The Relationship between Critical Thinking Dispositions and Critical Thinking Skills of Selected Youth Leaders in the National FFA Organization

John C. Ricketts, University of Georgia
Rick Rudd, University of Florida

Abstract

The primary purpose of this correlational study was to explain the relationship between discipline specific critical thinking skills in agriculture and leadership and critical thinking dispositions of selected youth leaders in the National FFA Organization. Voluntary participants in the study included 212 youth leaders from 50 states. The researcher-developed critical thinking skills tests and critical thinking disposition inventory (*EMI*), which were distributed online and by conventional mailing procedures indicated positive, but low relationships between critical thinking skills and the innovativeness and engagement dispositions. Additionally, low, but negative relationships were found between critical thinking skills and the maturity critical thinking disposition. In the recommendations section, educators are asked to consider influencing critical thinking dispositions by exposing students to a wide range of cultures and experiences through field trips, service-learning activities, videotapes, and the Internet. It is also recommended that agricultural educators influence critical thinking by infusing teaching for critical thinking into agricultural education courses and in leadership training activities. Lastly, the researchers recommended further research on the instruments used to collect data on critical thinking skills and dispositions. Specifically, the cognitive maturity disposition of the EMI should be further developed, and the skills instrument should be altered to achieve more variability.

Introduction

Determining the composition of critical thinking skills could be the missing link in preparing students of agriculture to be competent problem solvers and decision makers. If agricultural education students can critically examine and evaluate their own reasoning processes, then they could learn how to think more objectively and logically about the field of agriculture; expand their repertoire of more specialized procedures in agriculture; and increase their base of information and life experience for success in a future career.

Agricultural education professionals have determined that critical thinking skill is an important part of what we do. 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.

In a synthesis of research, Edwards (2003) concluded the student behavior of critical thinking "ought to be occurring in secondary-level agricultural education classrooms and laboratories" (p. 189). But is it occurring in these settings? If critical thinking is occurring, to what extent is it occurring, and does it help students in any way? Although critical thinking studies (Cano, 1993; Rollins, 1990; Rudd, Baker, & Hoover, 2000; Torres, 1993; Vygotsky, 1978) have been numerous 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 (Cano & Martinez, 1991; National Research Council, 1988; Ware & Kahler, 1988), but few answers to those calls have been provided.

Theoretical / Conceptual Framework

Formal educational philosophy and epistemic origins of critical thinking in the United States can be traced back to Dewey (1933), who believed that there were three attitudes necessary to reflective action (critical thinking); open mindedness, responsibility, and wholeheartedness. Glaser (1941) believed critical thinking is the "attitude of being disposed to consider in a thoughtful way the problems and subjects that come within the range of one's experiences; knowledge of the methods of logical inquiry and reasoning; and some skill in applying those methods" (pp. 5-6).

Richard Paul (1995) defined critical thinking as "A unique and purposeful thinking in which the thinker systematically and habitually imposes criteria and intellectual standards upon the thinking, taking charge of the construction of thinking, guiding the construction of the thinking according to [critical thinking] standards, and assessing the effectiveness of the thinking according to the purpose, criteria, and the standards [of thinking] (p. 21). Rudd, Baker, and Hoover (2000) provide the description of critical thinking guiding this study. They determined that "Critical thinking is a reasoned, purposive, and introspective approach

to solving problems or addressing questions with incomplete evidence and information and for which an incontrovertible solution is unlikely" (p. 5).

Peter Facione (1990), who conducted a national Delphi study of experts to define critical thinking, came up with the following definition: "We understand critical thinking to be 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).

Each of the aforementioned critical thinking researchers making major contributions to the development of critical thinking believed that critical thinking consisted of a dispositional and skill dimension. This study seeks to determine the relationship between critical thinking dispositions and discipline-specific critical thinking skills in agriculture and leadership. Findings of some researchers (Facione, Facione, & Giancarlo, 1996; Jones, Ratliff, Tibbetts, & Glick, 1994; Giancarlo & Facione, N., 1994; Facione & Facione, 1997) have found there is a relationship between critical thinking skills and dispositions. Similar findings in an agricultural and leadership context for youth would provide valuable information for educators seeking to improve critical thinking in their students.

