

# Relationships between Critical Thinking Disposition and Need for Cognition among Undergraduate Students Enrolled in Leadership Courses

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## Abstract

This study sought to explore the relationship between critical thinking disposition and need for cognition. As instructors and researchers work to enhance student's critical thinking when faced with problems, it may be the case that their internal need for cognition may affect how they are disposed to critically think. Four leadership classes, each at a different institution, were administered the UF-EMI (critical thinking disposition inventory) and the Need For Cognition (NFC) scale to examine correlations. Findings indicated that there was a moderate relationship between these psychometric constructs. While the literature shows a gap in this area of research, this study provides a base line finding that critical thinking and need for cognition are in fact related. Institutional differences were also examined and findings indicated that one institution had lower critical thinking disposition and need for cognition scores which may stem from demographic variables. The authors call for more research to examine relationships between critical thinking disposition and other attitudinal instruments to bring greater understanding to these constructs.

## Introduction

Never has there been a more pertinent need for intelligible stewards of agriculture and the environment who will engage in critical thinking to solve problems, make decisions, and communicate agricultural and environmental issues to and among the general public. Bright-minded students on campuses

offering high-end agricultural science education have the potential to usher in a new era of critical thinking and fact-based articulation in agriculture and natural resources. To equip and enable students for this mission, educators must teach important agriculturally-based content, but because of the rapid pace of change in information, technology, and the environment, educators must also foster students' attitudes and skills in critical thinking. Critical thinking allows students to work through and investigate issues facing these areas. Researchers have studied many variables associated with the predisposition toward critical thinking. This study aims to explore the relationship between critical thinking disposition and one's need for cognition. Identifying how these psychological variables are related may contribute to future explanation of student success in colleges of agriculture and life sciences (Osborne, n.d.).

## Theoretical Background

According to the epistemology of Constructivism and the theories therein (Piaget, 1954; Vygotsky, 1978), education is developmental, and that development is built internally, socially, and culturally. Likewise, critical thinking is internal and developmental, but it is also contextual (social). As part of Social Cognitive Theory and Bandura's (1989) Triadic Reciprocal Determinism model of causation, behavior (i.e. critical thinking), cognition (i.e. need for cognition), and the environment (i.e. school) interact, and thus, influence/impact each other. This study tested Bandura's theory by determining,

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comparing, and identifying relationships among personal (demographics) and cognitive (need for cognition), behavioral (critical thinking disposition), and environmental (school/university) factors.

### **Critical Thinking Disposition**

Critical thinking is a major goal/outcome for graduates of all levels and types of education. Harvey Siegel (1988) noted that critical thinking should be a part of the educational system. He believed students deserved to be able to think critically, because critical thinking is becoming a necessary component of living life, and because today's youth are tomorrow's leaders. In fact, most critical theorists (Ennis, 1985; Facione, et al., 1997) agreed that people in power and leadership positions should make decisions which consider all people, situations, and options.

Critical thinking, as defined by Glaser (1941) is the: "(1) attitude of being disposed to consider in a thoughtful way the problems and subjects that come within the range of one's experiences, (2) knowledge of the methods of logical inquiry and reasoning, and (3) some skill in applying those methods" (p. 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 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).

There are many conceptualizations of critical thinking, yet a consensus definition does exist. Peter Facione (1990) conducted a national Delphi study of experts to define 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). This conceptualization has been most accepted by researchers as specific skills employed by individuals when considering concepts. The Delphi study also indicated that a preference to employ these skills, or a critical thinking disposition, is evident (Facione); however the constructs of critical thinking disposition have not been agreed upon in the literature.

Most researchers believe critical thinking is attitudinal and skills based. In other words, critical thinking disposition is a predisposed attitude one innately possesses in regards to utilizing critical thinking skills. Alternatively, a critical thinking skill is the competency of utilizing the components of critical thinking. Critical thinking dispositions have been shown to be associated with critical thinking skills. In most of the literature reviewed, the dependence between dispositions and skills was significant, even though the relationship was usually low

(Facione and Facione, 1997; Facione, et al., 1996; Jones, et al., 1994; Giancarlo and Facione, 1994). Therefore, a critical thinking disposition may be an indication of a student's skill or ability to think critically.

