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Lee Rincker
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CRITICAL THINKING DISPOSITIONS OF STUDENTS RECEIVING
LIVESTOCK EVALUATION TRAINING

A Thesis

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CRITICAL THINKING DISPOSITIONS OF STUDENTS RECEIVING LIVESTOCK EVALUATION TRAINING

by

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This study sought to evaluate critical thinking disposition of students within the College of Agriculture at California State University, Chico. A cross-sectional design was conducted using the University of Florida (UF-EMI) assessment to measure critical thinking disposition scores among a sample of undergraduate students registered in one of three courses (1) introduction to animal science; (2) livestock selection and carcass evaluation, and (3) members of a livestock judging team. Additionally, other potential predictors of performance including prior livestock judging experience, GPA, major and demographics including gender and age were also considered. Difference between groups were not observed. Additionally, prior livestock judging experience, GPA, major, and age failed to yield differences in scores. The only significant differences were found in the Cognitive
Maturity sub-scale where females received significantly ($p < .01$) higher average score ($M = 31.3$) compared to males ($M = 28.6$). Overall, 68.5% students were categorized as having a moderate critical thinking disposition and 29.6% demonstrated a strong critical thinking disposition. These findings may carry some implications for changing teaching pedagogy to enhance critical thinking among students in the College of Agriculture at California State University, Chico.
CHAPTER I

INTRODUCTION

Background

As the agricultural sector continues to evolve, expand and intensify, employers expect higher education to graduate students with the ability to meet increasing workforce demands (Association of American Colleges and Universities [AACU], 2013). In the past, academic performance was the sole means of predicting future success as information was slow to change (Smith, 1989; Terenzini, Springer, Pascarella, & Nora, 1995). However, advancements in technology and swift dissemination of current information have led to an increasingly complex society (Rudd, Baker, & Hoover, 2000). As such, colleges and universities have revised core learning outcomes reflective of societal demands. A frequent and commonly referenced outcome is critical thinking (Voluntary System of Accountability [VSA], 2009).

Critical thinking is a broad and inclusive term, carrying many definitions. Although a concrete definition remains elusive, critical thinking usually entails being able to do the following:

. . . identify central issues and assumptions in an argument, recognize important relationships, make correct inferences from data, deduce conclusions from information provided, interpret whether conclusions are warranted on the basis of the data given, and evaluate evidence or authority. (Pascarella & Terenzini, 1991, p. 118)
Almost every academic discipline has identified critical thinking as an area of research interest and agricultural education is no exception (Rhoades, Ricketts, & Friedel, 2009). Studies conducted in agricultural education have focused on skills and dispositions of critical thinking as it relates to instructional strategies (Whittington, 1995), learning styles (Rudd et al., 2000; Torres & Cano, 1995), benchmarking (Lewis, 2012), and assessment (Ricketts, 2003). Although laudable, many studies have reported low-levels of critical thinking (Rudd et al., 2000), and poorer scores in comparison to non-related disciplines (Rhoades et al., 2009). While results are non-generalizable, the findings are alarming if similar scenarios are present at other universities. If higher education is to continually be viewed as a magical elixir, greater opportunities existing in and outside of the classroom should be explored.

A pre-existing activity which embodies the mode of teaching critical thinking is livestock [judging] evaluation (White, 2009). Livestock judging teams have long been an extracurricular activity housed by universities and community colleges offering degrees in agriculture (Field, Green, Gosey, Ritchie, & Radakovich, 1998; Heleski, Zanella, & Pajor, 2003). The original intent of livestock judging was to develop the livestock breeders’ selection skills (Kaufmann et al., 2013), but was eventually organized into a competitive format to add incentive and gauge mastery (Heleski et al., 2003). Central to the industry and production knowledge gained through livestock judging are the enhancement of life skills (Rusk, Martin, Talbert, & Balshweid, 2002). According to Nash and Sant (2005), skills gained through livestock judging participation are used in everyday situations and help prepare students for future careers. The skills believed to be fostered through livestock judging include decision making, interpersonal
communication, problem solving, and critical thinking (Rusk et al., 2002; Smith, 1989;)
A majority of the studies assessing critical thinking in colleges of agriculture seemingly have not included livestock judging instruction as a possible contributing variable. Consequently, there are few studies that have objectively measured critical thinking and livestock judging together (Miller et al., 2011; Shann, Carr, & Berg, 2006; White, 2009). Most literature concerning livestock judging has primarily been supplied through qualitative research, and has focused on 4-H youth (Cavinder, Byrd, Franke, & Byrd, 2011). Thus, it is imperative to seek greater documentation of participants involved in this activity prior to workforce entry. This study differs from former studies as it sought to identify whether previous livestock evaluation experience had a relationship to the disposition of critical thinking.

Statement of the Problem
The ability to critically think has become a desired skill demanded by employers (AACU, 2013). Graduating students with the ability to think critically will benefit future employers. Literature examining critical thinking dispositions and agriculture, more specifically livestock judging, are quite limited (Miller et al., 2011; Shann et al., 2006; White, 2009). Additionally, livestock judging and evaluation programs are not always viewed as a practical and valuable component to modern undergraduate curricula (Field et al., 1998). Consequently, it is imperative that possible factors which may contribute to critical thinking be explored.
Purpose of the Study

The purpose of this study was to determine the critical thinking disposition of students enrolled in the College of Agriculture at California State University, Chico at the end of a semester period within (1) introduction to animal science, (2) livestock selection and carcass evaluation, and (3) members of livestock judging team. The objectives of this study were as follows:

1. Describe the demographic characteristics of the sample population, including gender, age, GPA, major, and prior livestock judging experience.
2. Determine the critical thinking dispositions of students in an introduction to animal science course, livestock selection and carcass evaluation course, and recent participants on the intercollegiate livestock judging team, as measured by the UF-EMI: Critical Thinking Disposition Assessment.
3. Examine the differences between critical thinking disposition scores and gender, age, GPA, major and prior livestock judging experience.

Significance

The significance of this study is relevant to understanding the possible factors which influence critical thinking. Additionally, the intent of this study was to determine if a relationship between critical thinking and livestock judging exist. Knowledge of the effectiveness of critical thinking disposition training through the participation in livestock judging may increase funding for programs and the number of students participating in judging activities. Results may also prompt educators to modify teaching strategies that model livestock judging instruction to foster critical thinking dispositions. Although the
Definition of Terms

Critical Thinking

“. . . a reasoned, purposive, and introspective approach to solving problems of addressing questions with incomplete evidence and information for which an inconvertible solution is unlikely” (Rudd et al., 2000, p. 5).

Critical Thinking Disposition

“the pre-disposed attitude one innately possesses regarding critical thinking” (Ricketts, 2003, p. 23).

UF-EMI: Critical Thinking Disposition Assessment

A 26 item Likert instrument used to measure the critical thinking dispositions of Innovativeness, Cognitive Maturity, Engagement and an overall score (Rhoades et al., 2009)

Livestock Judging

The study of the relationship between form and function of livestock which involves a thorough analysis of each animal, comparison of the animals to each other as well as the ideal industry standard, and finally, justifying decisions through reasoning.
Limitations of the Study

The sample was non-randomized and purposely selected, thus findings cannot be generalized beyond this study. Additionally, critical thinking dispositions were only measured at one point in time and any changes in development cannot be inferred.
CHAPTER II

REVIEW OF LITERATURE

Introduction

Critical thinking is a common term in education however its usage is often misplaced. Paul (1997) stated, “The phrase is used so imprecisely that no one knows exactly what is being said nor how to access its unclarified effect” (p.4). Numerous terms have been used synonymously with critical thinking (e.g. ‘higher order thinking’, ‘creative thinking’, and ‘problem solving’ (Beyer, 1995; Ricketts, 2003). Although these terms serve as complementary elements for the critical thinking process, they are not interchangeable. In order to effectively teach and assess critical thinking it is important to have a clear understanding of what it means to critical think (Ennis, 1985).

