© Journal of Agricultural Education
Volume 53, Number 2, pp 1–14
DOI: 10.5032/jae.2012.02001

The Impact of Preparing Agriculture Faculty to Influence Student Critical Thinking Disposition

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This study examined the effect of agriculture faculty training in and practice of methodologies to explicitly teach critical thinking skills related to course content and subsequent change in student critical thinking disposition. Twelve instructors in 14 agriculture courses underwent a year–long program of instruction in effective critical thinking development. Students completed the University of Florida–Engagement, Maturity, and Innovativeness assessment (UF–EMI) at the beginning and the end of the semester. Pair–wise comparisons showed significant increases in all three critical thinking dispositions (i.e., engagement, cognitive maturity, and innovativeness). In addition, a step–wise regression on the data gathered at the end of the semester showed that grade point average was positively related to all three critical thinking dispositions and being in one's first year of college was negatively related to each dimension. The 300 course level was negatively related to innovativeness and engagement. Being in the second and third year of college were also negatively related to engagement. This study supports the notion that instructors can influence students' critical thinking disposition within the limited time of a college semester.

Keywords: critical thinking dispositions, critical thinking skills, faculty development

This project was supported by Higher Education Challenge Grant no. 2007–38411–18114 from the USDA National Institute of Food and Agriculture.

Introduction

Calls for higher education to increase critical thinking in college students have existed for many years (e.g., Association of American Colleges [AAC], 1985; Garrison, 1991; National Institute of Education, 1984; National Research Council, 1996). Technological changes and increasingly complex workplaces have made critical thinking more important than ever before (Department of Education, 2006; Wade, 2009). Consequently, employers are increasingly expecting colleges and universities to prepare students to think critically (Association of American Colleges and Universities [AACU], 2010; American Institute of Certified Public Accountants [AICPA], 2008; Burnett, 2003, Casner–Lotto, Barrington, & Wright, 2006; Landrum & Harrold, 2003; McMurtrey, Downey, Zeltmann, & Friedman, 2008). Recent college graduates agree that critical thinking is one of the most important skills employers look for (AACU, 2007). While employers may be seeing improvement in student critical thinking skills, fewer than 28 percent of employers rate four–year college graduates' preparation as *excellent* in critical thinking (Casner–Lotto, Barrington, & Wright, 2006).

Although many faculty claim critical thinking is a primary objective in their courses (Paul, Elder, & Bartell, 1997), in reality they mostly teach at low levels of cognition (Ewing & Whittington, 2009; Whittington, 1995), and fail to develop student critical thinking skills

(Browne & Freeman, 2000; Fox & Hackerman 2003, Handelsman et al., 2004; Paul, Elder, & Bartell, 1997; Shamian, 1991). Educational theories, supported by research, which can lead to increased student critical thinking skills are often poorly implemented in the classroom (Dolmans, De Grave, Wolfhagen, & van der Vleuten, 2005; Maddox & Cummings, 2004). Moreover, many faculty lack the ability or training to develop student critical thinking skills (Tsui, 2007). Agricultural and life sciences faculty at the University of Florida rated competency in teaching critical thinking as one of their greatest teaching needs (Harder, Roberts, Stedman, Thoron, & Myers, 2009).

Developing students' critical thinking skills is a stated goal of most institutions of higher education. However, a student's inclination to use critical thinking processes when examining a problem is also important to evaluate. An individual's critical thinking disposition is as important as an individual's critical thinking skills. When researchers have examined critical thinking they have primarily focused on the outcomes of critical thinking. This has led to the neglect of empirical investigation of the antecedents of critical thinking. A critical thinking disposition has been defined as an internal motivation to use critical thinking skills (Pascarella & Terenzini, 2005). Scholars have recently called for more empirical studies that examine students' critical thinking disposition (Stupnisky et al., 2008).

