

CRITICAL THINKING SKILLS OF SELECTED YOUTH LEADERS: THE EFFICACY OF CRITICAL THINKING DISPOSITIONS, LEADERSHIP, AND ACADEMIC PERFORMANCE

John C. Ricketts, Assistant Professor

University of Georgia

Rick D. Rudd, Associate Professor

University of Florida

Abstract

The purpose of this correlational study was to identify and explain the agricultural and leadership specific critical thinking skills of selected youth leaders in the National FFA Organization. From the conceptual model of critical thinking skills development in Figure 1, the following sets of variables were related to critical thinking skills: Grade point average (GPA), leadership training score, and the critical thinking disposition of innovativeness explained 12% of the variance in combined critical thinking skill; GPA, gender, age, and innovativeness explained 13% of the variance in the specific sub-skill of Analysis; and GPA and the Innovativeness disposition explained nine percent of the variance in the specific sub-skill of Inference.

Introduction

Researchers and practitioners have determined that critical thinking is an important part of Agricultural Education. The Committee on Agricultural Education in Secondary Schools (National Research Council, 1988) concluded that redirecting agricultural education programs was in order, if graduates of those programs were going to be successful in college or the workforce. One of the key points of the committee's report was their conclusion that ample opportunities should exist for practicing critical thinking skills with increasing variety and frequency. This was also supported by the National FFA Task Force on Leadership, Personal Growth, and Career Success (2002) as they included critical thinking as one of the key factors of youth development in agricultural education programs.

Edwards (2003) concluded that the student behavior of critical thinking "ought to be occurring in secondary-level agricultural education classrooms and laboratories" (p. 189). But is critical thinking occurring in these settings? If

critical thinking is occurring, to what extent is it occurring, and does it help students? Although several critical thinking studies (Cano, 1993; Rollins, 1990; Rudd, Baker, & Hoover, 2000; Torres, 1993; Whittington, 1997) have been conducted in previous years, limited research related to critical thinking and youth was identified, especially in the fields of agricultural education and leadership development. Calls for further critical thinking research have been made by agricultural education professionals (Cano & Martinez, 1991; National Research Council, 1988), but few answers to those calls have been provided. This study seeks to identify and explain critical thinking skills of selected youth leaders in the National FFA Organization within the contexts of agriculture and leadership.

Theoretical / Conceptual Framework

The theoretical framework for this study is supported by a National Delphi study conducted by Peter Facione (1990), who defined critical thinking as "purposeful, self-regulatory judgment, which results in interpretation, analysis, evaluation, and

inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based” (p. 2). The critical thinking skills identified by the panel of experts in that study were Interpretation, Analysis, Evaluation, Inference, Explanation, and Self-regulation. This study sought to quantitatively measure three of those skills: Analysis, Evaluation, and Inference.

A student competent in the critical thinking skill of Analysis can effectively identify the relationship between statements, questions, concepts or descriptions in order to express beliefs, judgments or reasons. Students excelling at Inference consistently demonstrate the ability to draw reasonable conclusions and/or hypotheses based on facts, judgments, beliefs, principles, concepts or other forms of representation. Finally, students competent in the skill of Evaluation can effectively assess the credibility of statements and representations of others, and are proficient in assessing the logical strength of statements, descriptions or questions (Facione, 1998).

In addition to a complete list of critical thinking skills, the Delphi study identified a list of critical thinking dispositions that are necessary for critical thinking. Facione (1998) referred to the dispositions as approaches to life that characterize critical thinking. In the California Critical Thinking Disposition Inventory (CCTDI), which has been a standard instrument used to measure the approaches to life, Truth-Seeking, Open-mindedness, Analyticity, Systematicity, Self-confidence, Inquisitiveness, and Maturity are measured.

This study used a researcher-developed instrument that measured those same approaches to life. Because the length, amount of time it takes to complete the CCTDI, and the questionable reliability scores of the CCTDI (Moore, Rudd, & Penfield, 2002), researchers developed the EMI. The instrument, referred to as the EMI, contained three scales (Engagement, Cognitive Maturity, and Innovativeness). A content analysis of Facione’s original Delphi study was used to develop the three-scale instrument. The Engagement disposition measured students’ predisposition to look for opportunities to use reasoning; anticipating situations that require reasoning; and confidence in reasoning ability. The Innovativeness disposition measured students’ predisposition to be intellectually curious and wanting to know the truth. The Cognitive Maturity (Maturity) disposition measured students’ awareness of the complexity of real problems; being open to other points of view; and being aware of their own and others’ biases and predispositions.