Defining Critical Thinking

The literature on critical thinking is large in breadth, consequently offering an array of definitions to consider. Many theorists, representing numerous academic disciplines, have reported definitions that align with their particular agenda. Amongst the most prevalent contributing fields are philosophy, psychology, and education. Although a concrete definition appears elusive, many definitions share similar concepts.

The lineage critical thinking can be traced back as far as 2500 years ago to Socrates (Paul, Elder, & Bartell, 1997). Through a method now known as ‘Socratic Questioning’, Socrates found that people could not support their claims of knowledge
with logic and reason (Paul et al., 1997). Socrates “established the importance of seeking evidence, closely examining reasoning and assumptions, analyzing basic concepts, and tracing out implications not only of what is said but of what is done as well” (Paul et al., p. 8). Socrates outlined the basic concepts of critical thinking, entailing reasoning, logic and questioning.

Many scholars have shaped and defined the concept of critical thinking since Socrates. For example, Ricketts (2003) suggested it would be difficult to find a more influential advocate of critical thinking than John Dewey. Although terms have changed over time, Dewey (1933) proposed a characterization of reflective thinking [critical thinking], stating it was “active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusions to which it tends, constitutes reflective thought” (p. 9). Edward Glaser (1941), co-developer of the Watson-Glaser Critical Thinking Appraisal (WGCTA), held a similar belief to that of Dewey (Fisher, 2001). Glaser (1941) believed critical thinking was also comprised of a skill and an attitudinal element, but identified knowledge as a third component (Ricketts, 2003).

Perhaps one of the simplest definitions of critical thinking was supplied by Ennis (1985), who suggested critical thinking was “reasonable and reflective thinking focused on deciding what to do or believe” (p. 3). Lipman (1988) offered a more inclusive definition and stated critical thinking is “skillful, responsible thinking that facilitates good judgment because it 1) relies upon criteria, 2) is self-correcting, and 3) is sensitive to context” (p. 39). Similarly, Paul (1989) described critical thinking as “disciplined, self-directed thinking which exemplifies the perfection of thinking
appropriate to a particular mode or domain of thought” (p. 214). Both Paul (1989) and
Lipman (1988) believed critical thinking was guided by specific subject matter. Chaffee
(1988) defined critical thinking as “our active, purposeful, and organized efforts to make
sense of our world by carefully examining our thinking, and the thinking of others, in
order to clarify and improve our understanding” (p. 29). For Chaffee (1998), critical
thinking was not about solely monitoring one’s own thoughts, but taking into
consideration the thoughts of others. A characterization indicating the function of critical
thinking was supplied by Halpern (1989), who believed critical thinking was about “. . .
solving problems, formulating inferences, calculating likelihoods, and making decisions”
(p. 5).

One of the most comprehensive and well-devised definitions of critical
thinking was the result of an American Philosophical Association-funded project,
organized by Peter Facione (1990). The project was known as the Facione (1990) Delphi
Study and was formulated to create a clear and accurate conceptualization of critical
thinking. A group of 46 experts in the area of critical thinking representing the disciplines
of philosophy, education, social sciences, and physical sciences participated in six rounds
of questioning to form a characterization of critical thinking. The questioning and
activities completed by the panel resulted in a consensus model of critical thinking to aid
in guiding curriculum reform, instruction, and assessment. The critical thinking experts
synthesized the following definition of critical thinking and the personification of the
ideal critical thinker:

We understand critical thinking to be purposeful, self-regulatory judgment
which results in interpretation, analysis, evaluation, and inference, as well as
explanation of the evidential, conceptual, methodological, criteriological, or
contextual considerations upon which that judgment is based. Critical thinking is essential as a tool of inquiry. As such, critical thinking is a liberating force in education and a powerful resource in one’s personal and civic life. While not synonymous with good thinking, critical thinking is habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and circumstances will permit. Thus, educating good critical thinkers means working toward this ideal. It combines developing critical thinking skills with nurturing those dispositions which consistently yield useful insights and which are the basis of a rational and democratic society. (Facione, 1990, p.3)

While there are numerous areas for disagreement, the Facione (1990) Delphi Report definition is the most cited and commonly referred to as the most all-encompassing definition of critical thinking.

Within the context of agricultural education, a commonly cited definition is “a reasoned, purposive, and introspective approach to solving problems or addressing questions with incomplete evidence and information and for which an incontrovertible solution is unlikely” (Rudd et al., 2000, p. 5). In a review of critical thinking literature in agricultural education, most research has endorsed the three-component model of critical thinking (see Figure 1) (Rhoades et al, 2009).

Components of Critical Thinking

Critical Thinking Skills

Generally, scholars supply a specific set of abilities or skills, which align with their definitions. The Facione (1990) Delphi study reported a list of their own set of skills and sub-skills they believed were a fundamental part of critical thinking. The skills
Figure 1. Model of critical thinking.


identified by the group of experts included interpretation, analysis, evaluation, inference, explanation, and self-regulation. The definition of each skill is as follows:

- Interpretation: to comprehend and express the meaning or significance of a variety of experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures or criteria. . .
- Analysis: to identify the intended and actual inferential relationships among statements, questions, concepts, descriptions or other forms of representation intended to express beliefs, judgments, experiences, reasons, information, or opinions. . .
- Evaluation: to assess the credibility of statements or other representations which are accounts or descriptions of a person’s perception, experience, situation, judgment, belief, or opinion; and to assess the logical strength of the actual or
intended inferential relationships among statements, descriptions, questions or other forms of representation. . .

- **Inference:** to identify and secure elements needed to draw reasonable conclusions; to form conjectures and hypotheses; to consider relevant information and to educe the consequences flowing from data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions, or other forms of representation. . .
- **Explanation:** to state the results of one’s reasoning; to justify that reasoning in terms of evidential, conceptual, methodological, criteriological and contextual considerations upon which one’s results were based; and to present one’s reasoning in the form of cogent arguments. . .
- **Self-Regulation:** to self-consciously monitor one’s cognitive activities, the elements used in those activities, and the results educed, particularly by applying skills in analysis and evaluation to one’s own inferential judgments with a view toward questioning, confirming, validating, or correcting either one’s reasoning or one’s results. (Facione, 1990, p. 6-10)

**Background Knowledge**

In order for an individual to think critically about an issue, there must be something to think about (McPeck, 1990). According to Balin (2002), “background knowledge is an important determinant of the quality of thinking in the area and is thus central to the making of reasoned judgments” (p. 368). Background knowledge allows a student to narrow their focus and begin to study the underlying problem or situation (Willingham, 2007). Although the experts of the Facione (1990) Delphi study did not include knowledge as a component in their model, they stated:

While critical thinking skills themselves transcend specific subjects or disciplines, exercising them successfully in certain contests demands domain-specific knowledge, some of which may concern specific methods and techniques used to make reasonable judgments in those specific contexts. (p.5)

Ricketts (2003) suggested the literature regarding critical thinking emphasized a need for background knowledge and that it was an essential component.
Critical Thinking Disposition

Critical thinking disposition differs from a skill, in that, having a repertoire of skills does not ensure they will be utilized (Friedel, 2006). “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.” (Halpern, 1999, p. 72). Likewise, Facione (2000) suggested disposition is a component of a person’s character profile and is the “consistent internal motivation to act toward, or respond to, persons, events, or circumstances in habitual, and yet potentially malleable, ways” (p. 64). Ennis (1996) believed disposition to be “[the] tendency to do something, given certain conditions” (p.166). “Critical thinkers . . . have been persons of intellectual courage who were willing to question what others accepted without question” (Paul, Linder, & Bartell, 1997, p. 13). Regardless of word choice (‘motivation,’ ‘tendency,’ ‘habits,’ ‘attitudes,’ ‘values’), dispositions play a role in improving and practicing critical thinking skills (Stupnisky et al., 2008).

