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Student Perceptions of Messages Regarding Genetically Modified Organisms Delivered Using Creative Media

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Cover Page Footnote

Faith Mills is a May 2022 honors program graduate with a major in Agricultural Education, Communication and Technology. Cassandra K. Cox, the faculty mentor, is an Instructor Professor in the Department of Agricultural Education, Communication and Technology.

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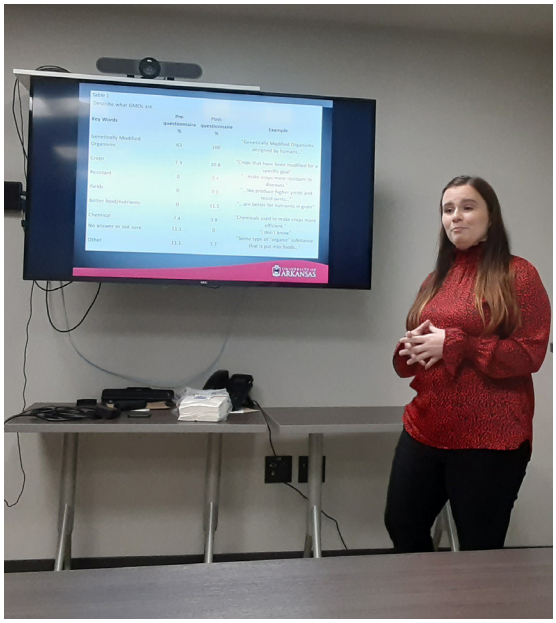
Student Perceptions of Messages Regarding Genetically Modified Organisms Delivered Using Creative Media

Meet the Student-Author

Faith Mills



Faith presenting research at her thesis defense.

I am from Asbury, Missouri and graduated from Carl Junction High School in 2018. I am graduating magna cum laude in May 2022 with a degree in Agricultural Education, Communications, and Technology with an Agricultural Communications concentration. During my undergraduate career I was a member and leader in the Razorback Marching Band and Kappa Kappa Psi. I was also a member of Sigma Alpha, Agricultural Communicators of Tomorrow, and FFA Alumni and Supporters. I was awarded Senior of Significance in the spring of 2022. I held an internship position as the Communications Assistant with the Bumpers Dean's Office and a position as Agricultural Communications Intern with the University of Arkansas System, Division of Agriculture, Share Grounds. After graduation I am pursing a career in marketing communications and looking to attend graduate school in the near future. During my junior and senior year, I worked on my honors project with Mrs. Casandra Cox. I utilized my passion for agriculture and innovative communication methods to develop a research project I was truly passionate about. I would like to thank my thesis mentor Mrs. Casandra Cox, and my thesis committee, Dr. Jill Rucker and Dr. Lisa Wood, for the wonderful help and encouragement they offered throughout the process. With their support I have completed an honors project I am happy to have been a part of, and I hope it will influence further similar research.

Research at a Glance

- Infographics are effective persuasion communication tools for presenting scientific data about genetically modified organisms (GMOs) to millennial and Generation Z students.
- Millennials and Generation Z students demonstrated limited initial knowledge of GMOs.
- Millennial and Generation Z students rate organization, aesthetics, and cited sources as key factors contributing to the credibility of infographics.

Student Perceptions of Messages Regarding Genetically Modified Organisms Delivered Using Creative Media

Faith Mills and Cassandra K. Cox†*

Abstract

The purpose of this study was to determine how communicating authentic agricultural information using an infographic affects Millennial and Generation Z students' perceptions of genetically modified organisms (GMO) and to determine the perceptions of college students regarding the infographic used to convey agricultural messages. This study used survey research methods with open- and closed-ended questions administered through Qualtrics. The questionnaire was designed with five sections including a pre-questionnaire, content presentation, post-questionnaire, infographic perception questionnaire, and demographics section. All questions in the pre- and post-questionnaire were focused on the content found in the researcher developed infographic. Overall, participants increased accuracy of their responses and reported more positive perceptions of GMOs after reviewing the infographic. The majority of participants also 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 are to utilize infographics to present GMO messages to Millennials and Generations Z students at the University of Arkansas, further test the accuracy of responses and perceptions of other agricultural topics presented using infographics with this audience, and use well organized, aesthetically pleasing infographics that have sources cited.

