthen construct validity. Construct validity was evaluated by comparison to other surveys intended to evaluate similar subjects. Situational factors are situations presented by the environment around the individual that may sway perceptions and opinions of certain topics (Scrutton & Beams, 2015). To mitigate situational factors, surveys were administered, and content was viewed on the participant's own time. Selection bias was also a threat and was addressed by using defined criteria of appropriate participants.

Population and Sampling

A non-probability purposeful sampling of undergraduate students was chosen to take part in a survey and content presentation online. The population of students included University of Arkansas students not majoring in agriculture in the Dale Bumpers College of Agriculture, Food and Life Sciences (DBCAFLS). Student in the School of Human and Environmental Sciences in DBCAFLS were included in the population. This population was selected to alleviate the bias of

students in agriculture towards the industry as well as their probable prior knowledge of the content.

The sample was drawn from students enrolled in the classes at the University of Arkansas during the spring of 2022 who responded to posted announcements about the study and choose to participate, students who were in the Razorback band, and those who chose to respond during a 1-day face-to-face participant recruiting event. The sample was appropriate because the survey was available to a variety of college-aged students. This study was intended to gather data from non-agriculture students. Non-probability sampling was chosen for this survey since the logistics of gathering a complete list of all students and their majors was not plausible. Non-probability purposeful sampling allowed for samples to be the correct subset, students who were not majoring in subjects related to agriculture, of the campus population to be chosen which was necessary to get the appropriate participants.

Instrumentation

This study was conducted through on online researcher and thesis mentor developed instrument with quantitative and qualitative questions. These questions were intended to evaluate the perceptions of GMOs and their impacts on humans and the environment. These topics aligned with the study purpose because my research focus was on communicating about agricultural subjects that are highly misunderstood. Within the agricultural community GMOs were identified as commonly misunderstood (Wightman, 2017). The questions and statements in this questionnaire were developed based on GMO data collected from scientific sources and presented in a researcher generated infographic (see Appendix C). All sources to this information were cited and provided for the viewer. At the end of the content presentation the participant continued to the post-questionnaire. After the post-questionnaire participants completed a section

collecting opinions about infographics and their perceptions of the presented infographic. This section was about the use of infographics to present technical information. It was not an evaluation of the design of the presented infographic. This description was presented to the participants before completing that section. At the end of the survey participants completed a demographics section. The full survey with consent can be viewed in Appendix B.

Data Collection

The data for this research was collected through multiple channels including online e-mail listservs, organization group chats, campus daily news, and on campus in-person methods. The questionnaire was completed in Qualtrics. Participants were asked to complete the pre-intervention survey, after which they viewed the informational content, and then immediately completed the post-intervention survey (which was the same as the pre-intervention survey). To ensure that order was maintained online, participants could not return to previous sections once they continued to a new section. In an attempt to ensure participants were viewing the infographic before continuing to the post-questionnaire, participants had to stay on the infographic for at least one and a half minutes before continuing. Data was collected over the period of three weeks online and once for four hours in-person using QR codes for mobile device access or via researcher provided iPads. Individuals participating were not enrolled in majors relating directly to agriculture.

Data Analysis

The results and findings of this study were based on data collected from 118 undergraduate students at the University of Arkansas who were non-agriculture majors, and due to limited responses, the findings apply to respondents only. Conclusions were drawn in conjunction with the two research questions:

1) How does communicating scientific GMO information using an infographic affect millennial and Generation Z students' perceptions on the agriculture industry?
2) What are the perceptions of college students regarding the infographic used to convey agricultural messages?

Findings

The questionnaire contained five sections including the pre-questionnaire, infographic presentation, post-questionnaire, infographic perception questions, and demographic questions. The pre-questionnaire and post-questionnaire were evaluated together to determine the answer to research question number one.

Pre- and Post-Questionnaire. In this section participants answered six questions. Number one was an open response. Questions two through five were Likert-type questions, and question six was select all that apply.

