

**ASSESSING CRITICAL THINKING SKILLS THROUGH
COLLEGIATE LIVESTOCK EVALUATION PARTICIPATION**

A Dissertation

by

ALLEN BRANT POE

Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Chair of Committee,	Chris Skaggs
Committee Members,	David Forrest
	W. Shawn Ramsey
	John Rayfield
Head of Department,	H. Russell Cross

August 2016

Major Subject: Animal Science

Copyright 2016 Allen Brant Poe

ABSTRACT

Career-building competitions, such as collegiate livestock evaluation, claim to enhance writing and speaking skills, confidence in making decisions, teamwork, and critical thinking skills of participants, yet there is limited data to validate these claims. The aim of this study was to assess and record the role participating on a collegiate livestock team might play in developing critical thinking skills. The Watson-Glaser™ II Critical Thinking Appraisal (WGCTA) exam provided a way to objectively assess and record the critical thinking skills of collegiate livestock evaluators at two community colleges and two universities. Demographic information was obtained from 84 study participants to describe the characteristics of collegiate livestock evaluation. Although no statistically significant correlations were found between the demographic components and WGCTA scores, university participants recorded higher WGCTA mean scores in comparison to community college evaluators ($P = 0.0019$). The primary objective of this study was to assess the critical thinking level of collegiate livestock evaluation team members. The mean WGCTA score for all evaluators was ($M = 20.92$, $SD = 4.65$) out of a possible 40. The overall mean of community college participants ($M = 19.30$, $SD = 3.52$) and university participants ($M = 22.39$, $SD = 5.08$) was tabulated. In this study, male participants recorded higher mean WGCTA scores ($M = 21.13$, $SD = 4.90$) than females' ($M = 20.56$, $SD = 4.25$); although a difference of 0.57 was recorded, a *t-test* concluded there was no significant statistical difference between the total raw critical thinking scores across genders. Participants with a GPA between 3.0–3.49 recorded the

highest mean score in this study ($M = 21.47$, $SD = 4.99$), followed by those with a GPA of 3.5 and greater ($M = 20.85$, $SD = 4.39$), while participants with a GPA less than 2.9 recorded the lowest WGCTA mean ($M = 19.00$, $SD = 1.42$). A Pearson product-moment correlation was computed and identified a positive correlation between Top 10 individual finishes and the number of Top 10 finishes in oral reasons ($r^2 = 0.84$, $n = 84$, $p < .0001$). A positive correlation was discovered between Top 10 oral reason finishes and the number of contests attended ($r^2 = 0.66$, $n = 84$, $p < .0001$). Additionally, a positive correlation existed between Top 10 individual finishes and the number of contests attended ($r = 0.59$, $n = 84$, $p < .0001$). Likewise, as the total number of contests attended increased, the number of Top 10 finishes in oral reasons and Top 10 finishes individually increased. The mean WGCTA score for all livestock evaluators in this study was ($M = 20.92$, $SD = 4.65$) out of a possible 40, which positions collegiate livestock evaluators in the 22nd percentile of the *3–4 years of college* norm group. These results contrast the findings of previous work, where participants from collegiate evaluation teams recorded higher critical thinking skills than non-evaluators. The results of this study indicate the need to incorporate various training activities to stimulate the development of critical thinking skills of collegiate livestock evaluators.

DEDICATION

This dissertation is dedicated to my loving wife, Lauren, and daughter, Addison.

ACKNOWLEDGEMENTS

I would like to thank my committee chair, Dr. Skaggs, and my committee members, Dr. Rayfield, Dr. Forrest, and Dr. Ramsey, for their guidance and support throughout the course of this research.

Thanks also to my friends, colleagues, faculty, and staff in the Animal Science Department at Texas A&M University for making my time there a great experience. I also want to extend my gratitude to Blake Bloomberg, Brandon Callis, Brice Mund, Doug Pierce, and Joseph Rathmann for assisting in the recruitment of the study participants. To all of the participants, a heartfelt thank you for making this study possible.

Thanks to my mother and father for their inspiration, support, and encouragement. Finally, my wife has been my rock through this entire process, and I cannot thank her enough for her patience and love!

TABLE OF CONTENTS

	Page
ABSTRACT	ii
DEDICATION	iv
ACKNOWLEDGEMENTS	v
LIST OF FIGURES	ix
LIST OF TABLES	x
CHAPTER I INTRODUCTION	1
Background and Setting	1
Statement of the Problem	3
Purpose and Research Question	4
Definition of Terms	4
Limitations of the Study	8
Basic Assumptions	10
Significance of the Study	10
CHAPTER II REVIEW OF LITERATURE.....	11
Conceptual Framework	11
Critical Thinking Skills	13
Characteristics of Critical Thinking Disposition.....	16
Characteristics of Critical Thinking Skills	17
Watson-Glaser™	19
Decision Making	21
Experiential Learning.....	22
Animal Science Departments	26
Community Colleges.....	28
Evaluation Courses.....	28
Collegiate Livestock Judging Competitions	30
Characteristics of Judging Team Members	33
4-H and FFA Livestock Judging Competitions.....	35
Literature Summary.....	36
CHAPTER III METHODOLOGY.....	38

Research Design and Methods	38
Population and Sample	39
Instrumentation.....	39
Data Collection and Analysis.....	40
 CHAPTER IV RESULTS	 43
Objective 1: Collegiate Livestock Evaluation Members’ Critical Thinking Scores....	43
Objective 2: Evaluator Demographics	44
Objective 3: Demographic Impact on Critical Thinking Skills.....	51
Objective 4: Gender Differences in Relation to Critical Thinking Skills	55
Objective 5: Critical Thinking Skills Variance among Community College and University Evaluators and the Level Where the Most Critical Thinking Skills Were Produced.....	57
 CHAPTER V SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS	 61
Purpose and Objectives	62
Summary of Methodology	62
Summary of Findings	64
Objective 1: Collegiate Livestock Evaluation Members’ Critical Thinking Scores	65
Objective 2: Define Demographic Variables of Survey Participants.....	66
Objective 3: Demographic Impact on Critical Thinking Skills.....	68
Objective 4: Gender Differences in Relation to Critical Thinking Skills	70
Objective 5: Critical Thinking Skills Variance among Community College and University Evaluators and the Level Where the Most Critical Thinking Skills Are Produced.....	70
Future Studies.....	72
 LITERATURE CITED	 75
 APPENDIX A IRB OUTCOME LETTER.....	 84
 APPENDIX B HUMAN RESEARCH CURRICULUM COMPLETION REPORT.....	 86
 APPENDIX C CONDUCT OF RESEARCH CURRICULUM COMPLETION REPORT.....	 87
 APPENDIX D TAMU SITE RESEARCH PERMISSION LETTER	 88
 APPENDIX E BLINN RESEARCH PERMISSION LETTER	 89
 APPENDIX F REDLANDS RESEARCH PERMISSION LETTER	 90

APPENDIX G OKLAHOMA STATE RESEARCH PERMISSION LETTER	91
APPENDIX H RECRUITING SCRIPT	92
APPENDIX I RECRUITING EMAIL SCRIPT	93
APPENDIX J STUDY INFORMATION SHEET	94
APPENDIX K CONSENT FORM	96
APPENDIX L EXAMPLE INTRODUCTORY EMAIL.....	99
APPENDIX M DEMOGRAPHIC SURVEY	100
APPENDIX N ASSESSMENT INTRODUCTION EMAIL.....	102
APPENDIX O TEST REMINDER EMAIL	103
APPENDIX P PEARSON TEST INSTRUMENT APPROVAL	104
APPENDIX Q WGCTA INSTRUCTIONS AND SAMPLE QUESTIONS	105

LIST OF FIGURES

	Page
Figure 1. Kolb's learning styles and experiential learning theory.	25

LIST OF TABLES

	Page
Table 1. Descriptive Statistics for Livestock Evaluation Team Members' Scores on the Watson-Glaser II™ Critical Thinking Appraisal (n=84)	44
Table 2. Demographic Information of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)	46
Table 3. Number of Competitions of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)	47
Table 4. Contest Performances of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)	48
Table 5. Levels Competed of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)	49
Table 6. Youth Experience of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)	50
Table 7. State from which Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal Graduated High School (n=84)	51
Table 8. Mean Critical Thinking Scores by Years of 4-H Participation of Collegiate Livestock Evaluators Who Completed the Watson- Glaser II™ Critical Thinking Appraisal (n=84)	52
Table 9. Mean Critical Thinking Scores by Years of FFA Participation of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)	53
Table 10. Pairwise Correlations by Demographic Variable of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)	54
Table 11. GPA by Raw Score of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)	55
Table 12. Mean Raw Critical Thinking Scores by Gender of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)	55

Table 13. Differences in Mean Raw Critical Thinking Scores of Gender by Subtest of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)	56
Table 14. Mean Critical Thinking Scores across Each Classification of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)	57
Table 15. Comparisons of Mean Critical Thinking Scores by Classifications of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)	58
Table 16. Comparison of Mean Raw Critical Thinking Scores of Community College to University Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84).....	59
Table 17. Mean Critical Thinking Scores of Transfer versus Non-Transfer Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=44)	59

CHAPTER I

INTRODUCTION

Preparing graduates for long-term career success has remained the longstanding mission of higher education. Within the agriculture field, not only is maintaining an adequate, safe food supply capable of providing nutrients for an expanding society a great challenge, but justifying production practices and sustainability plans appear to be of equal value for those 21st century graduates. A multi-dimension skillset incorporates creativity and issue resolution while clearly communicating decisions and discoveries to those removed from production agriculture will likely enhance students' marketability.

Background and Setting

Opportunities for high-impact courses and participation in research, internships, and studies abroad not only promote interaction and communication among peers, they also provide participants with opportunity for personal growth and learning. Co-curricular activities promote interaction and personal investments beyond a lecture setting and heighten the positive impact higher education may have on an individual's success. Acquiring skills and demonstrating knowledge extends beyond the classroom and into areas where co-curricular activities promote the development of soft skills sought by prospective employers. Various co-curricular competitions, such as collegiate livestock judging, promote the development of a competitive spirit, character, a sense of teamwork, and the discipline necessary to enrich the lives of participants.

Lynch (2000) stated, “Twenty-first century students must not only be trainable for specific jobs, but they must possess elevated decision making, and problem-solving skills while incorporating vast knowledge and ability to adjust to change, challenge and normal occurrences in the workplace” (p. 156). According to a recent Hart Research Associates (2015) study, regardless of major, activities that encourage resolving issues with people who have opposing views should be encouraged. Strong decision-making incorporates information from various sources when forming a judgment or decision. Livestock evaluation participants face this task, as they must integrate multiple factors while judging a class to arrive at a final placing. Teaching, demonstrations, and experiences all culminate to enhance livestock judges’ abilities to identify, assess, and prioritize the various characteristics of an animal prior to arriving at an ultimate placing.

The Morrill Act of 1862 was pivotal in stimulating the education of the working class in the fields of agriculture and mechanical arts (Herren and Edwards, 2002; Parker, 1971). This resulted in the development of land-grant universities to educate the agricultural and industrial population through instruction, research, and off-campus extension work (Madsen, 1976). The University of Wisconsin was one of the first universities to provide animal husbandry studies within its College of Agriculture and in 1892 hired a Canadian, Professor John Craig, who is often credited as the father of the technical art of livestock judging in America (Shepperd, 1922). John Craig’s passion and enthusiasm for evaluating horses, cattle, sheep, and swine quickly spread beyond the University of Wisconsin’s classes and laboratories. Craig introduced the stock farm

visiting idea where students traveled to stock farms developing their evaluation skills in preparation for competitions (Shepperd, 1922).

Career-building competitions, such as collegiate livestock judging team participation, have often claimed to enhance the critical thinking skills of those participants; yet limited data exists to validate those claims. The aim of this study was to elucidate the role livestock evaluation participation plays in enhancing critical thinking skills of participants at the community college and university levels.

Statement of the Problem

According to a survey conducted by Hart Research Associates (2015), the ability to collaborate, apply critical thought, and communicate effectively was of greater importance than a candidate's undergraduate major. Kuh (2008) concluded that future research should focus on providing high-impact learning opportunities where students can see how learning works in various settings, thus improving both retention rates and student engagement. Doerfert (2011) stressed exploration should focus on how various learning environments may influence specific cognitive, affective, and psychomotor learning outcomes. Previous studies have stated further research is necessary to examine factors that affect critical thinking skills and measure how critical thinking skill levels increase as time and experience progresses (Cano, 1990; Ricketts and Rudd, 2004). Although former participants, employees, and instructors suggest participation in collegiate livestock evaluation supports the development of higher order thinking skills, few studies validate this claim.

Purpose and Research Question

The purpose of this study was to assess and describe the role livestock evaluation plays in expanding critical thinking skills of participants at the community college and university levels. This study's research aims included:

- assessing the critical thinking level of collegiate livestock evaluation team members;
- defining demographic variables of survey participants;
- determining if demographic variables impact critical thinking skills of collegiate livestock evaluators;
- determining if gender modifies the level of critical thinking skills of collegiate livestock evaluators; and
- determining if critical thinking skills vary among community college and university livestock evaluators. If so, determining at what level are the most critical thinking skills produced.

Definition of Terms

Vocabulary used in this study includes the following terms commonly associated with critical thinking in the United States and Livestock Evaluation:

Assessment—A systematic collection of information, usually through the administration of tests, used to measure user performance or aptitude (Watson and Glaser, 2010).

Community College Livestock Judging Team—A group of participants in livestock judging competition who represent a two-year institution, a community

college, that has an agriculture department and offers a two-year degree or certificate program. Community college national eligibility spans one calendar year beginning after the completion of one full term at the school. Contestants must record a minimum of a 2.0 grade point average (GPA) on a 4-point scale to be eligible. Contestants must be regularly enrolled in a community college while not exceeding 66 semester credit hours or the equivalent. Community college competitions are also available for novice/freshman participants at various invitational competitions that do not activate the one calendar year of eligibility (National Junior College Livestock Judging Coaches' Association, 2015).

Critical Thinking—Purposeful, self-regulatory judgment that results in interpretation, analysis, evaluation, and inference; an explanation of the evidential, conceptual, methodical, or contextual considerations that merited judgment (Facione, 1990; Ricketts and Rudd, 2004).

Critical Thinking Disposition—The pre-disposed attitude one innately possesses regarding critical thinking or an individual's internal motivation to use critical thinking skills (Ricketts and Rudd, 2004; Pascarella and Terenzini, 1991).

Critical Thinking Skills—An individual's ability to competently identify critical issues and assumptions within an argument, identify important relationships, infer from data, reach conclusions from the case provided, and determine if the conclusions are warranted based upon the data given and evaluation of evidence (Pascarella and Terenzini, 1991).

Decision-Making Skills—The analyzation of problems and risk management which leads to the formation of ideas and action.

4-H—The youth development branch of the Cooperative Extension System of land-grant system with the mission of empowering youth ages 9–18 to reach their potential by working and learning in partnership with adults (National 4-H Council, 2015).

FFA—The youth organization aimed at making a positive difference in the lives of students by developing their potential for premier leadership, personal growth, and career success through agricultural education (National FFA Organization, 2015).

Judging Contest—A competition comparing an individual’s ability to evaluate, rank, and ultimately defend the alignment of animal classes in comparison to an official panel’s collective assessment of form as it relates to expected function. Fifty points are possible for each class judged and 50 points are possible for each set of oral reasons given.

Livestock Judging—The process of observing, analyzing, and ranking of domesticated animals based upon their expected value. Participants demonstrate knowledge and decision-making skills via animal selection using research-based standards based on the evaluation of animals according to expected breeding and productive qualities. Livestock judging may begin with an individual analysis, followed by a comparison to contemporaries, then by a comparison to an ideal standard, which results in a ranking.

Livestock Judging Team—A group of college students who have completed a course in livestock evaluation and who meet the eligibility requirements of their respective Coaches Association and the specific contest rules as outlined in the competitions rulebook.

Livestock Show—The presentation of livestock by youth and/or breeders for ranking based upon on phenotypic and genotypic traits adopted by their respective breed association as the standard.

Norms—Mathematical conversions, score distributions, and related statistics derived from test scores of a large reference population of examinees (Watson and Glaser, 2010).

Oral Reasons—the verbal justification of how a participant ranked a class of animals previously evaluated, which is given to a contest official/industry expert. After an individual has placed the classes of four animals, judges are organized for the reasons portion of the contest; the individual will construct an oral defense of his or her observations will be scored (a 50-point maximum per class) by an industry expert/official based upon content, logic, and delivery.

Raw Score—The number of items answered correctly per subtest. The total number of items varies from test to test; thus, raw scores cannot be directly compared with each other (Watson and Glaser, 2014).

Senior College Livestock Judging Team—A group of participants in a livestock judging competition representing an institution offering a well-rounded curriculum in the animal sciences and a B.S. degree in agriculture. Eligibility begins in January at the

National Western Livestock Exposition and terminates in November at the North American International Livestock Exposition (NAILE), which closes the calendar year of eligibility for university evaluators. Any agricultural college undergraduate student representing his or her institution who has never represented a four-year college may compete, provided they prove attendance as a regularly enrolled student in the institution they represent and have not at any time served in the capacity of animal husbandry instructor at any agricultural college (National Collegiate Livestock Coaches Association, 2016).

Transfer Student—A student who accumulated hourly credits at a community college and applied those earned credits toward a degree at a four-year university.

Watson-Glaser™ II Critical Thinking Appraisal Form E (WGCTA)—A multiple-choice, formatted test designed to record various interdependent aspects of critical thinking through various constructs identified as recognizing assumptions, evaluating arguments, and drawing conclusions (Watson and Glaser, 2010).

Limitations of the Study

The following limitations were noted for this study:

1. Study participants' critical thinking abilities were not scored prior to their collegiate livestock evaluation experience; thus, we cannot confirm nor deny critical thinking abilities were developed.
2. The scope of this critical thinking study included 84 collegiate livestock evaluators representing two community colleges and two universities; thus, generalizations should not be made to other programs.

3. The WGCTA was administered at the end of the spring judging season; thus, many students may not have given the appraisal their undivided attention due to other factors.
4. The demographic information was self-reported and could illustrate the halo error effect, or cognitive bias.
5. This study exclusively reflects the critical thinking scores of livestock evaluators based upon the Watson-Glaser™ II Critical Thinking Assessment.
6. The results were compared to the Watson-Glaser™ *3-4 years of college* norm group; thus, comparing these participants to the norm group may not be an equal comparison.
7. The study results can only be postulated to those who participated in the study.
8. Correlations between students' scores on the critical thinking appraisal and across various demographics cannot imply those demographic activities are the exclusive reason students have a higher or lower critical thinking score. Fraenkel et al. (2012) state correlational studies do not validate cause and effect.
9. The community college participants completed this study in the month during and after completion of their final community college competition while university participants were at the midpoint of their senior college year of participation. The spring contests have a greater emphasis on market animal evaluation versus breeding animals, whereas the fall competitions focus

heavily upon breeding animal analysis with greater incorporation of production scenarios and performance records, which heighten the decision-making and problem solving among participants.