A common measure of critical thinking disposition is the California Critical Thinking Disposition Inventory (CCTDI; Facione, et al., 2001). The 75-item instrument includes the constructs: truthseeking—the pursuit of intellectual honesty in any situation, open-mindedness—tolerance for new ideas and divergent views, analyticity—an alertness to potential difficulties, systematicity—being organized and diligent in inquiry approach, critical thinking self-confidence—trust of own reasoning in decision making, inquisitiveness—intellectual curiosity with an intention to learn, and maturity of judgment—an inclination to make good decisions in complex situations (Facione, et al., 1995). However, other researchers have been using the University of Florida EMI assessment (UF-EMI), which was a result of a factor analysis of the CCTDI in which there was no support for the original disposition constructs (Irani, et al., 2007). The UF-EMI has 26 items and comprises three constructs: engagement—anticipating situations to use reasoning, cognitive maturity—being aware of predispositions and biases, and innovativeness—actively seeking to learn more (Irani, et al., 2007).

Some research indicates that critical thinking skills can be taught in a course, but a critical thinking disposition may take a longer time to develop (Tishman and Andrade, 1996). Besides the positive impact content has in developing thinking (Whittington, 1997), specific teaching strategies and the amount of educational experience also affect critical thinking. Instruction emphasizing reflection has a positive influence on critical thinking skills (Stoiber, 1991). Pre-service teachers receiving reflection instruction, as opposed to traditional instruction emphasizing technical skills, used strategies more often to solve problems, provided more reasons for decisions, and felt more responsibility for motivating student learning (Stoiber, 1991). Additionally, individual and group journaling was found to be an effective way to improve students' analytical ability and writing skills (Reinertsen and Wells, 1993).

Teaching courses with the intent of increasing the critical thinking ability (skills and disposition) of students appears to enhance critical thinking (Peters, et al., 2002). Peters et al. developed a teaching strategy known as CITE (Critical Interactive Thinking Exercises) and concluded the exercises enhanced students' critical thinking. Another course, "Algebra for the Sciences," produced larger gains in critical thinking skills and significantly more positive attitudes towards mathematics (Elliott, et al., 2001). Solon (2001) found students taught critical thinking skills in an introductory psychology course, raised their level of academic performance in an aesthetic principles class.

## Relationships

Simply going to school (college) may influence critical thinking skills. Terenzini and Springer (1995) noted both classroom/instructional and out-of-class experiences make positive, statistically significant, and unique contributions to gains in critical thinking. Claytor (1997) indicated skill is influenced by how much educational experience students have received. Pascarella (1989) reported students who attended college were more adept at critical thinking than non-attendees, and full time students developed a higher level of critical thinking skills than did part-time students (Pascarella, 1996).

An additional variable which is a potential predictor of critical thinking ability is student academic performance. Many studies (Ricketts, 2003; Rollins, 1990; Torres and Cano, 1995) used grade point average (GPA) to indicate academic performance, but standardized tests (Matthews, 1989; Rollins, 1988; Wilson; 1989) and IQ scores (Tuma and Reif, 1980) have also been used. In fact, according to Facione (1990) critical thinking skills could be predicted by a combination of SAT verbal ( $r = 0.55$ ), SAT math ( $r = 0.44$ ), and GPA ( $r = 0.20$ ) data with an  $R^2$  of 0.71 (Facione, 1990). Also there still seems to be some disagreement in the literature regarding the gender influence on critical thinking disposition. Findings have either indicated that females critically think at higher levels than males (Claytor, 1997), or that there is no significant difference (Wilson, 1989).