A Delphi study sponsored by the American Philosophical Association to develop an expert consensus definition of critical thinking determined that critical thinking includes the dimensions of skill and disposition (Facione 1990). "In addition, a good critical thinker . . . is habitually disposed to engage in, and to encourage others to engage in a wide range of contexts and for a wide variety of purposes" (p. 13). A disposition to think critical thinking is a consistent willingness, motivation, inclination, and intention to engage problems and make decisions by using thinking (Facione & Facione, 1997; Facione, Facione, & Giancarlo, 2001). As Halpern (1999) reminds:

> Critical thinking is more than the successful use of the right skill in an appropriate context. It is also an attitude or disposition to recognize when a skill is needed and the willingness to exert the mental effort needed to apply it. (p. 72)

A number of studies have demonstrated that teachers of higher education can positively influence student's critical thinking skills, particularly when purposely and explicitly teaching critical thinking (e.g., Abrami et al., 2008; Bensley, Crowe, Bernhardt, Buckner, & Allman, 2010; Miri, Ben–Chaim, & Zoller, 2007). And, more specifically, faculty development programs can lead to improved students' critical thinking skills (Felder & Brent, 2010; Wald, Davis, Reis, Monroe, & Borkan, 2009). More pertinent to this study, a growing body of literature indicates that teachers of higher education can influence students' disposition to think critically as well. Moreover, influencing students' critical thinking disposition may be harder than influencing students' critical thinking skills (Reed & Kromrey, 2001; Ricketts, Irani, Rudd, & Gallo–Meagher, 2003).

Recent research offers evidence of factors influencing college students' critical thinking disposition. Time spent in college tends to increase the overall disposition to think critically. Giancarlo and Facione (2001) found that seniors had increased their overall critical thinking disposition over the course of their four years in college. Similarly, Lampert (2007) found juniors and seniors had a significantly higher overall critical thinking disposition than freshmen. Colucciello (1997) and McCarthy Shuster, Zehr, and McDougal (1999) found junior and senior nursing students had a significantly higher overall critical thinking disposition than sophomores. However, Rhoades, Ricketts, Irani, Lundy, and Telg (2005) found year in school was not significantly associated with the critical thinking disposition of agriculture communications students from 12 universities.

Tiwari, Lai, So, and Yuen (2006) found first year Hong Kong nursing students who participated in a course delivered by problem based learning methods had higher critical thinking dispositions than those taught by lecture methods. Likewise, Ozturk, Muslu, and Dicle (2008) found senior Turkish nursing students who participated in a course delivered by problem based learning methods had higher

critical thinking dispositions than those taught by traditional methods.

Ricketts et al. (2003) found small but significant increases in some targeted dispositions in students in a general education course restructured to focus on teaching students to think critically compared to a control course not privy to the critical thinking teaching methodology. However, one critical thinking disposition decreased in both the control and experimental group. While a growing body of research indicates that certain teaching methods may increase student critical thinking dispositions, little research has focused on the effects of faculty development on student critical thinking dispositions. The impact of faculty development in purposely teaching to increase critical thinking dispositions remains unresolved.

Purpose and Objectives

The purpose of this study was to examine the effectiveness of a year–long program of instructor training in and practice of methodologies to increase student critical thinking skills and dispositions. This information can be used to plan future professional development programs for agricultural education instructors. The objectives of this study were as follows:

1. Measure the change in student critical thinking disposition over the course of a semester when students were explicitly taught critical thinking skills and dispositions related to course content.
2. Examine age, grade point average, gender, class size, course level, and year in school as antecedents to critical thinking disposition.

Methods

Participants

Four hundred twenty–six students completed the University of Florida–Engagement, Maturity, and Innovativeness assessment (UF–EMI) pre– and post–course. The sample was made up of 193 male undergraduates and 233 female undergraduates in 14 courses. The participants' average age was 20.9 years with a range of 19 to 40. The sample consisted of 10.7% freshman, 25.5% sophomores, 20.4% juniors, and 43.2% seniors. The average grade point average was 3.22. In addition, 33.6% of the sample was from 100 level courses; 11.0% from 200 level courses, 31.5% from 300 level courses, and 23.9% from 400 level courses.

