

An Analysis of a High-Impact Field Experience in Agriculture: Documenting Critical Thinking Skills through Reflection

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Abstract

This study sought to describe the critical thinking levels of students enrolled in an agriculture course at Texas A&M University that included a high-impact, domestic, experiential learning trip. Articulated learning statements of 25 undergraduate students enrolled in the course were reviewed using the DEAL Model critical thinking rubric to assess students' levels of critical thinking. Students completed articulated learning statements in three categories: personal growth, academic enhancement and civic learning. Eleven standards were used to measure critical thinking: integration, relevance, accuracy, clarity, precision, writing, depth, breadth, logic, significance and fairness. Students' critical thinking scores were considered good in the learning categories of academic enhancement and personal growth. In the learning category of civic learning, students' critical thinking scores were considered slightly under-developed. In regard to the specific standards through which critical thinking was measured, writing was consistent as being one of the highest standards for each learning category. Student scores on the significance standard were considered good for the academic enhancement and personal growth learning categories, but were considered slightly underdeveloped for the civic learning category.

Introduction

A challenge faced by personnel in higher education is how to help the nation's diverse students reap the full benefits of a college education and be prepared for the workforce (Casner-Lotto and Barrington, 2006; Kuh, 2008). The measure of success for college students has shifted from simply earning a degree to learning essential skills that will allow them to be successful in terms of thriving in highly demanding contexts after graduation.

A key learning outcome for students in higher education is the ability to think critically across the curriculum (Kronholm, 1996; Tsui, 2002; AACU, 2004). Ironically, critical thinking is a skill purported by many to be deficient in college students, including students in colleges of agriculture (Flores et al., 2010; Jones and Merritt, 1999; Keeley et al., 1982; Rudd et al., 2000; Zascavage et al., 2007). Some researchers and educators have even placed critical thinking as one of the highest priorities in a college education (Halonon and Gray, 2001). Employers have recognized the need for critical thinking skills development in future programs focused on agriculture and natural resources education for a global economy (National Research Council, 2009; Scanlon et al., 1996). Quinn et al. (2009) contended critical thinking skills are essential to natural resource and agriculture students who will be decision-makers faced with ethical, political and economic implications.

One way colleges have sought to meet the challenge of preparing college graduates for essential learning outcomes is through the offering of high-impact learning experiences. High-impact learning experiences have been identified as those experiences that lead to increased student engagement and, thus, deeper learning in college courses (Kuh, 2008). Researchers have suggested several practices lead to increased rates of student retention and student engagement, including first-year seminars and experiences, common intellectual experiences, learning communities, writing-intensive courses, collaborative assignments and projects, undergraduate research, diversity/global learning, service learning and community-based learning, internships and capstone courses and projects (Kuh, 2008). Because high-impact field experiences have the potential to "help students explore cultures,

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life experiences and worldviews different than their own” (Kuh, 2008, p. 9), they fall under the high-impact practice of diversity/global learning. High-impact field experiences can also be classified as service learning when such is incorporated into the experience.

Journal writing and self-reflection can increase depth of learning and critical thinking (Jones and Brown, 1993; Lizzio and Wilson, 2007; Sessa et al., 2009). A study by Burbach et al. (2004) identified that active learning techniques such as instructor-mediated reaction journals, student presentations and class discussion lead to increased critical thinking. Although some teaching and learning practices have been evaluated and shown to be beneficial for college students of many backgrounds (Kuh, 2008), more intentional practices connected to essential learning outcomes need to be developed (Kuh, 2008). Reflection can be a powerful mechanism to document students’ ideas on what they are learning in a course (McClam et al., 2008; Sessa et al., 2009). Reflection can also be used to document the depth of student learning and their critical thinking level about this learning (Molee et al., 2010).

Field experiences fit the definition of a high-impact practice, but assessment of this practice is needed to document and create clear connections between the intended learning outcomes and this specific practice (Kuh, 2008). This study’s high-impact practice used reflection to document the critical thinking ability of students. This study sought to describe and assess through reflection the critical thinking of students enrolled in an agricultural course at Texas A&M University that included a domestic field experience.