Considering the review of literature concerning critical thinking skill and its related influential variables, the conceptual/behavioral model, which is represented in Figure 1, was developed. In the model adapted from Triandis (1980), critical thinking skill is the behavior that is influenced by critical thinking dispositions (attitudes) and a set of “facilitating factors.” This conceptual/behavioral model includes leadership experience, leadership training, gender, GPA, and age as the facilitating factors that might contribute to the behavior of critical thinking skill.

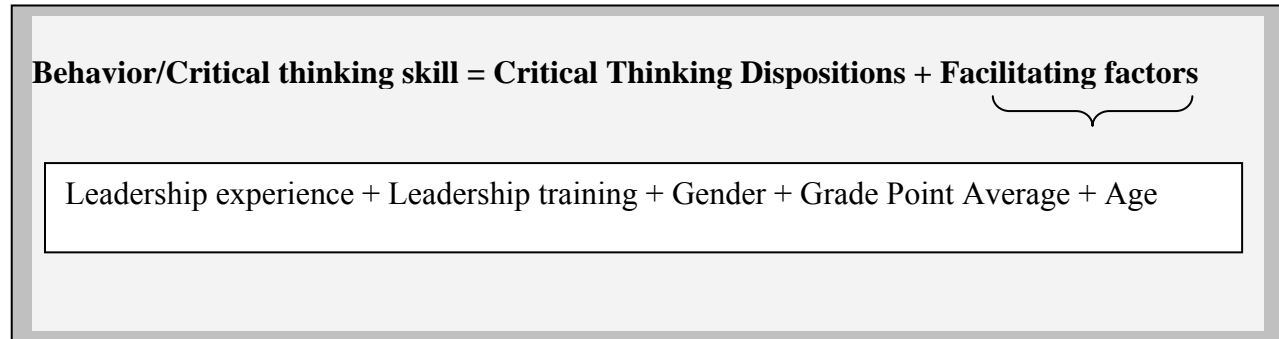


Figure 1. Conceptual Model of Critical Thinking Skills (Behavior) Development

Purpose and Objectives

The purpose of this exploratory study was to identify and explain the agricultural and leadership specific critical thinking skills of youth leaders in the National FFA Organization. To accomplish the purpose the following research objectives were used to guide this study:

1. Describe the critical thinking skill scores, critical thinking dispositions scores, leadership scores, GPA, age, and gender of selected leaders in the National FFA Organization.
2. Determine the relationship between critical thinking skill scores and critical thinking dispositions scores, leadership scores, GPA, age, and gender of youth leaders in the Organization.
3. Explain variance in the Analysis, Inference, Evaluation, and combined critical thinking score of youth leaders using age, gender, GPA, leadership and critical thinking disposition variables.

Methods and Procedures

Since the purpose of this study was to explain the agricultural and leadership specific critical thinking skills of youth leaders in the National FFA Organization, the research design was correlational and descriptive. Descriptive methods were used

to report the demographics of participants and to report critical thinking skills, dispositions, and leadership scores. The target population (N = 462) was a list of 2002 National FFA Convention delegates specifically selected because of their leadership record in the FFA.

A pilot version of the researcher-developed critical thinking skills test was administered to 33 subjects at the Florida State FFA Convention. A pilot test of the new critical thinking disposition test, which will be referred to as the EMI, was administered electronically to 60 subjects from a successful FFA Chapter in Tennessee. The pilot samples were purposively selected because of their similarities to the target population. Tests revisions of both instruments were made as a result of the pilot tests.

Since there was not an agricultural and/or leadership specific measure of critical thinking, the researchers developed a critical thinking skills test to measure the discipline-specific skills of Analysis, Inference, and Evaluation (Facione, 1990). The researcher-developed EMI measured the student dispositions of Innovativeness, Engagement, and Maturity. Prior to pilot testing, a panel of experts in critical thinking and agricultural and leadership education checked the multiple-choice skills test, the 5-point-Likert-type EMI, and the leadership and demographic instruments for content and face validity. Table 1 provides sample items from each construct of the EMI.

