

Seeking and Engaging: Case Study Integration to Enhance Critical Thinking About Agricultural Issues

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Abstract

The agriculture and natural resources (ANR) sectors are facing many complex and controversial issues today, including animal health, biotechnology, climate change, food safety, food security, invasive species, marketing and trade, and water. Undergraduate students, as the future ANR workforce, must use critical thinking skills to find solutions to these issues. This study sought to determine if a course that integrated case studies, as opposed to a classroom with no case study integration, influenced students' critical thinking. A pretest/posttest, quasi-experimental research design was used to determine if undergraduate students' critical thinking styles changed as a result of the case study integration. Three undergraduate communication courses focused on issues education at three universities were the sample. Based on the results, students were more willing to seek out information and engage with their peers about the issues facing ANR after the course with the case studies integrated. Case studies should be integrated into the classroom to encourage critical thinking based on these findings. Future research should include investigating the effects of using case studies in other undergraduate courses not focused on issues, in graduate courses, and extension education programs that could determine the effect in a non-formal education setting.

Keywords: case study integration; agricultural issues education; critical thinking styles; higher education; undergraduate education

Acknowledgement: This study was part of a project funded by the USDA Higher Education Grant Award no. 2016-70003-24829. Correspondence concerning this article should be addressed to Courtney Meyers, Department of Agricultural Education & Communications, Texas Tech University, Box 42131, Lubbock, Texas 79409, Phone: (806) 742-2816, courtney.meyers@ttu.edu.

Introduction

As the global population continues to increase to a projected 9.8 billion people by 2050 (United Nations, 2017), the agricultural and natural resources (ANR) sectors continue to address many complex, and often controversial, issues. Climate change, water, food security, food safety,

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and bioenergy are among the top ANR issues in the United States (United States Department of Agriculture – National Institute of Food and Agriculture, n.d.a). At all levels of formal education a need exists for creative and innovative instruction focusing on food, agriculture, natural resources, and human sciences issues (United States Department of Agriculture – National Institute of Food and Agriculture, n.d.b). Undergraduate students, as the future ANR workforce, must be prepared to think critically to address these issues.

Critical thinking is one of the most important cognitive traits and has been linked to an individual's success (Lamm et al., 2011). According to Paul (2002), as change occurs and issues become more complex, critical thinking is vital to be successful. Critical thinking must be active, purposeful, and organized (Chafee, 1988) and “involves solving problems, formulating inferences, calculating likelihood, and making decisions” (Halpern, 2002, p. 6). Rather than critical thinking being a set of skills, researchers have identified critical thinking as a disposition (Facione, Giancarlo, Facione, & Gainen, 1995), style (Lamm & Irani, 2011), and process when a connection is made between the thinking and reasoning process with the outcome of a decision or action (Huitt, 1998). Critical thinking research continues to appear in agricultural education literature (Edgar, Edgar, Briers & Rutherford, 2008), but research connecting ANR issues and critical thinking is still needed.

The use of case studies as an educational tool has been shown to enhance critical thinking (Popil, 2011) because of the real-world experience a case study brings to the learning environment (Naumes & Naumes, 2012). Case studies are a written narrative based on facts and data (Naumes & Naumes, 2012). Dori, Tal, and Tsaushu (2003) specifically found benefits of case studies when teaching about complex topics. Case studies bring an authentic nature to the classroom (Naumes & Naumes, 2012) because of the real-world issues they present, allowing students to experience the issues for themselves. Student engagement is a key aspect of successful case studies where students are encouraged to partake in “learning by doing” (Naumes & Naumes, 2012, p. 5). This type of learning, when compared to traditional lecture teaching, has resulted in more positive and longer-term attainment (Naumes & Naumes, 2012). To make a case study interactive, multimedia elements such as videos, audio clips, web resources, other visuals, and animations can be included to give a well-rounded experience and equip students with more in-depth knowledge about the specific issue at hand (Chattaraman, Sankar, & Vallone, 2010). Today's students are more familiar with technology than ever before, and the multimedia elements allow them to use their knowledge of technology to learn about pressing issues (Naumes & Naumes, 2012).

