

ASSESSING CAREER DEVELOPMENT EVENT PLACEMENT FREQUENCIES TO EXPLORE
EVALUATION AND EQUITY IN AGRICULTURAL EDUCATION

BY

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THESIS

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Abstract

Each fall hundreds of students compete in Career Development Events (CDEs) at the National Future Farmers of America (FFA) annual convention. This study assesses trends in placement at National FFA CDE competitions and develops a parameter by which to monitor and compare success rates across states. Additionally, this study reports achievement trends by state and region to evaluate competition equity and discuss implications for diversity in agricultural education and optimizing administrative processes for CDE programming.

Using census data from national FFA archives, we identify states that hold disproportionately high and low accumulations of National FFA CDE placements, first through tenth. Each state receives a raw score and a relative achievement score (RAS). Raw scores are a weighted summation of the total number of competitions won throughout seven-year time span this study covers. A relative achievement score (RAS) is calculated for each state by normalizing state placements with respect to its population representation in the FFA organization (proportion of placements/proportion of national membership).

Within the seven-year span of 2009 and 2015, Texas, California, Missouri have the highest raw accumulation of successes at National FFA CDE competitions. When raw accumulations are converted to RAS Virginia, Connecticut, and Missouri have a much higher rate of success than the calculated expected achievement score. Both measures are an indication of advantages and disadvantages in systems of administration for student competitors. This study investigates factors that contribute to achievement in each state such as geographic location, rural population, and agricultural production. South Dakota and Colorado are consistently in the lowest RAS and Raw rankings.

Based on our findings we recommend that CDE schedules mimic that of high scoring states. Findings also denote implications for fostering workforce diversity and ensuring equity in competition between urban and rural students.

Acknowledgments

I was first introduced to the idea of studying Agricultural Education while working in agricultural chemistry industry but dreaming of becoming a teacher. Agricultural Education extraordinaire Stacey Vincent called me with the idea of becoming an agriculture teacher, and the rest became history. I sincerely thank him for connecting me with opportunity that has forever guided the path I am currently paving. Additionally, a special thank you goes to my advisor Dr. Erica B. Thieman, who has supported my development as a scholar and an individual throughout my time the Agricultural Education Program. Additionally, Ms. Debra Korte made priceless contributions of support that I cannot go without mentioning. Of course, my biggest gratitude goes to my parents and sister, without whom the trajectory of my life, academically and personally, would be very flat.

This thesis is the culmination of my two years of study at the University of Illinois' Agricultural Education (AGED) program. A biochemist by training and praxis, my tenure in AGED was a very new, very rich experience for me. AGED allowed me to maneuver my way into a social science journey that has been deeply inciting and enlightening. This experience has afforded me the opportunity to view the world through lenses and at angles that were once hidden from me and will inform my research endeavors throughout my career. Although my next steps will not include formal agricultural education, the insights I've gained have heavily shaped my research and teaching manifesto.

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Chapter 1: Introduction

Background

The history and development of formal agricultural education: Post-secondary and secondary.

Since early European immigrants to the “New Land” sought to learn to cultivate tobacco and corn cultivation from indigenous people in the 1600’s, United States populations have been seeking education on how to produce sustenance from U.S soil (Cochrane, 1993). Native Americans were among the first agricultural experimentalists and informal agricultural educators (Nabhan, 1989) and today this precedent of informally transmitting knowledge of cultivation methods from teachers to pupils, generations to generations, still takes place, informally and formally.

In the 19th century, the enduring practices of informal agricultural education evolved to include formal agriculture education pedagogy. Agriculture colleges in the U.S date back to 1855 with the inception of Agricultural College of the State of Michigan, now Michigan State University. One of the first secondary agricultural education programs can be identified as Rufus Stimson’s agriculture program at Northampton School in Massachusetts around 1908 (Foor & Connors, 2010). These pioneer programs grew rapidly throughout the following decade, and were dispersed throughout the nation, usually with little ties to one another (Foor & Connors, 2010; Hillison, 1986).

The interconnected and somewhat centralized formal agricultural education programs we know today were largely established by two major legislative events: The Morrill Act of 1862 and The Smith Hughes Act in 1917. Both acts have been identified as one of the 10 major events in the history of agricultural education (Camp & Crunkilton, 1985) and are thought to have spurred the development of agricultural education by instituting Land Grant Colleges, calling for implementation of vocational farm practice programs, defining the purpose of agricultural education, and providing federal funding for nationwide program establishment and sustenance (Stimson & Lathrop, 1942; Camp & Crunkilton, 1985). Together, these acts not only established the field of agricultural education as we know it, but created an unprecedented relationship between the USDA, Federal Education Bureaus, State Departments of Education, and classrooms. This relationship is responsible for opening the door for Public Law 740,

which offers legal fortification to agricultural education that no other vocational education programs are privileged with.

Since this cornerstone legislation, contemporary agricultural education has evolved to be well-established and developed in post-secondary and secondary classrooms throughout every state in the nation. Universities, colleges, vocational/trade schools, and high schools are charged and equipped each year with developing students with practical and theoretical knowledge in the full array of subjects that fall under the umbrella of agricultural studies. There is quite a bit of interplay between the students, programs, systems, educators, and administrator of these three levels of agricultural education. A particular connection to note is that secondary agricultural education often serves as a pipeline for agriculture trade schools, post-secondary agriculture studies, and agriculture careers.