Basic Assumptions

The assumptions of the researcher were as follows:

1. Administration and completion of the instrument was conducted in a similar fashion.
2. Honest responses were given to demographic questions and participants contributed their best effort while completing the assessment.
3. The assessment recorded the proper variables within the study.

Significance of the Study

Because technology now provides efficient, objective tools for livestock selection, critics question the value of participating on a collegiate livestock evaluation team. Ultimately, producing marketable graduates who possess the skills to become a productive member of society is the goal of education. Career-building competitions, such as collegiate livestock evaluation participation, claim to enhance communication, decision-making, teamwork, and critical thinking skills of those participants, yet there is limited data to validate these claims. The purpose of this study is to assess and describe the role livestock evaluation may play in developing critical thinking skills of participants at the community college and university levels.

CHAPTER II

REVIEW OF LITERATURE

In order to study the influence participation on a collegiate livestock evaluation team may have on the expansion of critical thinking skills, a review of literature to define critical thinking, determine the components of critical thinking, provide a historical illustration of agricultural institutions, and define livestock evaluation is necessary.

This chapter examines the conceptual framework for the study and provides a review of applicable literature. The researcher reviewed literature to identify applicable research and a theoretical layout to support the aims and objectives of this study. This review illustrates how critical thinking is related to collegiate livestock evaluation.

Conceptual Framework

Beyer (1987) stated psychology provides a look into the process by which thinking occurs and how cognition may be taught, while philosophy provides insight into what should be included within a thinking skills program. While critical thinking may entail the application of reasoning to questions that results in logical outcomes, decision making tends to occur when one believes in his or her analysis and acts accordingly.

This study's framework was based on Beyer's (1987) theory that thinking can be learned. Progression through the six stages of this theory is believed to produce the greatest critical thinking proficiency. Initially, in the first stage, a single lesson related to a specific thinking skill is accomplished through an introduction. Livestock evaluation

courses often begin with classroom instruction including anatomy and physiology. Next, in stage two the skills are executed through guided practice. Digital image libraries and hands on laboratories allow the beginning livestock evaluator to demonstrate their learning. Providing repeated exercises allow learners to demonstrate their skills makes up the third stage—the independent application stage—of Beyer’s theory. Livestock evaluation practices simulate competitions and often include ranking more than one class of livestock and talking more than one set of oral reasons. In the fourth stage, transfer and elaboration, students are shown how previously learned skills can be applied to a new setting. Each practice class of animals is somewhat different which encourages participants to reflect on the entirety of their knowledge versus simply applying the lesson used on the last class they judged. In the fifth stage, students practice repetition through guided practice as they apply skills to a new setting. The sixth and final stage includes the student’s independent application of his or her thinking ability, categorized as autonomous use.

Countless independent decisions are made throughout a livestock judging competition, where participants act alone, under pressure, while ranking an animal on its expected value for either consumption or breeding purposes (Smith, 2001). Similar to the system outlined in Beyer’s (1987) six stages, livestock evaluation coaches invest many hours facilitating learning through individual lessons, guided practices early in the judging year, coordinating repeatable exercises where student contestants can demonstrate their skills, and organizing experiences where contestants observe various production systems, breeds, and management schemes while building knowledge and

confidence. McCann (1998) postulated training, practice, and experience should allow contestants to identify superior or inferior animal characteristics, all while observing intricate details such as travel, toe shapes, and even scars. Judging contestants must identify the various species' anatomy, understand how those anatomical features contribute to the market or breeding value of the animal, have a vision of the ideal animal, weigh the strengths and weaknesses of the animal, and develop a system of observing while keeping the primary production practices in focus (Landers et al., 1986).

Critical Thinking Skills

Through his probing questioning, Socrates explored the underlying beliefs that shaped his students' views and perspectives. Socrates believed thinking was driven by questioning which provided a glimpse of how the mind worked in the search of meaning and truth (Peterson, 2009). Facione (1990) defined critical thinking as:

“purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment was based” (p. 2).

The students of the 21st century are challenged with filtering through a readily available abundance of information in order to determine validity. Constant reassessments of knowledge and skills are demanded within a constantly transforming world. Volumes of work outline the subject of critical thinking, a popular topic in the educational field, and much of this discussion originated with John Dewey (1933), who believed three characteristics allowed critical thought: (a) an open-mind, (b) obligation,

and (c) sincerity. Glaser (1941) stated enhancing the ability to think effectively exists by recording evidence demonstrating improvement of skills. Watson and Glaser (2010) opined that critical thinking includes:

A curious nature that promotes the recognition of issues while concurrently accepting the desire for confirming the hypothesized truth, establishing validity of inferences, abstractions and overviews from which, the validity of various components of truth are determined, ultimately employing this mindset and knowledge.

Forty-plus scholarly individuals who were noted to be the leaders within their field conducted a Delphi study (Facione, 1990) that greatly shaped the studies of critical thinking:

- Experts reported good critical thinking included both a dispositional dimension and a skill dimension (p. 4).
- Improvement of one's own critical thinking can occur in several ways:
 - One could critically examine and evaluate one's own reasoning processes (p. 4).
 - One could learn how to think more objectively and logically (p. 4).
 - Enhancement of critical thinking may occur through reviewing and assessing one's reasoning approach, incorporate more objective and logical thought, and involvement permits greater experience expands the bank of information one can draw inference from (p. 4).

- One could increase one's base of information and life experience (p. 4).
- Demonstrating critical thinking skills with competence demands a thorough understanding of the subject and the factors that may be incorporated to make a sound judgment within that specific area (p. 5).
- A defined attitude and curiosity coupled with a sharp mind coupled with a quest for reason wrapped together with an eagerness to learn are all traits that a strong thinker possesses (p. 11).
- A good critical thinker is habitually disposed to engage in, and to encourage others to engage in, critical judgment. They make such judgments in a wide range of contexts and for a wide variety of purposes. Although perhaps not always uppermost in mind, the rational justification for cultivating those affective dispositions, which characterize the paradigm critical thinker, is soundly grounded personal and civic value of critical thinking (p. 13).
- Critical thinking is known to contribute to the fair-minded analysis and resolution of questions (p. 13).
- Critical thinking is a powerful tool in the search for knowledge (p. 13).
- Critical thinking can help people overcome the blind, sophistic, or irrational defense of intellectually defective or biased opinions (p. 13).
- Critical thinking promotes rational autonomy, intellectual freedom and the objective, reasoned and evidence based investigation of a very wide range of personal and social issues and concerns (p. 13).

Characteristics of Critical Thinking Disposition

The development of critical thinking dispositions expands the application of critical thinking skills beyond a narrow instructional setting. Facione (1990) reported those capable of incorporating critical thinking skills into their daily lives had developed more of an affective disposition than those who acquired the skills, yet were not disposed to utilize them. These critical thinking dispositions include:

- “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 processes 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, and 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).

Facione’s (1990) expert panel concluded critical thinking includes the following skills: (a) regulation of self, (b) ability to infer, (c) explanatory skills, (d) analyzation

skills, (e) appraisal, and (f) ability to translate. These skills may be applied to any activity, process, or procedure, yet applying these skills in the correct context demands extensive knowledge of the subject.

The application of critical thinking skills aligns with Smith (2001) who stated, “careful evaluation, recognition and recollection of standards, and making logical comparisons culminate in a judging participant’s critical thinking development” (p. 25). Judging encourages participants to weigh positive and negative features while at the same time accounting for all consequences of the decisions they make. Representative traits of the judging process, such as unbiasedness, obligation, curiosity, deduction, resolution, drawing conclusions, assessing validity, and the strength of information, are often described when referring to critical thinking skills (Facione, 1998; Glaser, 1941; Dewey, 1933).

The ability to precisely define terms, analyze information, and attain reasonable conclusions not only enhances problem-solving abilities, it also defines critical thinking skills (Sternberg and Baron, 1985). Developing critical thinking skills in students hinges on their achieving a mastery of knowledge. Comprehension and application of the information taught promotes the advancement of a student’s critical thinking skills, according to Pithers and Soden (2000).

Characteristics of Critical Thinking Skills

Countless studies have been conducted to gain information about the role various demographic features may play in advancing critical thought. Education level, gender,

age, and GPA correlational studies are prominent among the critical thinking literature available, yet differ much in their findings.

Does gender impact critical thinking? A sizable portion of the literature observed no significant influences of gender on critical thinking (Friedel et al., 2006; Ricketts and Rudd, 2004; Torres & Cano, 1995). However, one study by Rudd et al. (2000) did observe significant differences, noting female mean scores were higher than males'.

Students with higher GPAs were noted to have higher critical thinking scores in studies conducted by Giancarlo (1996) and Jenkins (1998). GPA was a factor influencing critical thinking scores in studies conducted by Giancarlo and Facione (2001), White et al. (2015), and Ricketts and Rudd (2004).

As age and maturity increase, it might seem plausible with more experience, older participants would record higher critical thinking scores. However, oddly enough, in the majority of studies, no significant effects were found of age on critical thinking ability (Facione, 1990; Facione, 1991; Jenkins, 1998; Rudd et al., 2000; Ricketts and Rudd, 2004).

Research showed incoming freshmen portrayed a level of critical thinking classified as low (Rudd et al., 2000). Supporting these studies, Cano and Martinez (1991) reported significant differences between senior and freshman/sophomore students' scores on the Developing Cognitive Abilities Test (DCAT), yet on the WGCTA, no classification effect was observed. Thinking creatively, resolving problems, and understanding new concepts are realms of learning only reachable by approaches that go beyond memorizing facts (Darling-Hammond et al., 2008). According to Beyer

(1987), when critical thought is applied, problem solving is surpassed via the incorporation of both evaluation and thorough review prior to making judgment. The ability to implement knowledge and think critically in response to new challenges is skills after by employers in today's information-saturated society (Heerwagen, 2007; Shann et al., 2006). Critical thinking and problem solving are often assumed characteristics of participants on a livestock judging team, where constant observations form comparisons and decisions reflective consumer demand, breeding progression, or structural soundness.

Watson-Glaser™

In order to make improvement in critical thinking skills, we must first know where we stand. As higher education encourages the incorporation of critical thinking as proficiency among graduates, assessing where instructional efforts need to be centralized in order to enhance the development of critical thinking skills should be developed.

Watson and Glaser (2010) stated their assessments are

“designed to measure important abilities and skills involved in critical thinking.

It has been used in organizations as a selection and development tool and in academic settings as a measure of gains in critical thinking resulting from specific coursework or instructional programs” (p. 1).

The new RED model follows previous Watson-Glaser™ assessments in that it is written on the ninth grade level. The Watson-Glaser II consists of the following subtests:

“Recognition of Assumptions remains an independent factor in the assessment where proposals, policies and practices can be concluded via the identification of

assumptions within schemes, ideas, and presentations. The lack of proof creates a hunger for validity which stimulates the recognition of information lapse and heightening of the views of controversial issues” (Watson and Glaser, 2010, p. 2-3).

“Evaluation of Arguments remains an independent factor in the assessment which includes controversial passages, which foreshadow the participant’s ability to think critically about such issues. Attempts to influence one’s belief or behavior define arguments, which are often overshadowed by emotion. Objectively identifying such assertions precisely aids in believability and may facilitate action” (Watson and Glaser, 2010, p. 2-3).

“Drawing Conclusions is a composite of the formerly used Inference, Deduction and Interpretation subtests. The largest component of the WGCTA, with 16 total questions, is the Drawing Conclusions subtest Analysis of applicable information prior to action, while reviewing various hypothetical outcomes with selection of the most appropriate action, is the primary aim of this subtest” (Watson and Glaser, 2010, p. 2-3).

In comparison to previous versions of the assessment, enhanced interpretability and reliability was accomplished through organizing the Watson-Glaser™ II into the three subscales mentioned earlier (Watson and Glaser, 2010). Equivalency between Form D and E was established through a counterbalanced study using a sample of over 200 people from various fields (Watson and Glaser, 2010). To support Mead and Drasgow’s (1993) study found untimed, computer-based assessments to be equivalent to

paper-based studies, Watson and Glaser (2010) conducted a study using computer-based and paper-based assessments to merit equivalency of the short form where both assessments were found to have equal responses.

A participant's score can be compared to a perfect raw score of 40, yet little can be inferred from such data. Pearson provided 14 normative sample groups that reflect converted raw scores on the Watson-Glaser™ Form A to the Watson-Glaser™ II to allow comparisons (Watson and Glaser, 2010). According to Ryan and Sackett, (1987) the Watson-Glaser™ has remained the most popular assessment which stretches internationally across the fields of business, academics, government, and law since it originated in the 1930s. The WGCTA provides adequate internal consistency and test reliability between forms and over time, which further demonstrates face, content, criterion and construct validity (Watson and Glaser, 2010). In a review of the WGCTA, Possin (2014) challenged that although the assessment tests for a few of the vital components of critical thinking skills, it omits the identity of fallacies and overlooks abuse of definitions and analog.

Decision Making

Greater than 75% of potential employee applicants surveyed in one study were identified as being deficient in the following areas: problem solving, communication skills, critical thinking, and applied knowledge in real-world situations (Hart Research Associates, 2015). These statistics are alarming and further validate communication is a paramount skill for any employment path. Phelps, (1977), showed expert livestock judges were capable of integrating many sources of information in the formation of their

decisions. Further, Klein (1998) found experts learn through setting measurable goals while engaging in deliberate practice. Additionally, expert learners have volumes of observations stored in their experiences from which they can draw the best decisions. Collectively, these experts seek rapid, accurate feedback in order to make a diagnosis that will promote new vision while minimizing repeated mistakes (Klein, 1998).

Animal evaluation competitions are complex events that use multiple judgment dimensions; thus, judges with at least four years of training and experience should be considered expert decision makers (Phelps and Shanteau, 1978). In a study of the 1975–1976 judging team members at Kansas State, findings indicated nine to 11 pieces of information were used to formulate their rankings, which surpassed the number of informational pieces used by other experts such as physicians and lawyers (Phelps and Shanteau, 1978).

Livestock evaluation competitions encourage participants to overcome their prejudices, develop a spirit of fairness, and seek an open mind in order to make sound decisions. Livestock judging participants, according to Phelps (1977), are decision makers of the highest order who, as they prepare to place classes, must incorporate information about livestock evaluation from textbook learning, experiences, and observations when forming a decision.

Experiential Learning

Dewey (1933) stated necessary and intimate relationships exist between education and the processes of actual experience and advised the learning value of an experience is only be obtained through reflection. Experiential learning is defined when

a student has had concrete experience, made observations, and reflects upon the experience in order to construct ideas and judgments of concepts can be applied to new experiences (Kail and Cavanaugh, 2007). According to Piaget (1954) and Piaget and Inhelder (1974), to facilitate learning, the active engagement of the learner is required. Providing high-impact learning environments where students can see teachings come to life in various settings, both within and outside of the classroom, confirm the value of extracurricular activities.

Kolb and Kolb (2005) referred to cognition as the continuous process of developing knowledge and abilities from the experiences one has observed. This *experiential learning theory* was shaped and popularized by scholars including: John Dewey, Kurt Lewin, Jean Piaget, and many others (Kolb and Kolb, 2005). The experiential learning theory defines learning as “the process whereby knowledge is created through the transformation of experience; this knowledge results from the combination of grasping and transforming experience” (Kolb, 1984, p. 41).

The experiential learning theory portrays two opposing means of gaining experiences—abstract concepts and concrete experience. Yet in order to transform the previously gained experiences, reflective observation and active experimentation must still occur. Yeganeh and Kolb (2009) provided four phases by which education occurs: observing through the experience, reflecting upon the occurrences, forming alternatives, and acting. When a learner has a concrete experience, this becomes the basis of observations and reflections, which will be integrated into abstract concepts where implications are actively reviewed which springboard the development of a new

experience (Yeganeh and Kolb, 2009). Understanding the various ways humans learn shapes the path of an individual's development, according to Kolb and Kolb (2005), who stressed needs for students to experiment and apply what they have learned to real-world settings and reflect upon those experiences. McCleod (2013) provided an illustration of Kolb's learning styles and experiential learning theory, as shown in Figure 1. Promoting the growth of critical thinking skills and their use outside of the classroom requires instructors to model desired behavior in the classroom for students while rewarding attempts of higher order thinking (Kail and Cavanaugh, 2007). As a facilitator, one must be prepared for varied feedback due to each individual's unique response to stimulus since various factors may influence an individual's preferred learning style. Awareness of learning styles allows educational instruction to be tailored for a preferred style, which can enhance learning. Kolb (1999, 1984) categorized learning styles in four ways: "(a) diverging, or feeling and watching, (b) assimilating, or watching and thinking, (c) converging, or doing and thinking, and (d) accommodating, or doing and feeling" (p. 4). These various learning styles also influence psychological behaviors, convey perception, and influence interaction with and response within an environment (Keefe, 1979).

Astin's (1984) developmental theory of involvement implies that the more a student invests, the greater the involvement, the more they learn and become engaged in their own education. Gellin (2003) opined, the interest levels of students may be elevated for in-class activities, if they have been involved in various co-curricular activities. In terms of judging livestock, teaching, repetition, and hours of practices are required in order for a team to reach a common assessment of livestock; in addition, team members

must acquire the discipline and dedication required to deliver a persuasive, accurate, and logical sets of oral reasons. Training, practice, and experience all permit contestants to identify superior from inferior animal characteristics, yet forming the most correct placing of average contemporaries often poses the greatest challenges for contestant evaluators. Evaluators must capably identify the anatomy of the various species and comprehend the relationship of conformation to function for either breeding or terminal purposes, envision the ideal for that animal class and age, while balancing strengths and weaknesses to develop a system of observing while keeping the primary production practices in check (Landers et al., 1986).

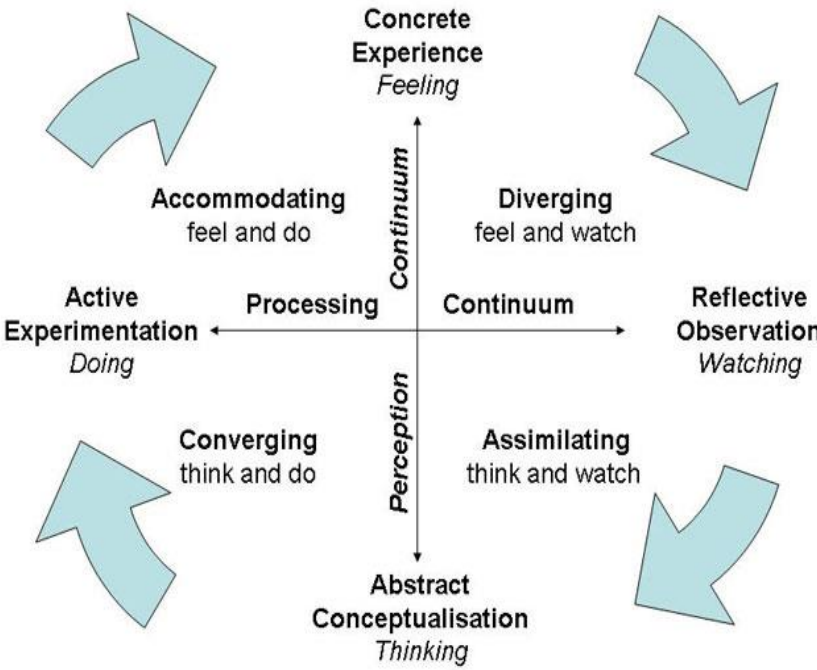


Figure 1. Kolb's learning styles and experiential learning theory (McLeod, 2013).