The theoretical framework for this study is supported by the Delphi study of Peter Facione (1990). The critical thinking skills identified by the panel of experts in that study were Interpretation, Analysis, Evaluation, Inference, Explanation, and Self-regulation. Following the lead of Facione (2000) and the *Test for Everyday Reasoning (TER)*, three critical thinking skills, Analysis, Evaluation, and Inference were the skills measured in this study. Facione created the TER to test critical thinking skills. The TER did not specifically try to measure interpretation, explanation, and self-regulation. The skills used in this study (Analysis, Evaluation, and Inference) were selected to represent critical thinking skill because of their orientation to objective measurement; their indicativeness of all the critical thinking skills in the construct; and because subsequent studies have been conducted to validate their usage (Facione, 1990; Jones, et al., 1994; Giancarlo, 1996).

A student competent in the critical thinking skill of Analysis can effectively identify the relationship between statements, questions, concepts or descriptions 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 at 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 needed for critical thinking. Facione (1998) has occasionally referred to the dispositions as approaches to life that characterize critical thinking. They are as follows:

> inquisitiveness with regard to a wide range of ideas, concern to become and remain well-informed, alertness to opportunities to use critical thinking, trust in the process of reasoned inquiry, self-confidence in one's own abilities to reason, open-mindedness regarding divergent world views, flexibility in considering alternatives and opinions, understanding of the opinions of other people, fair-mindedness in appraising reasoning, honesty in facing one's own biases, prejudices, stereotypes, or egocentric tendencies, prudence in suspending, making, or altering judgments, willingness to reconsider and revise views where hones reflection suggests that change is warranted (p. 8).

In the California Critical Thinking Disposition Inventory (CCTDI), which has been the standardized instrument used to measure the above approaches to life, the scales, Truth-Seeking, Open-mindedness, Analyticity, Systematicity, Self-confidence, Inquisitiveness, and Maturity are used (Facione, et al., 2001). This study used a researcher-developed instrument that measured those same approaches to life. The researcher-developed instrument contained only three scales (Innovativeness, Maturity, and Engagement). Facione's Delphi study was used to develop the three-scale instrument. A description of the researcher-developed critical thinking dispositions (scales) follow:

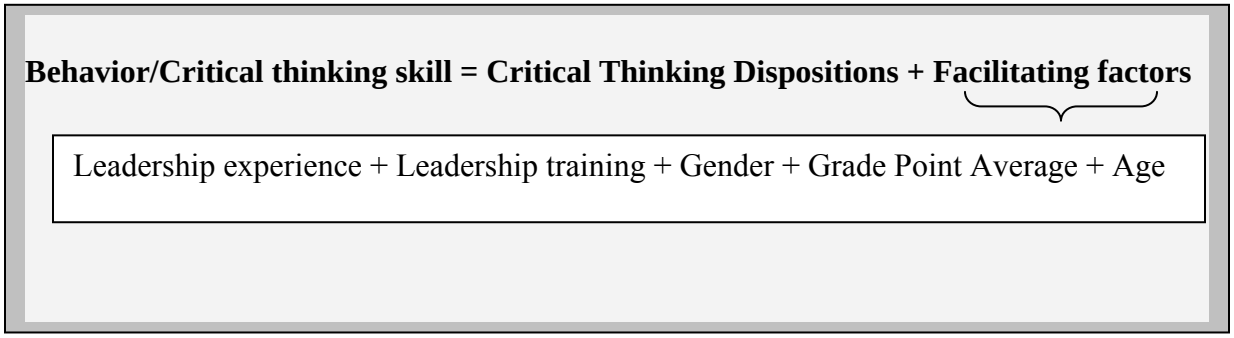
- The Engagement disposition measured students' predisposition to looking for opportunities to use reasoning; anticipating situations that require reasoning; and confidence in reasoning ability.