Table 1
Sample Items from the EMI Instrument

	SD	D	U	A	S
1. I always believe there is more to be learned.	1	2	3	4	5
4. I am interested in many issues.	1	2	3	4	5
18. Good leaders listen to different opinions.	1	2	3	4	5

Note: e.g., 1 = Innovativeness item; 4 = Engagement item; 18 = Cognitive Maturity item

After pilot testing and item analysis, Cronbach's alpha for each critical thinking sub-skill was .83 for Analysis with eight items, .66 for Inference with five items, and .63 for Evaluation with seven items. It may be important to note that the CCTDI only reported individual scale reliabilities ranging from .60 to .78 (Facione, Facione, & Sanchez, 1994). Cronbach's alpha is reported instead of KR-20 because they are identical coefficients for tests in which each item has one correct answer and all correct answers are worth the same number of points (Nunnally, 1967). Cronbach's alpha coefficients for the subscales of the EMI critical thinking disposition assessment were .79 for the 11-item Innovativeness scale, .75 for the 10-item Maturity scale, and .89 for the twelve-item Engagement scale. Reliability ratings were not strong, but researchers proceeded with the study since Norris and Ennis (1989) suggested reliability ratings as low as .67 were appropriate in critical thinking; "to the extent that the disposition toward critical thinking is not a singular thing, but actually a long list of . . . [several] . . . dispositions and correlative dispositions, such that a person might have some and not others" (Facione, Facione, & Giancarlo, 2000, p. 15).

The instrument used to collect data for the other variables - leadership training score, leadership experience score, age, gender, and GPA - was also developed by the researcher. To measure leadership, participants were asked to write the number of times they had participated in a given list of leadership activities that are available in the FFA. Additionally, participants responded to the following questions: "What

other activities in the FFA, not listed above have contributed to your leadership development?" and "What activities outside of the FFA have contributed to your leadership development?"

The list of items and the responses were classified as either formal leadership training (i.e., leadership workshops, leadership conferences, or formal leadership courses) or as leadership experiences (i.e., public speaking, livestock judging, state FFA convention). An index method of scoring leadership participation, inspired by Dormody and Seevers (1982), was utilized whereas Local activities were given a value of one point, District or Area activities were given a value of two, Regional activities were given a value of three, State activities were given a value of four, and National and International activities were given a value of five. A formal leadership development course was also given a value of 5.

Survey implementation followed Dillman's (2000) system of five compatible contacts. The instrument was initially available online, but non-respondents were ultimately sent a paper version of the instrumentation. There were 229 responses from a population frame of 462 possible participants for a response rate of 50%. Seventeen of those respondents were removed from the database because of missing or erroneous data, which left (N = 212) usable responses. To account for non-response, 158 early respondents were compared to 54 late respondents (Miller & Smith, 1983). This comparison yielded no significant differences in early and late respondents so the results were generalized to the target population.

Data were analyzed using the SPSS[®] for Windows[™] statistical package. Backward elimination multiple regression procedures, which keeps only meaningful and significant predictors of the dependent variable in a model (Pedhazur, 1982), were used to explain combined critical thinking skill scores and each of the individual constructs. Adjusted R^2 was used as an index of the proportion of variance in critical thinking skills explained by the independent variables; critical thinking disposition, leadership training, leadership experience, age, gender, and GPA. Adjusted R^2 was reported instead of the Coefficient of Determination (R^2), because it is a standardized, more conservative estimate of variance.

Findings

Objective One - Describe the critical thinking skill scores, critical thinking dispositions scores, leadership scores, and GPA, age, and gender of selected leaders in the National FFA Organization

Critical thinking skill scores ranged from a low score of 67.86 to a maximum score of 300. The scores for Analysis ranged from a low of 25 to the highest possible score of 100. Inference scores ranged from 0 to 100, and Evaluation scores ranged from 14.29 to 100. The highest scores were recorded for the Analysis construct (Table 2). All of the skill scores means were above 70 in the possible range of 0 to 100. Students also scored in the upper range of scores for Inference and Evaluation skills.

Innovativeness disposition scores ranged from 16 to 35. Engagement scores ranged from 29.00 to 55.00. Cognitive Maturity scores ranged from 13.00 to 36.00. Combined EMI critical thinking disposition scores ranged from 76 to 117. (See Table 2 for mean scores) Leadership training scores ranged from zero to 64, and leadership experience scores ranged from four to 87.