* Faith Mills is a May 2022 honors program graduate with a major in Agricultural Education, Communication and Technology.
† Cassandra K. Cox, the faculty mentor, is an Instructor Professor in the Department of Agricultural Education, Communication and Technology.

Introduction

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 misinformation to create communication noise. 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).

Issues like genetically modified organisms (GMOs), organic farming, pesticides, food security, farmers, agribusiness, animal welfare, family owned, and food safety are common topics surrounding the agriculture industry among the general public (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.

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. An audience-appropriate message is vital (Johnson and Hamernik, 2015). A clear message that has sound support from credible sources is particularly important and can effectively educate an audience (Grantham, 2009). 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 technical agricultural subjects.

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 the message using logic. The peripheral route is when individuals have lower levels of involvement and are influenced by surface characteristics. The 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).

The purpose of this research was to evaluate Millennial and Generation Z students' perceptions of GMOs. Information was presented in graphic content (infographic) to college-age students to evaluate their ability to understand the message. The focus was on the development of creative content that would effectively relay correct information and to assess students' perceptions of GMOs.

Materials and Methods

A mixed methods sample survey design was used to obtain qualitative and quantitative data to evaluate perceptions of respondents and determine the accuracy of their responses before and after viewing a GMO infographic. Two research questions guided this study: 1) How does communicating authentic agricultural information using an infographic affect Millennial and Generation Z students' perceptions of GMOs and 2) What are the perceptions of college students regarding infographic use to convey an agricultural message?

Quantitative survey questions used a numerical scale and did not benefit from elaborate answers. Qualitative open-ended responses were used for questions where elaboration was useful and beneficial. Qualitative questions included multiple choice, Likert-type, and select-all-that-apply questions. Section one asked participants about their awareness of GMOs by answering a set of six questions. Question 1 was an open response question. Questions 2 through 5 were Likert-type questions with responses including strongly disagree, disagree, neutral, agree, and strongly agree, and question 6 was a select- all-that-apply. In section 2, respondents viewed the researcher-developed infographic for 1.5 minutes before progressing to section 3 which repeated the questions from section 1. Section 4 assessed infographic preferences. In section 4, participants answered 7 questions about the use of infographics to present technical information. The answers to these questions were based on preference, opinion, and perception, not the design of the researcher-generated infographic. Questions 1 through 5 were rated on a Likert-type scale, question 6 was a select-all-that-apply, and 7 was multiple choice. Section 5 collected demographic data about respondents. The questionnaire was developed based on GMO data collected from scientific sources and presented in a researcher-generated infographic, which was also based on scientific sources (Fig. 1). All infographic sources were cited and provided for the viewer. The survey allowed the researcher to determine if the content influenced the participants' awareness of the GMOs and their preferences for alternative formats of media.

Internal validity evaluated 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 were potential internal validity threats from historical events or maturation. In order to avoid instrumentation issues, all materials and the survey were constructed prior to the start