Secondary school agricultural education.

Secondary agricultural education takes place in accredited high schools throughout the United States. For years, it has relied on the Agricultural Education Three Component Model as a theoretical definition of high school agricultural education. The three ring model defines Agricultural Education as the intersection of classroom instruction, Supervised Agriculture Experiences (SAE), and a student leadership organization called FFA to be discussed further later. There is no regulation or measure of maintaining the balance implied by the structure of the model. Therefore, teachers are given generous flexibility to have an unbalanced mixture of the three components and rarely follow the theoretical model in practice. The most common piece of the model and one part of the model that is rarely curtailed is the FFA component. FFA needs can easily direct a teacher's classroom time, guide SAE implementation, and dictate administrative decisions. In fact, 12 month contracts only existed after FFA duties began to extend to summer activities.

Intimate ties between FFA and agricultural education.

FFA is a national organization with an annual membership of over 500,000 students from all 50 states. It stands on the mission of using agricultural education to develop "...leadership, personal growth, and career success." Since its inception in 1928 this missions and FFA has been intimately tied to

secondary and post-secondary agricultural education. Behind only the legislation that formed and funds agricultural education (Morrill and Hatch Acts), the founding of FFA has been identified by agricultural education leaders and as the second most important event in the history of agricultural education (Camp & Crunkilton, 1985). In 1950, Public Law 740 granted the FFA a federal charter requiring its perpetual existence and creating a political and legal dimension to the ties between FFA and formal secondary agricultural education. This concept has been driven home graphically by the three ring model of agricultural education which advertises FFA as a fundamental part of agricultural education's existence and identity.

Generally, secondary students are urged to participate in FFA if they choose to take a single agricultural education class and usually encouraged to do so all four years. Some students do FFA without agricultural education classes, but this is rarely permitted as FFA is often written into students' grades somehow. Beyond high school, FFA perpetuates into many of the most committed students post-secondary lives, although at the University and college level the organization is not a formal component of studying agriculture. Vocational agriculture professionals also often remain very connected to FFA after secondary school.

Students, educators, and professional participants alike work diligently in the organization learning to do, doing to learn, earning to live, and living to serve. It can be argued that the motivation of this hard work comes from a variety of places, but most importantly the culture and inundation of tradition plays a large role. Students work hard to advance in FFA leadership and competition. Student officers are elevated, given unique opportunities for networking and socializing with like minds, and even international travel. This recognition and accolades could serve as an explanation for the sustained success of FFA and its ability to rule agricultural education...could be the tangible and immediate awards of FFA participation.

FFA, agricultural education, and CDEs.

Since 1947 contests have been an integral component of agricultural sciences education and the National FFA Organization. Today these contests are termed Career Development Events (CDEs) and are

an essential element in most secondary school students' agricultural education experience. At its inception CDEs were for the purpose to create better farm skills but have evolved to attempt to create well rounded agriculturalists to embark on academic or vocational futures. Successful performance in CDE competition requires the integration of conceptual knowledge attained from books, technical and vocational skills gained through Supervised Agricultural Experiences, and leadership skills developed through FFA participation (Dailey, Conroy, & Shelley-Tolbert, 2001). For top competitors, competition extends from state and often regional contests and culminates at the annual Future Farmers of America National Convention where thousands of FFA members assemble in one place for workshops, ceremonies, meetings, presentations, fraternization and salient competition for national CDE titles.

Each year tens of thousands of students participate in National CDE competitions. These students reign among the tens of thousands who have advanced in many cases from local, regional, and state competitions. There are currently 25 competitions at the national level for students to choose from. They include the following:

- | | |
|---|-----------------------------------|
| 1. Agricultural Communications | 13. Food Science & Technology |
| 2. Agricultural Issues Forum | 14. Forestry |
| 3. Agricultural Sales | 15. Horse Evaluation |
| 4. Agricultural Technology & Mechanical Systems | 16. Job Interview |
| 5. Agronomy | 17. Livestock Evaluation |
| 6. Creed Speaking | 18. Marketing Plan |
| 7. Dairy Cattle Evaluation & Management | 19. Meats Evaluation & Technology |
| 8. Dairy Cattle Handlers Activity | 20. Milk Quality & Products |
| 9. Environmental & Natural Resources | 21. Nursery/Landscape |
| 10. Extemporaneous Public Speaking | 22. Parliamentary Procedure |
| 11. Farm Business Management | 23. Poultry Evaluation |
| 12. Floriculture | 24. Prepared Public Speaking |
| | 25. Veterinary Science |

Regional, state, and district/local competitions have varying lists of competitions, sometimes adding competitions not included at nationals and most often only including an abbreviated list of those offered at national competitions. Also, the composition and implementation of the competitions vary by contests level and state. Regardless, students and teachers devote large amounts of time and effort, both in class and extracurricular time to prepare for competitions. Informal conversations with students and teachers

reveal that the average student spends several hours each week preparing for CDEs and teachers have identified preparing for the competitions as a primary source of stress.

State of diversity in agriculture and urban agriculture education.