Procedure

Twelve instructors of undergraduate agriculture courses at a major midwestern university completed a year–long program of instruction in developing student critical thinking skills and dispositions. The objective of the program was to explore theory and pedagogy in the development and use of critical thinking skills and dispositions in the classroom to improve teaching. The program began with a one–day workshop for faculty from across the university on building student critical thinking skills and dispositions. The workshop was conducted by a nationally recognized expert in critical thinking. During the workshop, faculty members were instructed in how to integrate new critical thinking pedagogy into their courses. Topics covered included overtly teaching critical thinking skills and dispositions, integration of critical thinking into a course, lesson preparation, student preparation, assignments, and evaluation. After the workshop, instructors of agriculture courses were solicited to participate in a one–year program to increase the instructors' capacity to develop students' critical thinking skills and dispositions.

Instructors participated in a monthly peer–discussion colloquium. The colloquia were facilitated by campus experts in the development of student critical thinking skills. Instructors were required to attend all colloquia. The colloquia provided an informal opportunity for instructors to learn from each other and offer peer support. Instructors shared experiences and successes and developed constructive approaches to critical thinking challenges. Instructors were encouraged to share pedagogy at the meetings and solicit feedback from other instructors in a safe environment. Instructors were required to share their plans for revising their courses, and provide feedback to others on their plans.

Throughout the year, instructors reviewed current literature and pedagogy associated with critical thinking best practices (e.g., Burbach, Matkin, & Fritz, 2004; Dunn, Halonen, & Smith,

2008; Halpern, 1998; Smith, 2003; Tsui, 1999, 2002). This was considered important since familiarity with current literature is associated with teaching success (Harada & Hughes–Hassell, 2007). Topics reviewed included critical thinking pedagogy, assignments and exercises, resources, training and preparing students, diversity, accountability and grading, feedback and communication, and self–assessment. The problems that can arise in the course of a semester (for instance, motivation, diversity issues, time constraints, group think, etc.) and ways to address them were also reviewed (e.g., Nelson Laird, 2005; Wlodkowski, 2004).

Assessment of students' critical thinking dispositions occurred in the second half of the instructors' year–long instruction program. In the fall of 2009, students in 14 courses completed the UF–EMI assessment in the first week of the semester (pre–course) and again the week prior to final exams (post–course). With the assistance of trained graduate assistants the principal investigators proctored the surveys during class time. All IRB protocols were followed and volunteer participation of students was ensured.

Measures

The UF–EMI is a 26–item, five–point Likert–type scale. The engagement disposition subscale measures predisposition to look for opportunities to use reasoning, to anticipate situations that require reasoning, and confidence in reasoning ability (Irani et al., 2007). The engagement disposition was measured using 11 items.

The cognitive maturity disposition subscale measures 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. Cognitive maturity was measured using 8 items.

The innovativeness disposition subscale measures predisposition to be intellectually curious and a desire to know the truth. Innovativeness was measured using 7 items.

The internal reliability for all 26 items of the UF–EMI for this study was .89 at the pre–course assessment and .92 at the post–course assessment. The internal reliability of the cognitive maturity disposition pre– and post–course was .65 and .72, respectively. The internal reliability of the innovativeness disposition pre– and post–course was .78 and .80, respectively. The internal reliability of the engagement disposition pre– and post–course was .81, and .88, respectively.

Finally, a few items were added to the UF–EMI measure to be used as predictors of students' cognitive maturity, innovativeness, and engagement. These included items to assess students grade point average, age, gender, class size, year in school (i.e., freshman, sophomore, junior, or senior), and the course level (100, 200, 300, or 400).

Results

A series of paired–samples *t*–test were conducted to compare pre–course and post–course critical thinking dispositions. Results from the pair–wise comparison showed an overall significant increase in students' total critical thinking disposition scores from pre–course (M = 98.93, SD = 10.6) to post–course (M = 103.88, SD = 11.7); $t(426) = 11.44$, p = 0.000, d = .44. Results are summarized in Table 1. All three dispositions showed a significant increase from pre–course.