Just as scholars supply a list of skills with aligned definitions, many carry an established list of dispositions, which they believe to be important. The Facione (1990) Delphi study offered a broad list of dispositions for life and living in general. They include the following:

- inquisitiveness with regard to a wide range of issues,
- concern to become and remain generally well-informed,
- alertness to opportunities to use critical thinking,
- trust in the process of reasoned inquiry,
- self-confidence in one’s own ability to reason,
- open-mindedness regarding divergent world views,
- flexibility in considering alternatives and opinions,
- understanding of the opinions of other people,
• fair-mindedness in appraising reasoning,
• honesty in facing one’s own biases, prejudices, stereotypes, egocentric, or sociocentric tendencies,
• prudence in suspending, making, or altering judgments, and
• willingness to reconsider and revise views where honest reflection suggests that change is warranted. (Facione 1990, p. 13)

The approaches or dispositions outlined by the Facione (1990) Delphi study were the basis for the creation of the California Critical Thinking Disposition Inventory (CCTDI) (Facione & Facione, 1992). The CCTDI is one of the most well-known standardized instruments used to measure a person’s willingness to engage in critical thinking. The survey contains 75 Likert-type questions that range from “strongly agree” to “strongly disagree.” The seven scales used are: Truth-Seeking, Open-mindedness, Analyticity, Systematicity, Self-confidence, Inquisitiveness, and Maturity (Facione, Facione, & Giancarlo, 2001). In 2003, a group of researchers from the University of Florida performed a factor analysis of the CCTDI and found issues with construct organization (Ricketts, 2003). Ricketts (2003) and researchers devised a shorter 3-scaled instrument using the findings of the Facione (1990) Delphi Study. The three dispositions identified were: Engagement, Maturity, and Innovativeness. The instrument was named the “UF-EMI assessment” and has been used in agricultural education research.

Most research in the area of critical thinking has focused on the development of critical thinking skills. As a result, less is known about factors affecting the dispositional side of critical thinking (Burbach et al., 2012). Of the few studies conducted, several have found an interdependent relationship between critical thinking skills and critical thinking dispositions (Stupnisky et al., 2008). Unfortunately, while critical thinking skills can be developed in a short amount of time, critical thinking
dispositions are not as easily influenced. According to Friedel (2006), “... critical thinking skills can be taught in a semester, but a critical thinking disposition takes a much longer time to develop” (p. 9). Ricketts (2003) suggested dispositions are the result of a culturing process formed over the course of an individual’s life.

In order to better understand dispositions, numerous variables have been analyzed to determine a relationship to critical thinking disposition. The ability to predict a student’s critical thinking disposition and extrapolate across a student population is of value to higher education and future employers. White (2009) suggested overall involvement in the college experience is a primary contributor for critical thinking. Other studied contributors are age, gender, academic performance, classification level in school, and major.

Age

The significant relationship of age and critical thinking appears to be uncertain. King and Kitchner (1994) suggested that the ability to think critically develops over time as a function of age and cognitive development (as cited by Burbach et al., 2012, p. 7). However, in a study directed by Burbach et al., (2012) consisting of 426 students from a major Midwestern university, age was not found to be related to the overall critical thinking disposition score or a single construct (i.e. cognitive maturity, innovativeness, engagement) as measured by the UF-EMI. Others have reported similar findings (Lewis, 2012; Reed, 1998; Rudd et al., 2000; Seamon, 2010). One of the few studies which found a correlation between age and critical thinking disposition was conducted by Facione and Facione (1997) using the CCTDI. It is important to note that the researchers only found a significant relationship to the truth-seeking subscale and no
other portion of the CCTDI. In a study of much older participants, Kelly (2003) found age of participant had a significant relationship with critical thinking disposition scores and reported increasing age result in higher disposition score. A majority of study findings indicate that age is not a predictor of critical thinking disposition. However, Lewis (2012) suggested very few studies have used the UF-EMI and examined age. It appears age should be investigated using the UF-EMI instrument.

Gender

Gender is a commonly assessed variable in critical thinking disposition studies. A majority of studies using the UF-EMI failed to report gender as a predictor of overall critical thinking disposition (Friedel, Irani, Rudd et al., 2008; Hofreiter, 2005; Lewis, 2012; Merrikhi, 2010; Seamon, 2010). Although gender and the use of UF-EMI do not appear to be related, multiple studies using the CCTDI have reported females score higher in at least portions of the critical thinking disposition, specifically in the scale of cognitive maturity (Facione & Facione, 1997; Giancarlo & Facione, 2001; Rudd et al., 2000; Walsh & Hardy, 1999). Conversely, males have scored higher in the analyticity subscale of the CCTDI (Facione, Sanchez, & Facione, 1994; Giancarlo & Facione, 2001). Given the findings, gender appears to be a variable that could possibly have predictive value for critical thinking dispositions.

Grade Point Average

It would seem logical that students more inclined to engage in critical thinking would exhibit greater academic performance. Tishman and Andrade (1996) stated “part of being intelligent means being able think well. And people who think well have strong thinking dispositions” (p. 9). In a majority of critical thinking studies, academic
performance has been the only variable with predictive strength. Burbach et al., (2012) findings showed that classification in school and GPA were positively correlated to students’ critical thinking disposition. Furthermore, the researchers found that higher GPA scores positively related to every construct of UF-EMI instrument. In a similar study, Friedel, Irani, Rhoades, Fuhrman, & Gallo (2008) found students’ self-reported GPA was moderately correlated to the overall critical thinking disposition score. In another robust study, Facione and Facione (1997) used the CCTDI to assess critical thinking disposition. The results showed that critical thinking dispositions had a positive relationship to SAT and ACT scores of nursing students (Facione and Facione, 1997). Other studies have reported GPA to be at least a factor on certain constructs of the CCTDI (Giancarlo & Facione, 2001).

Major

Walsh and Hardy (1999) conducted a study of undergraduate students and classified them as either practice (i.e., nursing, education, or business) or non-practice disciplines (i.e., English, history, or psychology). The researchers reported that non-practice disciplines boasted higher overall critical thinking disposition scores as measured by the CCTDI (Walsh & Hardy, 1999). Lampert (2006) reported that arts undergraduates scored significantly higher than non-art undergraduates on three subscales of the CCTDI. Rhoades et al., (2009) conducted one of the few studies that compared non-agriculture and agriculture majors. The findings showed that students in a non–agriculture major scored significantly higher ($M = 103.25$) than agriculture majors ($M = 97.81$) (Rhoades et al., 2009). The researchers recommended future research focus on majors within the college of agriculture to determine if differences exist (Rhoades et al., 2009).
Livestock Evaluation Training and Critical Thinking

There have been many studies outlining the importance of livestock judging and the benefits it provides participants. “Livestock judging consists of making a careful analysis of animals. Measuring them against a standard commonly accepted as the ideal” (Kays, 1937, p. 177). Livestock judging has remained true to this definition for over a century as it takes into consideration traits which can be objectively measured, while subjectively taking into consideration traits which cannot be measured. For Kowalski (1991), livestock judging is important because participants form opinions based on careful considerations and current knowledge. Livestock judging exists in youth programs as well as in post-secondary education.