Courses focused on business, medicine, and science utilize the case study method of teaching (Bonney, 2015) to provide a rich learning experience in complex areas. Case studies are flexible educational tools (Zimmerman, 2002) and provide the instructor the ability to adapt to meet the needs of their students. Not only do case studies provide real-world experiences, but they also help students to connect theory and practice (Naumes & Naumes, 2012). Case studies are suitable to address big-picture problems that merit thorough discussion (Wassermann, 1994). Using case studies in the classroom can also allow for a supportive environment for students to discuss and critically think about the issue with their peers (Cassimjee, 2007). For this study, case studies were used to expose students to real-world situations about invasive species, antibiotic use in animal agriculture, rural community resilience, crisis communication, and water conservation with opportunities to critically think about solutions.

Literature Review and Conceptual Framework

Experiential learning (Dewey, 1938) was the theoretical foundation that guided this study. Experiential learning theory is the basis for student-oriented education (Kolb, 1984), implying

students can learn through their experiences in the classroom by applying the curriculum to their own lives. Dewey (1938) explained the experience of application will then impact later experiences. Experiential learning teaches students to apply prior knowledge and experiences to complex situations in a critical and active manner (Baker & Robinson, 2016). Students' critical thinking is encouraged when case studies are used in the classroom because they are able to think about the relevance of the issue and associate the issue with real-life (Dewey, 1938).

Critical thinking is one of "the most important intellectual skills for the 21 century" (Halpern, 2002, p. 3). Critical thinking is considered a higher-order of thinking (Burden & Byrd, 1994). Although critical thinking skills are identified in the literature, another component studied and acknowledged of critical thinking are the critical thinking styles (Lamm & Irani, 2011). "The cognitive style of critical thinking explains how an individual prefers one particular method to another when processing information, or critically thinking about a particular topic" (Gorham, Lamm, & Rumble, 2014, p. 44). Critical thinking is not only a unique, purposeful type of thinking but also a type of thinking where standards are established to assist students to reason through complex situations that do not have a clear right or wrong answer (Lamm & Irani, 2011).

Lamm and Irani (2011) identified two cognitive styles of critical thinking that exist on a continuum: a tendency toward either seeking information or engagement. Those who recognize their own experiences, biases, predispositions, and environment are more likely to seek information. Seekers are "hungry learners" who listen to others' opinions, are always looking for new knowledge, and long for the truth, even if it conflicts with their current beliefs (Lamm & Irani, 2011, p. 7). Individuals who tend to seek information while critically thinking will seek out a variety of sources by researching, reading, and questioning to gain knowledge on the issue or topic about which they critically think. Seekers understand problems usually are not solved with only one answer; they can appreciate the complexity of problems and look for all answers to solve the problem, not just a singular response (Lamm & Irani, 2011).

Those who prefer engagement when critically thinking are confident in their abilities to communicate and look for opportunities to reason with others, showing their ability to problem solve and arrive at a decision (Lamm & Irani, 2011). Individuals who tend to engage will be proficient in demonstrating how they arrived at the solution they did for the problem at hand. Engagers also have awareness of their surroundings to determine when situations require good reasoning to solve a problem. While neither style is considered better or worse than the other, the ultimate critical thinker will be able to work within both styles when thinking through an issue critically (Lamm & Irani, 2011).

Previous research has shown case studies are effective in promoting critical thinking (Popil, 2011). Popil (2011) investigated various studies that analyzed the use of critical thinking and found case studies to have positive effects in the domains of nursing, psychology, and criminal justice. Case studies have shown to encourage active learning, which then initiates critical thinking. Popil (2011) pointed out case studies have been beneficial to teach students about complex issues. Case studies also challenge instructors to rethink their teaching style and encourage more enthusiasm in the course and for the topic.

Another study that focused on a case study used in a criminal justice course suggested case studies should be used broadly across the social sciences (Kunselman & Johnson, 2004). This study was based on active learning theory to determine the effects four case studies had on student critical thinking when enrolled in a criminal justice course. The researchers found almost all students (95%) enjoyed the case study activities that made them *think* more (Kunselman & Johnson, 2004). Because the case studies made the students think more, they also reported being "more aware of

other issues” (Kunselman & Johnson, 2004, p. 91) through critically thinking about the case study. Furthermore, because case studies promoted critical thinking, Kunselman and Johnson (2004) concluded “students [are able] to make better decision[s] and become better students and, ultimately, better employees” (p. 92).