Since its inception in 1928 FFA, then Future Farmers of America, has burgeoned, consistently adding members, developing student and community programs, and offering opportunities for vocational agriculture students to develop their skills. The goal of the organization at establishment was to provide leadership training for Caucasian farm boys (IUPUI, 2015) Nearly 40 years later the organization broadened its membership in 1965 when it engulfed the agricultural leadership organization for African-American students and in 1969 when female students were allowed national membership. Throughout these changes, however, the goal of developing leaders remained a central priority of the organization and boasts to do so still today.

The newcomers to the organization (blacks and women) were several decades behind the original demographic served by the organization, but caught up fast. Today, as times change and the face of agriculture evolves there is likely to be a comparable demographic shift as new group of students become involved in FFA, that is, if the organization makes needed changes to accommodate them. The incentive is that agriculture and FFA will need to respond to demographic shifts remain relevant.

CDEs and the FFA organization have not mimicked the amount of growth and changes that have occurred in agricultural research, vocational outlooks, demography and ethnography of the U.S., changes in land and arability and farm practices, urban farming, or the needs of a rapidly urbanizing world. The relevance of these concepts for CDEs and agricultural education will be discussed in detail in the literature review of this thesis. It is important to mention here though that since agricultural education serves as a pipeline of post-secondary education and agriculture sector it is important that all of the aforementioned changes are reflected in agricultural education. Efforts and initiatives to address these things have been made, however, programs are still concentrated in rural areas. The slow expansion of agricultural education programs to urban areas is underway, but will come with a learning curve.

Literature has addressed perceptions of students in urban settings that may contribute to this learning curve, but few explore programmatic or systematic setups that induce or inhibit success. The system is never the subject, only the students who we want to fit into the system. Further, agricultural education is fairly comfortable with the current conditions and programs. Its homey space that agriculture students flock to for comfort and a family feel. Change becomes a threat to this safe haven and thwarts a whole hearted effort to make progress that reflect the needs of the nation.

Problem Statement, Purpose, and Research Questions

CDEs are an integral part of formal agricultural education. The contests are used within classrooms to develop students' technical and professional skills as well as their character and leadership abilities. State and national CDE victories are rewarded through plaques and monetarily in the form of scholarships to be applied toward post-secondary education (Franklin & Armbruster, 2012). Additionally, there are implicit rewards including exposure to notable professionals in the agricultural sector, name recognition, and networking opportunities. Skills coupled with access to sponsors connect the CDE winners to opportunities to employ their abilities beyond the FFA/CDE realm and contribute to students' ability to make career decisions related to the agriculture industry (Marx, Simonsen, & Kitchel, 2014). Therefore, systematically, CDEs serve as not only student development but also largely determine the trajectory of a student's path in their post-secondary vocation and in higher education. As such, it is vital for CDE contests to be evaluated to ensure all student participants are fairly competing for exposure at National FFA CDEs. Anecdotally, we observed trends where the same states and even same school are repeatedly winning. If we assume normal distribution of student ability, states should have equal opportunity at success.

Methods of evaluation should enable us to identify and understand systemic factors which impact student success at CDE competitions. Application of insights gained through CDE evaluation can translate to improvement of agricultural education programs for students nationwide through more equal access to opportunities gained by those achieving success at the National CDE level. This evaluative

information can be used to increase consistency among the states in program preparations, resources, and know-how that arises from repeated success. These changes could reduce the disparity in institutional knowledge base which could disproportionately benefit well-established programs over newly-established programs.

This study will evaluate the broad spectrum of National CDE competitions by determining the frequency of CDE placement occurrences by state. The numbers will allow us to assess the equity of contest structures and systems. The study will also explore what systemic factors contribute to states achievement levels and analyze trends in efforts to predict how changes in structure and methods of preparation can heighten winning potentials.

This study asks the following questions in its evaluation:

1. Raw vs RAS: What is a good measure for achievement in FFA CDEs?
2. How do geographic trends contribute to CDE achievement capacity?
3. How can we utilize RAS for evaluation?
 - a. Are CDEs distributed throughout individual states?
 - b. Does RAS vary between states that utilize a single annual window of competition and those the utilize competition throughout the academic year? t-test (1 sample t-test)

Research Framing and Contributions

Theoretical framework.

Our study is driven by the principles of Social Cognitive Career Theory (SCCT; Lent, Brown, & Gail, 1994) and the Structure of Competition proposed by Ronald S. Burt (Burt, 1993). Social Cognitive Career theory explains the social dynamics that motivate a student interests and goals related to career choice. It has been used to evaluate and predict career choices in specific fields (Rowan-Kenyon, Swan, & Creager, 2012), among specific ethnicities (Rasheed-Ali & Menke, 2014; Liao & Ji, 2015; Zhang & Zhang, 2012), and various age groups. Burt's work proposes three forms of capital (financial, human, and social) that are the primary contributors to competition performance. This work speaks of economic

competition but has been modified and adapted to the situational context of CDEs in the conceptual model in Figure 1.

When applied to the scheme of CDEs together, these theories can be used to explain why evaluation of CDE successes is related to students' post-secondary success. In particular, we can create a quantitative comparison of where CDEs are won most frequently by state to identify loci of privilege. We can identify factors that contribute to disproportionate success and uncover practices for arranging and preparing for CDEs in more uniform and most equitable manners.