The sample was 37.3% male ($n = 79$), 60.4% female ($n = 128$). Critical thinking skill scores ranged from 67.86 to 287.50 for male participants and from 120.36 to 300 for female participants. Ages ranged from 16 to 21. The average age of the participants was $M = 17.81$ ($SD = .99$). The participants' GPAs ranged from 2.0 to 5.0 with an average of $M = 3.67$ ($SD = .39$).

Objective 2 - Determine the relationship between critical thinking skill scores and critical thinking dispositions scores, leadership scores, GPA, age, and gender of youth leaders in the Organization

Table 2 details the bivariate relationships between each of the variables. According to Davis (1971), a Pearson product moment correlation coefficient of .01 - .09 represents a negligible relationship; .10 - .29 represents a low relationship; and .30 to .49 represents a moderate relationship. Using Davis' determination, there was a low, but positive relationship between GPA and Analysis, $r(212) = .23$, $p < .05$, $r^2 = .05$ and Inference, $r(212) = .19$, $p < .05$, $r^2 = .04$.

Table 2
*Relationships between Critical thinking Skills, Critical thinking Dispositions,
 Leadership, and Demographics.*

Variable	Y ₁	Y ₂	Y ₃	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	M	SD
Analysis (Y ₁)		.37*	.24*	.20*	-.18*	.17*	.12	.12	.12	.07	.23*	82.17	15.12
Inference (Y ₂)			.14*	.28*	-.13*	.25*	.04	.09	.05	.04	.19*	73.40	20.74
Evaluation (Y ₃)				-.03	-.07	.12	.14*	.07	.00	.05	.10	71.50	17.70
Innovation (X ₁)					-.29*	.75*	.09	.17*	.05	-.04	.20*	46.82	4.25
Maturity (X ₂)						-.19*	-.05	-.06	-.07	.05	-.13	26.12	4.02
Engagement (X ₃)							.16*	.18*	.01	.02	.24*	54.50	5.51
Leadership Training (X ₄)								.27*	.05	.16*	-.01	17.05	9.97
Leadership Experience (X ₅)									.05	.24*	.05	31.13	13.19
Gender (X ₆)										-.18*	.07	1.62	.48
Age (X ₇)											-.19*	17.81	.99
GPA (X ₈)												3.67	.39

Note. Gender (X₆), male = 1; female = 2

* $p < .05$, 2-tailed.

A low, but positive relationship existed between the Innovativeness critical thinking disposition score and the Analysis and Inference critical thinking skill score. The relationships between Analysis, $r(201) = .20$, $p < .05$, $r^2 = .04$ and Inference, $r(201) = .28$, $p < .05$, $r^2 = .08$ with Innovativeness were significant.

The Engagement disposition score also had a low, but positive relationship with the specific skill of Inference. The relationship between critical thinking skill scores and Engagement was significant for Analysis, $r(201) = .17$, $p < .05$, $r^2 = .03$ and Inference $r(201) = .25$, $p < .05$, $r^2 = .05$, which explained five percent of the variance. (Note that the Innovativeness and Engagement dispositions appear to have a multicollinearity problem, as indicated by the intercorrelation of $r = .75$ between the two independent variables.)

The magnitude of the relationship between the Maturity disposition and critical thinking skill was low, but the direction of the relationship was negative. This low, but negative relationship was significant for Analysis $r(201) = -.18$, $p < .05$, $r^2 = .04$, and Inference $r(201) = -.13$, $p < .05$, $r^2 = .02$.

A low, but positive relationship existed between leadership training score and each sub-skill of critical thinking, indicating a trend of higher critical thinking scores for higher levels of leadership training. This relationship was significant for Evaluation, $r(209) = .14$, $p < .05$, $r^2 = .02$. Likewise, there was also a low, but positive relationship between leadership experience score and critical thinking skills, indicating a similar trend of higher critical thinking scores for higher levels of leadership experience. This relationship was not significant for Analysis, $r(209) = .12$, $p > .05$, $r^2 = .02$.

Objective 3 - Explain variance in the Analysis, Inference, Evaluation, and combined critical thinking score of youth leaders using age, gender, GPA, leadership and critical thinking disposition variables

Variables were also analyzed in concert to further explain critical thinking skill scores. Alpha was set *a priori* at .05 to test statistical hypotheses about R^2 . Backward elimination multiple regression was used to identify the “best” model. The “best” model explains the most variance when only meaningful and significant predictors of the dependent variable remain in a model (Pedhazur, 1982). Significant variance in Analysis, Inference, and combined critical thinking skill score was explained by GPA, Innovativeness, Age, and Leadership training.