Echoing the results of Kunselman and Johnson (2004), Forsgren, Christensen, and Hedemalm (2012) found value in using case studies for nursing students to enhance critical thinking. By engaging in case studies, nursing students had longer-lasting knowledge because the case studies “stimulate their own thinking and that it provides for opportunities of [one’s] own reflection as well as group reflection when working together” (Forsgren et al., 2012, p.166). This study found students were better able to critically think about the complex concepts in a nursing program because of the case studies. Ultimately, these researchers concluded case studies better prepared students to enter the workforce by equipping them with critical thinking skills (Forsgren et al., 2012).

Previous research shows support for using case studies in the higher education agricultural education classroom. Perry, Paulsen, and Retallick (2015) investigated the use of active learning, such as that found in case studies, and whether it increased critical thinking during a farm management capstone class. The results indicated, students only increased critical thinking in one area researchers measured (Perry et al., 2015). While the difference for overall critical thinking was not statistically significant, the change in separating relevant and irrelevant information had a statistically significant change from pretest to posttest. This positive change is important because it indicated case studies helped students sort through information when they were asked to solve real-world problems (Perry et al., 2015), and may be an expression of the seeking information critical thinking style (Lamm & Irani, 2011).

In another study, researchers selected a genetics course to determine the effects of inquiry-based and problem-solving teaching methods similar to those of methods found in a case study (Friedel, Irani, Rhodes, Furhman, & Gallo, 2008). The study also sought to determine the relationship between critical thinking and problem-solving. For the relationship between critical thinking and problem solving, no statistical significance was found. For critical thinking, independently, students in the course did not score significantly higher for critical thinking (Friedel et al., 2008). These researchers called for more research to be done on this type of teaching method to measure its influence on critical thinking.

A conceptual model was created to describe the effects the case studies might have on critical thinking based on the literature. Going into the course, all students have some degree of seeking and engaging critical thinking styles. After the experience of the case study, which has been shown to increase critical thinking (Forsgren et al., 2012; Kunselman & Johnson, 2004), students should increase their seeking tendency and their engaging tendency. Below, the model demonstrates the process as to how a course with no case study integration and a course with integration should differ when comparing students’ seeking and engaging scores.

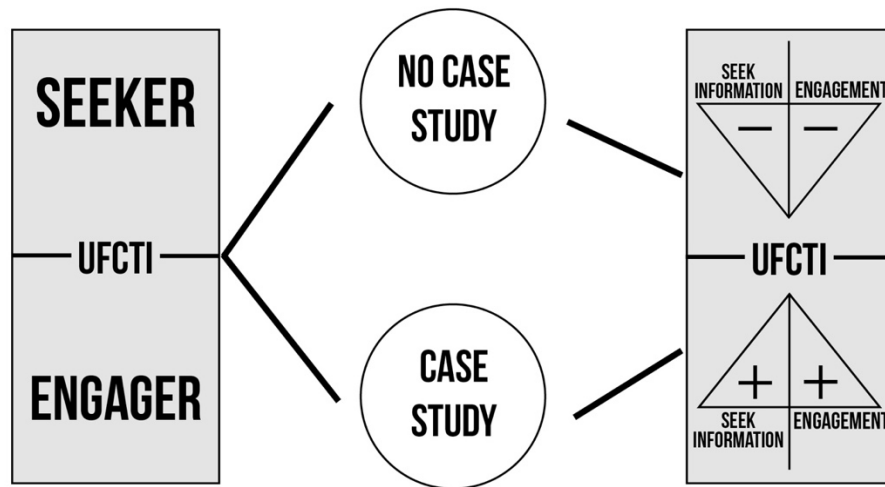


Figure 1. Model for Integration of Case Studies on Critical Thinking Style.

Based on previous research, case studies have shown positive benefits to students' critical thinking (Forsgren et al., 2012; Kunselman & Johnson, 2004; Popil, 2011). Studies have also concluded an increase in critical thinking equips students to understand and solve complex problems and issues in the real world as demonstrated in the proposed model through increased seeking and engaging tendencies. However, in courses focused on agricultural topics, additional research has been suggested to determine impacts of case studies on students' critical thinking.