The first question presented in both the pre- and post-questionnaires was "Describe what GMOs are". This question was left open-ended. The most common result from the pre- and post- questionnaire was the use of at least one word from "Genetically Modified Organism." The post-questionnaire had more in-depth responses and less unanswered or unknown answers. Common themes, phrases and words from the pre- and post-questionnaire are presented in Table 1.

Table 1
Describe what GMOs are.

Key Words	Pre-Questionnaire %	Post-Questionnaire %	Pre-Questionnaire Examples	Post-Questionnaire Example
Genetically Modified Organisms	45.8	62.7	"Genetically Modified Organisms"	"Genetically Modified Organisms"
Genetic(s)(ally)	71.2	69.5	GMOs are genetically modified foods and animals…	...selectively genetically bred for favorable resistance characteristics and higher production.
Modify/Alter	83.9	87.3	Genetic materials being altered.	Organisms that have their genes altered to produce a desired result.
Organism	64.4	83.1	Organisms (typically plants) that have their gene artificially altered to…	Artificially manipulated organisms.
Food	24.6	7.6	Something you find in food to make it last longer.	...grow better food and protect plants from natural environmental problems.
Crop/plant	21.2	37.3	GMOs are any plant or animal product that have been genetically altered by human	used to increase the yield of crops
DNA/Genes	8.5	18.6	The study of using DNA and genetic science of living organisms to produce clones…	...organisms whose DNA sequence has been modified or... selected

Key Words	Pre-Questionnaire %	Post-Questionnaire %	Pre-Questionnaire Examples	Post-Questionnaire Example
Resistant	6.8	13.6	…Same crop but modified to be pesticide resistant…	... make plant and produce resistant to environmental diseases and infections…
Chemical	5.9	1.7	...these organisms may contain harmful chemicals…	Chemicals that make plants resistant to diseases…
Nutrition	3.4	8.5	...substance that is put into foods for maybe preservation of food, or even for nutrients…	They reduce insects on crops, increase produce nutritional value, and increase profits
Yields	3.4	11	...DNA in vegetables and fruits that can improve aspects like appearance, higher crop yields…	...They are used to increase crop yields and used to develop resistance to certain environmental elements such as pests, bruising…
No answer/not sure	7.6	3.4	Not Sure	No Answer

The second statement presented was “GMOs are safe for human consumption”. This statement was rated on Likert-type scale with responses including strongly disagree, disagree, neutral, agree, and strongly agree. The highest result of the pre-questionnaire was “neutral” at 31.4%. The highest result of the post-questionnaire was “agree” at 44.9%. Overall, the post-questionnaire results showed a higher percentage of favorable responses of agree or strongly agree by participants. Table 2 contains pre-and post- test finding.

Table 2
GMOS are safe for human consumption.

Answer	Pre-Questionnaire %	Post-Questionnaire %
Strongly Disagree	5.1	0.8
Disagree	24.6	3.4
Neutral	31.4	6.8
Agree	28	44.9
Strongly Agree	11	44.1

The third statement presented was “GMOS are safe for animal consumption”. This statement was rated on Likert-type scale. The highest result of the pre-questionnaire was “disagree”, “neutral”, and “agree” at 28.8%, and the highest results of the post-questionnaire was “agree” 44.1%. Overall, the post-questionnaire results showed a higher percentage of favorable responses of agree or strongly agree by participants. Table 3 provided below presents the percentages for each answer and percentage changed for each answer.

Table 3
GMOS are safe for animal consumption.

Answer	Pre-Questionnaire %	Post-Questionnaire %
Strongly Disagree	3.4	0.8
Disagree	28.8	3.4
Neutral	28.8	11
Agree	28.8	44.1
Strongly Agree	10.2	40.7

The fourth question statement was “GMOS have negative environmental impacts”. This statement was rated on Likert-type scale. The highest result of the pre-questionnaire was “agree” with 40.7% of respondents, and the highest result of the post-questionnaire was “disagree” at 43.2% of respondents. Overall, the post-questionnaire results showed a

higher percentage of favorable responses of disagree or strongly disagree. Table 4 provides the percentages for each answer.

Table 4
GMOS have negative environmental impacts.