4-H Youth Livestock Judging

Livestock judging has been a widely accepted program that offers participants a foundational understanding of evaluating livestock while serving as a vehicle to promote essential life skills. The skills learned through livestock judging have been reported to be transferable to real-life situations (Nash & Sant, 2005). For example, Rusk et al., (2002) sought to describe the impact that 4-H livestock judging had on past participants’ advancement of ten life skills. One hundred and eighty-five former livestock judging members were asked to rate the impact of the 4-H livestock judging program on the development of ten life skills, which included decision making, ability to verbally defend a decision, livestock industry knowledge, oral communication, organization skills, problem solving, self-confidence, self-discipline, self-motivation, and teamwork. These skills were chosen based on their association with workforce preparedness (Rusk et al.,
2002). Participants were asked to rank each skill using a five-point scale of influence on the development of this attribute. The five point scale included: 1 = not influential at all, 2 = mildly influential, 3 = moderately influential, 4 = highly influential, 5 = almost essential. Results suggested 4-H livestock judging highly influenced the development of the ability to verbally defend a decision, livestock industry knowledge, oral communication, and decision making. Similarly, Nash and Sant (2005) studied participants of the Idaho 4-H livestock judging program. Participants were asked to rank their influence using the five-point scale on the same 10 life skills. Researchers concluded that judging had the greatest impact on animal industry knowledge and reported a moderate influence on life skill development (Nash & Sant, 2005).

Kowalski (1991) conducted the only known study which assessed the critical thinking ability of participants in the 1990 senior 4-H livestock judging contest using the Watson Glaser Critical Thinking Appraisal. The WGCTA reports a total critical thinking score and subscores based on five aspects of critical thinking (Inferences, Recognizing Assumptions, Reasoning by Deduction, Drawing Conclusions and Evaluating Arguments). Kowalski grouped students based on judging performance into upper and lower quartiles. Findings yielded no significant difference ($p > .05$) between the two groups. However, Kowalski (1991) noted, “the population of the 1990 Nebraska 4-H Senior Livestock Judging Activity ranked above the national average on overall performance of the WGCTA for their age group” (p. 39).

**Collegiate Livestock Evaluation Training**

Few studies have objectively measured the critical thinking ability or critical thinking disposition of students receiving livestock evaluation training in the university
setting. Shann, Carr, and Berg (2006) used a pre/post-test design utilizing the WGCTA Test to assess the critical thinking ability of undergraduate students enrolled in a live animal and meat evaluation course. Shann et al., (2006) reported findings that showed significant ($p < .001$) improvements from the first ($M = 39$) to the last day of instruction ($M = 55.5$). However, researchers were not aware of participation on a collegiate judging team or past participation in livestock evaluation training.

In a more recent study, Ricketts, Pringle, & Douglas (2007) evaluated the critical thinking disposition of students enrolled in the *Introduction to Animal Science* course and *Live Animal and Carcass Evaluation* course at University of Georgia. Students were asked to complete the UF-EMI assessment at the beginning of the course and at the end of the course. Researchers reported that students enrolled in the *Live Animal and Carcass Evaluation* course in critical thinking disposition than the *Introduction to Animal Science course*. Researchers suggested that applied, experiential learning courses play a role in developing critical thinking dispositions of animal science students (Ricketts et al., 2007).

Using a pre/post-test design, Miller et al., (2011) conducted a study to assess the critical thinking dispositions of students within the Department of Animal Sciences at the University of Florida. Courses examined included Introduction to Animal Science, Live Animal and Carcass Evaluation, Meat Selection and Grading, and Live Animal Evaluation. In addition, students recently participating on the Intercollegiate Meats and Livestock Judging Team were included. Course students were given the UF-EMI instrument on the first and last day of instruction, although judging team students completed the instrument only once. Findings showed student critical thinking
disposition scores increased as the result of a single semester’s instruction. Furthermore, students participating on the intercollegiate meats and livestock judging team reported significantly higher scores for engagement \((p \leq 0.03)\) and innovation \((p \leq 0.03)\) than other study groups. Although this study objectively showed that students who received livestock evaluation training scored higher in critical thinking disposition, demographic variables were not examined as possible contributors (i.e., age, major, GPA, or prior livestock judging experience).

Similarly, White (2009) sought to determine demographic predictors of critical thinking skills as assessed by the WGCTA of undergraduate students enrolled within the Animal Sciences Department at the University of Clemson. The independent variables included: age, GPA, gender, classification level in school, and previous judging experience. White reported that students who received livestock judging training for at least a semester scored higher than those who had never received training \((M = 64; \bar{M} = 59)\). White (2009) concluded “age, GPA, and previous judging experience do appear to be useful descriptors related to critical thinking ability” (p. 69). However, it is important to note that age was only compared between two groups (18-20 vs. >20), and furthermore, the WGCTA measures critical thinking ability, but not the disposition dimension.

Summary

The literature outlining critical thinking is large in breadth. Consequently, offering a wide variety of terms and descriptions to consider. Regardless of the definition, evidence found within the literature suggests that critical thinking plays an important role in
everyday life. Most studies have been conducted on critical thinking skills, but many researchers agree that dispositions are just as important. Findings indicate that students involved in livestock judging are more prone to use critical thinking skills. However, former studies on livestock judging did not examine the factors which may contribute to critical thinking. The lack of research involved in livestock judging and the relationship with critical thinking suggests the need to address this apparent gap in research.
CHAPTER III

METHODOLOGY

Research Design

This study used a quantitative cross-sectional design to determine the critical thinking disposition of students enrolled in the College of Agriculture at California State University, Chico at the conclusion of a semester period. The independent variables used in this study include gender, age, major, GPA, and prior livestock judging experience. The dependent variables included critical thinking dispositions, as measured by the UF-EMI assessment.

Population and Sample

The target population for this study was undergraduate students currently enrolled in the College of Agriculture at California State University, Chico. The approach for selecting a sample of students was similar to that used by Miller et al., (2011). The University of Florida researchers selected three groups of students to represent a traditional animal science program. The groups included: (1) introduction to animal sciences, (2) meat animal evaluation, and (3) membership on a livestock and meat evaluation teams. Following the selection criteria of Miller et al., (2011), the sample population of this study also consisted of three subgroups (1) introduction to animal
Historically, the introduction to animal science course has large student enrollment, attracting students with a wide range of characteristics (i.e. academic performance, age, gender, and livestock judging experience.) Livestock selection and carcass evaluation is offered as an elective, but is also a prerequisite course for students to join the intercollegiate livestock judging team. The final group comprised the intercollegiate livestock judging team participants. It was concluded the accessible sample were representative of future groups of students at CSU, Chico, thus respondents can be seen as a time and place sample (Oliver & Hinkle, 1982).

Treatment

Instrument

An instrument known as the UF-EMI (Appendix C) was used to determine the critical thinking dispositions of students in this study. The instrument was developed over several years by a research team at the University of Florida and has been used to measure the critical thinking dispositions of participants in a variety of populations (Irani et al., 2007). The UF-EMI consists of 26 questions represented by three constructs. Eleven questions assessed Engagement, eight questions assessed Cognitive Maturity, and seven questions assessed Innovativeness. Each question was measured on a 5-point likert scale (1 = strongly disagree) to (5 = strongly agree). The total score on the instrument ranged from a low of 26 to a high of 130 points. It is assumed that the higher the score, the stronger the respondent’s critical thinking disposition (Miller et al., 2011). In addition
to completion of the UF-EMI instrument, demographic data including gender, age, major, grade point average, and livestock judging experience were also collected.

Reliability

The UF-EMI manual (Irani et al., 2007) reported a reliability coefficient for the total critical thinking disposition score ($\alpha = 0.94$). The reliability for the separate scales were tested and reported by the developer team as Engagement ($\alpha = 0.91$); Cognitive Maturity ($\alpha = 0.79$); and Innovativeness ($\alpha = 0.80$). A post-hoc Cronbach’s Alpha was calculated for this study to estimate the reliability of instrument for this sample. Results were very strong for Engagement ($\alpha = 0.90$), Cognitive Maturity ($\alpha = 0.78$), Innovativeness, ($\alpha =0.87$), and a Total UF-EMI ($\alpha = 0.88$).