Purpose, Objectives, and Hypotheses

The purpose of this research study was to assess if case studies enhanced the way undergraduate students think critically when enrolled in communication courses that included content about ANR issues. For this study, a model was created to demonstrate the effects of a case study. Based on previous research, case study integration enhanced students' critical thinking. In this study, seeking information and engagement were the measures that defined critical thinking styles (Lamm & Irani, 2011). The following objectives, hypotheses, and associated nulls directed the study:

1. Determine a change in students' critical thinking style from enrollment in a communications course taught without case studies.
 H_0 : No significant change occurred in students' critical thinking style after enrollment in a communication course with no case study integration.
2. Determine a change in students' critical thinking style from enrollment in a communications course taught with case studies.
 H_0 : No significant change in students' critical thinking style after enrollment in a communication course with case study integration.
3. Determine a difference in critical thinking style between the communication courses that taught with case studies and without case studies.

H₀: No significant change in students' critical thinking style between those enrolled in communication courses that taught with no case study and case study integration.

Methods

A pretest/posttest, quasi-experimental research design was used to determine if integrating ANR issues-based studies into undergraduate courses influenced students' critical thinking style. The courses were all designated as agricultural communication courses at three land-grant universities. During the study, in the control period, which was spring semester 2016, each course varied slightly in their focus, but none included the case studies. The case studies, integrated in spring semester 2017, highlighted nine significant ANR issues specified by USDA as challenge areas (USDA, n.d.): animal health, biotechnology, climate variability and change, conservation, food safety, food security, invasive species, marketing and trade, and water. The case studies and their respective topics included:

1. Crisis communication in a food recall;
2. Invasive species and citrus greening;
3. Water conservation and the Ogallala Aquifer;
4. Rural community resilience in a natural resource-dependent community; and
5. Antibiotic use in livestock.

The case studies were designed similarly to include definitions of terminology, background and relevant history of the issue, and a focus on communication theory, processes, and outcomes associated with each issue. Each case study incorporated videos that featured experts and those directly affected by the issue to provide students with a vicarious learning experience. The students' learning experiences included instructional activities that encouraged problem-solving, critical thinking, and communication skills practice.

Measures, Procedure, Sample, and Analysis

The survey instrument for the pretest/posttest included the University of Florida Critical Thinking Inventory (UFCTI; Lamm & Irani, 2011), which is an established, reliable instrument to determine students' critical thinking style. It contains 20 statements to gauge respondents' critical thinking styles. These statements encompass how respondents interact with others, deal with issues, solve problems and preferences of learning. The response scale for each item was a 5-point Likert-type scale of agreement/disagreement. An overall critical thinking style score was calculated for each student along with a score for the amount they engage when critically thinking and seek information when critically thinking. Respondents with a score of 79 or higher are considered seekers and respondents with a score of 78 or lower are classified as engagers (Lamm & Irani, 2011). The instrument was reviewed by a panel of experts in the subject matter addressed in the case studies and in program evaluation to improve face and content validity.

An online survey platform administered the instrument to students. The researchers collected the first dataset, the control, during the spring 2016 semester when the case studies were not integrated into the courses. Pretest data were collected during the first week of class, and posttest data were collected at the conclusion of the course within a week. In spring semester 2017, the case studies were integrated into the same courses. The same instrument and procedures were used to collect data from these treatment groups.

The purposive sample consisted of 83 undergraduates at three land-grant universities who were enrolled in agricultural communication courses that included content about ANR issues. Although some students were from outside the respective colleges of agriculture, most students enrolled in the classes were in the college of agriculture. There were 26 respondents in the control group and 57 in the treatment group.

The 26 students in the control group with matched pre/posttests were from the University of Florida, Colorado State University, and Texas Tech University. These students ages ranged from 20 to 24 years old, and they self-identified as white and non-Hispanic. Juniors (38.5%) and seniors (38.5%) in college made up most of the sample with all four college ranks represented in the sample. The majority of students in the control group were female (80.8%) and had a major in agricultural education, communication and/or leadership (65.4%). Other majors represented included journalism and media communication (18.5%), agricultural literacy (7.7%), environmental communications (3.8%), and natural resource recreation and tourism (3.8%).

Regarding the treatment group, the 55 students represented the same three universities as the control group. The treatment group had a larger age range of students from 20 to 27 years old, and one student older than 27. Hispanic students made up 8.9% of the sample, and multiple races were a part of this group. Similar to the control group, the majority of students were self-identified juniors (41.1%) and female (75%). The largest represented major was, again, agricultural education, communication, and/or leadership (64.3%). Other majors with more than one student were journalism (8.9%), business (5.4%), communication (3.6%), and environmental sociology (3.6%). Majors represented with only one student were natural resource tourism, cultural anthropology, ecosystem science, agricultural literacy, animal science, natural resource conservation, advertising, agricultural business, and a double major (agricultural education and agricultural business).