Answer	Pre-Questionnaire %	Post-Questionnaire %
Strongly Disagree	4.2	27.1
Disagree	10.2	43.2
Neutral	33.1	13.6
Agree	40.7	11
Strongly Agree	11.9	5.1

The fifth statement presented was “GMOs have positive environmental impacts”. This statement was rated on Likert-type scale. The top result of the pre-questionnaire was “neutral” at 46.6% of respondents. The highest result of the post-questionnaire was “agree” at 49.2% of respondents. Overall, the post-questionnaire results showed a higher percentage of favorable responses of agree or strongly agree by participants. Table 5 provided below reports the percentages for each .

Table 5
GMOs have positive environmental impacts.

Answer	Pre-Questionnaire %	Post-Questionnaire %
Strongly Disagree	4.2	1.7
Disagree	19.5	3.4
Neutral	46.6	13.6
Agree	24.6	49.2
Strongly Agree	5.1	32.2

The sixth question presented was “What are the benefits of GMOs?”. This question was a mark all that apply answering system. The four highest results of the pre-questionnaire were “GMOs help prevent the effects of environmental threats (diseases, etc.).”,

"GMOs make plants more insect and pest resistant.", "GMOs increase the amount of grains produced per acre.", and "GMOs are used to modify nutritional value." The same four choices were selected by the highest number of participants. These four answers were correct based on the scientific data presented. All answer choices increased in the post-questionnaire. Table 6 provided below presents the percentages for each selected response in the pre- and post-questionnaires.

Table 6
What are the benefits of GMOs?

Answer	Pre-Questionnaire %	Post-Questionnaire %
Feeding GMO grains reduces methane production in livestock.	30.5	43.2
GMOs help prevent the effects of environmental threats (diseases, etc.).	45.8	78
GMOs makes plants more insect and pest resistant.	75.4	83.9
GMOs increases the amount of grains produced per acre.	60.2	88.1
GMOs are used to modify nutritional value.	66.9	85.6
GMO fields regrow yearly, so replanting is not needed.	16.9	44.1

Infographic Perception. When viewing the infographic, participants were required to remain on the infographic for at least a minute and a half before they could proceed. In this section participants answered seven questions about the use of infographics to present scientific information. The answers to these questions were based on preference, opinion, and perception. This section was not an evaluation of the design of the infographic presented, but overall infographic preferences and perceptions of how

content was presented using the infographic. Questions one through five were rated on a Likert-type scales. Question six was a select all that apply, and seven was multiple choice.

The first question asked was “After viewing the infographic, I know more information about GMOs.” The highest response was “agree” at 50.8%, followed by “strongly agree” at 43.2%. Findings are presented in table 7.

Table 7
After viewing the infographic, I know more information about GMOs.

Answer	%
Strongly Disagree	0
Disagree	0.8
Neutral	5.1
Agree	50.8
Strongly Agree	43.2

The second question addressed personal preference about receiving scientific information through infographics. The answer with the highest percentage was ‘agree” at 43.2% of respondents, followed by “strongly agree” at 33.1%. Table 8 presents this data.

Table 8
I prefer to receive information about scientific topics, like GMOs, through infographics.

Answer	%
Strongly Disagree	0.8
Disagree	4.2
Neutral	18.6
Agree	43.2
Strongly Agree	33.1

The third question was “I found the infographic content useful”. “Strongly agree” had the highest percentage of responses at 52.5%, followed by “agree” at 44.9% of respondents. The findings of this question are presented below in Table 9.

Table 9
I found the infographic content useful.

Answer	%
Strongly Disagree	0
Disagree	0
Neutral	2.5
Agree	44.9
Strongly Agree	52.5

The fourth question asked about the comparison of infographic structure and a research paper. The most common answer was “strongly agree” at 63.2% followed by “agree” which indicated respondents preferred the infographic structure when compared to a research paper. No respondents disagreed or strongly disagreed. Below the findings are presented in Table 10.

Table 10
I found the infographic structure appealing compared to the structure of a research paper presenting the same information.