Data Collection

The UF-EMI instrument was administered to the livestock judging members subsequently 2013 fall academic semester. In an attempt to prevent a low response, initial contact was made following the recommendations of Dillman (2007) and Gall, Gall, & Borg (2007), who reported higher participation responses when contact was made prior to administering a survey. Therefore, students were first invited to participate in person about the purpose of the study and when the survey could be expected to be administered. The second contact was made by email and included a link to GoogleForms, which contained the UF-EMI assessment and demographic questions. A cover letter and informed consent form were used to authenticate student participation. Students were ensured that all information would be kept confidential and that they would not be penalized for lack of participation. The Institutional Review Board for the Protection of Human Subjects at California State University, Chico approved the instrument. A total of
100 students were invited to participate in the study. Slightly more than half of the students responded \((n=54)\) yielding a 54% response rate over a 15 day study period. An analysis of variance was used to determine if a significant difference existed between early and late responders. No significant differences was found between early and late respondents \((p >0.05)\). Unfortunately, non-response error was not fully accounted for, thus findings cannot be generalized past this sample.

Data Analysis Procedures

Responses were collected in Google Forms and then transferred to excel. Data were then coded and analyzed using the Statistical Package for Social Sciences (SPSS v. 21.0). Descriptive statistics and inferential statistics were used to analyze the data. Frequencies, percentages, means, and standard deviations were calculated to describe the sample demographics and average scores. The Total UF-EMI mean \((M = 102.9)\) and median scores \((Mdn = 102.0)\) were comparable with low skew (.249). The histogram also revealed a normal distribution curve for the Total UF-EMI score. The sample was therefore treated as normally distributed. The alpha level was set a priori at 0.05 for all statistical tests.
CHAPTER IV

RESULTS AND DISCUSSION

Presentation of Findings

Objective One

The first objective sought to determine the demographic characteristics of students by gender, age, GPA, major, and prior livestock judging experience (see Table 1). There were more female (72.20%) students than males students. A majority of the students were 18-19 years of age (40.70%). This was followed by 20-21 year olds (37.00%) and those 22 years of age and over (22.20%). Self-reported GPA ranged between 2.19 to 4.0 and were collapsed into three categories and distributed as 2.0-2.99 (24.10%), 3-3.49 (50.00%), and 3.5-4.0 (25.90%). Most students reported being Animal Science majors (61.10%), followed by Agriculture Business (13.00%), Agriculture with Crops, Horticulture, and Land Resource Management option (13.00%), Agricultural Science and Education (11.10%), and Non-Agriculture Major (1.90%). Nearly half of the students (48.10%) claimed to have prior livestock judging experience.

Objective Two

Critical thinking dispositions of students were examined according to team or course enrollment which included: (1) introduction to animal science, (2) livestock selection and carcass evaluation, and (3) participants on the intercollegiate livestock judging team. Table 2 illustrates the means and standard deviations for the subscale
Table 1

Demographics of Students within College of Agriculture at CSU, Chico (n = 54)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>15</td>
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<td>Female</td>
<td>39</td>
<td>72.20</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 – 19</td>
<td>22</td>
<td>40.70</td>
</tr>
<tr>
<td>20 – 21</td>
<td>20</td>
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</tr>
<tr>
<td>22 and over</td>
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<td>22.20</td>
</tr>
<tr>
<td>GPA</td>
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<td></td>
</tr>
<tr>
<td>2.00 – 2.99</td>
<td>13</td>
<td>24.10</td>
</tr>
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</tr>
<tr>
<td>3.50 – 4.00</td>
<td>14</td>
<td>25.90</td>
</tr>
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<td>Major a</td>
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<td></td>
</tr>
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<td>13.00</td>
</tr>
<tr>
<td>AGED</td>
<td>6</td>
<td>11.10</td>
</tr>
<tr>
<td>ANSC</td>
<td>33</td>
<td>61.10</td>
</tr>
<tr>
<td>PSSC</td>
<td>7</td>
<td>13.00</td>
</tr>
<tr>
<td>Other</td>
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<td>1.90</td>
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<tr>
<td>Judging Experience</td>
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<td></td>
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<td>Yes</td>
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<td>48.10</td>
</tr>
<tr>
<td>No</td>
<td>28</td>
<td>51.90</td>
</tr>
<tr>
<td>Years of Exp. b</td>
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<td></td>
</tr>
<tr>
<td>0</td>
<td>28</td>
<td>51.90</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
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<td>2</td>
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<td>18.50</td>
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<tr>
<td>3</td>
<td>6</td>
<td>11.10</td>
</tr>
<tr>
<td>4 or more</td>
<td>6</td>
<td>11.10</td>
</tr>
</tbody>
</table>

Note. aABUS; Agricultural Business. AGED; Agricultural Science and Education. ANSC; Animal Science. PSSC; Crops, Horticulture, and Land Resource Management. Other; Non-Agriculture Major. b Years of Exp; years of livestock judging experience.
Table 2

*Critical Thinking Disposition Scores of Introduction to Animal Science, Livestock Selection and Carcass Evaluation, Participants on the Intercollegiate Livestock Judging Team (n = 54)*

<table>
<thead>
<tr>
<th>Class</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
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</thead>
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<td><strong>Introduction</strong></td>
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<td></td>
<td></td>
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<td></td>
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<td>Engagement</td>
<td>31</td>
<td>43.52</td>
<td>4.35</td>
<td>36</td>
<td>54</td>
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<tr>
<td>Cognitive maturity</td>
<td>31</td>
<td>30.94</td>
<td>4.12</td>
<td>21</td>
<td>39</td>
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<tr>
<td>Innovativeness</td>
<td>31</td>
<td>27.87</td>
<td>2.83</td>
<td>22</td>
<td>35</td>
</tr>
<tr>
<td>Total UF-EMI</td>
<td>31</td>
<td>102.32</td>
<td>9.46</td>
<td>87</td>
<td>126</td>
</tr>
<tr>
<td><strong>Evaluation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engagement</td>
<td>17</td>
<td>45.88</td>
<td>5.11</td>
<td>39</td>
<td>55</td>
</tr>
<tr>
<td>Cognitive Maturity</td>
<td>17</td>
<td>31.00</td>
<td>3.64</td>
<td>25</td>
<td>38</td>
</tr>
<tr>
<td>Innovativeness</td>
<td>17</td>
<td>28.76</td>
<td>3.25</td>
<td>25</td>
<td>35</td>
</tr>
<tr>
<td>Total UF-EMI</td>
<td>17</td>
<td>105.65</td>
<td>10.46</td>
<td>94</td>
<td>126</td>
</tr>
<tr>
<td><strong>Team</strong></td>
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<tr>
<td>Engagement</td>
<td>6</td>
<td>42.67</td>
<td>6.19</td>
<td>34</td>
<td>52</td>
</tr>
<tr>
<td>Cognitive Maturity</td>
<td>6</td>
<td>28.50</td>
<td>4.04</td>
<td>21</td>
<td>32</td>
</tr>
<tr>
<td>Innovativeness</td>
<td>6</td>
<td>26.83</td>
<td>4.23</td>
<td>20</td>
<td>32</td>
</tr>
<tr>
<td>Total UF-EMI</td>
<td>6</td>
<td>98.00</td>
<td>12.82</td>
<td>75</td>
<td>111</td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engagement</td>
<td>54</td>
<td>44.17</td>
<td>4.86</td>
<td>34</td>
<td>55</td>
</tr>
<tr>
<td>Cognitive Maturity</td>
<td>54</td>
<td>30.69</td>
<td>3.97</td>
<td>21</td>
<td>39</td>
</tr>
<tr>
<td>Innovativeness</td>
<td>54</td>
<td>28.04</td>
<td>3.12</td>
<td>20</td>
<td>35</td>
</tr>
<tr>
<td>Total UF-EMI</td>
<td>54</td>
<td>102.89</td>
<td>10.23</td>
<td>75</td>
<td>126</td>
</tr>
</tbody>
</table>


and Total UF-EMI scores. The evaluation course students achieved a mean Total UF-EMI score ($M= 105.65; SD = 10.15$) while the team participants posted the lowest score ($M = 98.00; SD = 11.70$). An Analysis of Variances (ANOVA) was conducted to assess the difference between groups. There were no differences in scores by courses or team group for Engagement, ($F = .37, p >0.05$), Cognitive Maturity ($F = 2.43, p = .20$), Innovativeness ($F = 1.02, p = .36$), and Total UF-EMI score ($F = 1.42, p = .26$).
Objective Three

Objective three sought to determine the mean differences between critical thinking disposition scores and respondent demographic characteristics including gender, age, GPA, major, and prior livestock judging experience.