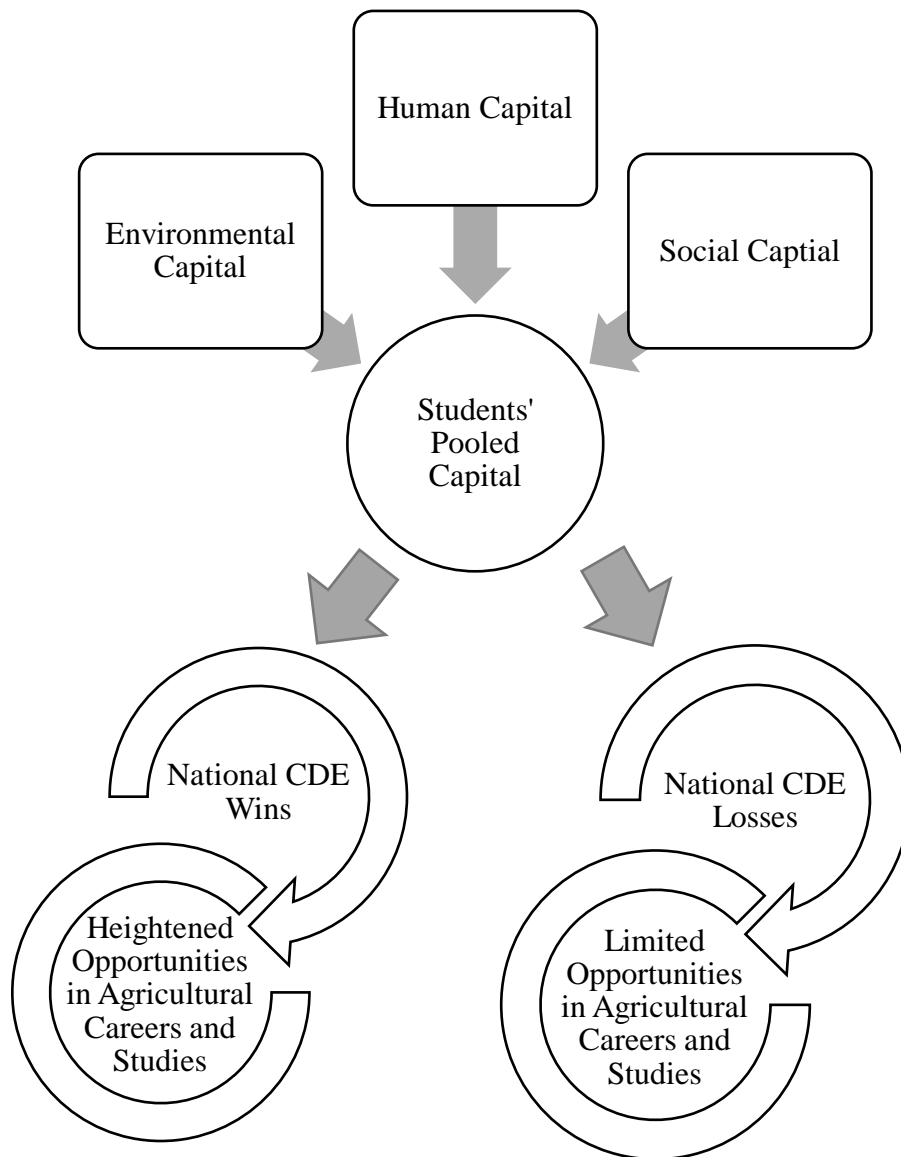
Conceptual model.

Our adaption of Burt's theory posits that student competitors to bring environmental capital, human capital, and social capital to the CDE competition arena. Environmental capital is any form of pre-exposure, real-world practice, or other practical experience related to the area of competition. A students' human capital includes their health (mental and physical), personality disposition, stature, and other natural abilities that increase a student's competitive abilities. Finally, social capital includes all social connectedness that increases the competitors' adeptness or readiness in competition. Connections can include teachers, coaches, prior competitors, familial supports, local vendors or others equipped to heighten the student's competitive edge. Ultimately, it is this competitive edge CDE success allows students to experience the full potential of their abilities and develop positive outcome expectancies. SCCT predicts that the positive outcome expectancies direct students' interests, goals, and performance. Figure 1 is a visual diagram of this conceptual model.

Procedures.

The findings relied on data from the National FFA archives. The archived data provided winners of all national CDE competitions for the seven-year span of 2009 through 2013. Top ranking teams (1st through 10th place) are extracted to determine trends of success by specific attributes of state-level competitions. The data were normalized by taking into consideration FFA member enrollment for each state to calculate RAS.

Figure 1. Conceptual model depicting students' capital mediating their opportunities.



Significance and limitations.

The aim of our study is develop a simple way to assess and compare CDE achievement. Use of the comparisons can answer questions concerning best practices in CDE competition structures. Further, we aim to discuss our assessment of CDE achievement in the in the broader context of effective and equitable competition structures and schedules. Long-term goals are to establish a reliable prediction model by which educators can determine ways to prepare for CDEs and monitor inputs (educational or

otherwise) into the competition. Teachers can determine what is important based off the data. We will use our answers to these questions initiate discussions about equity, secondary agricultural educator attrition rates, and workplace diversity, and their relationship to CDEs, Agriculture Education, and FFA.