### Need for Cognition

Cohen, Stotland, and Wolf (1955) first described the idea of one's need for cognition (NFC) as a need to structure a situation in a meaningful way to help them understand the complex world in which they live. Cacioppo and Petty (1982) took this definition further by describing need for cognition as one's "tendency to engage and enjoy thinking" (p. 116). An individual's need for cognition (NFC) relates to how they think about events in a holistic manner.

Individuals who are high in NFC are intrinsically motivated to think and thus will seek more complex tasks (Coutinho, 2006). While those low in NFC would "rather avoid effortful, cognitive work required to derive attitudes based on merit" (Haugtvedt, Petty, and Cacioppo, 1992, p. 241). Those who are high in NFC have been found to look at weaker arguments with more unfavorable opinions.

NFC has been studied heavily in relation to communication and marketing. Research has shown those who are high in NFC will scrutinize communication more (Cacioppo, et al., 1983) and will scrutinize claims more than those low in NFC (Haugtvedt, et al., 1992). Low NFC individuals tend to be more susceptible to influences from peripheral contextual information and will base their attitudes on a single association (Haugtvedt and Petty, 1992).

Several variables have been studied in relation to what makes one high or low in their need for cognition. While no demographic variables related to

gender and age have shown an effect on NFC, intellectual ability has shown some correlation. Cacioppo and Petty (1982) found in one of their early studies that intelligence is positively related to one's tendency to enjoy thinking and to have a higher NFC. Students who are high in their NFC have been shown to use more elaborative learning strategies which lead to a better and deeper understanding of materials (Coutinho, 2006). Cacioppo, Petty, and Morris (1983) further looked at NFC's relation to learning and found abstract reasoning was unrelated to NFC, but that verbal reasoning was slightly related to NFC. Studies with college students have shown a relationship between NFC and a student's academic performance and grade (Leone and Dalton, 1988; Sadowski, and Gulgoz, 1996).

Coutinho (2006) found the need for cognition was of equal or more importance than metacognition when solving challenging problems. As instructors and researchers work to enhance student's critical thinking when faced with problems, it may be the case that their internal need for cognition may affect how they are disposed to critically think. Those who are low in NFC tend to have a higher threshold at which they will choose to increase their efforts of thinking than those who are high in NFC (Haugtvedt, et al., 1992). These students who are low in NFC may thus need increased help in developing their skills and dispositions to thinking critically.

Clearly comparisons can be drawn between critical thinking disposition and need for cognition. However, no studies have correlated these paradigms. Given that the Need for Cognition scale has been used since 1984, the degree of a relationship with critical thinking disposition may provide greater insight to the study of critical thinking disposition.

## Purpose and Objectives

The purpose of this study was to examine levels of critical thinking disposition and need for cognition among undergraduate students enrolled in leadership courses at four institutions. The study also aims to determine if a relationship exists between one's critical thinking disposition and their need for cognition. The specific objectives of the study were to: (1) Determine undergraduate student levels of critical thinking disposition and examine differences among participating institutions; (2) Determine undergraduate student levels of need for cognition and examine differences among participating institutions; and (3) Explore relationships among critical thinking disposition, need for cognition and selected student demographic variables.

## Methodology

Participants for this study were selected using convenience sampling from courses at four institutions in the Eastern United States during the fall quarter/semester. Of these institutions one was in the



northern portion of the country with the other three along the southern coast. Those selected included undergraduate courses teaching leadership skills such as public speaking and leadership theory. To ensure a mixture of majors and student rank, the courses selected were large service courses in each of the respective schools. Through a single direct administration, 317 students completed both instrumentation used to measure critical thinking disposition and need for cognition.

### Instrumentation

The UF-EMI was used to measure student's critical thinking disposition. The UF-EMI is a 26-item instrument using five-point Likert-type scales to measure three constructs of critical thinking: engagement, cognitive maturity, and innovativeness (Irani, et al., 2007). Total scores of the UF-EMI can range from 26-130. Overall reliability for the instrument is reported at .94 (Irani, et al., 2007). Post hoc reliability testing found a reliability of .92 for the UF-EMI. The engagement construct had a Cronbach's alpha of .87; the cognitive maturity construct had an alpha of .75; and the innovativeness construct showed an alpha of .82.