Gender

As noted in Table 3, females reported a higher Total UF-EMI mean score ($M = 103.79; SD = 8.34$) while males had a much lower score of ($M = 100.53; SD = 14.01$). Males and females achieved comparable scores for Engagement and Innovativeness. Neither scale were different by gender. However, differences between gender groups were detected ($p < .01$) for Cognitive Maturity where females achieved an average score of ($M = 31.59; SD = 3.15$) compared to males at ($M = 28.33; SD = 4.95$).

Table 3

*Differences in Mean Critical Thinking Disposition Scores by Gender: ANOVA (n = 54)*

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>F</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engagement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>15</td>
<td>44.53</td>
<td>6.67</td>
<td>.11</td>
<td>.73</td>
</tr>
<tr>
<td>Female</td>
<td>39</td>
<td>44.03</td>
<td>4.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive Maturity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>15</td>
<td>28.33</td>
<td>4.95</td>
<td>8.29</td>
<td>.00 *</td>
</tr>
<tr>
<td>Female</td>
<td>39</td>
<td>31.59</td>
<td>3.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovativeness</td>
<td></td>
<td></td>
<td></td>
<td>.28</td>
<td>.59</td>
</tr>
<tr>
<td>Male</td>
<td>15</td>
<td>27.67</td>
<td>4.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>39</td>
<td>28.18</td>
<td>2.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total UF-EMI</td>
<td></td>
<td></td>
<td></td>
<td>1.10</td>
<td>.29</td>
</tr>
<tr>
<td>Male</td>
<td>15</td>
<td>100.53</td>
<td>14.01</td>
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<td></td>
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<tr>
<td>Female</td>
<td>39</td>
<td>103.79</td>
<td>8.34</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. *$p < .001$
Age

According to Table 4, students in the 22 and over age group posted the highest overall mean score ($M = 106.08; SD = 9.19$), while students in the 20-21 group scored the lowest ($M = 101.65; SD = 11.49$). There were no differences between Total UF-EMI Scores and age groups. Scores for the Innovativeness subscale were similar across groups while the Engagement subscale appeared to increase with students’ age, while age trends with Cognitive Maturity did not follow a trend. Lack of statistically significance suggests that age is not a useful predictor of critical thinking disposition in this study.

**Table 4**

*Differences in Mean Critical Thinking Disposition Scores by Age Group: ANOVA (n = 54)*

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Age</th>
<th>n</th>
<th>$M$</th>
<th>$SD$</th>
<th>$F$</th>
<th>p-value</th>
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</thead>
<tbody>
<tr>
<td>Engagement</td>
<td>18-19</td>
<td>22</td>
<td>43.23</td>
<td>4.55</td>
<td>.93</td>
<td>.40</td>
</tr>
<tr>
<td></td>
<td>20-21</td>
<td>20</td>
<td>44.35</td>
<td>5.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td>12</td>
<td>45.58</td>
<td>4.91</td>
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<tr>
<td>Cognitive Maturity</td>
<td>18-19</td>
<td>22</td>
<td>30.91</td>
<td>4.31</td>
<td>1.23</td>
<td>.29</td>
</tr>
<tr>
<td></td>
<td>20-21</td>
<td>20</td>
<td>29.70</td>
<td>4.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>22 and over</td>
<td>12</td>
<td>31.92</td>
<td>2.99</td>
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<tr>
<td>Innovativeness</td>
<td>18-19</td>
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<td>28.14</td>
<td>2.63</td>
<td>.38</td>
<td>.68</td>
</tr>
<tr>
<td></td>
<td>20-21</td>
<td>20</td>
<td>27.60</td>
<td>3.68</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>22 and over</td>
<td>12</td>
<td>28.58</td>
<td>3.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total UF-EMI</td>
<td>18-19</td>
<td>22</td>
<td>102.27</td>
<td>9.62</td>
<td>.76</td>
<td>.47</td>
</tr>
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<td></td>
<td>20-21</td>
<td>20</td>
<td>101.65</td>
<td>11.49</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>22 and over</td>
<td>12</td>
<td>106.08</td>
<td>9.19</td>
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</tbody>
</table>
As seen in Table 5, students pursuing a degree in Agricultural Science and Education scored the highest on Total UF-EMI ($M = 111.17; SD = 13.35$). The lowest group score was achieved by students in the Agriculture with Crops, Horticulture, and Land Resource Management option ($M = 98.00; SD = 6.43$). These differences, however, did not reach statistical significance ($p = .12$). The analysis suggested an influence of major on Cognitive Maturity scores ($p = .08$).

Table 5

*Differences in Mean Critical Thinking Disposition Scores by Major: ANOVA (n = 54)*

<table>
<thead>
<tr>
<th>Major</th>
<th>$n$</th>
<th>$M$</th>
<th>$SD$</th>
<th>$F$</th>
<th>$p$-value</th>
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<td>44.43</td>
<td>4.08</td>
<td>1.52</td>
<td>.21</td>
</tr>
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<td>6</td>
<td>47.50</td>
<td>7.01</td>
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<tr>
<td>ANSC</td>
<td>33</td>
<td>43.85</td>
<td>4.54</td>
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<td></td>
</tr>
<tr>
<td>PSSC</td>
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<td>43.71</td>
<td>4.31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
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<td>36.00</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive Maturity</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABUS</td>
<td>7</td>
<td>31.29</td>
<td>3.04</td>
<td>2.20</td>
<td>.08</td>
</tr>
<tr>
<td>AGED</td>
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<td>33.50</td>
<td>3.73</td>
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</tr>
<tr>
<td>ANSC</td>
<td>33</td>
<td>30.79</td>
<td>3.97</td>
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<tr>
<td>PSSC</td>
<td>7</td>
<td>27.43</td>
<td>3.60</td>
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</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>29.00</td>
<td>-</td>
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</tr>
<tr>
<td>Innovativeness</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABUS</td>
<td>7</td>
<td>27.29</td>
<td>3.59</td>
<td>1.33</td>
<td>.27</td>
</tr>
<tr>
<td>AGED</td>
<td>6</td>
<td>30.17</td>
<td>3.13</td>
<td></td>
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</tr>
<tr>
<td>ANSC</td>
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<td>3.12</td>
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<tr>
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<td>26.86</td>
<td>2.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
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<td>25.00</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total UF-EMI</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>ABUS</td>
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<td>9.80</td>
<td>1.90</td>
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<tr>
<td>ANSC</td>
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<tr>
<td>PSSC</td>
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<td>6.43</td>
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<tr>
<td>Other</td>
<td>1</td>
<td>90.00</td>
<td>-</td>
<td></td>
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</tr>
</tbody>
</table>

*Note.* ABUS; Agricultural Business. AGED; Agricultural Science and Education. ANSC; Animal Science. PSSC; Crops, Horticulture, and Land Resource Management. Other; Non-Agriculture Major.
Grade Point Average

As reported in Table 6, students with GPA’s ranging from 3.5 to 4.0 reported
the highest Total UF-EMI mean score ($M = 106.71; SD = 8.49$) as well as for every
subscale. Students with GPA’s ranging from 3.0 to 3.49 recorded the lowest overall mean
score ($M = 101.11; SD = 11.17$) and were the lowest in the subscales of Innovativeness
and Engagement. The Cognitive Maturity subscale approached a level of significance ($p =
.08$). However, no statistically significant differences were found between GPA groups.