This study, merely quantitative in nature is not able to capture the personal experiences of individual students and programs. Additionally, the numbers do not capture or predict the drivers of CDE success and failures. Finally, our assessments depend only on teams that compete at the national level.

Organization.

Following this introduction will be a literature review to discuss previous CDE evaluation and situate the history leading to today's agricultural education needs. Methods used to collect and analyze data will be described in Chapter 3. Chapter 4 presents the results of winningest states by regions, rankings, and decreasing scores and compares evaluations measures. Chapter 5 will discuss the utility of each measure of CDEs, the implications of the rankings and scores of each state, and the story they tell about equity in FFA contests.

Chapter 2: Review of Literature

FFA is a national student organization with an annual membership of over 500,000 students from all 50 states. It stands on the mission of using agricultural education to develop "...leadership, personal growth, and career success" (National FFA, 2016). Since its inception in 1928 this mission and FFA has been intimately tied to secondary and post-secondary agricultural education. In 1950, Public Law 740 granted the FFA a federal charter requiring its perpetual existence and creating a political and legal dimension to the ties between FFA and formal secondary agricultural education. This concept has been driven home graphically by the three ring model of agricultural education which advertises FFA as a fundamental part of agricultural education's existence and identity.

Since 1947 contests have been an integral component of agricultural sciences education and the National FFA Organization. Today these contests are termed Career Development Events (CDEs) and are an essential element in most secondary school students' agricultural education experience. At its inception CDEs were for the purpose to create better farm skills but have evolved to attempt to create well rounded agriculturalists to embark on academic or vocational futures. For top competitors, competition extends from state and often regional contests and culminates at the annual Future Farmers of America National Convention where thousands of FFA members assemble in one place for workshops, ceremonies, meetings, presentations, fraternization and salient competition for national CDE titles.

Currently, there is no universal system to evaluate or compare CDE competitions and competitors. It is unclear if CDEs are accomplishing their objectives of student development and importantly who is experiencing the benefits of these contests (find citation that lays out CDE goals/purpose). Contests are widely perceived to be worthwhile and interesting educational activities and viewed as motivational tool for student achievement throughout the agricultural education community. However, their utility is merely theoretical at best and traditional propaganda at worst (Croom, 2008). Reports of systematic analyses and monitoring of CDE achievement is not readily available, yet is

pertinent to implementing equitable contest that will provide the readily increasing and diversifying agricultural sector.

Coupled with limited evaluation of programming is limited evolution and development of the contests themselves. Despite much evolution in the field of agriculture and education, CDE competition has had limited evolution since its inception in 1947. The number of contests has grown and some contests have changed the components or names of their contests, however, the core of National CDE competition remained unchanged. This steadfastness overtime brings about many questions: Are the systems in place still effective? Are they designed to allow all students development in vocational agriculture and success at competition? Will they sustain and develop 21st agriculturalists? Methods of evaluation and regular evaluation can enable these questions to be answered. This study is a stepping stone to allow such evaluation to become a part of the CDE tradition.

Due to indispensable academic, professional, and personal benefits of student participation in CDEs, it is of vital importance that all student competitors are equipped to compete at their maximum capacities and highest levels of cognitive and vocational development. Therefore, it is important to ensure that the policies that govern competition afford the opportunity for each willful student to have equally probable chances of success. This is particularly important at the current time as urban populations are forced to become more invested in agricultural issues. This changing demography of the agricultural industry and interests in issues of agriculture and the environment (Bowen, 2002) requires much intentionality in creating educational environments and cultures conducive to the success of both urban and rural populations in agricultural education. Particularly, it is displayed throughout history that educational systems can “track” students in order to direct the academic trajectory of their lives (Hallinan, 2011; Oakes, 1986). CDE competition administration must be deliberate to not propagate processes such as this tracking, often detrimental to the students.

More broadly, this study can offer insights to the engagement of Agricultural Education and the three ring model definition that is imposed on secondary Agricultural Education programming. Other

components of the model that have been identified to lack consistency include implementation, supervision, evaluation, and systematically proven value and agricultural educators are working consistently to add components to programs that keep it relevant to student and communities (Brown & Kelsey, 2013; Dyer & Williams, 1997; Woods, 2004; Zwilling, 2015). The efficacy of Agricultural Education can be studied on various levels and this study recognizes CDEs as only a single of many necessary evaluations of FFA CDEs and Agricultural Education programs at the secondary and post-secondary level. It is effective to begin evaluations of efficacy of agricultural education programming with a look at equity in CDEs because they can be directly tied into students futures in the agricultural industry. Additionally, CDEs demonstrate student knowledge trans-disciplinarily due to the contests' format allowing for the intersection of students' book knowledge, leadership, and vocational skills attainment. Anecdotally, we have observed that in some states agricultural education culture finds much value and gratification in CDEs, and therefore is an influential driver for classroom curriculum, motivating students, and engaging teachers.

This literature review aims to situate the study of CDEs by addressing the following three topics: prior knowledge of CDE evaluation, historical and contemporary events that shape agriculture and its educational systems, and sociological conditions that shape changes in the agriculture sector and agricultural education. The review has the following three objectives.