Experiential Learning

Experiential learning is a foundational practice in agricultural education (Baker et al., 2012). Experiential learning often includes service-learning, field trips, supervised agricultural experiences, or project based learning. In each of these areas, reflection is central to guide student learning. Dewey (1989), often cited as the founder of experiential education, emphasized the importance of learning from an experience rather than completing the experience and never revisiting the learning that took place. The key to learning from experience is identifying opportunities for reflection so that one may discover new ideas. Some scholars believe that reflection can be “associated with ‘touchy-feely’ introspection, too subjective to evaluate in a meaningful way and lacking in the rigor required for substantive academic work” (Ash and Clayton, 2009a, p. 27). In reality, if structured well, reflection should be “a process of metacognition that functions to improve the quality of thought and of action and the relationship between them” (Ash and Clayton, 2009a, p. 27).

DEAL Model

The DEAL (Describe, Examine and Articulate Learning) model has been used as an effective assessment measure of student learning through reflection

in service-learning courses (Molee et al., 2010). In the study conducted by Molee et al. (2010), student reflections were examined two times throughout the service-learning experience to assess depth of learning and levels of critical thinking in freshmen and upperclassman college students.

Based on the taxonomy of educational objectives (Bloom et al., 1956) and Paul and Elder’s (2002) Critical thinking: Tools for taking charge of your professional and personal life, the DEAL model was initially created to help students reflect on their service-learning experiences. The DEAL model has been commonly used in traditional and experiential pedagogies, including K-12, undergraduate and graduate courses and professional training settings (Ash and Clayton, 2009a). Ash and Clayton published their model in applied or experiential learning arenas, emphasizing the flexible nature of this reflection tool (Ash and Clayton, 2009a; Ash and Clayton, 2004). The DEAL model consists of three steps used to guide and structure student reflections about an experience.

The Describe step may appear to be a simple way for students to document their observations, but students often start with interpretation before analyzing what actually occurred in an experience. The describe step helps students in reflecting on the facts before making assumptions by enabling students to address where and when the experience occurred, who was involved, what actions (or lack thereof) took place and what they observed and heard (Ash and Clayton, 2009a). Further, the describe step may look different depending on how the instructor designs the questions. Students could reflect continuously over the course of an experience or it may be an oral exercise done in groups within the classroom setting (Ash and Clayton, 2009b).

The Examine step guides students in expressing their learning in relation to the desired learning outcomes of the experience. Learning outcomes are categorized within three categories, civic, personal and academic learning. The intent is for the examine step to “stimulate questions or surface issues for further discussion rather than to evaluate students’ reasoning” (Ash and Clayton, 2009a, p. 42). The first four levels of the taxonomy of educational objectives are addressed in the examine step: identification, explanation, application and analysis (Ash and Clayton, 2009b; Bloom et al., 1956).

In the Articulated Learning step, students move to synthesis and evaluation within the taxonomy of educational objectives (Bloom et al., 1956). Articulated learning statements are developed where students will deepen their learning by “re-considering and re-framing it in the context of four final questions” (Ash and Clayton, 2009b, p. 4-7): What did I learn? How did I learn it? Why does this learning matter? What will/could I or others do in light of this learning? This step allows students to rethink or extend their thinking from the previous step (Ash and Clayton, 2009b, p. 4-7). Articulated learning encourages students to provide specific evidence of their experiences to back up their arguments. Furthermore, it asks students to “find significance in your learning” (Ash and

An Analysis of a High-Impact

Clayton, 2009b, p. 4-8). Articulated learning also helps students to identify action steps that should be conducted based on the learning identified.

Ash and Clayton (2004) shared “*the ultimate goal of reflection is to help students explore and express what they are learning through their [service] experiences so that both the learning and the [service] are enhanced*” (p. 139). Articulated learning statements allow the instructor to give credit for the learning that took place not just the experience (Walker, 1990).