Table 1
Overall Results of Paired Samples t–Test (N = 426)

	Pre–test		Post–test						
Disposition	*M*	*SD*	*M*	*SD*	Diff.	*t*	*df*	*p*	Cohen's *d*
Cognitive Maturity	30.00	3.5	31.33	3.7	1.33	8.15	425	.000	0.37
Engagement	42.28	4.7	44.55	5.4	2.27	10.94	425	.000	0.45
Innovativeness	26.65	3.9	28.00	3.8	1.35	9.34	425	.000	0.35
Total Disposition	98.93	10.6	103.88	11.7	4.95	11.44	425	.000	0.44

In addition, results from the pair–wise comparison for each of the 14 courses were examined. Significant increases were observed on all three dimensions for seven of the 14

courses (Table 2). Four courses had significant changes on two of the three dimensions. One course had a significant change on one dimension. Two courses showed no changes in any of the three dimensions of critical thinking disposition.

Table 2
Results of Paired Samples t–Test for Each Course

		Pre–test		Post–test						
Class	Disposition	M	SD	M	SD	Diff.	t	df	p	Cohen's d
1 Fresh.	Cog. Mat.	32.09	2.25	33.00	3.92	0.91	1.31	21	.204	0.29
N = 22	Engagement	43.64	4.39	45.91	5.87	2.27	2.42	21	.025	0.44
	Innovativeness	27.27	4.19	28.91	4.17	1.64	2.10	21	.048	0.39
2 Fresh.	Cog. Mat.	32.33	3.83	31.50	3.78	-0.83	1.75	5	.141	0.21
N = 6	Engagement	44.00	7.16	44.17	6.85	0.17	0.31	5	.771	0.02
	Innovativeness	28.83	2.93	29.00	3.16	0.17	0.22	5	.833	0.06
3 Fresh.	Cog. Mat.	29.19	3.02	30.19	4.20	1.00	1.94	42	.060	0.26
N = 43	Engagement	41.79	4.52	42.81	6.33	1.02	1.31	42	.199	0.19
	Innovativeness	26.35	3.68	27.56	4.18	1.21	2.70	42	.010	0.31
4 Fresh.	Cog. Mat.	29.52	4.69	32.48	3.84	2.96	2.40	22	.025	0.69
N = 23	Engagement	42.00	5.08	46.96	4.99	4.96	4.68	22	.000	0.99
	Innovativeness	25.61	5.38	28.52	4.57	2.91	3.30	22	.003	0.58
5 Fresh.	Cog. Mat.	29.25	3.91	31.44	3.41	2.19	2.48	15	.025	0.60
N = 16	Engagement	40.81	3.87	44.06	5.62	3.25	3.78	15	.002	0.67
	Innovativeness	24.94	3.64	27.25	3.09	2.31	3.10	15	.007	0.68
6 Fresh.	Cog. Mat.	29.50	5.03	31.79	4.51	3.29	3.31	13	.006	0.48
N = 14	Engagement	41.50	5.11	44.64	5.53	3.14	2.57	13	.023	0.59
	Innovativeness	26.00	4.40	27.86	4.33	1.86	2.56	13	.024	0.43
7 Fresh.	Cog. Mat.	29.47	2.72	30.05	3.14	0.58	0.65	18	.523	0.20
N = 19	Engagement	40.74	4.45	41.84	4.17	1.10	1.06	18	.302	0.26
	Innovativeness	26.11	3.83	27.05	3.31	0.94	1.15	18	.266	0.26
1 Soph.	Cog. Mat.	30.00	3.42	30.82	2.89	0.82	1.33	21	.198	0.26
N = 22	Engagement	42.32	5.83	43.82	6.16	1.50	2.11	21	.047	0.25
	Innovativeness	26.77	3.85	28.09	3.78	1.32	2.85	21	.010	0.35
2 Soph.	Cog. Mat.	29.40	3.06	30.92	3.77	1.52	2.11	24	.045	0.44
N = 25	Engagement	41.88	4.12	45.20	6.72	3.32	3.73	24	.001	0.60
	Innovativeness	27.12	3.62	38.60	4.03	1.48	3.04	24	.006	0.39
1 Junior	Cog. Mat.	28.98	3.13	30.38	3.97	1.40	2.60	39	.013	0.39
N = 40	Engagement	39.95	4.68	42.73	4.47	2.78	5.59	39	.000	0.61
	Innovativeness	25.65	3.53	26.65	3.18	1.00	2.30	39	.027	0.30
2 Junior	Cog. Mat.	30.57	3.09	31.73	3.24	1.16	4.43	93	.000	0.37
N = 94	Engagement	42.50	4.70	44.19	4.98	1.69	3.89	93	.000	0.35
	Innovativeness	27.12	3.94	27.89	3.83	0.77	2.95	93	.004	0.20
1 Senior	Cog. Mat.	31.88	3.26	34.06	2.49	2.18	3.11	14	.007	0.75
N = 16	Engagement	45.38	4.97	49.00	3.62	3.62	3.58	14	.003	0.83
	Innovativeness	29.00	3.72	30.38	3.07	1.38	1.92	14	.075	0.40
2 Senior	Cog. Mat.	29.91	4.34	30.61	3.51	0.70	1.48	45	.146	0.18
N = 46	Engagement	43.28	4.43	44.85	4.08	1.57	2.70	45	.010	0.37
	Innovativeness	26.41	3.94	27.63	4.11	1.22	2.65	45	.011	0.30
3 Senior	Cog. Mat.	29.80	2.87	31.63	3.56	1.83	3.32	39	.002	0.57
N = 40	Engagement	43.23	4.33	46.33	5.25	3.10	4.61	39	.000	0.64
	Innovativeness	26.90	3.16	28.98	3.23	2.08	3.89	39	.000	0.65