- 1) Summarize prior assessments of CDEs noting their strengths, contributions, and limitations
- 2) Provide historical context for the disconnection between agricultural education and urban centers where new programs are needed.
- 3) Note contemporary growth trends in agriculture, jobs, and student population vocationally and academically
- 4) Tie the previous three objectives to the need for evaluation of CDEs

Previous Evaluations of CDEs

FFA Career Development events have been evaluated in the past. These examinations, have been limited to an evaluation of a single contest or a rudimentary evaluation on the needs of CDEs. A needs assessment of CDE's conducted in the 1980s emphasized the importance of regular CDE evaluation, suggesting that it occur every three years (Smith & Kahler, 1987) but the practice has not been adopted. No literature to date has affirmed or contested this call for regular evaluation of CDE administration. However, a 1986 study "demonstrate[d] the utility of contest score evaluation and the need for further evaluation" (Buriak, Harper, & Gliem, 1986). The study recommended that "National FFA Contests should be internally evaluated, not only in the area of significant differences in contestants' scores, but also in the area of score prediction and trend analysis" (Buriak, Harper, & Gliem, 1986). This need is imperative because it is argued that the national contest represents and impacts all 500,000 students who are enrolled in secondary agricultural education programs and participate in FFA (Smith & Kahler, 1987).

Nearly two decades beyond the suggested follow-up period, another evaluation of CDE scores in the Agricultural Mechanics contest was undergone (Franklin & Armbruster, 2012). The study confirmed results from the 1986 publication that significant differences in scores were present between regions. Specifically, both studies demonstrate that the central region outperformed others. Both studies also agreed the written examination had the highest contribution to the total variance in contestants' total score. Findings from a third study, this one a 1984 evaluation of factors associated with success in National Livestock Judging Contest, concurs that the Central region outperformed others (Herren, 1984). Other evaluations of single contests or all contests are not present in recent literature. The relationships among these existing evaluations are significant because it shows that nothing has changed between evaluations and highlights the need for on-going evaluation.

Changes to the design of the agricultural mechanics contest did occur between the 1986 and 2012 evaluative studies. Changes were not in response to any known literature or systematic research. This may explain the lack of difference in student achievement outcome between the two studies, since students are

observed to perform the same before and after changes are implemented. One very beneficial outcome of the 2012 study was a much needed model for conducting evaluation of the national agricultural mechanics CDE. It could serve as a model for other contests which collectively could inform broad range studies of all 24 such as this one.

Another moderately related study explored students Career Decision Self Efficacy (CDSE) as it related to their agricultural education experience. Several components of agricultural education were assessed to inquire about their influence on how ready a student believes they are to make appropriate career decisions. The tool used for the study assessed five career constructs (occupational information, goal selection, planning, self-appraisal, problem solving) and found low correlations in the relationships between 4 of 5 constructs and CDEs. Negligible correlations were found in the remaining construct. The sample population for this study, however, ranged from students who never competed in CDE competition (30%) to those who have competed at National Competition (7%). Our study focuses on solely the highest achieving students in CDEs, the upper end of the study's spectrum. Carrying out the CDSE experiment by sampling only the population of student competing at the national level, we predict, would likely show high correlations in the CDSE and CDE participation.

In fact, an evaluation of Oklahoma teachers who coached 1st place State teams in 2012 and 2013 show that teachers overwhelmingly agree that these top tier students are highly benefitted from CDE participation in career readiness (Lundry, Ramsey, Edwards, & Robinson, 2015). 93% of teachers in the study believe that CDEs expose students to specific agricultural careers and that students in CDEs have a greater likelihood of pursuing agriculture careers. 80% - 90% agree on the development of 24 skills. 84% believe CDEs deepen agricultural knowledge. 79% believe CDEs creates motivation to explore agricultural career interests. This belief in the power of CDEs conveys the importance of the ongoing analysis of CDE scores. "Investigations of the prediction value of selected variables could prove useful in the development and enhancement of the contests. The use of trend analysis could explore the progress of contestants' scores in the various areas of a contest and may indicate areas needing particular attention"

(Buriak, Harper, & Gliem, 1986, pg. 5). Moreover, other studies have shown that CDE participation boosts confidence and the Lent framework would support that the components of CDEs provided provide the path to career choice in agriculture fields.

Finally, a 1993 study showed that contestants characteristics, such as age, calculator use, grades, farm experience, previous courses in agricultural education or math show only low to moderate correlation to agricultural mechanics CDEs, which was also previously demonstrated by a 1984 livestock contest evaluation study (Herren, 1984; Johnson, 1993). None of the aforementioned agricultural mechanics CDE evaluations were able to produce a high correlation between contest factors or account for the variance in scores more than 35%. This leads me to believe studies, such as the one we are undergoing, are necessary to assess the broad range of all scores as it relates to systemic issues that may be able to provide explanation for the unaccounted variance. Additionally, our study can inform the development of professional development modules teachers have an overwhelming desire for and shape practices (Harris, 2008).