- The Innovativeness disposition measured students' predisposition to be intellectually curious and desire to know the truth.

- The Cognitive Maturity (Maturity) disposition measured students' predisposition to being aware of the complexity of problems; being open to other points of view; and being aware of their own and others biases and predispositions.

A conceptual model of critical thinking skill development was devised from the theoretical framework. The model is based on and adapted from the Triandis (1979) Model of Human Behavior. This study, which was part of a larger research project, focuses on critical thinking skill, and the facilitating factor of critical thinking disposition, within the context of leadership and agriculture. Age, gender, GPA, and leadership experience and training are addressed in supplementary studies.

Figure 1.
Conceptual model of critical thinking skills (behavior)



Purpose and Objectives

The primary purpose of this correlational study was to explain the relationship between discipline specific critical thinking skills and critical thinking dispositions of selected youth leaders in the National FFA Organization. To accomplish these purposes the following research objectives were used to guide this study:

1. Determine the relationship between critical thinking skills and the disposition of Innovativeness in selected youth leaders in the National FFA Organization.

2. Determine the relationship between critical thinking skills and the disposition of Engagement in selected youth leaders in the National FFA Organization.

3. Determine the relationship between critical thinking skills and the disposition of Cognitive Maturity (Maturity) in selected youth leaders in the National FFA Organization.

4. Determine the relationship between critical thinking skills and the total critical thinking disposition score in selected youth leaders in the National FFA Organization.

Methods and Procedures

Since the purpose of this study was to explain the relationship between critical thinking skills and dispositions, the research design was correlational. The target population for the study consisted of the 2002 National FFA Convention delegates specifically selected because of their leadership record in the FFA organization. A pilot test of the researcher-developed critical thinking skills test was administered to 33 subjects at the [a southeastern state] state FFA Convention. A pilot test of the critical thinking disposition test, which will be referred to as the *EMI*, from this point forward was administered electronically to 60 subjects from a successful FFA Chapter. The pilot samples were purposively selected because of their similarities to the target population.

The researcher-developed critical thinking skills test measured the discipline-specific skills of Analysis, Inference, and Evaluation (Facione, 1990). The 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 and the 5-item-Likert-type EMI for content and face validity. After pilot testing and item analysis, Cronbach's alpha for each critical thinking sub-skill was 0.83 for Analysis, 0.66 for Inference, and 0.63 for Evaluation. Cronbach's alphas for the subscales of the EMI critical thinking disposition assessment were 0.79 for Innovativeness, 0.75 for Maturity, and 0.89 for Engagement. These reliability ratings were deemed appropriate since Norris and Ennis (1989) recommended reliability ratings of 0.65 and 0.75 for any instrument testing a variety of critical thinking aspects.

Survey implementation followed Dillman's (2000) system of five compatible contacts. The instrument was initially available online. A paper copy of the instrumentation was sent to non-respondents. There were 229 responses from a population frame of 462 possible participants for a response rate of 50%. Twenty-seven of those respondents were removed from the database because of missing or erroneous data, which left (N = 202) usable responses. To account for non-response, early respondents were compared to late respondents (Miller & Smith, 1983), and no significant differences were found.

Data were analyzed using the SPSS® for Windows™ statistical package. Pearson's product moment (*r*) statistics were conducted to identify the magnitude of relationship of critical thinking skills to the other variables in the study. The Coefficient of Determination (R^2)was used as an index of the proportion of variance in critical thinking skills explained by the independent variables.

Findings

Critical thinking skill scores ranged from a low score of 67.86 to a maximum score of 300. The mean total critical thinking skill score was M = 227.86, SD = 37.91. 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 (M =82.17, SD =15.12) construct. All of the skill scores were above 70 for the possible range of 0 to 100. Students also scored in the upper range of scores for the Inference (M =73.40, SD =20.74) and Evaluation (M =71.50, SD =17.70) skills.