The response rate for the control group was 40% and, for the treatment group, there was a response rate of 83%. The control group had a low response rate due to students dropping the course after taking the pretest, students choosing to not participate in the study, and no incentive to participate with extra credit. These reasons are limitations to the control group and recognized by the researchers. Although the treatment group had a higher response rate, it had similar limitations as the control group. However, in addition to those limitations, students in the posttest also gained extra credit if they participated in the study. A Chi-square test was conducted comparing gender and college rank of those who chose to complete or not complete the survey to address non-response bias. The test did not indicate a significant difference, so the sample was considered representative of students in the three courses during the time of the study.

The researchers used SPSS 24 to analyze the data. Descriptive statistics were used to identify the mean differences. Paired *t*-tests were used to compare pretest and posttest data within each group. Finally, a *MANOVA* was used to determine the influence of the integration of the case studies on students' critical thinking styles when comparing the control and treatment groups.

Results

Critical Thinking Style – Comparing the Control

When students enrolled in the communication course with no case study integration, the use of both critical thinking style and the overall scores decreased (Table 1). After taking the course, students in the control group were not as likely to seek information or engage with others about ANR issues. Overall, students were the least likely to seek information after no case study

integration (Table 1). The t statistics were fairly low indicating there was not much difference between the pre/posttest scores. The researchers rejected the null hypothesis for objective one.

Table 1

Differences in Critical Thinking Style – Control

	Pre <i>M(SD)</i>	Post <i>M(SD)</i>	ΔM	t	p	Cohen's d
Overall	77.57 (3.13)	77.11 (5.04)	-.46	.38	.37	.08
Seeking Information	52.12 (4.38)	50.89 (6.84)	-1.23	.92	.54	.18
Engagement	51.54 (4.65)	50.76 (5.79)	-.78	.63	.70	.12

Critical Thinking Style – Comparing the Treatment

The treatment group, in which instructors integrated the case studies, had more positive results than the control group. Both seeking and engaging tendencies increased after the exposure to case studies focused on ANR issues (Table 2). Engagement had the largest difference (+1.54), suggesting students were more willing to engage with others after taking the course with case studies. The results of the t -tests had higher t statistics showing more difference existed between the scores of the pretest results and posttest results for seeking information and engaging information compared to the control group (Tables 1 & 2). For objective two, the researchers rejected the null hypothesis as well.

Table 2

Differences in Critical Thinking Style – Comparing Treatment Group's Scores

	Pre <i>M(SD)</i>	Post <i>M(SD)</i>	ΔM	t	p	Cohen's d
Seeking Information	53.74 (4.98)	54.70 (5.75)	+.96	-1.62	.11	.05
Engagement	52.90 (5.48)	54.44 (5.94)	+1.54	-2.59	.01**	.16
Overall	77.74 (3.58)	77.20 (3.64)	-.54	1.13	.26	.12

Note. ** $p < .01$.

Critical Thinking Style – Comparing the Control and Treatment

While comparing the control and treatment groups, none of the comparisons between pretest and posttest were significant, and the F statistic and R^2 for the control group were both lower than the treatment group (Table 3). Thus, these results indicated no significant difference existed between pretest/posttest results for the control group. The F statistic for the treatment group indicated students were more willing to critically think with the large difference between mean differences from control to treatment. The R^2 values showed the case studies accounted for 36% to 43% of the variance in seeking information and engaging with others (Table 3). In addition, when comparing the treatment and control mean differences, a statistically significant change in both seeking information and engagement (Tables 1 & 2). Therefore, the researchers also rejected the null hypothesis for the study's third objective.