GPA, gender, age, and the Innovativeness disposition score of participants yielded the model best explaining variance in the specific sub-skill of Analysis. Regression analysis revealed

that the model significantly explained the Analysis sub-skill, $F(4, 196) = 10.36, p < .05$. R^2 for the model was .14 and adjusted R^2 was .13. Table 3 displays the unstandardized regression coefficients (B), intercept, and standardized regression coefficients (β) for each variable. GPA, Innovativeness sum, gender, and age contributed 13 percent in shared variability to the Analysis sub-skill. According to Table 3 a one point increase in the value of GPA is expected to be accompanied by an increase of .82 points on the Analysis sub-skill, when Innovativeness, gender, and age are held constant. Innovativeness, gender, and age were represented by smaller partial correlation coefficients, which represent the magnitude of the relationship between the independent variable and the dependent variable when all other independent variables are controlled. The effect size (β) is strongest for GPA followed by Innovativeness, Gender, and Age (Table 3).

Table 3
Backward elimination regression explaining the Analysis sub-skill (N = 201)

	B	SE	Beta	t	Sig.
(Constant)	-2.09	1.89		-1.10	.27
GPA	.82	.22	.26	3.75	.00
Innovativeness disposition	.01	.03	.18	2.69	.01
Gender	.29	.17	.12	1.69	.09
Age	.18	.08	.15	2.19	.03

Note. Coding: 1 = male; 2 = female. $R^2 = .14$; Adjusted $R^2 = .13$.

The Innovativeness disposition and participants' GPA were the variables in the model best explaining variance in the specific sub-skill of Inference. Regression analysis revealed the model significantly explained the Inference sub-skill, $F(2, 198) = 11.07, p < .05$. R^2 for the model was .10, and adjusted R^2 was .09. Table 4

displays the unstandardized regression coefficients (B), intercept, and standardized regression coefficients (β) for each variable. A one point increase in GPA is expected by be accompanied by an increase of .36 points in the Inference sub-skill. The effect size (β) is strongest for Innovativeness (Table 4).

Table 4

Backward elimination regression explaining the Inference sub-skill (N = 201)

	B	SE	Beta	t	Sig.
(Constant)	-.09	.84		-.11	.91
Innovativeness disposition	.08	.02	.26	3.83	.00
GPA	.36	.19	.13	1.92	.06

Note. $R^2 = .10$; Adjusted $R^2 = .09$.

GPA of participants, leadership training score, and Innovativeness yield the model best explaining variance in combined critical thinking skill. Regression analysis revealed that the model significantly explained combined critical thinking score, $F(3, 197) = 10.32, p < .05$. R^2 for the model was .14, and adjusted R^2 was .12. Table 5 displays the unstandardized regression coefficients (B), intercept, and standardized regression coefficients (β) for each variable. The three variables, Innovativeness disposition,

GPA, and leadership training score contributed 12 percent in shared variability to combined critical thinking skill. However, a one point increase in the value of GPA is expected to be accompanied by an increase of 1.48 points on the combined critical thinking skill score when Leadership training score and Innovativeness disposition are held constant. The effect size (β) is strongest for GPA followed by Innovativeness, and Leadership training score (Table 5).

Table 5

Backward elimination regression explaining combined critical thinking skill score (N = 201)

	B	SE	Beta	t	Sig.
(Constant)	4.91	1.99		2.47	.02
GPA	1.48	.44	.23	3.37	.00
Leadership training score	.03	.02	.16	2.32	.02
Innovativeness disposition	.15	.05	.19	2.81	.01

Note. $R^2 = .14$; Adjusted $R^2 = .12$.

Conclusions and Recommendations

Since this study is a purposive population of selected youth leaders in the National FFA Organization, one should not generalize findings beyond the 2002 National FFA Convention delegate participants. This study uses new instrumentation, and the bivariate relationships were low at best. For the Analysis construct only four of the eight independent variables are significant; for the Inference construct only two of the eight independent variables are significant; and the Evaluation model is not significant. With these limitations in mind, the following conclusions were drawn.