Animal Science Departments

The development of land-grant institutions through the Morrill Act of 1862 led to the formation of colleges of agriculture that educated the working class in agriculture and mechanics (Shepperd, 1922). The Wisconsin College of Agriculture was one of the first animal husbandry departments of its kind, and the first to offer courses in livestock evaluation in the United States. Assessments were exclusively visual and served as the primary means of establishing an animal's worth. Because of the program's success and rapid acceptance, other institutions were quick to add evaluation courses to their agricultural colleges. For the decade following the introduction of livestock evaluation curriculum, visual appraisal skills learned through these courses was the primary technique used to assess a live animal's worth. Livestock judging activities continued to see tremendous growth until the 1960s, when departments began to shift toward lessons that could be applicable across various disciplines (Britt et al., 2008). Technology led to the development of many objective measures of livestock assessment, yet perhaps as impactful as any was the development of genetic estimates capable of foreshadowing both the individual's performance and value of an animal's offspring. Historically, breeding animal selection and mating decisions were based on a trained eye and the animal's lineage: whereas today, a mere collection of hair follicles or a blood sample can amplify the precision and predictability of these decisions. Undoubtedly, rapid progression can be made within a breeding operation or industry through applying these new technologies, yet the demand of visual appraisal remains for the evaluation of traits such as: structural soundness, health, udder soundness, and disposition. Presently

progressive stockmen rely on a sharply trained eye used in tandem with the available objective tools to make decisions that meet the demands of the consumers, and each of the production phases. In 2016, animal science classrooms were occupied with vastly different students versus yesteryear. At the time of the first animal science departments formation, according to the 1880 census, 43% of the labor force was comprised farmers and ranchers; yet this diminished to less than 5% in 2005; and in 2015, merely 2% of the population is comprised of farm and ranch families (Bureau of Labor Statistics, 2016). These statistics alone are enough to reflect the demanded evolution of agricultural curriculum to meet the needs of a changing world. The challenges animal science instructors face have remained consistent over time as Taylor and Kauffman (1983) noted challenges for animal science instructors as: greater number of transfer students, students having less livestock experience, and increased proportions of female students. To complement these concerns, Russell (1993) postulated, agricultural students from urban and suburban populations often lack awareness of even basic agricultural practices, and this shortage of background or experience potentially jeopardizes the sustainability of the agricultural industry. Animal science enrollment has continued to increase at Iowa State, where first-year animal science students indicated their species of interest as companion animals, equine, and exotic animals, which is also reflective of students' urban backgrounds (Sterle and Tyler, 2016). Much of the growth in the undergraduate animal science population is comprised of females; where some universities reported as many as 70% of those graduating with animal science bachelor's degrees were female (Esbenshade, 2007).

Community Colleges

Established in the education field in 1901, community colleges were first designated by the term “junior” in order to signify the first community colleges were viewed as precursors to attending four-year universities. In 1992, the name was changed from junior college to community college to reflect the fact these colleges support the many employment needs of their communities (Levin, 2001). Community colleges not only offer an open door to students of varying age, gender, and academic levels, they also provide opportunities to complete general education courses for transfer at affordable rates, while also preparing other students for the workforce through technical and certificate programs. Higher standards for admission and tuition hikes, have limited the entrance into many universities (Britt et al., 2008). This challenge has prompted developing incentives such as tuition reduction for low-income students and partnership admission programs where students attend lower-cost community colleges prior to transferring to a four-year university.

Evaluation Courses

Evaluation courses provide hands-on learning and have been part of the Animal Science curricula at universities since the late 1890s. As mentioned in Chapter 1, Professor Craig’s animal evaluation and exhibition knowledge was credited to his studies at Ontario Agricultural College and the University of Toronto and was further enriched by his interactions with premiere livestock breeders while serving as editor of the *Canadian Live Stock Journal* (Shepperd, 1922). Evaluation courses include the following—selection and evaluation of beef cattle, swine, sheep, goats, and horses—and

acquiring the skills to present accurate, clear, concise oral and written reason. Evaluation students' are expected to gain a greater understanding of market animal evaluation, breeding animal selection and genetic evaluations of beef cattle, sheep and swine. Evaluation of animal form as it relates to intended production function serves as the core for these courses, where lecture topics may include: ideal conformation, soundness, breed history, various production systems, proper terminology and various techniques used to rank and describe a group of animals. These evaluation courses lay the foundation for the formation of competitive events, where animals' form and function of are ranked by university team members and justified through oral reasons. Differentiating muscle from fat in meat animal classes poses a great challenge for evaluators, while understanding how to combine phenotypic traits with performance data and how each component relates to a specific production environment poses a challenge that requires a thorough knowledge base (Eversole, 1990). Through applying information gained through an evaluation course, students become proficient in ranking classes of four animals followed by constructing an oral defense of their observations (McCann and McCann, 1992). Animal genetics and technology have progressed rapidly over the last century, yet the need for livestock evaluation training still exists today. Beyond developing one's evaluation capabilities, the benefits of participation on a collegiate judging team go beyond evaluating four head of livestock. Problem solving and industry awareness are skills valued by agricultural employers (Berg, 2002; Field et al., 1998). Providing active learning through internships, judging programs and hands-on laboratories positively influence student learning (McCann and McCann, 1992; Taylor,

1990). Kuh (2008) reported activities held outside the classroom-heightened curiosity and provided challenges that developed employer sought after skills such as, communication and teamwork.

Collegiate Livestock Judging Competitions

According to Willham (2008), several other institutions quickly joined Wisconsin and Minnesota after soon realizing the value of livestock evaluation courses, which led to the first intercollegiate livestock judging contest held in 1898 in Omaha, Nebraska. Subsequently, the Union Stock Yard and Transit Company of Chicago hosted the first International Livestock Exposition in 1900 (Shepperd, 1922). The national competition has been held since 1900, excluding six years, 1914–1915 (due to a disease outbreak) and 1942–1945 (due to World War II) (North American International Livestock Exposition, 2015). In 1976, following the closing of the International Live Stock Exposition in Chicago in 1975, the National Collegiate Judging Contest was relocated to Louisville, Kentucky, to be held in conjunction with the NAILE (North American International Livestock Exposition, 2015). In addition to the national contest, additional intercollegiate livestock judging competitions are held annually across the country. A typical collegiate contest will consist of 12 classes of four animals. Participants will be given up to 15 minutes to evaluate and note the differences of the four animals. At the conclusion of analyzing and ranking the various classes of livestock, participants will then prepare for 15-20 minutes for their two-minute extemporaneous justification of their ranking of classes before a contest official, who will score their justification. Collectively, placing scores and oral reasons are tabulated in order to

account for recognition of individual and team performance. Today, 4-H and FFA livestock judging participants may earn scholarships to continue their judging careers at a community college prior to transferring to a four-year university, while others who enroll in a four-year university as freshmen may compete on wool and meat judging teams before joining the livestock judging team as juniors. According to Field et al. (1998), evaluation team participation is a valuable extracurricular activity at community colleges and four-year universities offering agricultural degrees. In contrast to athletic competitions, livestock evaluation relies primarily on cognitive skills with minimal physical demands. Not only are students trained to recognize differences in structural conformation, fat deposition and product potential product of animals, but then speaking publically about the rationale they used to make decisions builds confidence and character within participants (Rusk and Culp, 2007). Rusk and Culp (2007) opined participation in judging contests can enhance self-esteem and build character while developing leadership potential, which is a basic long-term goal of the activity. Nash and Sant (2005) reported preparation and participation in judging activities invoke critical assessments of livestock and equine as a technique for industry progress. Findings by Field et al. (1998) reiterated this fact, and concluded, “sponsorship of judging activities is deserved due to the participants enhanced skills in communication, decision making and enhancing industry awareness” (p. 29). According to Cavinder et al. (2011), students prepare for competition via gaining industry knowledge that applies to livestock selection and production. In the same study, continuance of judging and evaluation

programs was advocated through the favorable responses of competitors when asked if their judging experiences supplied the essential skills their current positions demanded.

According to Smith (2001) the primary importance of participation on a judging team does not lie in the visual ability to rank four hogs or in the ability to grade and price a fleece or carcass; instead, the value of participation comes through developing a thought process enables decisions to be made. Although the ability to discuss and describe the products of agriculture is valuable for those who choose that career path, other intangible, more general benefits such as thinking critically, leadership, making logical comparisons, making independent decisions, problem solving, and communication skills were also gained through judging team participation (Smith, 2001). Several studies Cavinder et al. (2011), Nash and Sant (2005) and Rusk et al. (2002) examined various animal evaluation programs where former team members credited judging teams for their personal skill development. Moreover, Houghton (1967) witnessed this personal growth through students' dedication and commitment to practice as one of the most satisfying experiences of coaching teams. Cavinder et al. (2011) noted, within 317 surveys of former judging team members, 13.56% of the participants reported both public speaking and decision making as the most useful life skills they improved through judging participation. Cavinder et al. (2011) reported clear and credible data exist that evaluation team involvement creates opportunities for developing life skills and critical thinking skills potentially make team members more marketable to employers and enhances their ability to deal with all forms of relationships. McCann and McCann (1992) opined developing leadership, character, knowledge, and

communication skills ultimately would enrich the marketability of university graduates. Within the same work, McCann and McCann (1992) also stated many critics questioned the value of training a livestock judging team, as technological advancements were much more accurate in relation to visually ranking animals. In contrast, other studies reported participation in livestock judging and other similar extracurricular activities were noted to improve life skills helped prepare members for career success (Anderson and Karr-Lilienthal, 2011; Cavinder et al., 2011; Miller et al., 2011; Ewing et al., 2009; Nash and Sant, 2005; Rusk et al., 2002; Layfield et al., 2000; McCann and McCann, 1992; Birkenholz and Schumacher, 1994; Potter and Mulroy, 1994; Love and Yoder, 1989; Smith, 1989).

Characteristics of Judging Team Members

A livestock evaluation team is comprised of a diverse population who represent various regions, backgrounds, and levels of experience. Coffey, (1930), declared decision-making skills of a student trained in livestock evaluation are developed through mastering information, making keen observations, weighing the positives, and negatives of those observations, and ultimately expressing a conviction with confidence. Coffey (1930) also identified weighing features, both positive and negative, as the greatest challenge in coaching, which could be accomplished only after a student has mastered the basic principles of selection. In 1937, Kays posited, in order for a correct judgment to be made, one must understand what constitutes excellence in each species. Poor performance in livestock evaluation competitions reflects unsystematic, incomplete, and inaccurate observations. In regards to a judging competition, if team members do not

share a common vision of the ideal type, it is almost impossible to get the team to place uniformly (Kays, 1937). For three academic years, McCann et al. (1989) studied the personalities of evaluation course participants who elected to judge (n=28) on the competitive team versus those who elected not to judge (n=47) using the Myers-Briggs Type Indicator (MBTI) and found intellect and previous involvement with livestock were important factors for successful judging students. Judging team participants definitively scored higher for the sensing and thinking traits than non-judger classmates. Moreover, judging team members relied on their senses and logic to evaluate, resulting in predictable alignments of judging classes. Meyers et al. (2015) studied the application of psychological indices as forecasters of performance and found highly competitive participants showed significantly less tension, depression, and confusion and showed greater skill in controlling anxiety and maintaining concentration. According to Phelps and Shanteau (1978) mastery of livestock judging requires a high degree of intelligence to process and strategize for successful judging outings. Although Meyers et al (2015) noted increased female participation in judging activities, males recorded greater psychological skills for anxiety management, confidence and motivation. Cavinder et al. (2011) also reported judging team members gained self-assertiveness, anxiety control, respect of other's opinions, communication skills, patience, and social confidence all while developing skills in hard work and dedication toward a common goal. In the same study, participation in judging activities were advocated by favorable responses when asked if their judging experiences supplied the essential skills their current positions demanded (Cavinder et al., 2011).

4-H and FFA Livestock Judging Competitions

Youth livestock judging competitions can also be traced to the early 1900s, when youth organizations were founded to develop leadership and foster the development of curiosity, decision-making, responsibility, and communication through experiences. Livestock judging contests for high school students were held prior to the formation of the FFA, which was created by the Smith-Hughes Act of 1917. According to Tenney (1977), Alabama and Virginia pioneered the inaugural statewide contest in 1919, while the 1925 National Dairy Show held in Indianapolis, Indiana, was the beginning of national judging contests for secondary agriculture students (Rayfield et al., 2007). Additional judging contests sponsored by the National Congress of Vocational Agriculture Students were sponsored from 1926–1936, and although contests were held alongside the National FFA Convention, judging contests were not included in the FFA program prior to 1947 (Rayfield et al., 2009, Tenney, 1977).

Mirroring the National FFA Organization, the National 4-H Council also offers youth a variety of leadership and life skill building activities in which they may participate and compete (National 4-H Organization, 2015). In 1914, the passing of the Smith-Lever Act established the Cooperative Extension Service, which led to county agents and local leaders organizing 4-H clubs (National 4-H Council, 2015). In 1920, the first national 4-H livestock judging contest was organized and held in Atlanta, Georgia, where the winning team from Texas earned the right to represent the United States against a team of English boys in London (National 4-H Council, 2015). The National 4-H Livestock Judging Contest was held in conjunction with the International Livestock

Exposition held each year in Chicago until 1974, when the contest began being held in conjunction with the NAILE in Louisville, Kentucky, as it is still today. Similar to the results of collegiate livestock judging member personality studies, in a study of the National FFA Livestock CDE participants, Rayfield et al. (2009) found FFA members with competitiveness and being coachable were favorable traits for recruitment on their chapter's team. Yet, Herren (1984) found the experience level of the coach, origin of the team, and the manner teams are selected to have the greatest impact on training successful teams. Rusk and Culp (2007) pointed out while livestock judging programs teach youth to evaluate cattle, sheep, hogs, and horses, the greatest leadership development components are the character and self-confidence built through making decisions and organizing reasons.

Literature Summary

Ultimately, producing marketable graduates who possess the necessary skills to become a productive member of society is the goal of education. Increasing content knowledge, as well as skills is a partnership shared by student and instructor where the knowledge groundwork is developed. Yet multiple sources express desire for skills in their prospective employees that cannot be attained in a classroom. In this review, the conceptual framework of the study has been outlined, along with a brief overview of critical thinking, decision making and experiential learning. In order to explore the influence of critical thinking skill development via livestock judging participation, knowing the origins of studies in animal husbandry, evaluation courses, and collegiate livestock judging competitions and youth organizations create a vision of the co-

curricular activity. Collectively, this review outlined much of the vocabulary and background needed to assess and describe the role livestock evaluation plays in developing critical thinking skills of participants at the community college and university levels.

CHAPTER III

METHODOLOGY

Research Design and Methods

The purpose of this study was to assess if participation on a collegiate livestock evaluation team influenced the critical thinking skills of community college and university participants. This study's research aims included:

1. Assess the critical thinking level of collegiate livestock evaluation team members.
2. Define demographic variables of survey participants.
3. Determine if demographic variables influence critical thinking skills of collegiate livestock evaluators.
4. Determine if gender influences the level of critical thinking skills of collegiate livestock evaluators.
5. Determine if critical thinking skills vary among community college and university livestock evaluators. If so, at what level are the most critical thinking skills produced?

This study was a descriptive-correlational study recorded the critical thinking levels and various demographic backgrounds of collegiate livestock evaluators. According to Fraenkel et al. (2012), relationship descriptions between two or more quantitative variables can be achieved via a correlational design. This descriptive study examined the influence of participation on a collegiate livestock evaluation team on

critical thinking skills of participants at the community college and university levels. One hundred collegiate livestock evaluators from two community colleges and two universities were selected to participate in this study.

Population and Sample

The generalizable population included livestock evaluators from the community college and university levels who have completed the WGCTA. Given the necessity of the sample size for this study, a purposive, nonrandom sample was used to select participants from community colleges and universities. This study identified members of collegiate livestock evaluation teams who were willing to discuss their livestock judging experiences and involvement in this extracurricular activity. According to Erlandson et al. (1993), random sampling is unnecessary to fulfill the researcher's objective when conducting naturalistic research intended to explore various features and developments, such as what this study involved. Although 100 collegiate livestock evaluators from four institutions were invited to participate in this study, only 84 participants completed the survey, resulting in an 84% response rate. This study aimed to describe existing differences between demographic and descriptive attributes of collegiate livestock evaluators with regard to critical thinking ability.

Instrumentation

Participants completed an online demographic questionnaire developed by the researcher in order to identify background similarities to permit group comparatives. Gender, classification, GPA, state graduated from high school, judging performances and previous judging experience were recorded through this instrument. Each

demographic characteristic was self-reported by the participant, and therefore may be subjective.

The collegiate livestock evaluators' critical thinking skills scores were collected via the online WGCTA. Reliability of the WGCTA has been established through a test-retest reliability of .89 and Cronbach's alpha of .81 (Watson and Glaser, 2010). Computerized and paper versions without time restraints have been found to be equivalent through studies conducted by Mead and Drasgow (1993). Not only were correlation coefficients for raw scores reported at .86 for paper-based and .88 for computer-based instruments, but these correlation results were mirrored in test-retest studies in a 2005 study conducted by Pearson (Watson and Glaser, 2006). The instrument used to assess the livestock evaluators' critical thinking skill level was comprised of three subtests: Recognize Assumptions, Evaluate Arguments, and Draw Conclusions.

Critical thinking scores of collegiate livestock evaluation team members were compared to the *3–4 years of college* norm group. The WGCTA provided quantitative information, permitting correlational scoring between the sample groups and their various levels of participation. Credibility to make comparisons of the evaluators' scores and national averages was established by Watson and Glaser (2010).

Data Collection and Analysis

Six collegiate livestock evaluation team coaches were initially contacted via email and by phone in order to seek their assistance in coordinating this study by providing email addresses of candidates who had participated in at least one collegiate

livestock judging competition. Four livestock evaluation coaches agreed to assist in recruiting and facilitating the instrument. Each coach completed training via PowerPoint presentation provided by the protocol director of the Texas A&M University Institutional Review Board. Each coach held an informational meeting where the recruitment script was read to each candidate. Then, prospective participants received an informational sheet about the project, and each participant signed a consent form confirming their willingness to participate and validating their age as being 18 years or older that was returned to the investigator. Once willingness to participate was determined, the test proctor's script was emailed to the livestock evaluation coach, and candidates were instructed if at any time they chose not to participate in the study, they could log out and terminate their participation. Pearson Education Inc., author of the Watson-Glaser™ Critical Thinking Appraisal, administered the online survey to each candidate via the email addresses provided on the returned consent form. Upon log in, participants completed a demographic questionnaire designed by the researcher was built into the introduction of the WGCTA to identify peers with similar demographic backgrounds so comparison groups could be made. Per Dillman et al.'s (2008) tailored design, electronic reminders were sent at Week 3 to the facilitators requesting participants complete the assessment.