Table 6

*Differences in Mean Critical Thinking Disposition Scores by GPA: ANOVA (n = 54)*

<table>
<thead>
<tr>
<th>GPA</th>
<th>$n$</th>
<th>$M$</th>
<th>$SD$</th>
<th>$F$</th>
<th>$p$-value</th>
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<tr>
<td>Engagement</td>
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<td></td>
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<td></td>
<td></td>
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<td>2.0-2.9</td>
<td>13</td>
<td>44.38</td>
<td>4.75</td>
<td>.37</td>
<td>.69</td>
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<td>3.0-3.49</td>
<td>27</td>
<td>43.63</td>
<td>4.99</td>
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<td>3.5-4.0</td>
<td>14</td>
<td>45.00</td>
<td>4.95</td>
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<td></td>
</tr>
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<td>Cognitive Maturity</td>
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<td></td>
</tr>
<tr>
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<td>13</td>
<td>29.85</td>
<td>3.48</td>
<td>2.43</td>
<td>.09</td>
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<td>30.07</td>
<td>4.37</td>
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<td>3.5 – 4.0</td>
<td>14</td>
<td>32.64</td>
<td>3.05</td>
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<tr>
<td>Innovativeness</td>
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<td></td>
</tr>
<tr>
<td>2.00 - 2.9</td>
<td>13</td>
<td>28.23</td>
<td>3.59</td>
<td>1.36</td>
<td>.26</td>
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<td>3.05</td>
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</tr>
<tr>
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<td>14</td>
<td>29.07</td>
<td>2.67</td>
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<td>Total UF-EMI</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0 – 2.9</td>
<td>13</td>
<td>102.46</td>
<td>9.43</td>
<td>1.42</td>
<td>.25</td>
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<td>3.0 – 3.49</td>
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<td>101.11</td>
<td>11.17</td>
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<td></td>
</tr>
<tr>
<td>3.5 – 4.0</td>
<td>14</td>
<td>106.71</td>
<td>8.49</td>
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</tr>
</tbody>
</table>

Judging Experience

According to Table 7, students subscale scores and Total UF-EMI scores did
not follow a trend by years of livestock judging experience. The highest overall means
score ($M = 105.67; SD = 17.21$) was reported by students with four or more years of
judging experience while students with three years of experience scored the lowest ($M = 100.90; SD = 6.45$). An analysis indicated that the categorized years of judging experience and critical thinking disposition scores are not related.

**Discussion of Findings**

The first objective of this study sought to describe the demographic characteristics of the sample population. A majority (78%) of the students in this study fell between the ages of 18-21. A majority of the respondents (78%) were female which
is consistent with trends in higher education and entering the field of animal sciences. The leading major reported on was animal science (61.10%). Exactly half of the scores reported for GPA fell between 3.0 - 3.49, with a fourth reporting below 3.0 and one fourth above 3.5, suggesting a normal distribution of GPA’s. Lastly, nearly half the students claimed to have judging experience.

The second objective sought to determine the difference in critical thinking dispositions achieved by course. The results indicated there were no differences ($p = .26$) between the introduction to animal science course, livestock selection and carcass evaluation course, and recent members on the intercollegiate livestock judging team. However, students on the judging team posted the lowest numerical score ($M = 98.00; SD = 12.82$). The low sample size ($n = 6$) and given the lowest critical thinking disposition score was posted by a judging member, may have possibly skewed the data. Additionally, time of instrument administration may have contributed. Students on the livestock judging team were administered the UF-EMI after their last contest in November. Whereas, students in the remaining courses were given the assessment at the end of the semester. Added instruction time may have lent to higher disposition scores for the students in the introduction to animal science course and those enrolled in the livestock selection and carcass evaluation course. Lastly, the lower score of judging members may be due to coaching style. Anecdotally, livestock judging members have been trained to think in a pragmatic sense, to rank and order based upon traits of importance (Smith, 1989). Perhaps this type of assessment is not accurate in measuring the complexity of critical thinking and this type of student.
Although mean critical thinking disposition scores were compared between course types, students were also analyzed as an entire group using cutoff scores supplied by Lewis (2012). According to Lewis (2012), a critical thinking disposition “score of 106.7 and above indicates a strong critical thinking disposition; 85.9 to 106.6 indicates a moderate disposition; and 85.8 and below represent a weak disposition (derived from Bisdorf-Rhoades, Ricketts, Irani, Lundy, & Telg, 2005)” (p. 45). When scores were collapsed to follow these three cut off scores, it was found the majority of students (68.5%) had moderate critical thinking disposition scores followed by (29%) who posted a strong disposition score. It was noted only one respondent had a weak critical thinking disposition score.

Objective three sought to examine differences between critical thinking dispositions by demographics including gender, age, major, GPA, and prior livestock judging experience. Given the variables of this study, gender was the only variable related to critical thinking disposition. Females scored significantly \((p < .01)\) higher in the subscale of Cognitive Maturity. Cognitive Maturity by gender suggests that females in this study may be more willing to listen and consider views that may differ from their own (Bisdorf-Rhoades et al., 2005). This finding is similar to that of Hoover et al., (2000), yet a majority of the studies in the literature base are contradicting. Is the difference in cognitive maturity a reflection of teaching instruction? Given the plurality of females in the College of Agriculture, it may be that instruction has gradually become more accommodating towards females as opposed to males. Although several other variables under investigation had an influence on the subscale of Cognitive Maturity, differences were not noteworthy.
CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The primary purpose of this quantitative cross-sectional study was to assess the critical thinking disposition scores of undergraduate students in the courses of (1) introduction to animal science, (2) livestock selection and carcass evaluation, and (3) members of the intercollegiate livestock judging team within the College of Agriculture at California State University, Chico. The UF-EMI instrument was used to measure the critical thinking disposition scores of the students. Of the 100 students asked to participate, 54 responded yielding a response rate of (54%). Findings suggested that there were no differences between the introduction to animal science course, livestock selection and carcass evaluation course, and recent members on the intercollegiate livestock judging team. Overall, a majority (68.5%) of the students were moderate in their overall critical thinking disposition score, and (29.6%) had a strong critical thinking disposition score. Of the variables under investigation, only one was related to critical thinking disposition. The subscale of Cognitive Maturity was significantly ($p < .01$) related to gender. Females achieved an overall higher mean score as opposed to males. Knowing females are better able to monitor their own thinking may lend support in
modifying teaching strategies to accommodate. No other variables under study were related to critical thinking disposition.

Conclusions and Recommendations

The primary purpose of this study was to assess the critical thinking disposition scores of students enrolled in introduction to animal science, livestock selection and carcass evaluation and recent participants on the intercollegiate livestock judging team. There failed to be a difference between course types. Since differences were not observed between judging members and students enrolled in the courses, the findings may imply the learning environments are similar. Conversely, using similar groups in a study conducted by Miller et al., (2011) data suggested significant difference existed. Students in their study who participated on either a livestock or meats judging team reported higher scores for the subscales of Innovativeness and Engagement. These findings differ substantially from the findings of this study.

There are conflicting studies reporting varying impacts of gender on critical thinking disposition. In a study conducted by Rudd et al., (2000), researchers concluded that it remains unclear if males and females are similar in their cognitive maturity. A majority of the studies utilizing the UF-EMI instrument have reported no difference between genders. However, the current study determined that females did score higher than males for the subscale of cognitive maturity. This finding is valuable for future employers and educators alike, to be aware that females in this sample are more open-minded and less prone to bias. Based on these findings, it can be concluded that females are more willing to entertain the notion that there are multiple answers and their answer
may not always be right. Largely, this will result in a more malleable and appreciated employee. This finding does, however, conflict with a majority of studies using the UF-EMI (Bisdorf-Rhoades et al., 2005; Lewis, 2012; Rhoades et al., 2009; Seamon, 2010). In conclusion, further research is needed to determine the influence gender plays on critical thinking disposition. Additionally, the effect of age in relation to critical thinking disposition was analyzed.