The Need for Cognition scale measured students' "tendency to engage and enjoy effortful cognition" (Cacioppo, et al., 1984, p. 306). The 18-item instrument uses a five-point Likert scale ranging from strongly disagree to strongly agree. Scores on nine items were reverse coded as suggested by Cacioppo and colleagues. Items were summed for an overall need for cognition score. The instrument has a reported Cronbach's alpha coefficient of .90. Post-hoc analysis in this study found a reliability of .84.

Demographic data was also collected on students to determine rank, major, gender, and age. Data is limited by the nonrandom sample used in the study. Results can only be generalized to the students who participated in the study.

### Data Analysis

To complete the objectives of this study, descriptive statistics were used to analyze students' demographic information, critical thinking disposition, and need for cognition. A one-way ANOVA was utilized to examine significant differences of student's critical thinking disposition and need for cognition among participating institutions. For objective four, all students were grouped together and Pearson's correlation coefficient was used to explore relationships among critical thinking disposition,

need for cognition and selected demographic variables. Throughout the presentation of the data, research institutions were coded one through four to maintain anonymity.

### Findings

Selected demographic information of participating undergraduate students was analyzed for the purpose of examining similarities and differences of students enrolled in leadership classes at their respective institutions (Table 1). At Institution One, 87 students participated of which 79% (n = 69) were female. The mode age for this leadership class was 21 years (n = 40) with everyone between the ages of 19 and 25 years except for one 37 year-old student. Most of the students classified themselves as seniors (n = 65, 75%) and juniors (n = 21, 24%). There was one sophomore in the class. Of the participants at Institution One, 14% (n = 12) were honors students and the average self-reported GPA was 3.47. There were 23 different majors accounted for in this leadership class and the most prominent were family youth and community sciences (n = 23, 26%), advertising (n = 9, 10%), and finance (n = 9, 10%). See Table 1.

At Institution Two, there were 86 participating students of which 58% (n = 50) were female. The mode age of participating students in this leadership class was 20 (n = 24) with all students between the ages of 18 and 23 minus one 30 year-old student. The students varied in class status as this group composed

**Table 1. Demographics of participating undergraduate students**

Institution	One	Two	Three	Four	Total
Participants (n)	87	86	52	92	317
Gender					
Male	21%	42%	40%	70%	44%
Female	79%	58%	60%	30%	56%
Age					
Mode	21	20	21	20	21
Class					
Senior	75%	33%	60%	35%	49%
Junior	24%	35%	35%	51%	37%
Sophomore	<1%	21%	5%	14%	11%
Freshman	0	11%	0	0	3%
Honors					
Yes	14%	21%	16%	4%	13%
No	86%	79%	84%	96%	87%
Grade	Point	Average			
Mean (M)	3.47	3.34	3.15	2.98	3.24

of 10 freshman (11%), 18 sophomores (21%), 30 juniors (35%), and 28 seniors (33%). Of these students, 21% (n = 18) were honors students and the average self-reported GPA was 3.34. A total of 34 academic majors were represented in this leadership class at Institution Two, of which the most prominent were agricultural education (n = 16, 19%), biological sciences (n = 10, 12%), and agricultural communication (n = 8, 9%). See Table 1.

There were 52 participating students enrolled in a leadership class at Institution Three. Of these students, 60% (n = 31) were female. The mode age of this group was 21 (n = 24) with most students

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between the ages of 19 and 23 years. Older students included a 27 year-old and a 28 year-old student. At Institution Three, the participants were mostly classified as seniors ( $n = 31, 60\%$ ) and juniors ( $n = 18, 35\%$ ). There were also three sophomores enrolled in the class. There were eight (16%) honors students in the class and the average self-reported GPA was 3.15. Participants represented 16 academic majors and the most prominent were business ( $n = 13, 25\%$ ), poultry science ( $n = 13, 25\%$ ), and general studies ( $n = 10, 19\%$ ). See Table 1.