Step–wise Regression

Next, a series of step–wise regressions were estimated on post–course critical thinking dispositions. The categorical variables of year in school and level of course were dummy coded. This enabled these categorical variables to be entered as predictors in the step–wise regression models. The predictor of year in school (i.e., freshman, sophomore, junior, and senior) was coded into three dummy codes. The predictor of level of course (i.e., course being a 100, 200, 300, and 400) was also coded into three dummy code variables. Gender and the continuous variables of age, grade point average, and class size were also entered into the regression models.

The step–wise regression for cognitive maturity showed that grade point average (β = .22, p<.000) was a significant predictor of cognitive maturity (Table 3). This means that those students with higher grade point averages also had higher levels of cognitive maturity. Also, being in one's freshman year was negatively related to students' level of cognitive maturity (β = -.20, p<.000), which means that freshman tend to have significantly lower levels of cognitive maturity.

Table 3
Step–wise Regression for Cognitive Maturity (N = 396, listwise deletion of missing data)

Variable	*B*	*SE B*	β
Constant	25.180	1.385	
GPA	1.911	.425	.217*
Year in School (Fr)	-2.601	.643	-.195*

Note. r^2 = 0.087; F = 19.276; *p < .000; Excluded variables: Age, Gender, Class Size, Yr in School (So, Jr, Sr), Level of Course (100, 200, 300, 400)

The step–wise regression for innovativeness showed that grade point average (β = .28, p<.000), being in one's first year of school (β = -.21, p<.000), and 300 course level (β = -.10, p<.05) were significant predictors of students' innovativeness (Table 4). This means that students with higher grade point averages had higher inclinations toward the critical thinking disposition of innovativeness. Being in one's freshman year was negatively related to students' level of innovativeness. Also, the 300 course level was negatively related to innovativeness. Students in 300 level courses had a significantly smaller increase in innovativeness than students in other course levels.