At the study's completion, Pearson Education Inc. provided the researcher with a Microsoft Excel spreadsheet that included each individual's coded response to the demographic information, raw scores, and percentile rank within the *3–4 years of college* norm group. Data analysis was conducted using the Statistical Package for Social

Sciences (SPSS) for Windows 2013, Version 22.0. Frequencies, percentages, means, and standard deviations were used to summarize data and illustrate each study objective. Relationships between various demographics and participant scores on the WGCTA were analyzed by a Pearson product-moment correlation. Each characteristic was self-reported by the participant. To ensure confidentiality, assessment scores and demographic responses will be stored online in a password-protected spreadsheet for three years following the completion of the study on the researcher's computer in the Agriculture and Life Sciences building at Texas A&M University in College Station.

CHAPTER IV

RESULTS

The purpose of this study was to assess the influence that participation on a collegiate livestock evaluation team has on the development of critical thinking skills. Eighty-four collegiate livestock evaluators completed the instrument and provided demographic information, resulting in an 84% response rate. Descriptive and correlational statistics were calculated and used to report the finding of this study's objectives.

Objective 1: Collegiate Livestock Evaluation Members' Critical Thinking Scores

The primary objective of this study was to assess the critical thinking level of collegiate livestock evaluation team members. To meet this objective, each participant completed the online version of the WGCTA, which recorded each student evaluator's critical thinking score. Table 1 provides mean scores for all collegiate livestock evaluators who completed the WGCTA. A mean score was calculated for the three subtests of the WGCTA, with perfect scores of 12 possible for the Recognize Assumptions and the Evaluate Arguments subtests, plus a perfect score of 16 on the Draw Conclusions subtest, culminating in a perfect score of 40 on the WGCTA. The mean score for all evaluators was ($M = 20.92$, $SD = 4.65$), which positions them within the 22nd percentile of students who have attended *3–4 years of college* (Watson and Glaser, 2014). In this study, overall mean scores ranged from (14-28) for community college participants and from (14-31) for university participants. Evaluators recorded the

highest score on the Evaluate Arguments subtest with a mean score of ($M = 7.80$, $SD = 2.07$) while they scored the lowest mean score ($M = 6.38$, $SD=2.67$) was recorded on the Recognize Assumptions subtest.

Table 1

Descriptive Statistics for Livestock Evaluation Team Members' Scores on the Watson-Glaser II™ Critical Thinking Appraisal (n=84)

WGCTA Total and Subtests	<i>M</i>	<i>PS</i>	<i>SD</i>
Recognize Assumptions Subtest Score	6.38	12	2.67
Evaluate Arguments Subtest Score	7.80	12	2.07
Draw Conclusions Subtest Score	6.74	16	2.42
WGCTA Total Raw Score	20.92	40	4.65

Note: WGCTA=Watson-Glaser II™ Critical Thinking Appraisal; PS=Perfect Score.

Objective 2: Evaluator Demographics

The second objective of this study was to define demographic variables of survey participants. This objective was met by comparing the evaluators' responses in the demographic survey. In completing the demographic survey, participants indicated their gender, classification, GPA, perceived strongest contest area, perceived weakest contest area, total number of contests they had competed in, and their individual performance. Table 2 reports the frequencies and percentages of the collegiate evaluators' responses to the demographic survey. The participants in this survey were 61.90% male and 38.10% female, while 36.90% of the participants classified themselves as juniors and 3.57% of the study participants were classified as graduate students. The GPA responses were categorized into five subtests, illustrated in Table 2, where 46.43% of participants

reported a GPA of 3.50 or higher, 42.86% reported a GPA between 3.00–3.49, 9.52% reported a GPA between 2.50–2.99, and 1.19% of participants reported a current GPA of 2.00–2.49.

Participants identified which area within a collegiate livestock evaluation competition they perceived as being their strongest, as well as which one they perceived as being their weakest. Of the collegiate livestock evaluators who completed the WGCTA, 46.43% perceived evaluation of beef cattle as their strongest area within a collegiate livestock evaluation competition, while 5.95% of this study's population perceived evaluating goats as their strongest area. In the category of perceived contest weakness, 30.95% of this study's participants perceived evaluating sheep as their weakness within a collegiate livestock evaluation competition, while 8.33% of the participants perceived evaluating goats as their weakest area.

Collegiate evaluators who completed the WGCTA also reported the total number of collegiate livestock evaluation competitions in which each participant had competed. It should be noted, in order to be eligible for this study, participants must have competed in at least one collegiate livestock evaluation competition. In Table 3, individual responses were collected in increments of five competitions, where $f = 18$, or 21.42% of the evaluators who completed the WGCTA reported having competed in less than five collegiate livestock evaluation competitions, while 4.76% of this study's participants had competed in more than 30 collegiate livestock evaluation competitions throughout their collegiate career.

Table 2

Demographic Information of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)

Evaluator Demographic Response	<i>f</i>	%
Gender:		
Female	32	38.10
Male	52	61.90
Classification:		
Freshman	25	29.76
Sophomore	15	17.86
Junior	31	36.90
Senior	10	11.90
Graduate	3	3.57
Grade Point Average:		
2.00–2.49	1	1.19
2.50–2.99	8	9.52
3.00–3.49	36	42.86
3.50–above	39	46.43
Perceived Strongest Contest Area:		
Cattle	39	46.43
Sheep	15	17.86
Swine	19	22.62
Goats	5	5.95
Oral Reasons	6	7.14
Perceived Weakest Contest Area:		
Cattle	16	19.05
Sheep	26	30.95
Swine	23	27.38
Goats	7	8.33
Oral Reasons	12	14.29

Table 3

Number of Competitions of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)

Number of Collegiate Competitions	<i>f</i>	%
1–5 Competitions	18	21.42
6–10 Competitions	16	19.05
11–15 Competitions	12	14.29
16–20 Competitions	17	20.24
21–25 Competitions	12	14.29
26–30 Competitions	5	5.95
31–35 Competitions	4	4.76

Evaluators who completed the WGCTA also reported the number of times they individually finished in the Top 10 in oral reasons and the number of times they finished in the Top 10 overall in a collegiate livestock evaluation competition, as illustrated in Table 4. Within the oral reasons category, 48.81% of participants reported having zero finishes in the Top 10, while 2.38% of those surveyed reported finishing in the Top 10 in oral reasons 21-25 times. Thirty-eight study participants reported finishing in the Top 10 overall 1–5 times, while six participants reported individually finishing in the Top 10 more than 10 times.

Table 4

Contest Performances of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)

Contest Performance	<i>f</i>	%
Finishes in the Top 10 in Oral Reasons:		
0 Finishes	41	48.81
1–5 Finishes	29	34.52
6–10 Finishes	9	10.71
11–15 Finishes	2	2.38
16–20 Finishes	1	1.19
21–25 Finishes	2	2.38
Finishes in the Top 10 Overall:		
0 Finishes	30	35.71
1–5 Finishes	38	45.24
6–10 Finishes	10	11.90
11–15 Finishes	3	3.57
16–20 Finishes	3	3.57
21–25 Finishes	0	0.0

The level that each respondent had participated at a collegiate livestock evaluation competition was self-reported within the demographic questionnaire. In response to the question, “I have competed in a collegiate livestock judging contest as a freshman representing a community college,” 88% of the study participants responded “Yes”, while 66.67% responded “Yes” to having competed in a collegiate livestock judging contest as a sophomore representing a community college as sophomores, and 52.38% responded “Yes” to the question “I have competed in a collegiate livestock judging contest representing a senior college. These percentages illustrate a climbing number of judging participants electing to initiate their judging career at a community college. Table 5 reports the frequency and percentages of study participants who have competed at each level.

Table 5

Levels Competed of Collegiate Livestock Evaluators Who Completed the Watson-Glaser IITM Critical Thinking Appraisal (n=84)

Level of Competition	<i>f</i>	%
Competed as a Freshman:		
No	10	11.90
Yes	74	88.09
Competed as a Sophomore:		
No	28	33.33
Yes	56	66.67
Competed in Senior College:		
No	40	47.62
Yes	44	52.38

Of the collegiate livestock evaluators who completed the WGCTA, 70.24% reported at least one year of 4-H participation prior to their collegiate career, while 79.77% reported at least one year of participation in FFA. Zero years of 4-H participation were reported by 29.76% of this study’s participants, while 20.23% of the evaluators in this study reported zero years of FFA participation. Table 6 outlines the years of experience in both youth organizations.

Table 6

Youth Experience of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)

Youth Experience	<i>f</i>	%
Years in 4-H:		
0 years	25	29.76
1 year	6	7.14
2 years	8	9.52
3 years	2	2.38
4 years	12	14.29
5 years	2	2.38
6 years	5	5.95
7 years	4	4.76
8 years	5	5.95
9 years	7	8.33
10 years	7	8.33
11 years	1	1.19
Years in FFA:		
0 years	17	20.23
1 year	8	9.52
2 years	7	8.33
3 years	8	9.52
4 years	33	39.29
5 years	6	8.45
6 years	3	3.57
7 years	0	0
8 years	1	1.19
9 years	0	0
10 years	1	1.19

Study participants provided the state from which they graduated high school; this information is provided in Table 7. In this study, participants reported 21 different states with the greatest representation of collegiate livestock evaluators from Texas, Oklahoma, and California respectively.

Table 7

State from which Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal Graduated High School (n=84)

State Graduated From	<i>f</i>	%
AL	1	1.19
AZ	1	1.19
CA	7	8.33
CO	1	1.19
GA	6	7.14
IN	2	2.38
KS	1	1.19
KY	1	1.19
LA	1	1.19
MD	2	2.38
MN	1	1.19
MO	5	5.95
MS	1	1.19
NV	1	1.19
OH	2	2.38
OK	12	14.29
OR	1	1.19
TX	35	41.68
VA	1	1.19
WA	1	1.19
WV	1	1.19

Objective 3: Demographic Impact on Critical Thinking Skills

The third objective of this study was to investigate if any demographic variable, such as previous youth experience, influenced the critical thinking scores of collegiate livestock evaluators who completed the WGCTA. When divided by years of 4-H participation, the lowest mean WGCTA score ($M = 18.63$, $SD = 3.50$) was recorded by eight evaluators who reported two years of membership. Of the years with multiple respondents, the five years of 4-H membership recorded the highest mean WGCTA

score at ($M = 26.0$, $SD = 2.83$). Thirty-three participants reported four years of FFA participation and recorded a WGCTA mean of ($M = 20.15$, $SD = 4.35$), while the highest WGCTA mean group was recorded by those with one year of FFA membership. WGCTA means were recorded by each year of participation in 4-H and FFA in Table 8 and Table 9.

Table 8

Mean Critical Thinking Scores by Years of 4-H Participation of Collegiate Livestock Evaluators Who Completed the Watson- Glaser II™ Critical Thinking Appraisal (n=84)

Years of 4-H	<i>n</i>	<i>M</i>	<i>SD</i>
0 years	25	21.92	4.85
1 year	6	22.67	6.28
2 years	8	18.63	3.50
3 years	2	21.50	6.37
4 years	12	20.25	4.54
5 years	2	26.00	2.83
6 years	5	20.40	5.13
7 years	4	21.25	5.74
8 years	5	19.20	5.81
9 years	7	18.71	3.50
10 years	7	20.71	2.14
11 years	1	27.00	0
Total	84	20.92	4.65

Table 9

Mean Critical Thinking Scores by Years of FFA Participation of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)

Years of FFA	<i>n</i>	<i>M</i>	<i>SD</i>
0 years	17	20.35	5.17
1 year	8	23.63	3.85
2 years	7	19.43	4.89
3 years	8	22.63	3.25
4 years	33	20.15	4.35
5 years	6	22.00	6.39
6 years	3	20.00	6.08
7 years	0	0	0
8 years	1	22.00	0
9 years	0	0	0
10 years	1	26.00	0
Total	84	20.92	4.65

A Pearson product-moment correlation coefficient was computed to assess the relationship between each of the various demographic variables. There was a positive correlation between Top 10 Individual finishes and the number of Top 10 finished in oral reasons, $r = 0.84$, $n = 84$, $p < .0001$. Additionally, a positive correlation was discovered between Top 10 Reasons finishes and the number of contest attended, $r = 0.66$, $n = 84$, $p < .0001$. The final was a positive correlation between Top 10 Individual finished and the number of contest attended, $r = 0.59$, $n = 84$, $p < .0001$. Increases in the total number of contest attended and top 10 finishes in reasons and Top 10 finishes individually. Correlations between the various demographic features are provided in Table 10.

Table 10

Pairwise Correlations by Demographic Variable of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)

Variable	By Variable	<i>n</i>	<i>R</i>	p-value
Top 10 Reasons	# Contests	84	0.59	<.0001*
Top 10 Individuals	# Contests	84	0.66	<.0001*
Top 10 Individuals	Top 10 Reasons	84	0.84	<.0001*
4-H	# Contests	84	-0.01	0.92
4-H	Top 10 Reasons	84	-0.04	0.70
4-H	Top 10 Individuals	84	0.09	0.37
FFA	# Contests	84	0.05	0.62
FFA	Top 10 Reasons	84	0.07	0.50
FFA	Top 10 Individuals	84	-0.05	0.59
FFA	4-H	84	-0.07	0.47
WGCTA Raw Score	# Contests	84	0.05	0.60
WGCTA Raw Score	Top 10 Reasons	84	0.06	0.55
WGCTA Raw Score	Top 10 Individuals	84	0.04	0.70
WGCTA Raw Score	4-H	84	-0.14	0.18
WGCTA Raw Score	FFA	84	0.02	0.85

A Pearson product moment correlation was calculated for each variable in Table 10. Participants were grouped into four GPA categories. One participant reported being in the 2.0–2.5 category, eight reported being in the 2.50–2.99 category, 36 were in the 3.0–3.49 group, and 39 were in the 3.50 and greater category. The single respondent with a GPA between 2.00-2.49 was combined to create a new group, 2.0–2.99, to allow for a comparison of WGCTA scores by GPA. Table 11 shows those evaluators who took the WGCTA for this study; those with a GPA of 3.0–3.49 recorded the highest mean score ($M = 21.47$, $SD = 4.99$), followed by the 3.5 and greater group ($M = 20.85$, $SD = 4.39$) and the less than 2.9 group ($M = 19.00$, $SD = 1.42$).

Table 11

GPA by Raw Score of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)

Level	<i>n</i>	M	SD	SEM
2.50–2.99	9	19.00	4.27	1.42
3.00–3.49	36	21.47	4.98	0.83
3.50–above	39	20.84	4.38	0.70

Objective 4: Gender Differences in Relation to Critical Thinking Skills

The fourth objective was to determine the difference in critical thinking scores between male and female collegiate livestock evaluators who completed the WGCTA. Participants were asked to identify their gender on the demographic survey, and responses were correlated to their score on the WGCTA. As shown in Table 12, males' WGCTA (M = 21.13, SD = 4.90) average score was higher than females' (M = 20.56, SD = 4.25) average score, although a difference of (0.57) was recorded, a t-test concluded there was no statistical difference between the total raw critical thinking score across gender.

Table 12

Mean Raw Critical Thinking Scores by Gender of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)

Gender	<i>n</i>	<i>M</i>	<i>SD</i>	<i>p-value</i>
Female	32	20.56	4.25	
Male	52	21.13	4.90	
Difference		0.57		0.57

The WGCTA scores for 32 females and 52 males were compared across the instrument's three subtests and the findings are reported in Table 13. On the Recognize Assumptions subtest, males ($M = 6.40$, $SD = 2.72$) scored higher than females ($M = 6.34$, $SD = 2.62$). The Draw Conclusions subtests recorded higher males Critical thinking scores ($M = 7.08$, $SD = 2.59$) in comparison to females ($M = 6.22$, $SD = 2.04$). Female participants ($M = 8.0$, $SD = 1.93$) recorded higher Evaluating Arguments subtest scores than males ($M = 7.67$, $SD = 2.16$). Although differences were computed, none were found to be statistically significant.

Table 13

Differences in Mean Raw Critical Thinking Scores of Gender by Subtest of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)

WGCTA Subtests	<i>n</i>	<i>M</i>	<i>SD</i>	<i>p-value</i>
Recognize Assumptions				
Female	32	6.34	2.62	
Male	52	6.40	2.72	
Difference		-0.06		0.92
Evaluate Arguments				
Female	32	8.00	1.93	
Male	52	7.67	2.16	
Difference		0.33		0.49
Draw Conclusions				
Female	32	6.22	2.04	
Male	52	7.08	2.59	
Difference		-0.84		0.12

Objective 5: Critical Thinking Skills Variance among Community College and University Evaluators and the Level Where the Most Critical Thinking Skills Were Produced

Objective 5 was to determine any differences in critical thinking scores among the various levels of collegiate competition. Graduate students recorded the highest critical thinking scores, yet the size of this sample group was too small to run inferential statistics. However, participants classified as seniors reported the highest mean score at ($M = 22.4$, $SD = 5.08$), followed by juniors at ($M = 21.94$, $SD = 5.05$), freshmen at ($M = 19.40$, $SD = 3.44$), and sophomores had the lowest mean score at ($M = 19.13$, $SD = 3.76$). Table 14 shows the mean WGCTA score for each classification group. Statistically significant differences were noted between graduate and sophomore students ($p = 0.0058$), graduate and freshman participants ($p = 0.0058$), junior and sophomore participants ($p = 0.0457$) and junior and freshmen participants ($p = 0.0347$).

Table 14

Mean Critical Thinking Scores across Each Classification of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)

Classification	<i>n</i>	<i>M</i>	<i>SD</i>
Freshman	25	19.40	3.44
Sophomore	15	19.13	3.76
Junior	31	21.94	5.05
Senior	10	22.40	5.08
Graduate	3	27.00	4.58

Table 15

Comparisons of Mean Critical Thinking Scores by Classifications of Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)

Level	Level	Difference	SE	p-value
Graduate	Sophomore	7.87	2.78	0.0058
Graduate	Freshman	7.60	2.68	0.0058
Graduate	Junior	5.06	2.65	0.06
Graduate	Senior	4.60	2.89	0.12
Senior	Sophomore	3.27	1.79	0.07
Senior	Freshman	3.00	1.64	0.07
Junior	Sophomore	2.80	1.38	0.0457
Junior	Freshman	2.54	1.18	0.0347
Senior	Junior	0.46	1.60	0.77
Freshman	Sophomore	0.27	1.43	0.85

The second component of Objective 5 was to describe any differences in critical thinking scores that may exist among the various levels of collegiate competition. Additionally, the measure of central tendency for community college participants was (M = 19.30 SD = 3.52), and university participants tabulated (M = 22.39, SD = 5.08) with a p = 0.0019. This finding identifies that a statistically significant difference exists in the WGCTA scores between community college, and university collegiate livestock evaluators. Table 16 provides the institutional means and suggests critical thinking skills can evolve over time and experience.