The DEAL model for critical reflection examines learning in three categories, which are considered as learning outcomes for the experiences: personal growth, civic learning and academic enhancement. These three categories of learning allow students to purposefully consider their learning outcomes outside the context of the experience. In the category of personal growth, reflection is focused on who an individual is including his or her strengths, weaknesses, assumptions, skills and convictions and who he or she wants to be both personally and professionally. Civic learning reflection is focused on how groups, including individuals, organizations and policies work together to accomplish common goals. Through reflection on civic learning, students examine roles and approaches to change and how this plays out in different situations. Reflection in the category of academic enhancement involves applying what students have learned in their courses to service-related activities to synthesize and develop greater understanding of the academic material.

Purpose and Objectives

The purpose of this study was to describe critical thinking levels of students enrolled in an agricultural course at Texas A&M University that included a domestic experiential learning trip, considered a high-impact experience. The specific research question guiding this study was: What was the level of critical thinking students achieved as measured by the DEAL model through an experiential learning trip?

This study was guided by three research objectives:

1. Describe students' level of critical thinking on academic enhancement as measured by the DEAL model critical thinking rubric;
2. Describe students' level of critical thinking on personal growth as measured by the DEAL model critical thinking rubric; and
3. Describe students' level of critical thinking on civic learning as measured by the DEAL model critical thinking rubric.

Methods

Subjects included in this study were students enrolled in an agriculture course incorporating a domestic experiential learning trip at Texas A&M University during the fall semester of 2012. During the first eight weeks of the semester, students met once per week for lecture and discussion. The 10-day field experience component of the course occurred during weeks nine and 10. Students

travelled via charter bus to various destinations in the Midwestern US: The stop in Joplin, Missouri included a service learning activity to help the tornado-damaged community of Joplin with home repairs. Another part of the trip involved students providing service to various CDEs at the National FFA Convention in Indianapolis, Indiana. Additionally, the field experience integrated tours of the Caterpillar Plant, an Amish community in Central Missouri, the Wild Turkey Distillery and Churchill Downs. During weeks 11 through 15, students met once per week for discussion related to the experiences during the field experience.

A total of 42 students were enrolled in the course; the accessible population included 25 students who completed and submitted usable articulated learning statements for each of the three areas: academic enhancement, civic learning and personal development. Among the students included in this study, four were male and 21 were female; 25 were Caucasian, of which five were Hispanic; students ranged in age from 18 to 30 years, with grade-point-averages that ranged from 2.3 to 4.0 on a four-point grade scale.

The Institutional Review Board at Texas A&M University approved the study protocol (Protocol Number: 2011-0894). This study was not exempt, but a waiver of written consent was obtained. Students received study information in the course syllabus and it was explained the first day of class. As a part of the course, students submitted reflections and blogs throughout the semester. An overview of the DEAL model was presented to students during a class lecture and provided guidance in applying this model throughout the semester. Prior to submitting written reflections and blogs each day during the field trip, students were assembled into nightly discussion groups facilitated by a discussion leader (faculty or graduate student). Students were engaged in the describe and examine steps of the DEAL model as they reflected and discussed with their small group and facilitator what they experienced that day and questions that surfaced about that experience. Students were then encouraged individually to describe what they experienced and to surface issues of the experience (examine) by completing their written blogs and reflections. The written blogs and reflections were a requirement of the field trip.

At the end of the semester, students reflected on the entire semester and completed articulated learning statements in three categories: academic enhancement, civic learning and personal development. Students' articulated learning statements were approximately one page for each learning category and addressed the following questions: What did I learn? How did I learn it? Why does this learning matter? and What will I do in light of this learning? Students' articulated learning statements served as the data in this study and were analyzed using The DEAL model critical thinking rubric (Ash et al., 2005). The rubric included 11 standards of critical thinking: integration, relevance, accuracy, clarity, precision, writing, depth, breadth, logic, significance and

Table 1. Standards of Critical Thinking

Standard	Guiding Question(s)
Integration	Are all of your statements relevant to the specific category of learning goal being discussed?
Clarity	Do you expand on ideas, express ideas in another way, provide examples or illustrations where appropriate?
Accuracy	Are all of your statements, is all of your information, factually correct and/or supported with evidence?
Precision	Do all of your statements or claims contain specific information, descriptions, or data?
Relevance	Are all of your statements relevant to the question at hand? Does what you're saying connect to your central point?
Depth	Do you explain the reasons behind your conclusions, anticipate and answer the question that your reasoning raises and/or acknowledge the complexity of the issue?
Breadth	Are you considering alternative points of view? Have you thought about how someone else might have interpreted the situation?
Logic	Does your line of reasoning make sense? Does it follow from the facts and/or what you said?
Significance	Do your conclusions or goals represent a (the) major issue raised by your reflection on experience?
Fairness	Do you represent perspectives other than your own integrity (without bias or distortion)?
Writing	Is your writing free of typographical, spelling, and grammatical errors?