Objective 1 - Determine the relationship between critical thinking skills and the disposition of Innovativeness in selected youth leaders in the National FFA Organization

Innovativeness disposition scores ranged from 16 to 35, with an average score of M = 29.52, SD = 3.24. There was a low (Miller, 1998) relationship between the Innovativeness disposition score and total critical thinking score. There was also a low relationship between the specific skills of Analysis and Inference and Innovativeness (Table 1). However, the

relationship was always positive. According to Table 1, the relationships between Innovativeness disposition and total critical thinking skill scores $r(201) = 0.26$, $p < 0.05$, $R^2 = 0.07$, which explained seven percent of the variance; Analysis $r(201) = 0.24$, $p < 0.05$, $R^2 = 0.06$, which explained six percent of the variance; and Inference, $r(201) = 0.29$, $p < 0.05$, $R^2 = 0.08$, which explained eight percent of the variance, were statistically significant compared to Evaluation, $r(201) = 0.03$, $p > 0.05$.

Table 1.
Correlation between critical thinking skills and Innovativeness disposition (N = 202)

Skill	*r*	df	Sig.(2-tailed)
Analysis	0.24	201	0.00
Inference	0.29	201	0.00
Evaluation	0.03	201	0.68
Total critical thinking	0.26	201	0.00

Objective 2 - Determine the relationship between critical thinking skills and the disposition of Engagement in selected youth leaders in the National FFA Organization

Engagement scores ranged from 29.00 to 55.00 with a mean of $M = 45.44$, $SD = 5.08$. The Engagement disposition score also had a low relationship with total critical thinking score and the specific skill of Inference. However, the relationships between Engagement and Analysis, Inference, Evaluation, and total critical thinking skill scores were positive. According to Table 2, this relationship between critical thinking skill scores and Engagement was significant for Analysis, $r(201) = 0.17$, $p < 0.05$, $R^2 = 0.03$, which explained three percent of the variance; Inference $r(201) = 0.23$, $p < 0.05$, $R^2 = 0.05$, which explained five percent of the variance; and total critical thinking, $r(201) = 0.24$, $p < 0.05$, $R^2 = 0.06$, which explained six percent of the variance. Evaluation, $r(201) = 0.11$, $p > 0.05$ displayed the same trend, but was not significant at the 0.05 alpha level.

Table 2.
Correlation between critical thinking skills and Engagement disposition (N = 202)

Skill	*r*	df	Sig.(2-tailed)
Analysis	0.17	201	0.02
Inference	0.23	201	0.00
Evaluation	0.11	201	0.11
Total critical thinking	0.24	201	0.00

Objective 3 - Determine the relationship between critical thinking skills and the disposition of Cognitive Maturity (Maturity) in selected youth leaders in the National FFA Organization

Maturity scores ranged from 13.00 to 36.00 with a mean of $M = 21.73$, $SD = 4.12$. The magnitude of the relationship between the Maturity disposition and critical thinking skill was low, but the direction of the relationship was negative. According to Table 3, this low, but negative relationship was significant for Analysis $r(201) = -0.19$, $p < 0.05$, $R^2 = 0.04$,

Inference $r(201) = -0.14$, $p < 0.05$, $R^2 = 0.02$ and total critical thinking skill score $r(201) = -0.18$, $p < 0.05$, $R^2 = 0.03$, explaining four, two, and three percent of the variance, respectively. Though Evaluation, $r(201) = -0.07$, $p > 0.05$ depicted the same inverse relationship, it was not statistically significant at the 0.05 alpha level.

Objective 4 - Determine the relationship between critical thinking skills and the total critical thinking disposition score in selected youth leaders in the National FFA Organization

EMI critical thinking disposition scores ranged from 76 to 117, with an average score of $M = 96.68$, $SD = 7.60$. There was a low relationship between critical thinking skills and total EMI scores. However, the relationship was always positive. According to Table 4, EMI score was significantly related to total critical thinking skill scores, $r(201) = 0.18$, $p < 0.05$, $R^2 = 0.03$, accounting for three percent of the variance; and the specific sub-skill, Inference, $r(201) = 0.20$, $p < 0.05$, $R^2 = 0.04$, accounting for four percent of the variance. The relationship was not significant for Analysis, $r(201) = 0.11$, $p > 0.05$ and Evaluation, $r(201) = 0.05$, $p > 0.05$.