Table 3

Differences in Critical Thinking Style

	Control					Treatment		
	<i>Df</i>	<i>F</i>	<i>p</i>	<i>R</i> ²	<i>df</i>	<i>F</i>	<i>p</i>	<i>R</i> ²
Overall	2	0.190	.22	.12	3	1.10	.35	.36
Seeking Information	2	1.633	.32	.09	3	15.03	.00**	.43
Engagement	2	1.196	.83	.02	3	20.06	.00**	.04

Conclusions, Implications, and Recommendations

Students must be able to think critically to solve the issues the ANR industries are facing now and are likely to encounter in the future. Critical thinking not only helps them be better students, but also better employees in the future (Forsgren et al., 2012; Kunselman & Johnson, 2004). Previous research has also recognized the need to further investigate the use of case studies in agricultural courses (Friedel et al., 2008). This study examined the impact of case study integration on critical thinking style in communication courses focusing on ANR issues. This study's sample included mainly upperclassmen, female, and agricultural education, communication, and/or leadership majors.

Overall, the results of this study support the use of case studies to encourage critical thinking about complex agricultural issues. The results indicated the integration of case studies encouraged students to seek out information and engage with others more than students who took the same course without case studies. A significant and positive difference was found between the groups.

The conceptual framework for this study identified two cognitive styles of critical thinking that exist on a continuum – seeking and engaging (Lamm & Irani, 2011). This continuum recognizes that while everyone participates in some level of critical thinking, how that is displayed may vary. Learners who are more “seekers” are more open to others’ perspectives and are always looking for new knowledge. Within the classroom, these types of critical thinkers would prefer opportunities to gather additional information from multiple perspectives. Students who fall on the “engagers” end of the continuum would appreciate opportunities to discuss the case studies with others to demonstrate how they arrived at a decision.

Knowing students’ critical thinking dispositions provides some recommendations for practice. When integrating case studies, instructors could organize group discussions with students who represent various points on the critical thinking disposition continuum (Lamm & Irani, 2011) to help students utilize each other’s strengths. Additionally, instructors could help students develop skills they are lacking. For example, individuals who are more prone to “seeking” behaviors, may need to be encouraged to arrive at a conclusion and be prepared to defend it. This could be accomplished by making them the leaders in a group discussion who must determine the appropriate action and justify the decision. Those who are more likely to be “engagers” may need support in recognizing how their own biases and predispositions are influencing their thinking. Therefore, they should be encouraged to seek additional perspectives on the topic at hand.

Previous research supports the finding that case studies improve students' critical thinking (Popil, 2011). These findings imply real-world experiences, such as those presented in the case studies, increase critical thinking. All students in this study were more willing to engage with others after exposure to the issues presented in the case studies. The current study's results echo the previous calls for more research to investigate the impact of case study teaching methods on critical thinking and contradicted the results of previous research in agricultural courses. Previous research (Friedel et al., 2008; Perry et al., 2015) found, overall, critical thinking was not enhanced by experiential learning teaching methods, whereas in this study, critical thinking strengthened for both.

However, the study's limitations should be recognized. First, the results should not be generalized to the larger student population due to the small sample size of the study groups. In addition, the study should be replicated to ensure the positive effect of incorporating case studies. Finally, the treatment group was the only group to receive an incentive to participate in the study. Even though these limitations are present, educators should still consider incorporating case studies into their courses based on the results and support found in the literature.

Additional research is needed to explore how a student's critical thinking style might influence how they evaluate the information presented and assess the credibility of that information. This area of future research should explore the role of students' epistemological perspectives and influence on critical thinking disposition. This would provide a more complete picture of how students evaluate the information presented in case studies and utilize it to make decisions.

Case studies should be integrated into courses that address ANR issues so students have an opportunity to experience the issues and critically think about them. This research begins to link the use of case studies and critical thinking style when teaching about ANR issues. Future research should examine if case studies increase critical thinking style in courses outside of communication courses, such as technical agricultural and natural resources courses in colleges of agriculture. These case studies also could be incorporated into non-formal education experiences, such as extension education programs (Gay, Owens, Lamm & Rumble, 2017, because these ANR issues do not only impact undergraduate students. The use of case studies in non-formal education with adult learners would allow them to lend their previous experience to provide potential solutions for significant issues facing the agriculture industry. The benefits of case studies can also be recognized at the secondary level. The case studies should be introduced in high school classrooms as a way for students to experience ANR issues and develop their critical thinking skills.

Finally, the extent and complexity of issues in agricultural and natural resources continue to increase. This presents the need to research the role of critical thinking regarding other ANR issues not examined in this study. Additional case studies should be developed to introduce individuals – through both formal and non-formal education – to additional issues facing the industry. These future efforts are necessary to prepare the ANR workforce to address the issues of today and be equipped to solve evolving issues in the future.

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