fairness (see Table 1). Nine of the 11 standards of critical thinking, except integration and writing, were described by Paul and Elder (2001) as universal intellectual standards. *“Universal intellectual standards are standards which must be applied to thinking whenever one is interested in checking the quality of reasoning about a problem, issue, or situation”* (Paul and Elder, 2001, p. 7). Ash and Clayton (2009b) added integration as a service-learning specific “standard” and “quality of writing” as a criteria, in acknowledgement of our conviction that careful thinking is closely linked to careful writing (Ash and Clayton, 2009b, p. 3-ii).

Three coders used the DEAL model depth of learning and critical thinking rubrics, (Ash et al., 2005) to assess the quality of student thinking, based on the elements of critical thinking within each of the three areas. One of the coders was not involved in the delivery of the course and did not participate in the experiential learning trip portion of the course. Thus, this coder was unfamiliar with specifics related to the course, including course content, and had no interaction with students in the course prior to data collection and analysis. The other two coders participated in the delivery of the course and the experiential learning trip included in the course.

Before independently scoring each articulated learning statement, the coders reviewed the rubric and standards of critical thinking (Ash and Clayton, 2009b). After scoring independently, the coders met to discuss the scores. In instances where scores differed among the coders, the articulated learning statement was reviewed and discussed and an overall score was determined by consensus. This resulted in one overall score for each articulated learning statement within each of the three areas. The resulting scores served as data for this study and were analyzed using IBM® SPSS® Statistics, version 20. Because the findings of this study were not inferential in nature, parameters were reported, rather than statistics.

Table 2. Students’ Critical Thinking Scores for Academic Enhancement Category (N=25)

Standard of Critical thinking	Min Score	Max Score	μ	σ
Fairness	3	4	3.68	.476
Writing	2	4	3.64	.638
Precision	2	4	3.44	.651
Clarity	2	4	3.40	.645
Integration	2	4	3.36	.638
Breadth	2	4	3.36	.700
Relevance	2	4	3.24	.663
Logic	2	4	3.24	.597
Accuracy	2	4	3.20	.645
Depth	2	4	3.20	.707
Significance	2	4	3.08	.702
Grand Mean			3.36	.533

Note. 1 = completely lacking; 2 = under-developed; 3 = good; 4 = excellent

Table 3. Students’ Critical Thinking Scores for Civic Learning Category (N=25)

Standard of Critical Thinking	Min Score	Max Score	μ	σ
Writing	3	4	3.56	.507
Fairness	2	4	3.20	.577
Precision	2	4	3.00	.408
Clarity	2	4	2.96	.539
Breadth	2	4	2.96	.611
Integration	2	4	2.80	.816
Accuracy	2	4	2.80	.577
Logic	2	4	2.72	.542
Depth	2	4	2.64	.638
Relevance	1	4	2.56	.821
Significance	2	4	2.56	.583
Grand Mean			2.90	.450

Note. 1 = completely lacking; 2 = under-developed; 3 = good; 4 = excellent

Results and Discussion

Students’ critical thinking scores for the category of academic enhancement were noted in Table 2. Except for fairness, students’ academic enhancement scores ranged from two to four for each of the 11 measures of critical thinking; fairness ranged from three to four. Therefore, students’ critical thinking scores for academic enhancement reflected ranges of student performance between under-developed and excellent. Five critical thinking measures were less than the academic enhancement grand mean ($\mu_{AE} = 3.36$; $\sigma_{AE} = 0.533$); whereas, two measures were equal to the grand mean and four measures exceeded the grand mean. Students scored highest on the fairness ($\mu = 3.68$; $\sigma = 0.476$) standard of critical thinking and lowest in the significance ($\mu = 3.08$; $\sigma = 0.702$) standard for the academic enhancement category of learning.