Table 16

Comparison of Mean Raw Critical Thinking Scores of Community College to University Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=84)

Level of Competition	<i>n</i>	<i>M</i>	<i>SD</i>	<i>p-value</i>
Community College	40	19.30	3.51	
University	44	22.39	5.08	
				0.0019

Of the 44 university participants, 36 were transfer students who had a mean WGCTA score of (M = 22.61, SD = 5.74), while eight non-transfer university participants had a mean raw score (M = 23.25, SD = 5.70) on the WGCTA. The size of this sample group was too small to run inferential statistic, yet the mean scores are displayed in Table 17.

Table 17

Mean Critical Thinking Scores of Transfer versus Non-Transfer Collegiate Livestock Evaluators Who Completed the Watson-Glaser II™ Critical Thinking Appraisal (n=44)

Transfer Status	<i>n</i>	<i>M</i>	<i>SD</i>
Transfer	36	22.61	5.74
Non-Transfer	8	23.25	5.70

According to the WGCTA, the mean raw score of (M=20.92) positions the collegiate livestock evaluators in this study in the bottom quarter of the 3-4 years of college norm group. A greater number of males completed this study and recorded higher WGCTA scores than females. Low relationships were found between an

evaluator's years of youth livestock judging and WGCTA scores. According to the WGCTA, university level livestock evaluators' recorded higher WGCTA scores than community college participants in this study.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to assess the critical thinking skills of collegiate livestock evaluation participants and various influences on the development of critical thinking skills of community college and university participants. Determining the critical thinking scores of collegiate livestock evaluators, describing the various demographical backgrounds of collegiate livestock evaluators, identifying any demographic variables that may impact critical thinking scores, observing if gender impacts the critical thinking score, and determining any existing differences between the critical thinking scores of community college and university participants allowed the researcher to fulfill the study's purpose. Eighty-four collegiate livestock evaluators completed the WGCTA and provided demographic information, resulting in an 84% response rate. Descriptive and correlational statistics were calculated and used to report the findings of this study's objectives. The previous four chapters discussed how critical thinking skills could be developed through livestock evaluation participation from a broad overview, review of applicable literature, methods for examining the topic, and discoveries of the experiment. This section will summarize the study, draw conclusions and implications of the findings, and outline recommendations for practice and further research related to this line of study.

Purpose and Objectives

The purpose of this study was to assess and describe the role livestock evaluation plays in expanding critical thinking skills of participants at the community college and university levels. This study's research aims included:

- assessing the critical thinking level of collegiate livestock evaluation team members;
- defining demographic variables of survey participants;
- determining if demographic variables impact critical thinking skills of collegiate livestock evaluators;
- determining if gender modify the level of critical thinking skills of collegiate livestock evaluators; and
- determining if critical thinking skills vary among community college and university livestock evaluators. If so, at what level are the most critical thinking skills produced?

Summary of Methodology

A study of collegiate livestock evaluation participants at two community colleges and two four-year universities was conducted to explore the existing differences between demographic and descriptive attributes of collegiate livestock evaluators with regard to critical thinking ability. This study was a descriptive-correlational study that recorded the critical thinking levels and various demographical backgrounds of collegiate livestock evaluators. According to Fraenkel et al. (2012), relationship descriptions between two or more quantitative variables can be achieved via a correlational design.

Given the necessity of the sample size for this study, a purposive, nonrandom sample was used to select participants from community colleges and universities. Six collegiate livestock evaluation coaches were initially contacted via email and by phone in order to seek their assistance in coordinating the study by providing email addresses of candidates who had participated in at least one collegiate judging competition. Four of the six institutions agreed to participate in the study where 100 collegiate livestock evaluators were eligible to participate.

The generalizable population was livestock evaluators from the community college and university levels who have completed the WGCTA. Although 100 collegiate livestock evaluators from four institutions were invited to participate in this study, only 84 participants completed the survey, resulting in an 84% response rate.

Participants completed an online demographic questionnaire developed by the researcher to identify background similarities to permit group comparatives. Gender, classification, GPA, state graduated from, judging performance and previous youth judging experiences were recorded through this instrument. Each characteristic was self-reported by the participant and therefore may be subjective.

The collegiate livestock evaluators' critical thinking skills were collected via the online WGCTA. The instrument used to assess the livestock evaluators' critical thinking skill level was comprised of three subtests: (a) Recognize Assumptions, (b) Evaluate Arguments, and (c) Draw Conclusions. Comparisons of critical thinking scores of collegiate livestock team members were made to the *3–4 years of college* norm group. The WGCTA provided quantitative information permitting correlational scoring

between the sample groups and their various levels of participation. Credibility to make comparisons of the evaluators' scores and national averages was established by Watson and Glaser (2010).

Once willingness to participate was determined, the test proctor's script was emailed to the livestock evaluation coach, and candidates were instructed if at any time they chose not to participate in the study, they could log out and terminate their participation. Pearson Education Inc., author of the WGCTA, administered the online survey to each candidate via the email addresses provided on the returned consent form. Upon log in, participants completed a demographic questionnaire designed by the researcher was built into the introduction of the WGCTA to identify peers with similar demographic backgrounds so that comparison groups could be made. At the study's completion, Pearson Education Inc. provided the researcher with a Microsoft Excel spreadsheet that included each individual's coded response to the demographic information, raw scores, and percentile rank across the *3–4 years of college* normative group. Data analysis was conducted using SPSS for Windows 2013, Version 22.0. Frequencies, percentages, means, and standard deviations were used to summarize data and illustrate each study objective. A Pearson product-moment correlation was calculated to determine if any relationships existed between demographics and participants' WGCTA scores.

Summary of Findings

This study provides insight into the effect of collegiate livestock evaluation participation on student livestock evaluators' critical thinking skills. Although these

results are not generalizable to all collegiate livestock evaluators, they provide an understanding of the level of critical thinking skills of evaluators as well as describe the demographical backgrounds of the study participants.

Objective 1: Collegiate Livestock Evaluation Members' Critical Thinking Scores

The primary objective of this study was to assess the critical thinking level of collegiate livestock evaluation team members. The mean WGCTA score for all evaluators was ($M = 20.92$, $SD = 4.65$) out of a possible 40. This positions collegiate livestock evaluators in the 22nd percentile of students who have attended 3–4 years of college (Watson and Glaser, 2014). These results contrast the findings of White et al. (2012) and Miller et al. (2011) where participants from collegiate judging teams recorded higher critical thinking skills. These results indicate a need for livestock evaluation coaches and agriculture instructors to strive to improve the development of critical thinking skills in collegiate livestock evaluators.

The student evaluators performed best on the Evaluate Arguments subtest, with a mean score of ($M = 7.80$, $SD = 2.07$), while they scored the lowest on the Recognize Assumptions subtest, with a mean score of ($M = 6.38$, $SD = 2.67$). Although the Evaluate Arguments subtest score was the highest for collegiate livestock evaluators, the mean score positions the livestock evaluators' group in the low range (0-8) in comparison to the Watson - Glaser *3–4 years of college* norm group (Watson and Glaser, 2014). These data support the findings of Loo and Thorpe (2002), whose study reported the highest subset scores for the Evaluate Arguments subset. The results of this study conclude collegiate livestock evaluators are most proficient at minimizing emotion and bias while

reviewing passages and assessing the believability of the arguments (Watson and Glaser, 2010). Collegiate livestock evaluators scored the lowest on the Recognizing Arguments subtest, which indicates participants' deficiency in recognizing the appropriateness of assumptions within a situation. Collegiate livestock evaluators should strive to enhance their skills in recognizing assumptions, which could be accomplished through incorporating activities such as production simulations.

Objective 2: Define Demographic Variables of Survey Participants

The second objective of this study was to identify the demographic backgrounds of collegiate livestock evaluators. Gender, GPA, years of 4-H experience, years of FFA experience, number of Top 10 finishes in oral reasons, number of Top 10 finishes overall, number of contests attended throughout their collegiate career, and the state from which the participant graduated high school were all questions built into the introduction section of the WGCTA. Of the 84 collegiate livestock evaluators in this study, 61.9% were male while 38.1% of the participants were female. The greater population of males is an interesting discovery considering studies by Esbenshade (2007) and Sterle and Tyler (2016) reported the majority of animal science undergraduates are female. The classification of the 84 collegiate livestock evaluators in this study identified 25 freshman, 15 sophomores, 31 juniors, 10 seniors, and three graduate students. The graduate school population was too small to merit standalone correlations. Academic eligibility requires participants on a collegiate livestock judging team maintain a cumulative GPA of a 2.0 or greater. Participant GPAs were reported in the following ranges: (a) 2.0–2.49, 1 participant; (b) 2.50–2.99, 8 participants; (c) 3.0–

3.49, 36 participants; and (d) 3.5 and greater, 39 participants. In this study, 89.3% of those surveyed reported a GPA of 3.0 or greater. A typical collegiate livestock evaluation competition will include placing beef, swine, sheep, and goat classes before presenting oral reasons over those classes. Participants identified which contest components they perceived as their strongest and weakest areas of the completion. Of the 84 collegiate livestock evaluators in this study, 46.4% perceived evaluating cattle as their strongest area within a collegiate competition, while in a follow-up question, 31.0% of those surveyed perceived sheep evaluation to be their weakest area within a contest. Many collegiate contests recognize the top placing individuals in each species, oral reasons and overall. Of the 84 collegiate livestock evaluators in this study, 48.6% of the participants responded they had never finished in the Top 10 in oral reasons, while 45.1% of participants reported finishing in the Top 10 overall between 1–5 times. Survey participants responded that 88.1% had competed in a collegiate livestock judging competition as a freshman in college. This finding reveals a large number of collegiate livestock judging participants from this study population who have attended a community. A large pool of literature covered the youth participation in livestock judging competitions. Of the 84 collegiate livestock evaluators in this study, 29.7% reported having zero years of livestock judging experience in 4-H, while 20.2% reported zero years of livestock judging participation in FFA. Participation in 4-H ranged from 0–11 years of experience, while FFA participation ranged from 0–10 years, with four years being the most popular range of experience (39.4%) of participants reporting. The 84 collegiate livestock evaluators in this study reported high school graduation from 21

different states, with 41.68% graduating from a Texas high school, 14.29% graduating from an Oklahoma high school, and 8.33% graduating from a California high school. The information collected from the demographic survey illustrates the diversity that exists among collegiate livestock evaluators.

Objective 3: Demographic Impact on Critical Thinking Skills

The aim of Objective 3 was to gain background knowledge about participants in collegiate livestock competitions in 2016 and explore if correlations potentially exist between the demographical information and raw scores on the WGCTA. According to the WGCTA, there are no statistically significant differences between WGCTA scores and gender, GPA, years of 4-H experience, years of FFA experience, number of Top 10 finishes in oral reasons, and number of Top 10 finishes overall in collegiate livestock judging contests. The critical thinking scores were compared for the 84 collegiate livestock evaluators across the GPA categories; because of the small sample size, the participants with a GPA of less than 2.99 were combined to allow for a comparison of WGCTA score by GPA. Those participants with a GPA of 3.0–3.49 recorded the highest mean score ($M = 21.47$, $SD = 4.99$), followed by the 3.5 and greater group ($M = 20.85$, $SD = 4.39$) and then the less than 2.99 group ($M = 19.00$, $SD = 4.27$). Thus, this study found no demographic predictors to be correlated to the critical thinking score among the study's participants. Although this discovery aligns with the results of White et al. (2015), it contrasts with the findings by Giancarlo (1996) and Jenkins (1998) who found GPA to be correlated to critical thinking score. Pairwise correlations were calculated and revealed statistically significant correlations between the following demographic

variables; the number of contests participated in was correlated to the number of top ten finishes over all ($r^2 = 0.59$, $p < 0.0001$), the number of contests participated in was correlated to the number of Top 10 individual finishes ($r^2 = 0.66$, $p < 0.0001$), and the number of Top 10 finishes overall was correlated to the Top 10 finishes in oral reasons ($r^2 = 0.84$, $p < 0.0001$). In summary, the more contests participants in this study attended, the more likely they were to report more Top 10 finishes overall as well as Top 10 finished in oral reasons. Complementing these findings, those participants who reported more finished in the Top 10 in oral reasons also reported more finishes in the Top 10 individuals overall. These results align with Rayfield et al. (2007) who studied the National FFA Livestock CDE, where the more events previously participated in resulted in greater contest performance.

In contrast to Rhoades et al.'s (2009) findings that younger participants in high school programs recorded higher critical thinking scores, this study showed as age increased, critical thinking scores also increased. This result supports the theory students must engage and dive deeper into topics in order to look critically at knowledge; therefore, deeper cognitive processing is demanded. The cognition needs may arise via experiences that require engagement in deeper thought (Cacioppo and Petty, 1982).

The 39 study participants who perceived cattle to be their strongest contest area had a mean WGCTA score of 21, while the five who perceived evaluating goats as their strongest area recorded the lowest mean WGCTA of 17. The six participants who perceived oral reasons to be their strongest area within the contest recorded the highest WGCTA mean score of 24. The 27 study participants who perceived sheep to be their

weakest contest area and the 22 participants who perceived swine to be their weakest content area had mean WGCTA scores of 20 and 21 respectively. Seven evaluators identified goats as their weakest contest area.

Twenty-five study participants indicated they had zero years of 4-H judging participation; this group recorded a mean WGCTA score of 22, while the 59 participants who reported at least one year of 4-H experience calculated a mean WGCTA of 20. Seventeen participants reported having zero years of FFA experience and recorded a WGCTA of 20, while the 67 former FFA participants recorded a WGCTA mean of 21.

Objective 4: Gender Differences in Relation to Critical Thinking Skills

A *t-test* was calculated for WGCTA subtest score by gender, which showed mean WGCTA scores were higher for males than the mean WGCTA score for females. There was no significant difference found between the WGCTA scores of collegiate evaluators in this study and gender, which aligns with the study of White et al. (2015). These findings contrast studies by Torres and Cano (1995), Ricketts (2005), Ricketts and Rudd (2004), Rudd et al. (2000), and Friedel et al. (2006), where gender was correlated to critical thinking scores.

Objective 5: Critical Thinking Skills Variance among Community College and University Evaluators and the Level Where the Most Critical Thinking Skills Are Produced

Based on the 84 collegiate livestock evaluators in this study, results indicated university livestock evaluators recorded 2.52 more points on the WGCTA in comparison to community college participants. The measure of central tendency for community

college participants was ($M = 19.30$ $SD = 3.52$), and university participants tabulated ($M = 22.39$, $SD = 5.08$) with a $p = 0.0019$. This finding identifies a statistically significant difference exists in the WGCTA scores between community college and university collegiate livestock evaluators. The 84 collegiate livestock evaluators in this study were categorized by classification, and the mean WGCTA score was calculated and compared per group. The highest mean WGCTA score was for graduate students ($M = 27.00$, $SD = 4.58$), followed by seniors ($M = 22.40$, $SD = 5.08$), juniors ($M = 21.94$, $SD = 5.05$), freshmen ($M = 19.40$, $SD = 3.44$) and concluded with sophomores ($M=19.13$, $SD 3.76$) reporting the lowest mean WGCTA score.

Higher admission requirements for a university may reflect the higher WGCTA scores. Likewise, this difference in university WGCTA scores versus community college scores may reflect higher admission standards, including higher standardized test scores, and greater transfer GPA requirements. The classification finding contradicts the report by White, et al., (2015) where younger animal science students recorded higher critical thinking scores than older students on the WGCTA. In this study, of those community college participants surveyed, freshman participants recorded a higher mean score than sophomore participants. A slight difference in WGCTA score was observed between participants classified as seniors when compared to juniors, which aligns with the findings of Cano & Martinez (1991), where the DCAT was used and concluded cognitive scores can be increased over time with maturity. This suggests the rigor of upper-level courses may prompt the participants' growth of critical thinking skills.

Future Studies

The makeup of Animal Science Departments and collegiate livestock evaluation teams have obviously transformed since their inception in the late 1800s. Advancements in technology have provided objective tools for use livestock selection and making animal breeding decisions, this has stemmed a critical review of the purpose of maintaining a collegiate livestock evaluation team. Ultimately, producing marketable graduates who possess the skills to become a productive member of society is the goal of education. To permit the growth of career building skills, the ability to communicate, make decisions, collaborate and think critically are paramount.

High impact learning opportunities through co-curricular events, such as participating on a livestock evaluation team, are well-documented means of not only enhancing knowledge, but valuable skills as well. Further research documenting recording the career journeys of those livestock evaluation participants beyond their years of competition could aide in building a strong defense.

Future studies across other institutions are merited to provide greater information regarding the critical thinking skills of livestock evaluation participants. To truly account for any pre-existing aptitudes for critical thinking, and accurately discern the potential role this activity may have on the development of critical thinking skills, assessments of livestock evaluation participants critical thought should be collected before their collegiate careers begin and at the conclusion of their evaluation careers to measure any differences that may exist.

Additional studies comparing critical thinking scores of collegiate livestock evaluators to non-livestock evaluators within the College of Agriculture could provide peer assessments amongst true contemporaries versus the WGCTA norm group. Future studies assessing and describing the role livestock evaluation participation can play in developing career-building skills can ultimately continue to build support for this co-curricular activity. The survey conducted by Hart Research Associates (2015) outlined critical thinking, communication, and problem solving as shortcomings of prospective employees. Although participating on a collegiate livestock evaluation team may provide opportunities for personal growth, only a joint effort by instructors, coaches, and participants will insure each participant reaps the benefits of this activity. This study indicates a need for the infusion of more critical thinking activities within the preparation of collegiate livestock evaluators. Discipline and patience from the coach is often required to avoid the temptation to prepare participants for a specific competition, versus taking the necessary time to guide participants through each phase of the experiential learning process, as they comprehend industry knowledge.

Just as Beyer (1987) outlined the six-step process of developing critical thinking, which served as the theoretical framework for this study, livestock evaluation coaches should strive to guide evaluators through each stage of learning with the ultimate goal of empowering participant's to make decision's based upon evaluation and analysis. The diverse backgrounds of team members create the needs for instruction through each step of the critical thinking process to insure all participants' have mastered each subject, indicating a higher level of critical thinking. Based upon the results of this study,

livestock evaluation coaches of all levels are encouraged to facilitate and coordinate activities, which incorporate the application, and examination of knowledge, a precursor for developing the critical thinking skills necessary to influence a participants' professional and personal life long after their last judging card has been marked.