For Institution Four, 92 students agreed to participate in this study. Of this group, 30% ( $n = 28$ ) were female and the mode age was 20 years of age ( $n = 37$ ). However, student age in this group varied between 19 and 31 years of age. Students enrolled in this leadership class were mostly juniors ( $n = 47, 51\%$ ) and seniors ( $n = 32, 35\%$ ). There were also 13 sophomores (14%) in the class. Included in this class were four honors students. The average self-reported GPA of students enrolled in this leadership course was 2.98. The class comprised of 18 academic majors of which the most prominent were construction systems management ( $n = 21, 32\%$ ), animal science ( $n = 26, 28\%$ ), and turf grass management ( $n = 7, 8\%$ ). See Table 1.

All participating students were combined to form one group for comparison purposes. Of the total student group, 56% ( $n = 178$ ) were female. The mode age of all students was determined as 21 years of age ( $n = 112$ ) while the youngest student declared an age of 18 years and the oldest student reported an age of 37 years. Participating students comprised mostly of seniors ( $n = 156, 49\%$ ), and juniors ( $n = 116, 37\%$ ). There were also 35 (11%) sophomores and 10 (3%) freshmen enrolled in these four leadership courses. In this group, 13% ( $n = 42$ ) were honor students and the average GPA of all students was 3.24. Among students enrolled in one of the four institutions, there were 57 different academic majors and the most prominent included animal science ( $n = 33, 10\%$ ), construction systems management ( $n = 29, 9\%$ ) and family youth and consumer sciences ( $n = 23, 7\%$ ). See Table 1.

The demographic information gathered on these participants indicated that most of these students were traditional undergraduate students and predominately juniors or seniors. However, students enrolled at Institution Four have a larger percentage of male students than the other

three institutions. In addition, Institution Four had the lowest self-reported GPA.

The first objective addressed in this study was to determine the critical thinking disposition levels of undergraduate students enrolled in leadership courses at these four institutions. The total critical thinking disposition mean score at Institution One was 101.70 ( $SD = 11.47$ ). This was in relation to the total scale score of 130. In this leadership class, the student with the lowest critical thinking disposition scored 57 points and the student with the highest total critical thinking disposition scored 130 points. At Institution Two, the mean critical thinking disposition score was 101.57 ( $SD = 13.53$ ) with a range between 63 and 128 points for the lowest and highest disposition scores respectively. Institution Three had the highest mean critical thinking disposition score ( $M = 104.54, SD = 9.77$ ). In this leadership class, students ranged from 84 points indicating a low critical thinking disposition and 127 points indicating a high critical thinking disposition. Institution Four had the lowest mean critical thinking disposition score ( $M = 95.03, SD = 14.11$ ). The participants at Institution Four with the lowest critical thinking disposition scored 48 points on the UF-EMI while the student with the highest critical thinking disposition in the class scored 126 points. These scores are similar to norms reported by Irani et al. (2007). See Table 2.

Researchers used a one-way ANOVA to examine significant differences of critical thinking disposition among the four participating institutions. A significant difference was found in total critical thinking disposition scores among the four institutions ( $F = 7.95, p < .05$ ) and a Bonferroni post-hoc test was conducted to determine among which institutions the significant differences exist. Students enrolled in leadership classes at Institution Four had signifi-