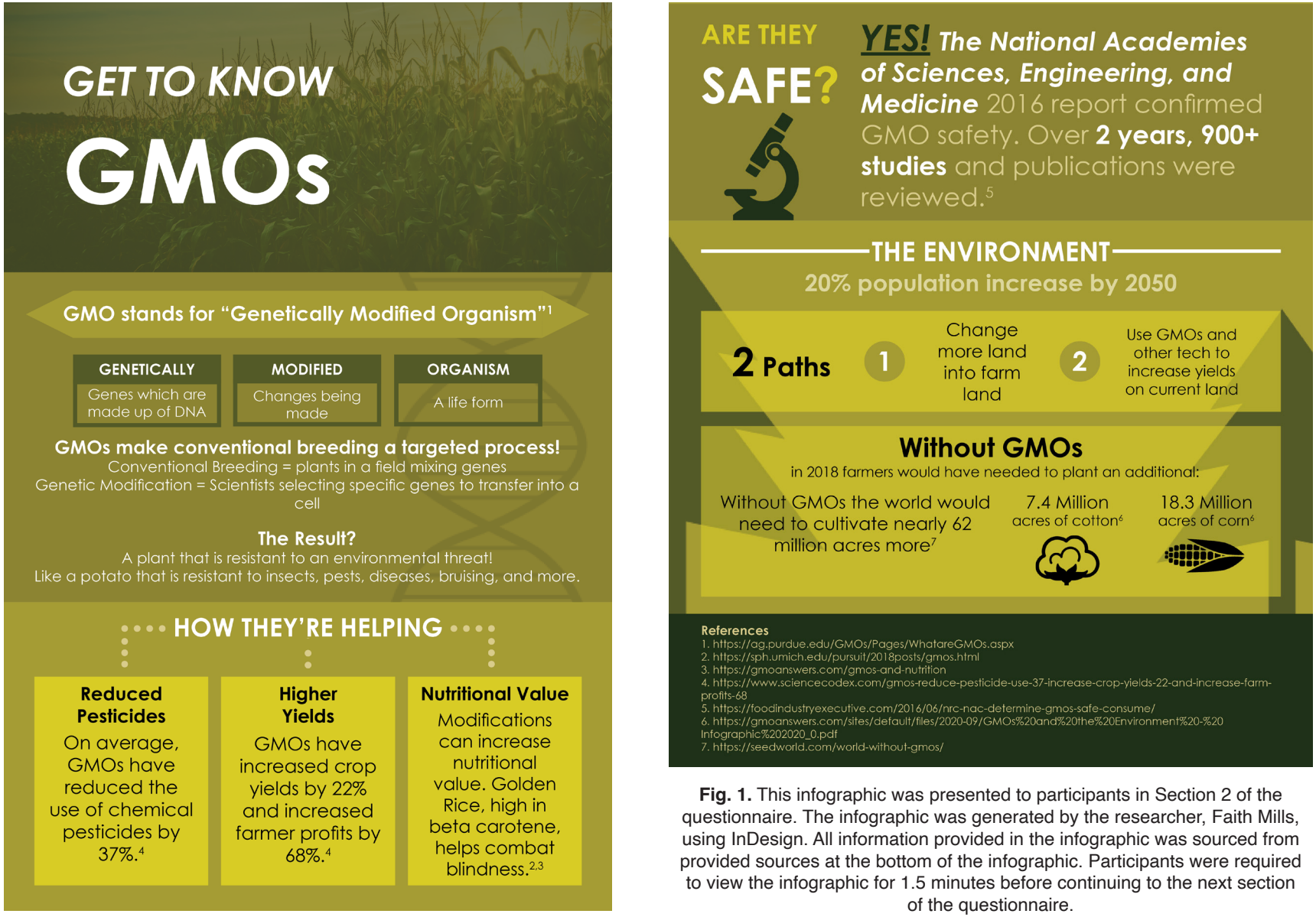


Fig. 1. This infographic was presented to participants in Section 2 of the questionnaire. The infographic was generated by the researcher, Faith Mills, using InDesign. All information provided in the infographic was sourced from provided sources at the bottom of the infographic. Participants were required to view the infographic for 1.5 minutes before continuing to the next section of the questionnaire.

of testing and remained the same for all participants. All questions in the survey were clearly worded and clarified through the use of cognitive interviews. The survey was designed with a grading system so those who scored and interpreted the results of the test did so consistently. Open-ended questions were evaluated based on a rubric to separate responses into thematic categories.

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. 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.

A non-probability purposeful sampling of students aged 18 through 25 were chosen to participate. The population of students selected were not majoring in agriculture in the Dale Bumpers College of Agriculture, Food and Life Sciences. 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 classes at the University of Arkansas during the spring of 2022 who responded to posted announcements about the study and choose to participate. The sample was appropriate because the survey was available to a large variety of college-aged 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.

Data for this research was collected through multiple channels including online e-mail listservs, organization group chats, and on-campus in-person methods. The questionnaire was presented in the form of a Qualtrics survey. Participants could not return to previous sections once they continued to a new section. Data were 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. The results and findings in the study were taken from 118 undergraduate students at the University of Arkansas who were non-agriculture majors, and the findings apply to this specific population.

Results and Discussion

The first question/statement presented in both the pre- and post-questionnaires was "Describe what GMOs are." This question was 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.