LITERATURE CITED

- Anderson, K. and Karr-Lilienthal. 2011. Team members perceptions of benefits of participation on a university equestrian team. *NACTA Jour.* 55(3): 8-13.
- Astin, A.W. 1984. Student involvement: A developmental theory for higher education. *Jour. Coll. St. Personnel* 25(4): 297-308.
- Berg, P. 2002. Meat judging as a learning tool: Gender comparison. *Jour. Anim. Sci.* 80(1): 165. (Abstr.)
- Beyer, B.K. 1987. *Practical strategies for the teaching of thinking.* Boston, MA: Allyn and Bacon.
- Birkenholz, R.J. and L.G. Schumacher. 1994. Leadership skills of college of agriculture graduates. *Jour. Agric. Educ.* 35(4): 1-8.
- Bloom, B.S., M.D. Engelhart, E.J. Furst, W.H. Hill and D.R. Krathwohl. 1956. *Taxonomy of educational objectives. Book 1: Cognitive domain.* New York: Longman.
- Britt, J.H., E.D. Aberle, K.L. Esbenschade and J.R. Males. 2008. Invited review: Animal science departments of the future. *Jour. Anim. Sci.* 86(11): 3235-3244. doi:10.2527/jas.2008-1015
- Bureau of Labor Statistics. 2016. *Occupational outlook handbook, 2016–17 edition: Farmers, ranchers, and other agricultural managers.* (<http://www.bls.gov/ooh/management/farmers-ranchers-and-other-agricultural-managers.htm>). U.S. Department of Labor. (Accessed March 10, 2016).
- Cacioppo, J.T. and R.E. Petty. 1982. The need for cognition. *Jour. Pers. Soc. Psychol.* 42(1): 116-131.
- Cano, J. 1990. The relationship between instruction and student performance at the various levels of cognition among selected Ohio production agriculture programs. *Jour. Agric. Educ.* 31(2): 74-80.
- Cano, J. and C. Martinez. 1991. The relationship between cognitive performance and critical thinking abilities among selected agricultural education students. *Jour. Agric. Educ.* 32(1): 24-29.

- Cavinder, C.A., B. Byrd, J. Franke and G. Holub. 2011. Texas A&M University student life skill development and professional achievement from participation on a collegiate judging team. *NACTA Jour.* 55(1): 60-62.
- Coffey, J.S. 1930. The science of livestock judging. *Jour. Anim. Sci.* 1930(1), 159-163.
- Darling-Hammond, L.J., G.L.E. Foundation, B.P. Barron and P.D. Pearson. 2008. *Powerful learning: What we know about teaching for understanding.* San Francisco, CA: Jossey-Bass.
- Dewey, J. 1933. *How we think.* Boston, MA: D.C. Heath and Co.
- Dillman, D.A., J.D. Smyth and L.M. Christian. 2008. *Internet, mail, and mixed-mode surveys: The tailored design method.* New York: Wiley Publishing.
- Doerfert, D.L. (Ed.). 2011. *National research agenda: American Association for Agricultural Education's research priority areas for 2011-2015.* Lubbock, TX: Texas Tech University, Department of Agricultural Education and Communications.
- Erlandson, D.A., E.L. Harris, B.L. Skipper and S.D. Allen. 1993. *Doing naturalistic inquiry.* London: Sage.
- Esbenshade, K.L. 2007. Changing demographics and enrollment trends. *Jour. Anim. Sci.* 85(Suppl. 1): 413. (Abstr.)
- Eversole, D.E. 1990. Video provides essential feedback for course in livestock judging. *NACTA Jour.* 34(6): 19-21.
- Ewing, J.C., J.A. Bruce and K.G. Ricketts. 2009. Effective leadership development for undergraduates: How important is active participation in collegiate organizations? *Jour. of Leadership Education* 7(3): 118.
- Facione, P.A. 1990. *Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction. Research findings and recommendations.* Millbrae, CA: California Academic Press.
- Facione, P.A. 1991. *Using the California Critical Thinking Skills Test in research, evaluation, and assessment.* Millbrae, CA: California Academic Press.
- Facione, P.A. 1998. *Critical thinking: What it is and why it counts.* San Francisco, CA: Academic Press.

- Field, T.G., R.D. Green, J.A. Gosey and H.D. Ritchie. 1998. A summary of intercollegiate judging activity, funding and philosophy. *NACTA Jour.* 42(3): 27-31.
- Fraenkel, J.R., N.E. Wallen and H.H. Hyun. 2012. *How to design and evaluate research in education.* 8th ed. New York: McGraw-Hill.
- Friedel, C., T. Irani, R. Rudd, M. Gallo and E. Eckhardt. 2006. Influence of overtly teaching for critical thinking on critical think skills of undergraduates in a college of agriculture. In: *Proc. from American Association of Agricultural Educators*, Charlotte, NC.
- Gellin, A. 2003. The effect of undergraduate student involvement on critical thinking: A meta-analysis of the literature 1991-2000. *Jour. Coll. Stud. Dev.* 44(6): 746-762.
- Giancarlo, C.A. 1996. *Critical thinking, culture and personality: Predicting Latino's academic success.* PhD Diss., Univ. of California at Riverside, Riverside, CA.
- Giancarlo, C.A. and P.A. Facione. 2001. A look across four years at the disposition toward critical thinking among undergraduate students. *Jour. Gen. Educ.* 50(1): 29-55.
- Glaser, E. 1941. *An experiment in the development of critical thinking.* New York: J. J. Little and Ives Company.
- Hart Research Associates. 2015. *Falling short? College learning and career success.* Washington, DC: Hart Research Associates.
- Heerwagen, P. 2007. Partnering for a 21st century education. *Quad-State Business Journal* 18(10): 18-19.
- Herren, R. 1984. Factors associated with the success of participants in the National Future Farmers of America livestock judging contest. *Jour. of the American Association of Teacher Educators in Agriculture* 25(1): 12-19.
- Herren, R.V. and M.C. Edwards. 2002. Whence we came: The land-grant tradition—origin, evolution, and implications for the 21st century. *Jour. Agric. Educ.* 43(4): 88-98.
- Houghton, F.B. 1967. Judging contest—A motivating factor. *NACTA Jour.* 11(4): 71-72.
- Jenkins, E. 1998. The significant role of critical thinking in predicting auditing students' performance. *Jour. of Education for Business* 73(5): 274-279.

- Kail, R.V. and J.C. Covanaugh. 2007. Human development: A life-span view. Fourth ed. Boston, MA: Thompson Learning, Inc.
- Kays, D.J. 1937. The teaching of livestock judging or selection. *Jour. Anim. Sci.* 1937: 177-181.
- Keefe, J.W. 1979. Learning style: An overview. NASSP's student learning styles: Diagnosing and proscribing programs (pp. 1-17). Reston, VA: National Association of Secondary School Principals.
- Klein, G. 1998. Sources of power: How people make decisions. Cambridge, MA: MIT Press.
- Kolb, A.Y. and D.A. Kolb. 2005. Learning styles and learning spaces: Enhancing experiential learning in higher education. *Academy of Management Learning and Education* 4(2): 193-212.
- Kolb, D.A. 1984. *Experiential learning: Experience as the source of learning and development.* Englewood Cliffs, NJ: Prentice-Hall.
- Kolb, D.A. 1999. Learning style inventory, version 3. Boston, MA: The Hay Group.
- Kuh, G.D. 2008. High-impact educational practices: What they are, who has access to them, and why they matter. Washington, DC: AAC&U.
- Landers, J.H., D. Frischknech, D.P. Johnson, K. Killingsworth, M. Howell, G. Brog and A. Hilliker. 1986. 4-H meat animal evaluation and judging. Corvallis, OR: Oregon State University.
- Layfield, K.D., R.B. Radhakrishna and R.J. Andreasen. 2000. Self-perceived leadership skills of students in a leadership programs in agriculture course. *Jour. of Southern Agricultural Education Research* 50(1): 62-68.
- Levin, J.S. 2001. *Globalizing the community college: Strategies for change in the 21st century.* New York: Palgrave.
- Loo, R. and K. Thorpe. 2002. Using reflective learning journals to improve individual and team performance. *Team Performance Management* 8(5/6): 134-139.
- Love, G.M. and E.P. Yoder. 1989. *An assessment of undergraduate education in American Colleges of Agriculture.* State College, PA: Pennsylvania State University Press.
- Lynch, R.L. 2000. High school career and technical education for the first decade of the 21st century. *Jour. of Vocational Education Research* 25(2): 155-198.

- Madsen, D. 1976. The land-grant university: Myth and reality. In: Land-grant universities and their continuing challenge. East Lansing, MI: Michigan State University Press.
- McCann, J. and M. McCann. 1992. Judging team members reflection on the value of livestock, horse, meats, and wool judging programs. *Professional Animal Scientist* 8(3): 7.
- McCann, J.S. 1998. Competitive personality types and the use of the MBTI in training collegiate livestock and horse judging team students. *Jour. of Psychological Type* 14(3): 37-39.
- McCann, J.S., J.C. Heird and D.Y. Roberts. 1989. Four personality types of competitive judging team students and classmates in livestock and horse evaluation classes. *NACTA Jour.* 33(4): 5-8.
- McLeod, S.A. 2013. Kolb—learning styles. (<http://www.simplypsychology.org/learning-kolb.html>). *Simply Psychology*. (Accessed March 10, 2016).
- Mead, A.D. and F. Drasgow. 1993. Equivalence of computerized and paper-and-pencil cognitive ability tests: A meta-analysis. *Psychological Bulletin* 114: 440-458.
- Meyers, M.C., A.E. Bourgeois and A.D. LeUnes. 2015. Psychological indices of animal judging team participants: Predictors for development of optimal performance. *NACTA Jour.* 59(1): 63-69.
- Miller, C., C. Carr, J. Brendemuhl, J. Ricketts, B. Myers and T. Roberts. 2011. Quantifying the critical thinking skills of students who receive instruction in meat-animal or meat product evaluation. *NACTA Jour.* 55(1): 50-54.
- Nash, S.A. and L.L. Sant. 2005. Life-skill development found in 4-H animal judging. *Jour. of Extension* 43(2).
- National 4-H Council. 2015. The birth of 4-H programs. (<http://www.4-h.org/about/4-h-history/>). 4-H.org. (Accessed February 6, 2015).
- National Collegiate Livestock Coaches' Association. 2016. Eligibility requirements for intercollegiate livestock judging contests. (<http://livestockcoaches.com/>). (Accessed February 13, 2016).
- National FFA Organization. (2015). Official FFA manual. Indianapolis, IN: National FFA Organization.

- National Junior College Livestock Judging Coaches' Association. 2015. Constitution and bylaws of the Junior College Livestock Coaches' Association: Eligibility requirements for intercollegiate livestock judging contests. Peoria, IL: National Junior College Livestock Judging Coaches' Association.
- North American International Livestock Exposition. 2015. 110th National Collegiate Livestock Judging Contest Awards Breakfast Program. (<https://www.livestockexpo.org/docs/Misc%20Results/collegiate/NAILE%20Breakfast%20Program%202015%20Results.pdf>). (Accessed January 14, 2016).
- Parker, W.B. 1971. The life and public services of Justin Smith Morrill. Boston, MA: Da Capo Press.
- Pascarella, E.T. and P.T. Terenzini. 1991. How college affects students: Findings and insights from 20 years of research. San Francisco, CA: Jossey-Bass.
- Peterson, T. H. 2009. Engaged scholarship: Reflections and research on the pedagogy of social change. *Teaching in Higher Education*, 14(5), 541-552.
- Phelps, R.H. 1977. Expert livestock judgment: A descriptive analysis of the development of expertise. PhD Diss., Kansas State Univ., Manhattan, KS.
- Phelps, R.H. and J. Shanteau. 1978. Livestock judges: How much information can an expert use? *Organizational Behavior and Human Performance* 21(2): 209-219.
- Piaget, J. 1954. The construction of reality in the child. (M. Cook, Trans.). New York: Basic Books.
- Piaget, J. and B. Inhelder. 1974. The child's construction of quantities. London: Routledge and Kegan Paul Ltd.
- Pithers, R.T. and R. Soden. 2000. Critical thinking in education: A review. *Educational Research* 4(3): 237-249.
- Possin, K. 2014. Critique of the Watson-Glaser Critical Thinking Appraisal Test: The more you know, the lower your score. *Informal Logic* 34: 393-416.
- Potter, J.T. and M.T. Mulroy. 1994. A tool to evaluate horse judging students' perceptions of critical thinking and life skills development. *NACTA Jour.* 38: 42-43.
- Rayfield, J., S.D. Frazee, M.T. Brashears, and D.E. Lawver. 2007. The relationship between student demographic variables and performance in a national FFA career development event. *Jour. of Southern Agricultural Education Research* 57(1): 4-15.

- Rayfield, J., S.D. Frazee, M.T. Brashears, and D.E. Lawver. 2009. An assessment of recruitment and training practices used in a National FFA Career Development Event. *Jour. of Southern Agricultural Education Research* 59(1): 81-93.
- Rhoades, E.B., J. Ricketts and C. Friedel. 2009. Cognitive potential: How different are agriculture students? *Jour. Agric. Educ.* 50(3): 43.
- Ricketts, J.C. 2005. The relationship between leadership development and critical thinking skills. *Jour. of Leadership Education* 4(2): 27-41.
- Ricketts, J.C. and R.D. Rudd. 2004. The relationship between critical thinking dispositions and critical thinking skills of selected youth leaders in the National FFA Organization. *Jour. of Southern Agricultural Education Research* 54(1): 21-33.
- Rudd, R., M. Baker and T. Hoover. 2000. Undergraduate agriculture student learning styles and critical thinking abilities: is there a relationship? *Jour. Agric. Educ.* 41(3): 2-12.
- Rusk, C. and K. Culp III. 2007. How to plan, organize, and administrate a livestock, dairy, or horse judging contest. *Purdue University Cooperative Extension*, 1-22.
- Rusk, C.P., C.A. Martin, B.A. Talbert and M.A. Balschweid. 2002. Attributes of Indiana's 4-H livestock judging program. *Jour. Extension*. [Online]. (<http://www.joe.org/joe/2002april/rb5.php>). (Accessed March 10, 2016).
- Russell, E.B. 1993. Attracting youth to agriculture: How colleges of agriculture can expand their role. *Jour. Extension* 31(Winter): 13-14.
- Ryan, A.M. and P.R. Sackett. 1987. A survey of individual assessment practices by I/O psychologists. *Personnel Psychology* 40: 455-488.
- Shann, I.P., C.C. Carr and E.P. Berg. 2006. Objective assessment of critical thinking ability of animal science undergraduates through use of Watson-Glaser Critical Thinking Appraisal. In: *Proc. from American Society of Animal Science Joint Mtg.*, Minneapolis, MN.
- Shepperd, J.H. 1922. *Livestock judging contests*. Fargo, ND: Agricultural Experiment Station, the North Dakota Agricultural College.
- Smith, G. 1989. Developing critical thinking, communication skills, and leadership in animal science students. *Jour. Anim. Sci.* 67(1): 601.

- Smith, G.C. 2001. Preparing animal science graduates to think critically, compare logically, decide independently, solve problems rationally, communicate effectively and lead decisively: Enhanced learning through intercollegiate judging experiences. In: Proc. of Annual Reciprocal Meat Conf., Indianapolis, IN.
- Sterle, J.A. and H.D. Tyler. 2016. The next generation of animal science students: Changing demographics dictate curriculum changes. *Jour. Anim. Sci.* 94: 185-186. doi:10.2527/msasas2016-396
- Sternberg, R.J. and J.B. Baron. 1985. A statewide approach to measure critical thinking skills. *Education Leadership* 43(2): 40-43.
- Taylor, M.E. 1990. Empowering freshmen to design their own learning experiences. *NACTA Jour.* 34(2): 46-49.
- Taylor, R. and R. Kauffman. 1983. Teaching animal science: Changes and challenges. *Jour. Anim. Sci.* 57(Suppl. 2): 171-196.
- Tenney, A.W. 1977. The FFA at 50: A golden past a brighter future. Alexandria, VA: National FFA Organization.
- Torres, R.M. and J. Cano. 1995. Examining cognition levels of students enrolled in a college of agriculture. *Jour. Agric. Educ.* 36(1): 46-54.
- Watson, G. and E.M. Glaser. 2006. *Watson-Glaser Critical Thinking Appraisal*. San Antonio, TX: Pearson Education.
- Watson, G. and E.M. Glaser. 2010. *Watson-Glaser Critical Thinking Appraisal*. San Antonio, TX: Pearson Education.
- Watson, G. and E.M. Glaser. 2014. *Watson-Glaser II Critical Thinking Appraisal*. San Antonio, TX: Pearson Education.
- White, L.M., K.D. Layfield, G. Birrenkott, P. Skewes and M.M. Beck. 2012. Appraisal of critical thinking skills in animal science undergraduates who participated on a nationally competitive collegiate judging team. *NACTA Jour.* 56(1): 43-47.
- White, L.M., M.M. Beck, G. Birrenkott, P.A. Skewes and K.D. Layfield. 2015. Demographic predictors of critical thinking ability in undergraduate animal science students. *NACTA Jour.* 59(1): 49-53.
- Willham, R. 2008. *Change: An illustrated history of the American Society of Animal Science: 1908 to 2008*. Savoy, IL: American Society of Animal Science.

Yeganeh, B. and D. Kolb. 2009. Mindfulness and experiential learning. *OD Practitioner* 41: 13-18.

APPENDIX A

IRB OUTCOME LETTER

DIVISION OF RESEARCH



DATE: July 28, 2015

MEMORANDUM

TO: John Rayfield
ALRSRCH - Agrilife Research - Ag Leadership, Education & Communication

FROM: Dr. James Fluckey
Chair
TAMU IRB

SUBJECT: Expedited Approval

Study Number: IRB2014-0601D
Title: Developing Critical Thinking Skills Through Livestock Evaluation Participation
Approval Date: 10/21/2014
Continuing Review Due: 06/15/2016
Expiration Date: 07/15/2016

Only IRB-stamped approved versions of study materials (e.g., consent forms, recruitment materials, and questionnaires) can be distributed to human participants. Please log into iRIS to download the stamped, approved version of all study materials. If you are unable to locate the stamped version in iRIS, please contact the iRIS Support Team at 979.845.4969 or the IRB liaison assigned to your area.