GPA, gender, age, and the Innovativeness disposition of participants were the variables in the model best explaining variance in the specific critical thinking sub-skill of analysis. This set of variables collectively accounted for 13 percent of the variance in the dependent variable, Analysis. Torres and Cano (1995), who explained critical thinking (Analysis), using a general critical thinking instrument (DCAT) and without looking at dispositions, also found that age, gender, and GPA collectively accounted for 13 percent of the variance in combined critical thinking skill. Instructors concerned with preparing students to think critically need to be aware of the fact that age and gender may account for some of the variance in a student's critical thinking skill of Analysis. Despite the negative bivariate relationship between age and Analysis, the best model explaining variance in Analysis indicated that older students may also have higher Analysis scores when Innovativeness and gender variables are held constant. Additionally, females might be expected to be more proficient at Analysis when age and Innovativeness are held constant. Educators should reward and push students to succeed academically, as well as structure and design activities that develop their attitude or disposition of Innovativeness if they are attempting to influence the development of the Analysis sub-skill. This study would indicate that particular attention should be paid to younger male students. However, 87% of the variance in Analysis is still

unexplained in the best model. Future research should investigate other variables contributing to the development of the Analysis sub-skill.

The Innovativeness disposition and participants' GPA were the variables in the model best explaining variance in the specific critical thinking sub-skill of Inference. This set of variables collectively accounted for nine-percent of the variance in the dependent variable of Inference. This is an interesting discovery, since few researchers have attempted to explain Inference or even identify its relationship to other variables. The theoretical framework for this study claims the purpose of Inference is "to identify and secure elements needed to draw reasonable conclusions; to form conjectures and hypotheses; to consider relevant information and to educe the consequences flowing from data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions, or other forms of representation" (Facione, 1998, p. 9). According to Facione's conceptualization of Inference, discipline-specific knowledge would be needed to successfully accomplish Inference, which may indicate why the statistically significant prediction equation for Inference included GPA, a measure of student competence in the discipline, and Innovativeness, a measure of students' desire to know more about the discipline. Recall that Innovativeness measured inquisitiveness with a wide range of issues, concern to become and remain generally well-informed, and diligence in seeking relevant information (Facione, 1998). Combining GPA and Innovativeness may yield students who demonstrate competence in the critical thinking skill of Inference, but 88% of the variance is still unexplained.

GPA of participants, leadership training score, and Innovativeness represented the model best explaining variance in combined critical thinking skill. This set of variables collectively accounted for 12 percent of the variance in the dependent variable, combined critical thinking skill score. The fact that a significant model was found to explain critical thinking was interesting since other research (Pretholdt, 1995) failed to identify a significant portion of the

variance in critical thinking skill. Other studies (Torres, 1993; Torres & Cano, 1995; Rollins, 1990) have attempted to explain critical thinking ability in agricultural education, but no studies identified the set of variables that were discovered in this study. Understandably, 88% of the variance in combined critical thinking skill is still unexplained, but inferences can still be gleaned from these findings.

This information is important to agricultural educators, leadership trainers, and even higher education administrators for a number of reasons. If other youth leaders in agricultural education are like the ones in this study, then agriculture teachers at the secondary and post-secondary levels could better prepare their students for successful critical thinking by encouraging them to keep their grades up, learn as much as they can about leadership by participating in leadership workshops, conferences, and/or formal leadership courses, and by challenging students to remain inquisitive, well-informed, eager learners.

GPA as an indicator of student academic performance is the best-known variable for explaining critical thinking. Holding other variables constant in the model explaining combined critical thinking, a one point increase in the value of GPA is expected to be accompanied by an increase of 1.48 points in the combined critical thinking score. This amount of change, however small, was echoed for the Analysis and Inference sub-skills. Hence students with poor GPA scores may also be poor critical thinkers.

Future research should seek to further explain critical thinking skill by examining other variables that could contribute to or do a better job of explaining critical thinking skills. Future research should also investigate Interpretation, Explanation, and Self-Regulation, which represent the remainder of the skills outlined in Facione's (1990) National *Delphi* study. Leadership skill and preparation or critical thinking dispositions may be more related to the unevaluated critical thinking skills, which do not lend themselves to quantitative inquiry, but may be measured with qualitative research and/or content analysis.

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JOHN C. RICKETTS is an Assistant Professor in the Department of Agricultural Leadership, Education, and Communication at the University of Georgia, 110 Four Towers, Athens, GA 30602-4355. E-mail: jcr@uga.edu.

RICK D. RUDD is an Associate Professor in the Department of Agricultural Education and Communication at the University of Florida, 218 Rolfs Hall, P.O. Box 110540, Gainesville, FL, 32611-0540. E-mail: rrudd@ufl.edu.