Table 3.
Correlation between critical thinking skills and Maturity disposition (N = 202)

Skill	*r*	df	Sig.(2-tailed)
Analysis	-0.19	201	0.01
Inference	-0.14	201	0.05
Evaluation	-0.07	201	0.33
Total critical thinking	-0.18	201	0.01

Table 4.
Correlation between critical thinking skills and total EMI scores (N = 202)

Skill	*r*	df	Sig.(2-tailed)
Analysis	0.11	201	0.12
Inference	0.20	201	0.00
Evaluation	0.05	201	0.47
Total critical thinking	0.18	201	0.01

Conclusions / Implications

Since this study purposively selected a population of selected youth leaders in the National FFA Organization, one should not generalize findings beyond the 2002 National FFA Convention delegate participants. With this limitation in mind, and based on the findings of this study, the following conclusions were drawn.

Innovativeness

There were low, but positive relationships between the Innovativeness disposition and critical thinking skills. This relationship was significant for total critical thinking skill

scores, Analysis, and Inference. Why would there be a significant relationship between these variables?

Innovativeness was a critical thinking disposition derived from the Facione theoretical framework, which embodied "inquisitiveness with regard to a wide range of issues," "concern to become and remain generally well-informed," and "diligence in seeking relevant information" (Facione, 1990, p. 25). Although the relationship is small, the positive nature of the relationship may indicate that it is easier to teach students to examine ideas, detect arguments, analyze arguments, examine evidence, ponder alternatives, and draw conclusions if they are inquisitive, informed, and continually seeking information. This should also show educators that there is more to concentrate on and to try to instill than skills alone, if students are to get better at critical thinking.

This finding could be implying that students have a better chance at becoming a critical thinker if they were equipped with the proper experiences and attitudes to engage in critical thinking. Agricultural educators and leadership trainers may be able to develop these attitudes and pre-dispositions with and without formal education.

To accomplish these purposes, teachers should expose students to a wide range of cultures through travel, videotapes, service learning, and the Internet. Agricultural educators should also reward students who bring helpful information to a discussion that challenge the disseminated curriculum or at least causes a different perspective. Research should be conducted to determine if these types of cognitive dissonance strategies influence the Innovativeness disposition, and/or critical thinking skills.

Engagement

The Engagement disposition had a low, but positive relationship to critical thinking skills. This relationship was significant for Analysis, Inference, and total critical thinking skill, but the relationship was not significant for Evaluation. The relationship is likely significant because the components of Engagement involve alertness to opportunities to use critical thinking; trust in the process of reasoned inquiry; and persistence, though difficulties are encountered. If participants were pre-disposed to look for opportunities to critically think, and even believe in the value of critical thinking it is no wonder they are also likely to be successful at analyzing and making inferential judgments.

Even though, there is literature to suggest that infusing critical thinking is better than pre-teaching it (Angeli, 1999; Hagelskamp, 2000), teachers and leadership trainers who understand this relationship would probably do well to not only try to teach students how to critically think, but they should also sell them on the value of critical thinking. Teachers should also model the attitudes of being alert to opportunities for critical thinking and believing in the process of reasoning.

Cognitive Maturity

There was a relationship between the Maturity disposition and critical thinking skill, but it was a negative relationship. This low and negative relationship was significant for Analysis, Inference, and total critical thinking skill score. Assuming that the critical thinking skills instrument and the EMI disposition instrument were measuring the constructs they were intended to measure, this finding was somewhat disturbing. It indicates that students who are competent at Analysis (examining ideas, detecting arguments, analyzing arguments) and Inference (querying evidence, conjecturing alternatives, making decisions) are not open-minded regarding different worldviews, not flexible in considering alternatives and opinions, not accepting of the opinions of others, and not willing to change a decision when reflection indicates a change is warranted.