**Table 2. Student mean scores of critical thinking disposition ( $n = 317$ )**

Institution	Construct	<i>M</i>	<i>SD</i>	Min	Max
One ( $n = 87$ )	Total critical thinking disposition	101.70	11.47	57	130
	Engagement	43.62	5.87	18	55
	Cognitive maturity	30.91	3.50	23	40
	Innovativeness	27.17	3.79	12	35
Two ( $n = 86$ )	Total critical thinking disposition	101.57	13.53	63	128
	Engagement	43.70	6.27	25	55
	Cognitive maturity	30.49	4.46	21	40
	Innovativeness	27.38	4.56	13	35
Three ( $n = 52$ )	Total critical thinking disposition	104.54	9.77	84	127
	Engagement	45.10	4.57	33	55
	Cognitive maturity	31.33	3.50	23	40
	Innovativeness	28.12	3.49	20	35
Four ( $n = 92$ )	Total critical thinking disposition	95.03	14.11	48	126
	Engagement	41.21	6.32	21	55
	Cognitive maturity	28.55	4.64	12	37
	Innovativeness	25.26	4.29	15	34
All Students	Total critical thinking disposition	100.19	13.03	48	130
	Engagement	43.18	6.05	18	55
	Cognitive maturity	30.18	4.25	12	40
	Innovativeness	26.83	4.23	12	35

Note. Critical thinking disposition was measured by the UF-EMI with 26 items. Theoretical range: Total disposition (26-130), Engagement (11-55), Cognitive maturity (8-40) and Innovativeness (7-35).

cantly lower total critical thinking dispositions than Institution One (MD = 6.67,  $p < .05$ ), Institution Two (MD = 6.54,  $p < .05$ ), and Institution Three (MD = 9.51,  $p < .05$ ). This evidence indicates students enrolled in this leadership class at Institution Four had significantly lower critical thinking scores than students in comparable leadership classes at the other three participating institutions.

To meet objective two, researchers utilized the Need for Cognition scale to determine undergraduate student levels of need for cognition and examine differences among participating institutions. On average, students enrolled in the leadership class at Institution Three had the highest scores ( $M = 62.79$ ,  $SD = 9.10$ ) on the Need for Cognition scale with a range of 45 to 83 points indicating low need for cognition and high need for cognition respectively. Institution Four students reported the lowest scores for Need for Cognition ( $M = 57.58$ ,  $SD = 9.58$ ) with one student acquiring the lowest score of 24 points. Combining all students together, students' mean need for cognition score was 60.44 ( $SD = 9.95$ ). The student with the lowest level of need for cognition scored 24 points on the Need for Cognition scale while the student with the highest level of need for cognition scored 83 points on the scale. Note that one student from Institution One did not complete the Need for Cognition scale. Scores seemed to approximate the norms set by Cacioppo, Petty and Kao (1984). See Table 3.

To examine differences among institutions, a one-way ANOVA was utilized to determine if significant differences of students' need for cognition exist among the selected leadership courses at participating land grant institutions. Using need for cognition as the dependent variable, a group effect was found

have significantly lower scores than students in comparable leadership courses at Institutions Two and Three.

Objective three was achieved by using Pearson's Product Moment correlation coefficients to explore relationships among critical thinking disposition, need for cognition and selected student demographic variables. Of particular interest, is the relationship between critical thinking disposition, as measured by the UF-EMI and students' need for cognition as measured by the Need for Cognition Scale. Combining all students from leadership classes at all four participating land grant institutions, the Need for Cognition scale had a moderate correlation with total critical thinking disposition ( $r = .63$ ,  $p < .05$ ). Furthermore, the Need for Cognition scale moderately correlated with the UF-EMI constructs: engagement ( $r = .59$ ,  $p < .05$ ), cognitive maturity ( $r = .46$ ,  $p < .05$ ), and innovativeness ( $r = .63$ ,  $p < .05$ ). This data indicates for these undergraduate students, there is an association between critical thinking disposition and need for cognition.

Considering the correlations between critical thinking disposition and selected student demographic variables, only students' self-reported GPA had a small significant correlation ( $r = .19$ ,  $p < .05$ ) with critical thinking disposition. This finding provides further evidence that the disposition to think critically has little relationship to student achievement. Students' need for cognition had a slightly stronger correlation ( $r = .28$ ,  $p < .05$ ) with self-reported GPA. This finding suggests a small relationship between need for cognition and student achievement among students enrolled in leadership classes at these participating universities.