Answer	%
Strongly Disagree	0
Disagree	0
Neutral	7.7
Agree	29.1
Strongly Agree	63.2

The fifth question was “I found the visual presentation of information appealing for learning versus reading paragraphs of the same information”. “Strongly agree” was

the answer with the highest percentage of responses at 69.5% followed by “agree” at 24.6%. Table 11 below displays these responses.

Table 11
I found the visual presentation of information appealing for learning versus reading paragraphs of the same information.

Answer	%
Strongly Disagree	0.8
Disagree	1.7
Neutral	3.4
Agree	24.6
Strongly Agree	69.5

The sixth question in this section was “In my opinion, the following factors impacted my perception of the credibility of an infographic”. This question was a choose all that apply. The most important factors were organization and structure of information (80.5%), graphics quality (74.6%), citation of sources (61.9%), and colors & fonts (46.6% each). The company or organization that produced the graphic was the least important factor on credibility (39.8%) among respondents. The responses are reported in Table 12.

Table 12
In my opinion, the following factors impacted my perception of the credibility of an infographic.

Answer	%
Citation of sources	61.9%
Colors used	46.6%
Fonts used to present information	46.6%
The quality of graphics	74.6%
Organization/structure of information	80.5%
Which company or organization produced the infographic	39.8%

The final question in this section was whether the participant found the infographic information credible or not. 99.2 percent of participants answered that the infographic was credible.

Demographics. The majority of participants were white at 83.1%. 17.8% were Hispanic, 2.5% were black or African American, 1.7% were American Indian or Alaska Native, and 1.7% were Asian. Other was reported by 1.7% as they did not fall into the listed categories. Participants were between the ages of 18 and 26 with four respondents over the age of 26. The majority of participants were female (72.9%), 26.3% were male, and 0.8% were non-binary. Thirty-three percent of participants were students in the College of Education and Health Professionals. Students in the Fulbright College of Arts and Sciences accounted for 28.8% of participants, 23.7% of participants were students in the Sam M. Walton College of Business, 11.9% of participants were students in the College of Engineering, and 4.2% of participants were non-agriculture majoring students in the Dale Bumpers College of Agriculture, Food and Life Sciences, and 2.5% were in the Fay Jones School of Architecture and Design.

Conclusions

Overall, respondents had increased accuracy with their responses to GMO related questions after viewing the infographic when compared to responses before viewing the infographic. Burnett et al. (2019) indicated infographics are peripheral cues in the ELM. The finding of increased elaboration aligns with Geddes (2016) recognition of the peripheral route using aesthetic cues and use by those who are not as involved with a topic.

The majority of participants had a more positive view of GMOs after viewing the infographic and they found the infographic helpful, appealing, and credible. Additionally, their preference was infographics over paragraphs and papers. This supports Siricharoen (2014) who indicated the popularity of infographics was growing due to the ease of conveying information, and Tonsor (2018) who underscored the importance of effective communication about agriculture. Johnson and Hamernik (2015) emphasized focused and simplified communication as key to communicating science related topics. This was reflected in the characteristics identified as favorable by respondents through this one medium presenting scientific GMO data.

One finding not explained by the literature was the increased selection of all options for the "What are benefits of GMOs" item. It was noted by the research that the responses for that item came from the overall presentation of content via the infographic and did not align with a single heading and block of content. This may have occurred because respondents were using the infographic (peripheral cues) and the questionnaire statement required a deeper involvement (central cues) to formulate an accurate response to the statement.

Recommendations

Based on the findings of this study, the researcher recommends using infographics to present GMO information to undergraduate students at the University of Arkansas who are not pursing agriculture majors. Infographics, for this audience, should be well organized, aesthetically pleasing, and cite sources to be viewed as credible. Future studies should be conducted with individuals who are millennials or Generation Z, who are not

pursuing college degrees, to determine if communicating about GMOs using an infographic has the same outcomes. This could be replicated with other samples to determine if infographics are effective with differing audience characteristics. Continued research using this instrument would be beneficial to obtain generalizable conclusions about the effectiveness of infographics as a GMO communication tool.