Students’ critical thinking scores for the category of civic learning were noted in Table 3. Civic learning score ranges varied among the measures; minimum range scores were as small as one and maximum range scores were as large as four. Thus, students’ critical thinking scores for civic learning reflected ranges of student performance from completely lacking to excellent. Six critical thinking measures were less than the civic learning grand mean ($\mu_{CL} = 2.90$; $\sigma_{CL} = 0.450$); whereas, five measures exceeded the grand mean. Students scored highest on the writing ($\mu = 3.56$; $\sigma = 0.507$) standard of critical thinking and were tied between significance ($\mu = 2.56$; $\sigma = .583$) and relevance ($\mu = 2.56$; $\sigma = 0.821$)

An Analysis of a High-Impact

Table 4. Students' Critical Thinking Scores for Personal Growth Category (N=25)

Standard of Critical Thinking	Min Score	Max Score	μ	σ
Writing	2	4	3.44	.583
Fairness	2	4	3.28	.614
Relevance	2	4	3.08	.640
Significance	2	4	3.08	.572
Logic	2	4	3.04	.539
Clarity	2	4	3.00	.707
Integration	2	4	2.96	.735
Precision	2	4	2.92	.702
Depth	2	3	2.88	.332
Accuracy	2	4	2.84	.688
Breadth	2	3	2.64	.490
Grand Mean			3.01	.393

Note. 1 = completely lacking; 2 = under-developed; 3 = good; 4 = excellent

Table 5. Students' Critical Thinking Learning Category Sums (N=25)

Learning Category	Min Score	Max Score	μ_{SUM}	σ_{SUM}
Academic Enhancement	20	36	30.20	4.796
Civic Learning	21	34	26.08	4.051
Personal Growth	20	32	27.12	3.539

Note. Possible range of scores: Minimum = 11; Maximum = 44

for the lowest standard of critical thinking of the civic learning category.

Students' critical thinking scores for the category of personal growth were noted in Table 4. Minimum personal growth range scores were consistent at two; whereas, the maximum range scores were either three or four, depending on the measure. Therefore, students' critical thinking scores for personal growth reflected ranges of student performance between under-developed and excellent. Six critical thinking measures were less than the personal growth grand mean ($\mu_{PG} = 3.01$; $\sigma_{PG} = 0.393$) and five measures exceeded the grand mean. Students scored highest on the writing ($\mu = 3.44$; $\sigma = 0.583$) standard of critical thinking and lowest on the precision ($\mu = 2.92$; $\sigma = 0.292$) standard for the personal growth category of learning.

Based on grand means for each category, students' scores indicated the highest performance in critical thinking related to academic enhancement ($\mu_{AE} = 3.36$; $\sigma_{AE} = 0.533$), followed by personal development ($\mu_{PG} = 3.01$; $\sigma_{PG} = 0.393$) and then civic learning ($\mu_{CL} = 2.90$; $\sigma_{CL} = 0.450$). The summated minimum, maximum, mean and standard deviation scores for each learning category were presented in Table 5 to serve as a secondary and more finite measure. Although minimum and maximum scores of critical thinking standards on a per-item individual basis ranged from one to four, no individual scored the lowest possible score of 11 or the highest possible score of 44.

Summary

The purpose of this study was to describe and assess, through reflection, the critical thinking levels of students enrolled in an agricultural course at Texas A&M University that included a domestic experiential learning trip. Specific objectives included describing students' level of critical thinking in the learning categories of academic enhancement, personal growth and civic

learning as measured by the DEAL Model Critical Thinking Rubric.

Critical thinking is a skill seen as important for college students to obtain (Kronholm, 1996; Tsui, 2002; AACU, 2004); therefore, a need exists to assess those skills in college students and examine whether they have acquired these skills through their college experiences. This study did not seek to compare the critical thinking abilities of college students, who were involved in different experiences, but simply to describe and document the critical thinking abilities of college students who participated in an agriculture course that included a high-impact domestic experiential learning trip. In this study, the average scores for critical thinking were considered good in the learning categories of academic enhancement ($\mu_{AE} = 3.36$; $\sigma_{AE} = 0.533$) and personal growth ($\mu_{PG} = 3.01$; $\sigma_{PG} = 0.393$). The average scores for critical thinking in the learning category of civic learning would be considered slightly underdeveloped ($\mu_{CL} = 2.90$; $\sigma_{CL} = 0.450$).