This is particularly disturbing in terms of leadership development. As students develop their leadership abilities, which include skills in critical thinking, they are better able to move and influence others towards a goal because of their skills. If a leader becomes competent in Analysis of arguments and Inference to make decisions, but is not considering the rights, opinions, or desires of other, then they are not a leader; they are a dictator. Formal training in leadership development, which takes the time to discuss the leadership attitude, will, and desires of others (Ricketts & Rudd, 2002) could be beneficial in stopping such a trend.

Total Critical Thinking Dispositions

Overall, there was a low, but positive relationship between total EMI and critical thinking skills. This relationship is important because EMI is the representation of "habits" and "intentions." Recall from the conceptual model: Behavior/Critical thinking skill = {Habits + Intentions} + Facilitating factors. According to model adapted from Triandis (1979), if someone has the habit and intends to do something, that is half the equation for human behavior, so it is very important that critical thinking disposition was found to be positively related to critical thinking skill, even though the relationship was minimal.

Recommendations

With the understanding that the relationships discovered were small, the EMI critical thinking disposition assessment and the critical thinking skills test should be further developed, and stronger versions of the instrument should be used to check for relationships between disposition and critical thinking skills. Specifically, the Maturity construct should be the focus of the disposition assessment to determine if the negative relationships were because of the instrument or the actual disposition of the participants. If the Maturity construct remains solid, then educators should turn their attention to improving students' predisposition to being aware of the complexity of real problems; being open to other points of view; and being aware of their own and others biases and predispositions.

The critical thinking skills test needs to be further refined. One of the reasons for the low relationships may have been the low level of variability attained using dichotomous scoring. Instrument changes that seek to improve the variability should be made, followed by a second iteration of this study. However, relationships did exist and the following recommendations were made for agricultural education professionals.

Educators and leadership trainers should still attempt to influence critical thinking dispositions by exposing students to a wide range of cultures and experiences through travel, video-tapes, service-learning, and the Internet. Educators should also reward students who bring helpful information to a discussion that challenges the curriculum or at least causes students to view information from a different perspective. Stronger instrumentation and similar studies with more heterogeneous groups should test these assumptions.

Since there is a relationship that exists between Engagement and Analysis and Inference, educators can promote competent Analysis and Inference by infusing critical thinking into the content of courses and leadership training, but also by providing information regarding the "nuts and bolts" of critical thinking. Testing secondary agricultural education students who have been exposed to pedagogy designed to improve their critical thinking skill level should also be evaluated.

Assuming the Cognitive Maturity scale is psychometrically sound, teacher educators and administrators need to develop sound curriculum that develops Cognitive Maturity. Pre-service and in-service training for teachers on how to develop the components (open-mindedness regarding different worldviews, flexibility concerning alternatives and opinions, understanding of the opinions of others, willingness to change a decision if needed) of Cognitive Maturity may prove to be very useful in the quest to develop students' critical thinking skills.

References

Angeli, C., M. (1999). *Examining the effects of context-free and context-situated instructional strategies on learners' critical thinking.* Unpublished doctoral dissertation, Indiana University, Bloomington, IN.

Cano, J. (1993). An assessment of the level of cognitive performance and critical thinking ability of selected agricultural education students. *Journal of Agricultural Education, 34*(2), 25-30.

Cano, J., & Martinez, C. (1991). The relationship between cognitive performance and critical thinking abilities among selected agricultural education students. *Journal of Agricultural Education, 32*(1), 24-29.

Dewey, J. (1933). *How we think: A restatement of the relation of reflective thinking to the education process.* Boston: Heath.

Dillman, D. A. (2000). *Mail and internet surveys: The tailored design method.* (2nd ed). New York: John Wiley & Sons, Inc.

Edwards, M. G. (2003). Cognitive learning and student achievement in secondary-level agricultural education: A synthesis with implications for future research. *Proceedings of the Southern Agricultural Education Research Conference* (pp. 182-194). Mobile, AL: Mississippi State University.