Urbanization and Agricultural Education

Immediately after the U.S civil war, during a time known as the reconstruction era, and continuing even today “the clearing and/or dispossession of subsistence farmers and herders from common land has resulted in the proletarianization of rural populations who flood into urban centers in search of work” (Mcclintock & McClintock, 2010, pg. 6). While some rejoiced in the prospect of taking on a new livelihood in cities, many others viewed the initial trends of urbanization as ‘systematic theft of communal property [that]...in ‘set free’ the agricultural population as a proletariat for the needs of industry” (Du Bois & Lewis, 1935; Marx, Mandel, & Fowkes, 1976, pg 886; McClintock, 2010, pg 6). The black farmer was most severely urged to migrate to urban centers by unsatisfactory economic opportunities, harsh segregationist laws, and a desire for physical safety. This is referred to as the Great Migration or Black Migration which is documented to have occurred between 1916 and 1975, but is known to have begun as early as 1877 (Du Bois & Lewis, 1935; Lemann, 1991). Beyond the displaced

and dispossessed Afro-descendants and European settlers, immigrants to the US traditionally live outside of US rural areas reflecting that most rural counties have less than 1.2% representation of foreigners and a national average of approximately 5% of foreign born immigrants residing in rural areas (U.S Department of Agriculture [USDA], 2013). The 5% are most heavily represented by Hispanic immigrants located in the southwest regions of the country (Jensen, 2006; USDA, 2013)

Industrialization, commercialization, and corporatization of agriculture within the last 3 decades further stabilize the demographic dichotomy between rural and non-rural U.S populations. “The rise of large- and industrial-scale farming has entailed the consolidation of land and expansion of mechanization and other new farming technologies, both of which reduce the demand for agricultural labor” (McClintock, 2010, pg. 6). 21st century agricultural practices, such as monocropping, are often imbued with economic motivations of corporations and are implemented at the expense of rural communities’ economic, social, and environmental health (“Corporatization of American Agriculture,” n.d.; Gray & Boehlje, 2007; Williams, Kenneth, Fellow, & Street, n.d.). These practices and imperialistic motivations fostered further disablement to repossess land and place potential metropolitan agriculturalists in food production and agricultural economy and are sustained by the wealth of a few corporate conglomerates. Current farmers benefit because conglomerates offset the discriminating burden of debt that farmers once incurred but it comes at the expense of loyalty to conglomerate products and policies that makes both parties profits, but disproportionately more for the corporations. Neither party can afford to allow social or demographic changes that alter the somewhat symbiotic (or possibly parasitic) relationship between farmers and corporations.

Whether perceived as positive or negative, the on-going displacement of farmers filtered out all except a very specific subset of Americans from agricultural production, resulting in the demographically homogenous rural U.S. and densely and diversely populated metropolitan U.S. Industrialization, commercialization and corporatization of agriculture encourage and stabilize the rural populations’ post-industrial agricultural practices and economy we know today. Together, the socio-political events help us

connect the history and development of agriculture to current structures of agricultural and provide a backdrop for the observed disconnection of urbanites from agriculture and agricultural education. Given this historical context in addition to the southern agrarian ideologies that are the foundations of FFA (M. Martin & Kitchel, 2013), it is logical that the current models of agricultural education cater to rural populations that are predominantly white.

This information, however, does not justify the disconnection of agricultural education from urban areas, its programming inconsistencies, or its inequitable practices that may disable contribution of all students to understanding food production and all aspects of the agricultural sector. Just as socio-political situations drove such formations, the current changes in agriculture, global populations and economies, must be reflected in today's structures of agricultural education. A splendid opportunity for reformation occurred during the great depression and WWII when victory gardens made their way into the lives of millions of Americans and refueled the idea of production for subsistence. Today such gardens are returning as community gardens, urban farms, and rooftop gardens, but have same function. Today's economic and social conditions, though, will not allow for such opportunity to be missed again by agricultural education and "It is not sufficient to merely expect students to accept the same antiquated models of agricultural education programs or for schools to be able to hire a few ethnically diverse teachers to meet the need" (Vincent & Torres, 2015, pg. 65). Agricultural education models need to be evaluated intentionally now rather than waiting until absolutely coerced by the state of needs in agriculture. It becomes the duty of agricultural education to reconnect to metropolitan areas but this cannot occur with said loyalties to antiquated rural driven systems and focuses especially if empirical evidence supporting the impact of these models beyond the mere impact of emotional affect and reinforcing or instilling ideological loyalties.

Currently, about 50% of all post-secondary students and workers in the agriculture sector had secondary agriculture program participation. Historically, however, agricultural education displayed its highest level of growth and development during a time when a majority of its teachers and students did

not come from agriculture backgrounds (Foor & Connors, 2010; Stimson & Lathrop, 1942). It may be important to note that this time period briefly overlapped with the industrial revolution. During this time the U.S population was not well removed from agrarianism, giving most citizens some connection to agriculture simply by living in society. It is reasonable during the 21st century, when 2% feeds the 100% of nation, for Agricultural Education to be densely populated by a rural demographic and for the communities to overlap. However, these figures point to the importance of every member of the agricultural workforce during this century. Every agriculture sector job must be filled given the number of people it effects, making it very important for agricultural education to be producing quality students.