Finally, there was a small correlation between gender and self-reported GPA ( $r = .22$ ,  $p < .05$ ). Being that the data for gender was coded one for males and two for females, this correlation indicates an association between being female and having a higher self-reported GPA in these leadership classes. See Table 4.

**Table 3. Student mean scores of need for cognition scale (n = 316)**

Institution	<i>M</i>	<i>SD</i>	Min	Max
One ( <i>n</i> = 86)	60.99	8.24	33	75
Two ( <i>n</i> = 86)	61.51	11.71	29	82
Three ( <i>n</i> = 52)	62.79	9.10	45	83
Four ( <i>n</i> = 92)	57.58	9.58	24	79
All Students	60.44	9.95	24	83

*Note.* Need for cognition was measured by the Need for Cognition scale with 18 items. Theoretical range of scale equals 18 to 90.

by Institution ( $F = 4.03$ ,  $p < .05$ ). A Bonferroni post-hoc test was used to further examine group differences. Students enrolled in the leadership course at Institution Four had need for cognition scores significantly lower than Institution Two (MD = 3.93,  $p < .05$ ) and Institution Three (MD = 5.21,  $p < .05$ ), but not Institution One (MD = 3.41,  $p > .05$ ). This evidence indicates that students enrolled in this leadership course at Institution Four

**Table 4. Correlations of critical thinking disposition, need for cognition, gender, and GPA (n = 316)**

Construct	1.	2.	3.	4.	5.	6.	7.
1. Total Critical Thinking Disposition	--						
2. Engagement	.94*	--					
3. Cognitive maturity	.82*	.61*	--				
4. Innovativeness	.93*	.84*	.65*	--			
5. Need for Cognition	.63*	.59*	.46*	.63*	--		
6. GPA	.19*	.19*	.09	.22*	.28*	--	
7. Gender	.07	.02	.16	.05	.16	.22*	--

\* $p < .05$



### Conclusions and Recommendations

Today there is an undeniable need to develop critical thinking skills among college graduates. Colleges of agriculture and life sciences are capable of providing this preparation to address the changes in agricultural technology, the environment, and natural resource sustainability. Dispositions or attitudes toward critical thinking can impact critical thinking skills; therefore, one's need for cognition could impact both critical thinking disposition and skill.

The findings of the study provided insight into three objectives identified by the researchers. The researchers first addressed the demographic make-up of the respondents. Demographic differences have not been consistently found to have significant variance on critical thinking disposition (Claytor, 1997; Wilson, 1989). The respondents in the study were predominately female, with only one institution reporting the majority of male respondents. This study found no relationship between gender and critical thinking disposition. However, note that critical thinking disposition on average was lowest at Institution Four, which had a higher percentage of males. This relationship was not further explored at Institution Four and little more can be discussed without statistical analysis. Nevertheless, more research is warranted to identify variables that may coincide with gender and critical thinking to better understand this matter.

While gender has not been documented consistently to show an effect on critical thinking, researchers have established a link between age and critical thinking disposition of cognitive maturity; although this is more of a practical finding versus significant. This study shows the respondents were primarily traditional ages, 18 to 23, college students with a few non traditional students ranging from 27 to 37. The non-traditional age students could create an overall impact on the scores with an increase in the reported mean for cognitive maturity. Critical thinking has not been shown to yield significant differences by age; however the elderly and youth have not been thoroughly examined to identify this relationship. The researchers call for more research to identify if age is associated with critical thinking disposition beyond traditional undergraduate students (i.e. community college or graduate student ages).