Findings supported respondents demonstrated improved response accuracy to GMO statements or questions when the infographic content areas, which were clearly defined with headings and the scientific content was presented under the heading. To identify benefits of GMOs, respondents had to synthesize the overall content presented in the infographic to identify accurate responses. Thus, the researcher recommends experimenting with changes to the infographic to determine if creating prominent peripheral cues would improve respondents' accuracy when asked to identify the benefits of GMOs after viewing the infographic.

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Appendix A

IRB Approval

UNIVERSITY OF ARKANSAS

To:	Faith Mills
From:	Douglas J AdamsJustin R Chimka, Chair IRB Expedited Review
Date:	03/29/2022
Action:	**Exemption Granted**
Action Date:	03/29/2022
Protocol #:	2201383813
Study Title:	Student Perceptions of Agriculture Messages Delivered Using Creative Media

The above-referenced protocol has been determined to be exempt.

If you wish to make any modifications in the approved protocol that may affect the level of risk to your participants, you must seek approval prior to implementing those changes. All modifications must provide sufficient detail to assess the impact of the change.

If you have any questions or need any assistance from the IRB, please contact the IRB Coordinator at 109 MLKG Building, 5-2208, or irb@uark.edu.

cc: Casandra K Cox, Investigator

Appendix B

Survey

Honors Survey FMills

Start of Block: Consent Statement

Consent Welcome and thank you for taking the time to participate in this survey!

We are seeking input from undergraduate students who are not majoring in agriculture at the University of Arkansas. If you agree to participate in this brief survey, 10 minutes or less, click the “Next” button. If at any point you need to revisit a question, click the “Back” button.

The purpose of this study is to understand student perceptions of an agricultural topic before and after viewing an infographic about the topic. If you agree to be in the study, you will be asked to answer a series of questions, review an infographic, and respond to another series of questions. Please note some of the questions are repeated. We ask that you only use your knowledge and your review of the infographic content to respond to the questions.

We do not anticipate any risks for you participating in this study, other than those encountered in daily life. Participation is voluntary. If you come to a question you prefer not to answer, you may skip it and proceed to the next question.

Participants, who meet the criteria and complete all three steps of this questionnaire, will be entered into a drawing for a chance to receive a $50 gift card. Six gift cards will be awarded at the end of data collection period.

All information collected will be kept confidential to the extent allowed by law and university policy. Your name will not be collected, but your email address is needed to contact recipients of the incentives. Your email address will not be linked to your individual answers in any data reports.

Should you have any questions, comments or concerns, please contact a member of our research team: Faith Mills at famills@uark.edu or Casandra Cox at ccrumle@uark.edu. Approval has been granted for

this project and you may contact Ro Windwalker, irb@uark.edu.

Your help with this honors research project is appreciated!

By clicking here, you provide consent to participate in this study about student perceptions of online and remote classroom etiquette.

- ○ Yes (1)
- ○ No (2)

Skip To: End of Survey If Welcome and thank you for taking the time to participate in this survey! We are seeking input fr... = No

Page Break

Q1 Are you an undergraduate student?

- ○ Yes (1)
- ○ No (2)

Skip To: End of Survey If Are you an undergraduate student? = No

Q2 Are you majoring in agriculture at the University of Arkansas? (These majors include: ag. business; ag. education, communication, and technology; animal science; crop science; environmental, soil & water science; food science; horticulture; landscape & turf sciences; or poultry science)

- ○ Yes (1)
- ○ No (2)

Skip To: End of Survey If Are you majoring in agriculture at the University of Arkansas? (These majors include: ag. busines... = Yes

Q3 Five participants who complete the entire survey will be randomly selected to receive a $50 gift card. Please enter your email address, so you can be contacted if you receive an incentive.

Identifying information will be saved separately from the data collected during this survey as soon as responses are verified as complete.

_____

End of Block: Consent Statement

Start of Block: Pre-Questionnaire

Description This section contains 6 questions regarding your perceptions and knowledge of Genetically Modified Organisms (GMOs). Answer each question to the best of your ability. There is no penalty for your answer choice.