Documents Reviewed and Approved:

Submission Components			
Title	Version Number	Version Date	Outcome
Actual Watson Glaser Appraisal	Version 1.1	09/22/2014	Approved
WatsonGlaser_Short_For001	Version 1.1	08/25/2014	Approved
recruiting_script	Version 1.1	08/25/2014	Approved
recruitingemail_script	Version 1.1	08/25/2014	Approved
demographic information2	Version 1.3	08/25/2014	Approved
adverse-event	Version 1.0	10/16/2014	Approved
Study Consent Form			
ANSC Facility Consent 7-17-15	Version 1.1	07/17/2015	Approved
Subject consent form	Version 1.1	08/25/2014	Approved

750 Agronomy Road, Suite 2701
 1186 TAMU
 College Station, TX 77843-1186
 Tel. 979.458.1467 Fax. 979.862.3176
<http://rcb.tamu.edu>

Document of Consent: Written consent in accordance with 45 CF 46.116/ 21 CFR 50.27
Waiver approved under 45 CFR 46.117 (c) 1 or 2/ 21 CFR 56.109 (c)1
Waiver of Consent:

Comments:

Investigators assume the following responsibilities:

1. **Continuing Review:** The study must be renewed by the expiration date in order to continue with the research. A Continuing Review application along with required documents must be submitted by the continuing review deadline. Failure to do so may result in processing delays, study expiration, and/or loss of funding.
2. **Completion Report:** Upon completion of the research study (including data collection and analysis), a Completion Report must be submitted to the IRB.
3. **Unanticipated Problems and Adverse Events:** Unanticipated problems and adverse events must be reported to the IRB immediately.
4. **Reports of Potential Non-compliance:** Potential non-compliance, including deviations from protocol and violations, must be reported to the IRB office immediately.
5. **Amendments:** Changes to the protocol and/or study documents must be requested by submitting an Amendment to the IRB for review. The Amendment must be approved by the IRB before being implemented.
6. **Consent Forms:** When using a consent form or information sheet, the IRB stamped approved version must be used. Please log into iRIS to download the stamped approved version of the consenting instruments. If you are unable to locate the stamped version in iRIS, please contact the iRIS Support Team at 979.845.4969 or the IRB liaison assigned to your area.
7. **Post Approval Monitoring:** Expedited and full board studies may be subject to post approval monitoring. During the life of the study, please review and document study progress using the PI self-assessment found on the RCB website as a method of preparation for the potential review. Investigators are responsible for maintaining complete and accurate study records and making them available for post approval monitoring. Investigators are encouraged to request a pre-initiation site visit with the Post Approval Monitor. These visits are designed to help ensure that all necessary documents are approved and in order prior to initiating the study and to help investigators maintain compliance.
8. **Recruitment:** All approved recruitment materials will be stamped electronically by the HSPP staff and available for download from iRIS. These IRB-stamped approved documents from iRIS must be used for recruitment. For materials that are distributed to potential participants electronically and for which you can only feasibly use the approved text rather than the stamped document, the study's IRB Study Number, approval date, and expiration dates must be included in the following format: TAMU IRB#20XX-XXXX Approved: XX/XX/XXXX Expiration Date: XX/XX/XXXX.
9. **FERPA and PPRA:** Investigators conducting research with students must have appropriate approvals from the FERPA administrator at the institution where the research will be conducted in accordance with the Family Education Rights and Privacy Act (FERPA). The Protection of Pupil Rights Amendment (PPRA) protects the rights of parents in students ensuring that written parental consent is required for participation in surveys, analysis, or evaluation that ask questions falling into categories of protected information.
10. **Food:** Any use of food in the conduct of human research must follow Texas A&M University Standard Administrative Procedure 24.01.01.M4.02.
11. **Payments:** Any use of payments to human research participants must follow Texas A&M University Standard Administrative Procedure 21.01.99.M0.03.

This electronic document provides notification of the review results by the Institutional Review Board.

APPENDIX B

HUMAN RESEARCH CURRICULUM COMPLETION REPORT

**COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI)
HUMAN RESEARCH CURRICULUM COMPLETION REPORT
Printed on 09/22/2014**

LEARNER	Allen Poe (ID: 4295944) 2471 TAMU College Station Texas 77843 US
DEPARTMENT	Animal Science
PHONE	979-845-6059
EMAIL	brau1_poe@tamuedu
INSTITUTION	Texas A&M University
EXPIRATION DATE	09/20/2017

GROUP 2: SOCIAL AND BEHAVIORAL RESEARCH INVESTIGATORS AND KEY PERSONNEL

COURSES TAGS:	IRB Social Basic Course/1
PASS ED ON:	09/21/2014
REFERENCE ID:	14090509

REQUIRED MODULES	DATE COMPLETED	SCORE
Statistics in Research	09/21/14	10/10 (100%)
Introduction	09/21/14	No Quiz
History and Ethical Principles - SBE	09/21/14	5/5 (100%)
Defining Research with Human Subjects - SBE	09/21/14	5/5 (100%)
The Regulations - SBE	09/21/14	5/5 (100%)
Assessing Risk - SBE	09/21/14	5/5 (100%)
Informed Consent - SBE	09/21/14	5/5 (100%)
Privacy and Confidentiality - SBE	09/21/14	5/5 (100%)
Research with Prisoners - SBE	09/21/14	4/4 (100%)
Research with Children - SBE	09/21/14	4/4 (100%)
Research in Public Elementary and Secondary Schools - SBE	09/21/14	4/4 (100%)
International Research - SBE	09/21/14	3/3 (100%)
Internet Research - SBE	09/21/14	5/5 (100%)
Conflicts of Interest in Research Involving Human Subjects	09/21/14	5/5 (100%)
Texas A&M University	09/21/14	No Quiz

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI Program participating institution or be a paid independent Learner. Plagiarized information and unauthorized use of the CITI Program course site is unethical, and may be considered research misconduct by your institution.

Paul Benschweiler Ph.D.
Professor, University of Miami
Director Office of Research Education
CITI Program Course Coordinator

APPENDIX C

CONDUCT OF RESEARCH CURRICULUM COMPLETION REPORT

**COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI)
SOCIAL AND BEHAVIORAL RESPONSIBLE CONDUCT OF RESEARCH CURRICULUM COMPLETION REPORT**
Printed on 09/22/2014

LEARNER: Allen Poe (ID: 4295944)
2471 TAMU
College Station
Texas 77843
US

DEPARTMENT: Animal Science
PHONE: 979-845-6059
EMAIL: brant_poe@tamuedu
INSTITUTION: Texas A&M University
EXPIRATION DATE:

SOCIAL AND BEHAVIORAL RESPONSIBLE CONDUCT OF RESEARCH: This course is for investigators, staff and students with an interest or focus in Social and Behavioral research. This course contains text, embedded case studies AND quizzes.

COURSE/STAGE: RCR/1
PASSED ON: 09/22/2014
REFERENCE ID: 14090510

ELECTIVE MODULES	DATE COMPLETED	SCORE
Responsible Conduct of Research (RCR) Course Introduction	09/21/14	No Quiz
Research Misconduct (RCR-SBE)	09/21/14	5/5 (100%)
Data Management (RCR-SBE)	09/21/14	5/5 (100%)
Authorship (RCR-SBE)	09/21/14	5/5 (100%)
Peer Review (RCR-SBE)	09/22/14	5/5 (100%)
Mentoring (RCR-Individuals)	09/22/14	5/5 (100%)
Using Animal Subjects in Research (RCR-Bas)	09/22/14	5/5 (100%)
Conflicts of Interest (RCR-SBE)	09/22/14	5/5 (100%)
Collaborative Research (RCR-SBE)	09/22/14	5/5 (100%)
Research Involving Human Subjects (RCR-Bas)	09/22/14	5/5 (100%)
Responsible Conduct of Research (RCR) Course Conclusion	09/22/14	No Quiz

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI Program participating institution or be a paid Independent Learner. Falsified information and unauthorized use of the CITI Program course title is unethical, and may be considered research misconduct by your institution.

Paul B. Ganschweiger Ph.D.
Professor, University of Miami
Director, Office of Research Education
CITI Program Course Coordinator

APPENDIX D

TAMU SITE RESEARCH PERMISSION LETTER



ANIMAL SCIENCE

July 17, 2015

Texas A&M University Institutional Review Board
c/o Office of Research Compliance and Biosafety
750 Agronomy Road, Suite 2701
TAMU 1186
College Station, Texas 77843-1186

To Whom It May Concern:

This is to formally authorize Dr. John Rayfield and Mr. A. Brant Poe, faculty members at Texas A&M, to conduct research at our Texas A&M Animal Science facility for their study, "Critical Thinking Development of Collegiate Livestock Evaluation Participants."

Dr. Rayfield or Mr. Poe may have access to the Animal Science student computer lab located in the Kleberg Center beginning October 31, 2015 and conduct research during working hours until the project end date of October 31, 2016. They will conduct a survey of livestock evaluation team members who agree to be part of the study. Our livestock judging coordinator will provide them with the names of potential participants.

Dr. Rayfield or Mr. Poe will contact students by email to recruit them, which will include a packet including a demographic survey that they will pick up at the time the survey is administered.

Dr. Rayfield and Mr. Poe have agreed not to interfere with scholastic activities and have been made aware of the schedule of activities for the computer lab. Dr. Rayfield and Mr. Poe have also agreed to provide to my office a copy of the Texas A&M University IRB-approved, stamped consent document before they recruit any participants and will also provide a copy of the published study.

If there are any questions, please contact my office.

Sincerely,

A handwritten signature in black ink, appearing to read "H. Russell Cross".

H. Russell Cross
Professor and Head

xc: Dr. John Rayfield
Mr. Brant Poe

Kleberg Animal and Food Science Center
2471 TAMU
College Station, TX 77843-2471

Tel. 979.845.1543 Fax 979.845.6433
<http://animalscience.tamu.edu>

APPENDIX E

BLINN RESEARCH PERMISSION LETTER



Joseph P. Baumann
Dean, Institutional Effectiveness and Enrollment Management

October 15, 2014

Texas A&M University Institutional Review Board
c/o Office of Research Compliance and Biosafety
750 Agronomy Road, Suite 2701
TAMU 1186
College Station, Texas 77843-1186

We formally authorize A. Brant Poe, a doctoral student at Texas A&M, to conduct research at Blinn College for his study, "Developing Critical Thinking Skills Through Collegiate Livestock Evaluation Participation."

Mr. Poe will gather data from approximately 25 members of the Blinn College Livestock Judging Team. The Blinn College Agriculture Department will assist in recruiting the students. Mr. Poe will gather demographic information using a paper form, and administer the online version of the Watson-Glaser Critical Thinking Appraisal Exam. Mr. Poe will provide potential participants with information about the study, risks and benefits, and informed consent. Mr. Poe has agreed not to interfere with work activities or to use any student contact information for any purposes other than this study. Pending IRB approval from Texas A&M, Mr. Poe will conduct his research in spring 2016. Mr. Poe has also agreed to provide to my office a copy of the Texas A&M University IRB-approved, stamped consent document before he recruits any students, and will also provide a summary of his results in the event that the findings may be useful to Blinn College as we serve our students.

If there are any questions, please contact my office.

Regards,



Joseph P. Baumann
Dean, Institutional Effectiveness and Enrollment Management

CAMPUS OR OFFICE
902 College Avenue • Brenham, Texas 77833 • (979) 830-4075 • Fax (979) 830-4155 • Joe.Baumann@blinn.edu

APPENDIX F

REDLANDS RESEARCH PERMISSION LETTER



Redlands Community College Agriculture Department
1300 S. Country Club Rd.
El Reno, Oklahoma 73036

October 16, 2014

Texas A&M University Institutional Review Board
c/o Office of Research Compliance and Biosafety
750 Agronomy Road, Suite 2701
TAMU 1186
College Station, Texas 77843-1186

We formally authorize Dr. John Rayfield and Mr. A. Brant Poe, a doctoral student at Texas A&M, to conduct research at Redlands Community College for their study, "Developing Critical Thinking Skills Through Collegiate Livestock Evaluation Participation."

Dr. Rayfield and Mr. Poe will gather data from approximately 25 members of the Redlands Community College Livestock Judging Team. The Redlands Community College Agriculture Department will assist in recruiting the students. Mr. Poe will gather demographic information and administer the online version of the Watson-Glaser Critical Thinking Appraisal Exam.

Mr. Poe will provide participants with information about the study, risks and benefits, and informed consent. Mr. Poe has agreed not to interfere with work activities or to use any student contact information for any purposed other than this study.

Pending IRB approval from Texas A&M, Mr. Poe has agreed to provide to my office a copy of the Texas A&M University IRB-approved, stamped consent document before he recruits any students, and will also provide a summary of his results in the event that the findings may be useful to Redlands Community College as we serve our students.

If there are any questions, please contact my office.

Regards,

A handwritten signature in black ink, appearing to read "Brandon Callis".

Brandon Callis
Livestock Judging Coach/Coordinator
Redlands Community College

APPENDIX G

OKLAHOMA STATE RESEARCH PERMISSION LETTER



Division of Agricultural Sciences & Natural Resources

Department of Animal Science
101 Animal Science Building
Stillwater, Oklahoma 74078-6051
Phone: (405) 744-6082
Fax: (405) 744-7390

August 15, 2015

Texas A&M University Institutional Review Board
c/o Office of Research Compliance and Biosafety
750 Agronomy Road, Suite 2701
TAMU 1186
College Station, Texas 77843-1186

To Whom It May Concern:

This is to formally authorize Dr. John Rayfield and Mr. A. Brant Poe, faculty members at Texas A&M, to conduct research at our Oklahoma State Animal Science facility for their study, "Influence of Collegiate Livestock Evaluation in Developing Critical Thinking."

Dr. Rayfield or Mr. Poe in coordination with Dr. Blake Bloomberg may have access to the Animal Science student computer lab to conduct research during working hours until the project end date of October 31, 2016. They will conduct a survey of livestock evaluation team members who agree to be part of the study. Our livestock judging coordinator, Dr. Blake Bloomberg will provide them with the names of potential participants.

Dr. Rayfield or Mr. Poe will contact students by email to recruit them, which will include a packet including a demographic survey that will be completed as the assessment is administered.

Dr. Rayfield and Mr. Poe have agreed not to interfere with scholastic activities and have been made aware of the schedule of activities for the computer lab. Dr. Rayfield and Mr. Poe have also agreed to provide my office a copy of the Texas A&M University IRB-approved, stamped consent document before they recruit any participants and will also provide a copy of the published study.

If there are any questions, please contact my office.

Sincerely,

Clint Rusk, Ph.D.

APPENDIX H

RECRUITING SCRIPT

Recruiting Script

Project Title: **Influence of Collegiate Livestock Evaluation in Developing Critical Thinking Skills**

TAMU IRB#2014-061D Approved: 07/28//2015 Expiration Date: 07/15/2016

Hello, my name is A. Brant Poe. I am a graduate student at Texas A&M University in the Animal Science Department. I am conducting research on critical thinking skill development of livestock judging team members and I am inviting you to participate because you are a member of a collegiate livestock judging team.

Participation in this research includes taking a survey about your demographic and livestock evaluation background, which will only take approximately 5 minutes. The primary instrument that will be used to examine the collegiate livestock evaluation team member's level of critical thinking skills is the Watson-Glaser™ II Critical Thinking Assessment Form E: Profile Report. If you agree to participate, in both the survey and the interview, your total time commitment will be approximately 45 minutes total.

If you have any questions or would like to participate in the research, you may contact the Principal Investigator, John Rayfield, PhD., at 979-862-3707 or jrayfield@tamu.edu, or you may also contact the Protocol Director, A. Brant Poe, at 979-845-6059 or brant_poe@tamu.edu

APPENDIX I

RECRUITING EMAIL SCRIPT

Recruiting email script

Project Title: **Influence of Collegiate Livestock Evaluation in Developing Critical Thinking Skills**
TAMU IRB#2014-061D Approved: 07/28//2015 Expiration Date: 07/15/2016

Hello, my name is A. Brant Poe and I am a graduate student at Texas A&M University in the Animal Science Department. I am conducting research on critical thinking skill development of livestock judging team members and I am inviting you to participate because of your involvement as a member of a collegiate livestock judging team.

Participation in this research includes taking a survey about your demographic and livestock evaluation background, which will only take approximately 5 minutes. The primary instrument that will be used to examine the collegiate livestock evaluation team member's level of critical thinking skills is the Watson-Glaser™ II Critical Thinking Assessment Form E: Profile Report. If you agree to participate, your total time commitment will be approximately 45 minutes total.

If you have any questions or would like to participate in the research, you may contact the Principal Investigator, John Rayfield, PhD., at 979-862-3707 or jrayfield@tamu.edu, or you may also contact the Protocol Director, A. Brant Poe, at 979-845-6059 or brant_poe@tamu.edu.

Rev: 9/12/12

APPENDIX J

STUDY INFORMATION SHEET

TEXAS A&M UNIVERSITY HUMAN SUBJECTS PROTECTION PROGRAM

INFORMATION SHEET

Project Title: **Influence of Collegiate Livestock Evaluation in Developing Critical Thinking Skills**

TAMU IRB#2014-061D Approved: 07/28//2015 Expiration Date: 07/15/2016

You are invited to take part in a research study being conducted by John Rayfield, a researcher from Texas A&M University and funded by Texas A&M San Antonio Livestock Exposition Chair, Chris Skaggs, PhD.

The information in this form is provided to help you decide whether or not to take part. If you decide you do not want to participate, there will be no penalty to you, and you will not lose any benefits you normally would have.

Why Is This Study Being Done?

The purpose of this study is to determine the effectiveness of participation on a collegiate livestock evaluation team in enhancing critical thinking skills in students.

Why Am I Being Asked To Be In This Study?

You are being asked to be in this study because you have been a member of an active collegiate livestock evaluation team.

How Many People Will Be Asked To Be In This Study?

Twenty five people will be invited to participate in this study locally. Overall, a total of one hundred people will be invited at four study centers.

What Are the Alternatives to being in this study?

The alternative to being in the study is not to participate.

What Will I Be Asked To Do In This Study?

Participants will be asked to complete a questionnaire designed to determine specific demographic information of the evaluation team members and will identify peers with similar demographic backgrounds such that a comparison group can be made. The primary instrument that will be used to examine the collegiate livestock evaluation team member's level of critical thinking skills is the Watson-Glaser™ II Critical Thinking Assessment Form E: Profile Report.

Your participation in this study will last approximately forty five minutes and will be completed in one single setting.

Visit 1

This visit will last approximately forty five minutes. During this visit, participants will be asked to complete a questionnaire designed to determine specific demographic information of the evaluation team members and will identify peers with similar demographic backgrounds such that a comparison group can be made. The primary instrument that will be used to examine the collegiate livestock evaluation team member's level of critical thinking skills is the Watson-Glaser™ II Critical Thinking Assessment Form E: Profile Report.

Are There Any Risks To Me?

The things that you will be doing are no more risks than you would encounter in everyday life. Although the researchers have tried to avoid risks, you may feel that some questions/procedures that are asked of you will be stressful or upsetting. You do not have to answer anything you do

Version Date: February 20, 2016

Page 1 of 2

TEXAS A&M UNIVERSITY HUMAN SUBJECTS PROTECTION PROGRAM
INFORMATION SHEET

not want to. Information about individuals who may be able to help you with these problems will be given to you.

Will There Be Any Costs To Me?

Aside from your time, there are no costs for taking part in the study.

Will I Be Paid To Be In This Study?

You will not be paid for being in this study.

Will Information From This Study Be Kept Private?

The records of this study will be kept private. No identifiers linking you to this study will be included in any sort of report that might be published. Research records will be stored securely where only Dr. John Rayfield and A. Brant Poe will have access to the records. All information about you will be stored in a locked file cabinet; computer files protected with a password.

Information about you will be kept confidential to the extent permitted or required by law. People who have access to your information include the Principal Investigator and research study personnel. Representatives of regulatory agencies such as the Office of Human Research Protections (OHRP) and entities such as the Texas A&M University Human Subjects Protection Program may access your records to make sure the study is being run correctly and that information is collected properly. Information about you and related to this study will be kept confidential to the extent permitted or required by law.

Who may I Contact for More Information?

You may contact the Principal Investigator, John Rayfield, PhD., to tell him/her about a concern or complaint about this research at: 979-862-3707 or jrayfield@tamu.edu. You may also contact the Protocol Director, A. Brant Poe at: 979-845-6059 or brant_poe@tamu.edu

For questions about your rights as a research participant; or if you have questions, complaints, or concerns about the research, you may call the Texas A&M University Human Subjects Protection Program office at (979) 458-4067 or irb@tamu.edu.