Self-reported GPA was found to range from 2.98 to 3.47 and had a small correlation ( $r = .22, p < .05$ ) with critical thinking disposition. Although this study found a small correlation, other studies support a stronger relationship between critical thinking and academic achievement (Ricketts, 2003; Rollins, 1990). A low relationship with GPA and need for cognition was also found ( $r = .28, p < .05$ ) and is supported by the literature (Leone and Dalton, 1988; Sadowski, and Gulgoz, 1996). Two recommendations result from this finding. The relationship between critical thinking disposition and academic achieve-

ment, albeit small in this study, is consistently positive in the literature. Perhaps this consistency and the requisite nature of critical thinking skills in education gives some indication of a necessity for including critical thinking disposition as a variable in the model to explain student achievement in colleges of agriculture and life sciences (Osborne, n.d.). Coutinho (2006) noted that in regards to NFC, those who are higher in will use more elaborative learning strategies coming to a deeper understanding of curriculum which could thus lead to higher academic success. It could be the case that the same is found with students who are more disposed to critical thinking. A model that uses critical thinking disposition or NFC to explain student achievement would help faculty and administrators in colleges of agriculture and life sciences promote academic success through the manipulation of the identified explanatory variables. Second, the finding gives another commonality between critical thinking disposition and need for cognition. More will be discussed concerning this in the following paragraphs.

The first and second objectives addressed the respondent scores of critical thinking disposition and need for cognition in four different institutions. This study found that Institution Four had significantly lower levels of critical thinking disposition and significantly lower levels of need for cognition. Given the critical thinking and need for cognition steadiness of the three institutions and the low levels of said variables at Institution Four, one could surmise that something is different about the environmental (i.e. school/university) factor at Institution Four. Further, more in-depth observational research ought to determine this discrepancy. Additionally, if critical thinking can be taught (Ennis, 1985; Facione, et al., 1997; Tishman and Andrade, 1996), then the researchers encourage practitioners in undergraduate classrooms to identify students' critical thinking disposition, and if low, begin using instructional techniques that promote critical thinking (Tishman and Andrade, 1996). Other questions that are raised include: What impact does the college experience have on critical thinking disposition? While the scores ranged across institutions the findings show the all respondents still require additional dispositional development, or at a minimum have room to grow.

A moderate relationship was found among the Need For Cognition scale and all three constructs of critical thinking disposition as measured by the UF-EMI. The moderate correlation found indicates a close relationship among these scales, but may bring more questions than answers. Is it possible that need for cognition is a scale that should be included in the measurement of critical thinking disposition? There are many similarities between the two scales in both the literature and relationship with other independent variables. Since critical thinking disposition was heavily derived from empirical data (Facione, 1990),

it may be justifiable to further examine the underpinnings of critical thinking theory with regard to relationships among thinking processes, behaviors, and environmental factors. Such research would clarify the literature and provide a theoretical justification for critical thinking disposition, which may or may not indicate if need for cognition should be incorporated into critical thinking disposition as a psychological construct.

Need for cognition is not a new concept (Cohen, et al., 1955), but still holds a great deal of interest by academics (Coutinho, 2006; Haugtvedt, et al., 1992; Sadowski and Gulgoz, 1996). The question remaining is at what point are students developing this need for cognition? The notion that individuals are intrinsically motivated to seek complex tasks (Coutinho, 2006) does not differ much from the disposition of cognitive maturity (Ricketts, 2003). The similarities and relationships of these two concepts are explored in this study and the findings show there is a moderate positive correlation between the two. While the literature shows a gap in this area, this study provides a base line finding that critical thinking and need for cognition are in fact related. Educators can use this information to develop curriculum, which engages students' desire to discover and address complex tasks. By doing so, there can be chain effect in a student's disposition toward critical thinking and thus their critical thinking skill (behavior). This relationship has the potential to further develop the problem-solving, decision-making and the articulation of issues as it relates to agriculture and natural resources for students.

The essential piece of this study is there remains many unanswered questions related to critical thinking disposition and student development, as well as the initial discovery linking critical thinking and need for cognition. Researchers should continue this line of inquiry further exploring the impact of demographic variables on these constructs. Educational programs have the capacity to build strong thinkers and leaders capable of solving the complex problems facing agriculture and natural resources.

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