Page Break

Directions Please answer the following question in your own words.

Q1
Describe what GMOs are.

_____

_____

_____

_____

_____

Directions Please answer the following questions on a scale of 1-5. 1 being strongly disagree and 5 being strongly agree.

Q2 GMOS are safe for human consumption.

- ○ Strongly Disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

Q3 GMOs are safe for animal consumption.

- ○ Strongly Disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

Q4 GMOs have negative environmental impacts.

- ○ Strongly Disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

Q5 GMOs have positive environmental impacts.

- ○ Strongly Disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

Directions In the following question, please mark all that apply.

Q6 What are the benefits of GMOs?

- ☐ Feeding GMO grains reduces methane production in livestock. (1)
- ☐ GMOs help prevent the effects of environmental threats (diseases, etc.). (2)
- ☐ GMOs makes plants more insect and pest resistant. (3)
- ☐ GMOs increases the amount of grains produced per acre. (4)
- ☐ GMOs are used to modify nutritional value. (5)
- ☐ GMO fields regrow yearly, so replanting is not needed. (6)

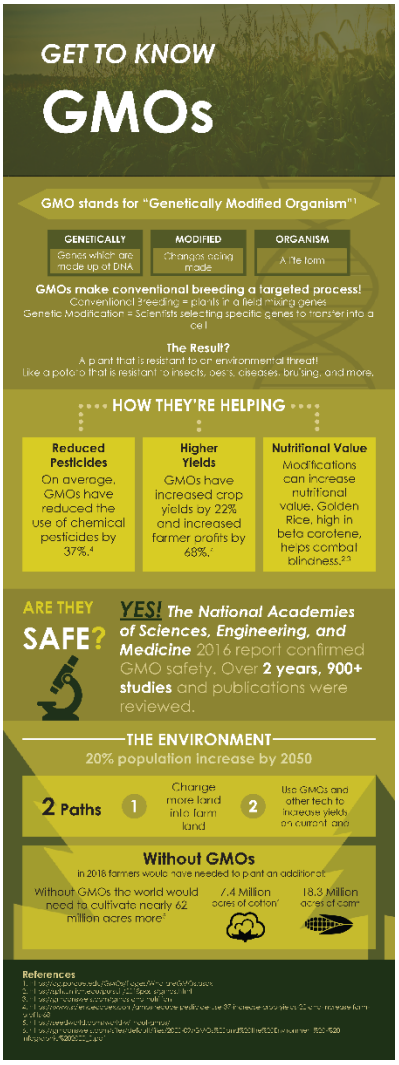
End of Block: Pre-Questionnaire

Start of Block: Infographic Viewing

Description In this section you will view an infographic related to GMOs. You must view this infographic for at least 1.5 minutes before you continue, but you may have as much time as needed. Please thoroughly review the infographic as you may not return to it after you move to the next page.

Page Break

Infographic



Timing 1.5 minutes

First Click
Last Click
Page Submit
Click Count

End of Block: Infographic Viewing

Start of Block: Post-Questionnaire

Description This section contains 6 questions regarding your perceptions and knowledge of Genetically Modified Organisms (GMOs). Answer each question to the best of your ability. There is no penalty for your answer choice.

Page Break

Directions Please answer the following question in your own words.

Q7
Describe what GMOs are.

_____

_____

_____

_____

_____

Q8 Please answer the following questions on a scale of 1-5. 1 being strongly disagree and 5 being strongly agree.

Q9 GMOS are safe for human consumption.

- ○ Strongly Disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

Q10 GMOs are safe for animal consumption.

- ○ Strongly Disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

Q11 GMOs have negative environmental impacts.

- ○ Strongly Disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

Q12 GMOs have positive environmental impacts.

- ○ Strongly Disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly agree (5)

Directions In the following question, please mark all that apply.

Q13 What are the benefits of GMOs?