What if I Change My Mind About Participating?

This research is voluntary and you have the choice whether or not to be in this research study. You may decide to not begin or to stop participating at any time. If you choose not to be in this study or stop being in the study, there will be no effect on your student status, medical care, employment, evaluation or relationship with Texas A&M University.

By completing the questionnaire and survey, you are giving permission for the investigator to use your information for research purposes.

Thank you.

John Rayfield, PhD

A. Brant Poe

APPENDIX K

CONSENT FORM

TEXAS A&M UNIVERSITY HUMAN SUBJECTS PROTECTION PROGRAM

CONSENT FORM

Project Title: **Influence of Collegiate Livestock Evaluation in Developing Critical Thinking Skills**

TAMU IRB#2014-061D Approved: 07/28//2015 Expiration Date: 07/15/2016

You are invited to take part in a research study being conducted by John Rayfield, PhD, a researcher from Texas A&M University, and funded by Texas A&M's San Antonio Livestock Exposition Chair, Chris Skaggs, PhD. The information in this form is provided to help you decide whether or not to take part. If you decide to take part in the study, you will be asked to sign this consent form. If you decide you do not want to participate, there will be no penalty to you, and you will not lose any benefits you normally would have.

Why Is This Study Being Done?

The purpose of this study is to determine the effectiveness of participation on a collegiate livestock evaluation team in enhancing critical thinking skills in students.

Why Am I Being Asked To Be In This Study?

You are being asked to be in this study because you have been a member of an active collegiate livestock evaluation team.

How Many People Will Be Asked To Be In This Study?

Approximately twenty five people will be invited to participate in this study locally. Overall, a total of one hundred people will be invited at four study centers.

What Are the Alternatives to being in this study?

The alternative to being in the study is not to participate.

What Will I Be Asked To Do In This Study?

Participants will be asked to complete a questionnaire designed to determine specific demographic information of the evaluation team members and will identify peers with similar demographic backgrounds such that a comparison group can be made. The primary instrument that will be used to examine the collegiate livestock evaluation team member's level of critical thinking skills is the Watson-Glaser™ II Critical Thinking Assessment Form E: Profile Report.

Your participation in this study will last approximately forty five minutes and will be completed in one single setting.

Visit 1

The entire visit will last approximately forty five minutes. During this visit participants will be asked to complete a questionnaire designed to determine specific demographic information of the evaluation team members and will identify peers with similar demographic backgrounds such that a comparison group can be made. The primary instrument that will be used to examine the collegiate livestock evaluation team member's level of critical thinking skills is the Watson-Glaser™ II Critical Thinking Assessment Form E: Profile Report.

TEXAS A&M UNIVERSITY HUMAN SUBJECTS PROTECTION PROGRAM
CONSENT FORM

Are There Any Risks To Me?

The things that you will be doing are no more risks than you would encounter in everyday life. Although the researchers have tried to avoid risks, you may feel that some questions/procedures that are asked of you will be stressful or upsetting. You do not have to answer anything you do not want to. Information about individuals who may be able to help you with these problems will be given to you.

Will There Be Any Costs To Me?

Aside from your time, there are no costs for taking part in the study.

If you suffer any injury as a result of taking part in this research study the sponsor of this study, Texas A&M's San Antonio Livestock Exposition Chair, will pay for reasonable and necessary medical expenses if the injury is a direct result of taking the study medicine or undergoing study procedures, and not due to the natural course of any underlying disease or treatment process. You should report any such injury to John Rayfield, 979-862-3707. You will not give up any of your legal rights by signing this consent form.

Side effects (injury) can happen in any research study. These effects may not be your fault or the fault of the researcher involved. Known side effects have been described in the "Are there any risks to me?" section of this consent form. However, side effects that are not currently known may happen and require care. You do not give up any of your legal rights by signing this form.

Will I Be Paid To Be In This Study?

You will not be paid for being in this study.

Will Information From This Study Be Kept Private?

The records of this study will be kept private. No identifiers linking you to this study will be included in any sort of report that might be published. Research records will be stored securely where only Dr. John Rayfield and A. Brant Poe will have access to the records.

People who have access to your information include the Principal Investigator and research study personnel. Representatives of regulatory agencies such as the Office of Human Research Protections (OHRP) and entities such as the Texas A&M University Human Subjects Protection Program may access your records to make sure the study is being run correctly and that information is collected properly.

Information about you and related to this study will be kept confidential to the extent permitted or required by law.

TEXAS A&M UNIVERSITY HUMAN SUBJECTS PROTECTION PROGRAM

CONSENT FORM

Who may I Contact for More Information?

You may contact the Principal Investigator, John Rayfield, PhD., to tell him/her about a concern or complaint about this research at 979-862-3707 or jrayfield@tamu.edu. You may also contact the Protocol Director, A. Brant Poe, at 979-845-6059 or brant_poe@tamu.edu

For questions about your rights as a research participant; or if you have questions, complaints, or concerns about the research, you may call the Texas A&M University Human Subjects Protection Program office at (979) 458-4067 or irb@tamu.edu.

What if I Change My Mind About Participating?

This research is voluntary and you have the choice whether or not to be in this research study. You may decide to not begin or to stop participating at any time. If you choose not to be in this study or stop being in the study, there will be no effect on your student status, medical care, employment, evaluation or relationship with Texas A&M University.

STATEMENT OF CONSENT

I agree to be in this study and know that I am not giving up any legal rights by signing this form. The procedures, risks, and benefits have been explained to me, and my questions have been answered. I know that new information about this research study will be provided to me as it becomes available and that the researcher will tell me if I must be removed from the study. You may ask more questions if you want by contacting the Principal Investigator, John Rayfield, PhD., at 979-862-3707 or jrayfield@tamu.edu, or you may also contact the Protocol Director, A. Brant Poe, at 979-845-6059 or brant_poe@tamu.edu .

A copy of this entire consent form will be given to me.

Participant's Signature

Date

Printed Name

Date

INVESTIGATOR'S AFFIDAVIT:

Either I have or my agent has carefully explained to the participant the nature of the above project. I hereby certify that to the best of my knowledge the person who signed this consent form was informed of the nature, demands, benefits, and risks involved in his/her participation.

Signature of Presenter

Date

Printed Name

Date

APPENDIX L

EXAMPLE INTRODUCTORY EMAIL

Example Introductory Email

Brant Poe,

You have been registered to take a demo assessment provided by Pearson. The assessment(s) you are to take is the Watson-Glaser™ II Form E: Profile Report, and I am your Test Administrator.

To take the assessment, click the following link:

<https://tara.vitapowered.com/TestEngine/TestLauncher.aspx?batteryID=4e872acc-da30-4841-86bd-dec4a4860bef&key=pmmRVp2GVweFOKH1Ewz5vqLvJruQRIANQddJ-h6PCls1>.

Follow the directions on the screen. If the link generates an error, instead of clicking the link directly, copy and paste the link into your browser.

If you have technical problems reaching the assessment, go to

<https://tara.vitapowered.com/barbrabasic> and click on the "Forgot your Info" link. An email will be sent to you with additional information.

Your assessment will expire on 04/02/2016.

For any additional questions, contact me.

Barbra-Ann Frazier

2103398454

barbra-ann.frazier@pearson.com

APPENDIX M

DEMOGRAPHIC SURVEY

Demographic Survey

Incorporated into the WGCTA Assessment

Please indicate your gender by selecting the appropriate response

Options (Male, Female)

Date of Birth: MM/DD/YYYY

Please indicate your current classification:

Options (Freshman, Sophomore, Junior, Senior, Graduate)

Please list the state from which you graduated high school. (Ex. CA, OK, TX)

Please indicate your cumulative college GPA by selecting the appropriate range:

Options (< 1.99; 2.0-2.49; 2.50-2.99; 3.0-3.49; >3.50)

Select your perceived strongest area within a collegiate livestock judging contest.

Options (Cattle, Swine, Sheep, Goats, Oral Reasons)

Select your perceived weakest area within a collegiate livestock judging contest.

Options (Cattle, Swine, Sheep, Goats, Oral Reasons)

I have competed in a collegiate livestock judging contest as a freshman representing a junior/community college:

Options (Yes; No)

I have competed in a collegiate livestock judging contest as a sophomore representing a junior/community college:

Options (Yes; No)

I have competed in a collegiate livestock judging contest representing a senior college.

Options (Yes; No)

Demographic Survey

Incorporated into the WGCTA Assessment-page 2

How many total collegiate livestock judging contests have you participated in?

Across your collegiate judging career, how many times have you finished among the Top 10 Individuals in Oral Reasons?

Across your collegiate judging career, how many times have you finished among the Top 10 Individuals Overall?

Please select your years of experience judging livestock in 4-H prior to joining the collegiate program.

 Options (1-12)

Please select your years of experience judging livestock in FFA prior to joining the collegiate program.

 Options (1-12)

APPENDIX N

ASSESSMENT INTRODUCTION EMAIL

Assessment Introduction Email

Test Test,

You have been registered to take an assessment for Texas A&M Allen Poe. The assessment(s) you are to take is the Watson-Glaser™ II Form E: Profile Report, and I am your Test Administrator.

To take the assessment, click the following link:

https://tara.vitapowered.com/TestEngine/TestLauncher.aspx?batteryID=743b25e6-be2d-41b6-9fea-fb34d88f372b&key=9IIN6XZcncdtoB73me_hSZWTNL5zROMhK7HuCOMAkB41.

Follow the directions on the screen. If the link generates an error, instead of clicking the link directly, copy and paste the link into your browser.

If you have technical problems reaching the assessment, go to

https://tara.vitapowered.com/TexasAM_AllenPoe and click on the "Forgot your Info" link. An email will be sent to you with additional information.

Your assessment will expire on 02/21/2016.

For any additional questions, contact me.

Barbra-Ann Frazier

210-339-8454

barbra-ann.frazier@pearson.com

APPENDIX O

TEST REMINDER EMAIL

Reminder Email

Test Test,

It has been 15 days since you were contacted to complete your assessment. Please complete the assessment as soon as possible, or contact your administrator if you have questions.

You have been registered to take an assessment for Texas A&M Allen Poe. The assessment(s) you are to take is the Watson-Glaser™ II Form E: Profile Report, and I am your Test Administrator.

To take the assessment, click the following link:

https://tara.vitapowered.com/TestEngine/TestLauncher.aspx?batteryID=743b25e6-be2d-41b6-9fea-fb34d88f372b&key=9IIN6XZcncdtoB73me_hSZWTNL5zROmhK7HuCOMAkB4I

Follow the directions on the screen.

If you have technical problems reaching the assessment, go to https://tara.vitapowered.com/TexasAM_AllenPoe and click on the "Forgot your Info" link. An email will be sent to you with additional information.

Your assessment will expire on 02/21/2016.

For any additional questions, contact me.

Barbra-Ann Frazier

210-339-8454

barbra-ann.frazier@pearson.com

APPENDIX P

PEARSON TEST INSTRUMENT APPROVAL

College of Agriculture and Life Sciences
Department of Animal Science

A. Brant Poe
Livestock Judging Coordinator & Lecturer



May 19, 2016

Pearson TalentLens

19500 Bulverde Rd. Ste. 201

San Antonio, TX 78259

Dear Barbra-Ann Frazier,

I am completing a doctoral dissertation at Texas A&M University within the Department of Animal Science entitled Influence of Collegiate Livestock Evaluation in Developing Critical Thinking Skills. I am enrolled in the Pearson RAP #1790325 and I am asking for your permission to reprint in my dissertation excerpts from the Watson –Glaser™ II Critical Thinking Appraisal Form E Assessment.

The excerpts to be utilized are in reference to the Watson –Glaser™ II Critical Thinking Appraisal Form E:

Watson-Glaser II–Form E Overall Critical Thinking Norm for the 3-4 years of college (2014)

Sample questions and subtest directions to be used in the Methods Section or Appendix as provided by Pearson

Raw Score Ranges and Subscale Results for 3-4 years of college (2014)

Warning: No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, or any information storage and retrieval system, without permission in writing from the copyright owner.

My dissertation will be produced electronically and made available to the public on the Web through Texas A&M University Libraries. I am requesting permission to include the excerpts in current and future revisions and editions of my dissertation, and to grant others the right to reproduce my entire dissertation, including the excerpts described above, for educational, non-commercial purposes. These rights will in no way limit republication of the material in any other form by you or others authorized by you.

Your signing will verify that your company owns the copyright to the above material.

If this meets with your approval, please sign this letter below and return it to me in the enclosed return envelope. Thank you very much for your attention to this matter.

Sincerely,

A. Brant Poe

PERMISSION GRANTED FOR THE USE REQUESTED ABOVE: Pearson TalentLens

By:

Title Senior Research Associate

Date: 5/19/2016

Kleberg Center, Rm. 116B

2471 TAMUJ

College Station, TX 77843

Tel. 979.845.6059 Fax 979.845.3294

Brant_poe@tamu.edu

APPENDIX Q

WGCTA INSTRUCTIONS AND SAMPLE QUESTIONS

WGCTA Instructions and Sample Questions

From: Watson and Glaser, 2010

Printed with permission

Test 1: Infer

Directions

An inference is a conclusion a person can draw from certain observed or supposed facts. For example, if the lights are on in a house and voices can be heard coming from the house, a person might infer that someone is at home. But this inference may or may not be correct. Possibly the people in the house did not turn the lights and the television off when they left the house.

In this test, each exercise begins with a statement of facts that you are to regard as true. After each statement of facts you will find several possible inferences - that is, conclusions that some persons might draw from the stated facts. Examine each inference separately, and make a decision as to its degree of truth or falsity.

For each inference you will find five choices of answers: **True**, **Probably True**, **Insufficient Data**, **Probably False**, and **False**. For each inference click on the circle beside the appropriate answer. Choose your answers as follows:

True if you think the inference is definitely TRUE; that it properly follows beyond a reasonable doubt from the statement of facts given.

Probably True if, in the light of the facts given, you think the inference is PROBABLY TRUE; that it is more likely to be true than false.

Insufficient Data if you decide that there are INSUFFICIENT DATA; that you cannot tell from the facts given whether the inference is likely to be true or false; if the facts provide no basis for judging one way or the other.

Probably False if, in the light of the facts given, you think the inference is PROBABLY FALSE; that it is more likely to be false than true.

False if you think the inference is definitely FALSE; that it is wrong, either because it misinterprets the facts given, or because it contradicts the facts or necessary inferences from those facts.

Sometimes, in deciding whether an inference is probably true or probably false, you will have to use certain commonly accepted knowledge or information that practically every person has. This will be illustrated in the example that follows.

Look at the inferences in the following example; the correct answers are indicated.

Please click the **Next Page** button to continue.

Test 1: Infer

Example

Two hundred students in their early teens voluntarily attended a recent weekend student conference in a Midwestern city. At this conference, the topics of race relations and means of achieving lasting world peace were discussed, since these were the problems the students selected as being most vital in today's world.

Inference 1

As a group, the students who attended this conference showed a keener interest in broad social problems than do most other students in their early teens.

- True
- Probably True
- Insufficient Data
- Probably False
- False

Test 2: Recognize Assumptions

An assumption is something presupposed or taken for granted. When you say "I'll graduate in June," you take for granted or assume you will be alive in June, that your school will judge you to be eligible for graduation in June, and similar things.

Next are a number of statements. Each statement is followed by several proposed assumptions. You are to decide for each assumption whether a person, in making the given statement, is really making that assumption - that is, taking it for granted, justifiably or not.

If you think that the given assumption is taken for granted in the statement, click on the circle beside **"Assumption made."** If you think that the assumption is not necessarily taken for granted, click on the circle beside **"Assumption not made."** Remember to judge each assumption independently.

Next is an example. The correct answers are indicated.

Test 2: Recognize Assumptions

Example

Statement: "We need to save time in getting there so we'd better go by plane."

Proposed Assumption: Going by plane will take less time than going by some other means of transportation.

- Assumption made
 Assumption not made

Test 3: Deduce

Directions

In this test, each exercise consists of several statements (premises) followed by several suggested conclusions. *For the purposes of this test, consider the statements in each exercise as true without exception.* Read the first conclusion beneath the statements. If you think it *necessarily follows* from the statements given, click on the circle next to "Conclusion follows." If you think it is *not a necessary conclusion* from the statements given, click on the circle next to "Conclusion does not follow" even though you may believe it to be true from your general knowledge.

Likewise, read and judge each of the other conclusions. Try not to let your prejudices influence your judgment - just stick to the given statements (premises) and judge each conclusion as to whether it *necessarily follows* from the statement.

The word *some* in any of these statements means an indefinite part or quantity of a class of things. *Some* means at least a portion, and *perhaps* all of the class. Thus, "Some holidays are rainy" means at least one, possibly more than one, and *perhaps* even all holidays are rainy.

Study the example carefully before starting the test.

Please click the **Next Page** button to continue.



Test 3: Deduce

Example

Some holidays are rainy. All rainy days are boring. Therefore,...

no clear days are boring.

- Conclusion follows
 Conclusion does not follow



Test 4: Interpret

Directions

Each of the following exercises consists of a short paragraph followed by several suggested conclusions.

For the purpose of this test, assume that everything in the short paragraph is true. The problem is to judge whether or not each of the proposed conclusions logically follows beyond a reasonable doubt *from the information given in the paragraph.*

If you think that the proposed conclusion follows beyond a reasonable doubt (even though it may not follow absolutely and necessarily), click on the circle next to "Conclusion follows." If you think that the conclusion does not follow beyond a reasonable doubt from the facts given, click on the circle next to "Conclusion does not follow." Remember to judge each conclusion independently.

Look at the next example.

Please click the **Next Page** button to continue.

Test 4: Interpret

Example

A study of vocabulary growth in children from ages eight months to six years old shows that the size of spoken vocabulary increases from zero words at age eight months to 2,562 words at age six years.

None of the children in this study had learned to talk by the age of six months.

- Conclusion follows
 Conclusion does not follow

Test 5: Evaluate Arguments

Directions

In making decisions about important questions, it is desirable to be able to distinguish between arguments that are strong and arguments that are weak, as far as the question at issue is concerned. *For an argument to be strong, it must be both important and directly related to the question.*

An argument is weak if it is not directly related to the question (even though it may be of great general importance), or if it is of minor importance, or if it is related only to trivial aspects of the question.

Next is a series of questions. Each question is followed by several arguments. *For the purpose of this test, you are to regard each argument as true.* The problem then is to decide whether it is a *strong* or a *weak* argument.

When the word *should* is used as the first word in any of the following questions, its meaning is, "Would the proposed action promote the general welfare of the people in your country?"

Click on the circle next to "Argument strong" if you think the argument is strong, or on the circle next to "Argument weak" if you think the argument is weak. Judge each argument separately on its own merit. *Try not to let your personal attitude toward the question influence your evaluation of the argument, because each argument is to be regarded as true.*

In the example, note that the argument is evaluated as to how well it supports the side of the question indicated.

Please click the **Next Page** button to continue.

Test 5: Evaluate Arguments

Example

Should all young adults in this country go to college?

Yes; college provides an opportunity for them to learn school songs and cheers.

- Argument strong
 Argument weak