Table 4
Step–wise Regression for Innovativeness (N = 396, listwise deletion of missing data)

Variable	*B*	*SE B*	β
Constant	20.121	1.418	
GPA	2.531	.431	.277**
Yr in School (Fr)	-2.912	.669	-.210**
Level of Course (300)	-.768	.390	-.095*

Note. r^2 = 0.122; F = 18.812; * p < .05 ** p < .001; Excluded variables: Age, Gender, Class Size, Yr in School (So, Jr, Sr), Level of Course (100, 200, 400)

The step–wise regression for engagement showed that grade point average (β = .33, p<.000), being in one's first year of school (β = -.23, p<.000), being in one's second year of school (β = -.16, p<.003), being in one's third year of school (β = -.13, p<.009), and 300 course level (β = -.15, p<.004) were significant predictors of students' engagement (Table 5). This means that students with higher grade point averages had higher inclinations toward the critical thinking disposition of engagement. Being a freshman, sophomore, and junior was negatively related to engagement. Students at a lower year in school had a significantly smaller

increase in engagement than their higher year in school counterparts. Also, the 300 course level was negatively related to engagement. Students in 300 level courses had a significantly smaller increase in engagement than students in other course levels.

Table 5
Step–wise Regression for Engagement (N = 396, listwise deletion of missing data)

Variable	*B*	***SE β***	***β***
Constant	32.508	1.979	
GPA	4.221	.601	.326**
Yr in School (Fr)	-4.541	.986	-.232**
Yr in School (So)	-2.032	.596	-.163*
Level of Course (300)	-1.723	.596	-.150*
Yr in School (Jr)	-1.749	.661	-.131*

Note. $r^2 = 0.158$; F = 15.161; * $p < .01$ ** $p < .001$; Excluded variables: Age, Gender, Class Size, Yr in School (Sr), Level of Course (100, 200, 400)

Discussion

Empirical evidence from this study supports the notion that well–prepared instructors can influence students' critical thinking disposition within the limited time of a college semester. Overall results showed that students' total critical thinking disposition increased during the span of a college semester. Students in seven of the fourteen courses had significant increases on all three dimensions of critical thinking disposition. Students in four courses improved on two of the three dimensions and students in one course improved on one of the three dimensions. Students in two courses did not show significant changes on any dimension of critical thinking disposition. Results from this study suggest that students' critical thinking disposition is malleable and higher education instructors can positively impact students' motivation to think critically. In contrast, Bers, McGowan, and Rubin (1996) did not find any significant change in college students' critical thinking dispositions over the course of a semester. None of the instructors in their study received specific training in developing students' critical thinking dispositions.

Also, several antecedents were examined in this study (i.e., age, GPA, gender, class size, year in school, and level of course). GPA and year in school were the most consistent predictors of students' critical thinking disposition. Student's GPA was positively related to all three dimensions of critical thinking disposition. Whereas, being in one's freshman year was negatively related to all three dimensions. This confirms results of others who found upperclassmen had a significantly higher overall critical thinking disposition than underclassmen (Lampert, 2007; McCarthy et al., 1999; Colucciello, 1997).

In addition to freshman year in school, sophomore and junior year in school were also negatively related to engagement. While students in all years in school had a significant overall increase in engagement, students at a lower year in school had a significantly smaller increase in engagement than their higher year in school counterparts.

The 300 course level was negatively related to the innovativeness and engagement. While students in 300 level courses experienced a significant increase in innovativeness and engagement, their increase in innovativeness and engagement was significantly smaller than other course levels. This may in part be explained by participants in this study tending to be at least one year in school higher than the corresponding course level and the high proportion of seniors in the study.

Age and gender were not significantly related to any disposition. Others have found age to be significantly related to student's disposition to think critically (e.g., Bers et al., 1996). King and Kitchner (1994) suggest that the ability to think critically develops over time as a function of age and cognitive development. While the relationship between gender and critical thinking disposition remains unclear, some studies have found female college students to have a significantly higher disposition to think

critically (e.g., Bers et al., 1996; Rudd, Baker, & Hoover, 2000).

In reviews of the literature on critical thinking Cuseo (2007) and McKeachie (1986) have concluded that large classes are not as effective as small classes in developing critical thinking. However, in this study, with class sizes ranging from 16 to 120 students, class size did not significantly affect critical thinking disposition.