- ☐ Feeding GMO grains reduces methane production in livestock. (1)
- ☐ GMOs help prevent the effects of environmental threats (diseases, etc.). (2)
- ☐ GMOs makes plants more insect and pest resistant. (3)
- ☐ GMOs increases the amount of grains produced per acre. (4)
- ☐ GMOs are used to modify nutritional value. (5)
- ☐ GMO fields regrow yearly, so replanting is not needed. (6)

End of Block: Post-Questionnaire

Start of Block: Block 6

Q42 This series of 7 questions is about the use of infographics to present technical information. This is not an evaluation of the color, visuals, and fonts of the provided infographic. The focus is about the general use of limited text and visuals found in infographics. Please answer each question to the best of your ability.

Q43 Please answer the following questions on a scale of 1-5. 1 being strongly disagree and 5 being strongly agree.

Q44 After viewing the infographic, I know more information about GMOs.

- Strongly Disagree (1)
- Disagree (2)
- Neutral (3)
- Agree (4)
- Strongly Agree (5)

Q45 I prefer to receive information about scientific topics, like GMOs, through infographics.

- Strongly Disagree (1)
- Disagree (2)
- Neutral (3)
- Agree (4)
- Strongly Agree (5)

Q48 I found the infographic content useful.

- Strongly Disagree (1)
- Disagree (2)
- Neutral (3)
- Agree (4)
- Strongly Agree (5)

Q47 I found the infographic structure appealing compared to the structure of a research paper presenting the same information.

- Strongly Disagree (1)
- Disagree (2)
- Neutral (3)
- Agree (4)
- Strongly Agree (5) Q46 I found the visual presentation of information appealing for learning versus reading paragraphs of the same information.
- Strongly Disagree (1)
- Disagree (2)
- Neutral (3)
- Agree (4)
- Strongly Agree (5)

Q50 In the following question, please mark all that apply.

Q49 In my opinion, the following factors impacted my perception of the credibility of an infographic.

- ☐ Citation of sources (1)
- ☐ Colors used (2)
- ☐ Fonts used to present information (3)
- ☐ The quality of graphics (4)
- ☐ Organization/structure of information (5)
- ☐ which company or organization produced the infographic (6)

Q53

Q51 Overall, I found the infographic information to be

- ○ Credible (1)
- ○ Not Credible (2)

End of Block: Block 6

Start of Block: Demographics

Directions Please respond to each item below

Q14 What is your age?

_____

Q15 What is your gender?

_____

Q16 What is your ethnicity?

- ☐ White (1)
- ☐ Black or African American (2)
- ☐ American Indian or Alaska Native (3)
- ☐ Asian (4)
- ☐ Native Hawaiian or Pacific Islander (5)
- ☐ Hispanic (6)
- ☐ Other (8)

Q17 Please select all colleges in which you are pursuing degrees.

- [ ] Fay Jones School of Architecture and Design (1)
- [ ] Fulbright College of Arts and Sciences (2)
- [ ] Sam M. Walton College of Business (3)
- [ ] College of Education and Health Professionals which includes Nursing (4)
- [ ] College of Engineering (5)
- [ ] Global Campus (6)
- [ ] Dale Bumpers College of Agriculture, Food and Life Sciences (7)

Q18 What is/are your major(s)?

_____

Q19 If you are affiliated (your values align, you financially support, or you are a member) with any animal rights organizations, list those organizations below. If not, list N/A.

_____

Q20 If you are affiliated (your values align, you financially support, or you are a member) with any environmental or GMO-free organizations, list those organizations. If not, list N/A.

_____

Q21 If you are or were involved in agriculture affiliated (your values align, you financially support, or you are a member) organizations (high school or college), please list those organizations. If not, list N/A

_____

Q22 In which state(s) have you lived prior to starting college?

_____

Q23 Do you have direct experience with production agriculture (row crops, forages, livestock, etc.)?

- Yes (1)
- No (2)

Q24 If yes to the previous question, please describe your experiences with production agriculture? If no, list N/A.

_____

End of Block: Demographics

Start of Block: Block 5

End Thank you for completing the survey. If you are selected for a prize, we will contact you via email.

End of Block: Block 5

Appendix C

Infographic