The second through fifth question/statements were rated on Likert-type scales. Statement two, "GMOs are safe for human consumption" had a most common pre-questionnaire response of "neutral" at 31.4% of responses. The greatest result of the post-questionnaire was "agree" at 44.9% of responses. Overall, the post-questionnaire results showed a greater percentage of agree or strongly agree responses by participants that GMOs were safe for human consumption.

The third question/statement presented was "GMOs are safe for animal consumption." The greatest result of the pre-questionnaire was "disagree," "neutral," and "agree" all at 28.8% of responses, and at 44.1% of responses, the greatest response on the post-questionnaire was "agree." Overall, the post-questionnaire results showed a greater percentage of agree or strongly agree responses that GMOs are safe for animal consumption.

The fourth question/statement was "GMOs have negative environmental impacts." The most popular response on the pre-questionnaire was "agree" at 40.7% of responses, and the most common response by participants on the post-questionnaire was "disagree" at 43.2% of responses. Overall, the post-questionnaire results showed a greater percentage of disagree or strongly disagree responses to the question about GMOs having negative environmental impacts.

The fifth question/statement presented was "GMOs have positive environmental impacts." "Neutral" was the top result of the pre-questionnaire at 49.2% of responses. The most common response on the post-questionnaire was "agree" at 49.2% of responses. Overall, the post-questionnaire results showed a greater percentage of favorable responses of agree or strongly agree by participants on GMOs having positive environmental impacts.

The sixth question/statement presented was "What are the benefits of GMOs?" This question was a mark-all-that-apply answering system. The four most popular choices on 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, which were correct based on the scientific data, were selected by a greater percentage of participants on the post-questionnaire (Table 2).

In section 4 there were 7 questions or statements. The first statement was "After viewing the infographic, I know more information about GMOs." The answer with the greatest percentage was "agree" at 50.8% of responses. Statement two addressed personal preference about receiving scientific information through infographics. "Agree" was the greatest response at 43.2% of responses. The third statement was "I found the infographic content useful," 52.5%

Table 1. Key words used by participants in response to "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…
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

of respondents answered, "Strongly agree." Statement four related to preference for the infographic or a research paper. The most common response was preference for infographic content presentation ("strongly agree" at 63.2% of responses). The fifth statement was "I found the visual presentation of information appealing for learning versus reading paragraphs of the same information." The greatest number of responses at 69.5% was "strongly agree."

The sixth statement in this section allowed respondents to choose all that apply for factors impacting respondent's perception of the credibility of an infographic. Respondents indicated organization/structure of information (80.5%), aesthetics (graphic quality at 74.6%, colors and fonts used at 46.6% respectively), and citation of sources at 61.9%) were the leading factors (Table 3). The final question found 99.2% of respondents rated the infographic as credible.

The majority of participants were white at 83.1%, 7.8% of participants were Hispanic, 2.5% of participants were black or African American, 1.7% of participants were American Indian or Alaska Native, and 1.7% of participants were Asian. "Other" was reported by 1.7% of participants as they did not fall into the listed categories. The majority of the participants were between the ages of 18 and 26 with 4 respondents over the age of 26. The majority of participants were female (72.9%), 26.3% of participants were male, and 0.8% of participants 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,

Table 2. Percentage of responses to pre- and post- questionnaire statement, "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

Table 3. Percentage of responses to the statement from section four, "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%

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.

Overall, participants had an increased positive opinion post-infographic viewing. The majority of participants had a better view and understanding of GMOs after viewing the infographic. Although, all answers to the question "What are the benefits of GMOs" increased, not just the correct answers. The preference was also in favor of infographics. The majority of participants found the infographic helpful, appealing, and credible. They also preferred infographics and their structure to receive information over paragraphs and papers.

Conclusions

Findings supported respondents demonstrating 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. 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 millennials or Generation Z, who are not pursuing college degrees, to determine if communicating about GMOs using an infographic has the same outcomes. To identify benefits of GMOs, respondents had to synthesize the infographic content to identify accurate responses. Thus, the researcher recommends experimenting with changes to the infographic to determine if creating prominent peripheral cues would improve respondents' understanding of GMOs.

Acknowledgments

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