Age did not appear to be related to critical thinking disposition. This finding mirrors the results of several studies, which examined similar age groups (Burbach et al., 2012; Rudd et al., 2000; Seamon, 2010). Maybe the UF-EMI is not sensitive to capturing critical thinking disposition differences as it relates to age. However, previous studies conducted with much older participants reported differences in critical thinking disposition (Kelly, 2003). It may be that critical thinking disposition is the result of greater exposure to an environment and not a result of chronological age (Rudd et al., 2000). More research is warranted to identify if age and critical thinking share a relationship. Another key factor investigated in this study was the correlation between student GPA and critical thinking disposition.

There are several studies that report GPA and critical thinking disposition to be related (Burbach et al., 2012; Ricketts, 2003). While academic performance and its influence on critical thinking is not new to the literature, findings in this study failed to suggest significant differences existed. A larger sample size studying similar participants may reveal statistical significance. Similarly, academic major was not a predictor of critical thinking disposition. However, a trend \( p = .09 \) for students majoring in agricultural education to score higher in the subscale of Cognitive Maturity was apparent.
Once again, a study involving a larger sample size could potentially reach a level of predictive strength. It is not only important to conduct more research related to this topic to assess whether it could be statistically significant, but also to help support the longevity of these collegiate academic programs such as livestock judging.

Livestock judging programs have been a staple at many universities and colleges and have reported the valuable experience and knowledge they provide the participants. Even though there are numerous personal testimonies and articles written in support of sustaining these programs, research and scientific evidence is vital for the longevity of these educational programs. Although the results from this study are inconclusive, there are findings that provide more concrete answers. White (2009) found students with prior livestock judging experience to have higher critical thinking scores ($M = 64$) than students with no experience ($M = 59$) as measured by the WGCTA. While this is strong evidence, more research is necessary to help sustain the continual support and importance of this student-based opportunity.

It would be advantageous to conduct a longitudinal study to map changes over the course of a student’s academic career. Furthermore, a majority of research on critical thinking and livestock judging have been primarily conducted in the Midwest. This may be the first study of its kind to be conducted on the West Coast. It would be of interest to see how students on the West Coast perceive livestock judging and if it is comparable to the Midwest. Comparing judging team members from various geographic regions to assess critical thinking disposition would be beneficial. If this region of the United States places minimal value on the impact of livestock judging team experience, then this may
possibly lend support to the lower numerical scores. Lastly, does mastery in livestock judging translate to a stronger critical thinking disposition?

Further research is needed to analyze critical thinking dispositions development using a pre/posttest method, while still accounting for variables that could offer predictive strength. Based on the study, it is difficult to ascertain when students made gains in critical thinking. One of the challenging obstacles in providing clarity in this study was the issue that the instrument used in this study has undergone several item changes (Bisdorf-Rhoades et al., 2005). Since the inception of the UF-EMI instrument, the number of items listed has ranged from 20 – 33 (Lewis, 2012). Given the modifications, and a majority of studies using the California Critical Thinking Disposition Inventory (CCTDI) extrapolation across similar student populations is not feasible.

Understanding the factors which contribute to each student’s critical thinking disposition is paramount. By knowing a student’s critical thinking disposition, educators may design course instruction which caters to the development of students with a higher capacity for reasoning and logical thinking. Ensuring that college graduates are prepared to use critical thinking skills should be a primary concern for any academic institution. Students who graduate with a greater ability to critically think will not only be a valued asset to the workplace, but will also have a heightened opportunity for a bright and successful future.
REFERENCES
REFERENCES


doi: http://dx.doi.org/10.3126/av.v2i1.8277


Seamon, A. (2010). *The development of youth leadership life skills including critical thinking dispositions as a result of commercial dairy exposition*. (Master’s thesis). University of Georgia, Athens, GA.


APPENDIX A
Informed Consent Form

This survey is part of a research project being conducted by Lee Rincker at California State University, Chico. You are being asked to participate because you are currently enrolled in an animal science course fitting population criteria. You will be asked questions that relate to your attitude towards critical thinking. While you may not receive a direct benefit for participating, it is the hope this study will strengthen the need and continuous support for collegiate livestock judging programs.

Your participation in this research study is voluntarily and you will not be penalized for not participating. If you choose to participate in this study, you may withdrawal at any time.

If you agree to be part of the research study, you will be asked to complete a computer survey that will take approximately 10 minutes. Your privacy will be protected. Your name will not appear on the survey and the researcher will not be able to link your responses to you. Once you have completed the survey, information will be transferred to a secure data base and the survey will be destroyed. The results of this study will be published in summaries and only used for academic purposes.

If you have any questions regarding the research study or subject rights, please contact Lee Rincker at rincker@csuchico.edu or (217) 827-9006. This research has been reviewed in accordance to California State University, Chico IRB procedures for research involving human subjects.

ELECTRONIC CONSENT:

I have read the above information and agree to participate by responding to the survey.

I choose not to participate and will exit out of the program at this time.
APPENDIX B
July 3, 2014

John C. Ricketts
3500 John A. Merritt Blvd
Nashville, TN 37209

Dear Dr. Ricketts:

I am writing to confirm our recent telephone conversation. I am currently a master's student at California State University, Chico and am completing a thesis entitled “Critical Thinking Dispositions of Students Receiving Livestock Evaluation Training.” I would like your permission to reprint the UF-EMI in my thesis. I have attached an exact representation of the instrument I wish to include.

Your signing of this letter will also confirm that you own (or your company owns) the copyright to previously mentioned material. If these arrangements meet your approval, please sign this letter indicated below and return it to me. Thank you very much.

Sincerely,

Lee M. Rincker

PERMISSION GRANTED FOR THE USE REQUESTED ABOVE:

John C. Ricketts, Ph.D.
Extension Associate Professor
TSU Agricultural & Extension Education
I look for opportunities to solve problems. *
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I listen carefully to the opinions of others even when they disagree with me. *
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I am interested in many issues. *
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I enjoy learning about many topics. *
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I am able to relate to a wide variety of issues. *
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I ask lots of questions in a learning environment. *
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree
I enjoy finding answers to challenging questions.*
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I am a good problem solver.*
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I am confident that I can reach a reasonable conclusion.*
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I strive to be well informed.*
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I am likely to change my opinion when I am given new information that conflicts with my current opinion.*
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I enjoy solving problems.*
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree
I try to consider the facts and not let my biases affect my decisions.
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I am able to apply my knowledge to a wide variety of issues.
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I enjoy learning even when I am not in school.
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I can get along with people who do not share my opinions.
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I am able to explain things clearly.
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I ask good questions when trying to clarify a solution.
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree
I present issues in a clear and precise manner. *
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I consider how my own biases affect my opinions. *
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I search for the truth even when it makes me uncomfortable. *
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I keep on working on things until I get them right. *
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I will go out of my way to find the right answers to a problem. *
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I try to find multiple solutions to problems. *
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree
I ask many questions when making a decision. *
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

I believe that most problems have more than one solution. *
- Strongly Disagree
- Disagree
- Uncertain
- Agree
- Strongly Agree

### Demographic Questions

What is your gender *
- Male
- Female

What is your age? *
- 18
- 19
- 20
- 21
- 22
- Over 22

What is your current major? *
- Agricultural Business
- Agriculture (Agricultural Science and Education)
- Agriculture (Animal Science)
- Agriculture (Crops, Horticulture, and Land Resource Management)
- Other (Non-Agriculture major)

What is your current cumulative GPA? *
Do you have prior livestock judging experience? *
○ Yes
○ No

If you answered yes to the above question, how many years? *
○ 1
○ 2
○ 3
○ 4
○ 5
○ >5