In examining the specific critical thinking standards measured by the DEAL model depth of learning and critical thinking rubric, students scored lowest in the significance standard for the learning categories of civic learning ($\mu = 2.56$; $\sigma = 0.583$) and academic enhancement ($\mu = 3.08$; $\sigma = 0.702$). However, it is also important to note students scored the third highest for the significance standard of personal growth ($\mu = 3.08$; $\sigma = 0.572$). The significance standard of critical thinking indicates whether students' goals or conclusions represent the major issues raised by their reflection on the experience. The results from this study suggest it is easier for students to establish goals as a result of their learning in the category of personal growth.

Another standard of critical thinking worth discussing is the writing standard. Students' writing standard scores were highest in the learning categories of civic learning ($\mu = 3.56$; $\sigma = 0.507$) and personal development ($\mu = 3.44$; $\sigma = 0.583$). In the category of academic enhancement, the writing standard was the second highest score ($\mu = 3.64$; $\sigma = 0.638$). The DEAL model depth of learning and critical thinking rubric, used to measure writing for this study, considers the writing standard to assess whether the writing is free of typographical, spelling and grammatical errors. Results of this study would suggest students' writing was somewhere between good and excellent when completing articulated learning statements in all learning categories of personal growth, academic enhancement and civic learning. The scores for the writing standard measure were fairly consistent throughout each learning category.

Because students' critical thinking abilities were not assessed prior to the experience, we cannot suggest critical thinking abilities were developed during this experience. However, critical thinking skills have been found to increase simply because students reflected on their experiences (Jones and Brown, 1993; Lizzio and Wilson, 2007; Sessa et al., 2009). This study documented students' critical thinking abilities through reflection.

It is important to note that pre- and post-test design would be ideal to assess whether students developed critical thinking skills through this course experience; however, the use of articulated learning statements does not allow for this type of evaluation. Other measures may be able to document this type of assessment, but the measure in this study is not effective for making this conclusion.

Further research should examine whether differences exist in critical thinking abilities of students who participate in high-impact experiences as compared to students who do not. Also, students scored lowest in the category of civic learning. Civic learning involves reflection about how groups including individuals, organizations and policies work together to accomplish mutual goals. Students examine roles and approaches to change and how this plays out in different situations in their reflections about civic learning. During this domestic experiential learning trip, students participated in several service learning experiences, including helping community members in the tornado devastated community of Joplin, MO and volunteering in the CDEs at National FFA Convention. However, specific instruction in civic learning was not provided to the students. It appears that students were better able to articulate their experience and growth in the learning categories of academic enhancement and personal growth than civic learning. Future research could explore whether instruction in civic learning leads to an increase in critical thinking skill outcomes in the area of civic learning.

Another area of future research is to examine whether critical thinking skills transfer to learning outside of one course. After this course experience, can students apply the DEAL model to other experiences? Because critical thinking skills are important for college students to develop to thrive in highly demanding contexts upon graduation, it would be desirable to investigate whether these skills transfer outside of one course experience. Further research could examine which high-impact experiences provide the highest impact for the development of critical thinking skills and whether students are able to think more critically as they participate in more courses that offer high-impact experiences.

This inquiry does have implications for practitioners. In this study, students were instructed in one class period about service learning and the DEAL model. The DEAL model includes three categories of learning for student reflection. This is an important part of the process in regard to what students are learning from their experiences. Because students were provided with limited instruction on these categories, this may have impacted their ability to reflect critically in all categories. Practitioners interested in developing critical thinking skills of college students through high-impact experiences should allow ample time to provide clear explanations of each of the three categories of learning and their different criteria. Practitioners should also encourage students to actively engage in all steps of the DEAL model and document the outcomes at each step of the DEAL model.

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An Analysis of a High-Impact

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