Employers of college graduates in agriculture, natural resources and related careers increasingly demand applicants have better critical thinking and problem solving skills (e.g., Crawford, Lang, Fink, Dalton, & Fielitz, 2011; Robinson, Garton, & Vaughn, 2007; Stauffer & McMullin, 2009). Furthermore, national advisory bodies are suggesting curriculum reform in order to meet employer expectations and global competitiveness (e.g., AACU, 2007; APLU, 2009). In light of these circumstances, colleges of agriculture and natural resources should consider the professional development program studied here as part of curriculum reform.

Future Research

Future research should examine, which specific teaching methods, strategies, and activities are effective in increasing students' critical thinking disposition. Is it the overall approach to refining the curriculum to explicitly teach critical thinking or are there specific pedagogical tools that positively influence dispositions? Advanced longitudinal studies are needed that can track the developmental change of students' critical thinking. These studies should include more than two time points so an in–depth understanding of students' development can be understood. These longitudinal studies should expand beyond one semester. Additionally, control groups should be employed to further tease out the impacts of teaching methods and faculty development programs on students' critical thinking dispositions. In this study, it is possible that the participants' increase in critical thinking dispositions could be the result of maturation over the course of the semester.

Researchers need to consider the multilevel nature of critical thinking. This can help researchers isolate both the individual and contextual predictors of students' critical thinking. Do students in classes with other students who have high levels of critical thinking dispositions change more than students in classes with few students with high levels of critical thinking dispositions? This study found students at a lower year in school had a significantly smaller increase in engagement than their higher year in school counterparts. What can instructors do to raise the critical thinking disposition of engagement in all students equally?

Many introductory, 100 level courses at universities can be quite large, with well over 100 students in a class. In this study, freshmen had a significantly smaller increase in all three critical thinking dispositions. Additionally, large class size may make it especially challenging for faculty to develop student critical thinking (Tsui, 2007). So, does the number of students in the class, particularly classes with many freshmen, influence students' development of critical thinking? Similarly, how do peers moderate the influence of instructors on students' dispositions? Participants in this study tended to be at least one year in school higher than the corresponding course level. This study should be replicated with participants' whose year in school is equivalent to the course level.

The courses in this study were all traditional, face–to–face courses; however, there are an increasing number of agriculture courses taught as distance learning courses and/or on–line. There is general acknowledgement by researchers that the pedagogical factors influencing students' critical thinking in distance and on–line courses are different than in traditional classrooms (e.g., Ransdell, 2010; Roberts & Dyer, 2005; Sizemore, Robbins, Hoke, & Billings, 2007). Mandernach, Forrest, Babutske, and Manker (2009) found that the instructor's level of interactivity in promoting active engagement with course material was more important to promoting critical thinking than the mode of instructional delivery, that is, face–to–face versus on–line. Thus, questions remain about the pedagogical factors influencing student' critical thinking dispositions. What specific role can on–line and Internet classes play in students' critical thinking disposition? Do these non–traditional methods increase or decrease the students' critical thinking disposition? How does the on–line method

compare with more traditional face–to–face teaching methods?

Implications for Practice

Given the nature of organizational expectations regarding the use of critical thinking and our increasingly global society, the need for working more productively is increasing. Therefore, agriculture instructors need to provide students with opportunities to practice their critical thinking skills and develop their critical thinking dispositions. Research increasingly demonstrates that higher education instructors need to explicitly teach critical thinking skills and dispositions in their courses (e.g., Friedel, et al., 2008). The research presented in this article provides evidence that a faculty development program focusing on the following practices can increase students' critical thinking dispositions: (a) reviewing current literature and pedagogy associated with critical thinking; (b) integrating critical thinking pedagogy into courses; (c) overtly teaching critical thinking skills and dispositions; and (d) engaging in peer support and opportunities for shared learning. Agriculture faculty should strongly consider following these practices.

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