Facione, P. A. (1990). *Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction. Research Findings and Recommendations*. (Report No. RIEJUN1990)Millbrae, CA: The California Academic Press. (ERIC Document Reproduction Service No. ED315423).

Facione, P. A. (1998). *Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction: Executive Summary: The Delphi Report*. Millbrae, CA: The California Academic Press.

Facione, P. A. (2000). *The test of everyday reasoning: A measure of critical thinking skills; TER support material*. Millbrae, CA: California Academic Press.

Facione, P. A., Facione, N., & Giancarlo, C. (1997). The motivation to think in working and learning. In E. Jones (Ed.), *Preparing Competent College Graduates: Setting Newer and Higher Expectations for Student Learning.* (pp. 67-79). San Francisco, CA: Jossey-Bass Publishers.

Facione, P. A., Facione, N., & Giancarlo, C. (2001). *California Critical Thinking Disposition Inventory: CCTDI Inventory Manual*. Millbrae, CA: California Academic Press.

Giancarlo, C., & Facione, N. (1994). A study of the critical thinking disposition and skill of Spanish and English speaking students at Camelback High School. Millbrae, CA: The California Academic Press.

Giancarlo, C. A. (1996). *Critical thinking, culture and personality: Predicting Latino's academic success.* Unpublished doctoral dissertation, University of California at Riverside, Riverside, CA.

Glaser, E. (1941). *An experiment in the development of critical thinking*. New York: J. J. Little and Ives Company.

Hagelskamp, J. L. (2000). *The effect of teaching critical thinking by infusion, with focus on transfer of skills, on the moral judgment and critical thinking of secondary school students.* Unpublished doctoral dissertation, University of San Francisco, San Francisco.

Jones, E. H., Hoffman, S., Ratcliff, G., Tibbetts, S., & Glick, B. (1994). *Essential skills in writing, speech and listening, and critical thinking for college graduates: Perspectives of faculty, employers, and policy makers.* (Project Summary OERI Contract No. 117G10037). University Park, PA: US Department of Education.

Miller, L. E. (1998). Appropriate analysis. *Journal of Agricultural Education, 39*(2), 1-10.

Miller, L. E., & Smith, K. L. (1983). Handling nonresponse issues. *Journal of Extension, 21*, 45-50.

National Research Council. (1988). *Understanding agriculture: New directions for education.* Washington, DC: National Academy Press.

Norris, S. P., & Ennis, R. H. (1989). Evaluating critical thinking. In R. J. Swartz. and D. N. Perkins (Ed.), *Teaching thinking*. Pacific Grove, CA: Midwest Publications.

Paul, R. (1995). *Critical thinking: How to prepare students for a rapidly changing world.* Santa Rosa, CA. Foundation for Critical Thinking.

Ricketts, J. C., & Rudd, R. D. (2002). A comprehensive leadership education model to train, teach, and develop leadership in youth. *Journal of Career and Technical Education, 19* (1), 7-17.

Rollins, T. J. (1990). Levels of critical thinking of secondary students. *Journal of Agricultural Education,31* (3), 47-53.

Rudd, R., Baker, M., & Hoover, T. (2000). Undergraduate agriculture student learning styles and critical thinking abilities: is there a relationship? *Journal of agricultural education, 41*(3), 2-12.

Torres, R. M. (1993). *The cognitive ability and learning style of students enrolled in the college of agriculture at The Ohio State University.* Unpublished doctoral dissertation, The Ohio State University, Columbus, OH.

Triandis, H. C. (Ed.). (1979). *Values, attitudes and interpersonal behavior.* Lincoln, NE: University of Nebraska Press.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Cambridge, MA: Harvard University Press.

Ware, C. M., & Kahler, A. A. (1988). Teaching critical thinking as perceived by Iowa vocational agriculture instructors. *Fifteenth Annual National Agricultural Education Research Meeting, 15,* 280-287