The relationships between post-secondary and secondary agricultural education, solidified by shared funding, missions, backgrounds, political affiliations, experiences and values, are highly beneficial to agricultural education and its continuous development. The pattern of funneling members from the secondary agricultural education to other areas of agriculture serves as a useful practice to the agriculture sector. It is important to ensure, however, that such strong interplay does not embed systemic flaws that become a detriment to the study and advancement of agriculture or create an exclusive field. Since secondary school serves as a principal source for future agriculturalists, here is a great initial place to monitor for systemic practices that can increase or reduce the quality and equity involved in Agricultural Education studies.

The Changing Face of Agriculture – Social and Scientific

The problems facing agriculture are more numerous than ever. Impact and adaptations of climate change alone amount to thousands of questions and unknowns (Kurukulasuriya & Rosenthal, 2003). Original and advanced ideas concerning biodiversity, new approaches to sustainable agriculture, and profound ways to connect citizens to the land through education and communication are imperative to the sustenance of today's standard of life for future generations. Additional scientific issues in agriculture include availability of nitrogen in the soil and environment, production of methane in agricultural practice, agricultural production and human diseases, energy production and fossil fuel usage, water

pollution and availability, advancement in agricultural technology, and farming in cities. Social and economic questions surrounding the interplay between agriculture, the environment, and societal issues such a poverty, political alignments, and global issues continually pervade the lives of citizens whether we are conscious of it or not. As answers to STEM and social issues arise, unprecedented agricultural business questions encouraging financial firms and businesses will answer new questions about agricultural organizational and market changes. These are all dire problems facing the new generations of agriculturalist and problems that the previous generations of agriculturalists did not face or were not able to solve.

The current agriculture sector reflects the social-political dynamic of land dispossession, black migration, and exclusion in that a majority of agriculture personnel come from rural populations and 84% of agricultural education programs are in rural areas (Team Ag Ed, 2006). However, the projected outlook for jobs in the agriculture sector will not be supported by these trends of rural only workers. USDA recently reported Colleges of Agriculture and Natural Resources will only be meeting 61% of the agricultural workforce need with graduation projections in the years 2015 – 2020 (USDA, 2013). Even more, continued urbanization drives the decline of the proportion of rural students to urban students and the development of rural farmland. Such shifts of the United States to a more pluralistic country makes maintaining high quality secondary agricultural studies very crucial (Villegas & Clewell, 1998; Woods, 2004; Census, 2008). It is important that educational systems are producing an inversely proportional number of skilled personnel and academics to answer the questions surrounding agriculture. This means the sector will be looking to the once alienated members of the urban centers to contribute to and help sustain the advancement of agriculture. It seems that urbanites are willing to answer the call, but many of them on their own terms, hence the increases of interest of urban farming, micro-lending, and cooperatives aimed at “de-alienation” of urban areas and their food and environmental concerns. Significant changes in ethnic composition will be reflected in classrooms across the United States (Diller & Moule, 2005; Luft, 1996; Milner, Flowers, Moore, Moore, & Flowers, 2003) as minority students

comprise about 48% of the nation's school age children by 2020 (Pallas, Natriello, & McDill, 1989).

Therefore, the population of students participating in FFA and CDEs are bound to change.

One of secondary agricultural education's responses to urbanization, demographic changes of the nation, the gap in supply and demand for the agricultural workforce, and many other agricultural needs was an aim to develop new secondary agricultural education programs every year, with a focus on urban areas. A 2007 statement of goals included a 10X15 initiative that aims to "create new programs in communities not yet served by agricultural education and FFA, and strengthen the quality of current programs providing personal, academic and career education in agriculture. It's our aim to have 10,000 quality agricultural education programs in operation by the year 2015" (Team Ag Ed, 2006). "Instead, a change in cultural sensitivity is needed in order to effectively teach ethnically and culturally different students " (Vincent & Torres, 2015, pg 65).

The outcome of this effort has not yet been reported, as the annual report does not follow a coherent pattern or format that follows from previous reports. However, since rural areas are already saturated with agricultural education programs and therefore a limited amount of programs can be added in these areas forcing additional programs to be established in urban, suburban, and second city communities or not added at all. As well, making up the 39% gap in jobs availability through 2020 and beyond will require non-traditional students, those from rural areas to take up agriculture and fill the job demands.

The existing 16% of FFA chapters that are not in town and rural areas are thriving entities, touting 52% FFA membership (Lawrence, Rayfield, Moore, & Outley, 2013). Only 7% of these programs are in urban or suburban places despite approximately 80% of the US population being non-rural (U.S Census Bureau, 2010; Lawrence et al., 2013; Martin & Kitchel, 2014). Program establishment in urban setting may come up against some resistance due to student and parent uncertainties or perceptions of agricultural careers (Osborne & Dyer, 2000), funding, or administrators and communities with apathy for agriculture, which is beyond the scope of this review. However, due to growth of interest in urban

agriculture and community gardening (Mougeot, 2000; Oakes, 1986; Wakefield, Yeudall, Taron, Reynolds, & Skinner, 2007; Zasada, 2011) the welcoming of these new programs is quite likely. Of interest to this review is how students and programs must be well equipped to hit the ground running when the newly formed programs comes to compete with much more senior programs.

Studies show that there will be cultural, pedagogical, organizational, and bureaucratic elements that contribute to immediate learning outcomes in new programs and even more in new urban programs (Bidwell & Kasarda, 1975; Henry, Talbert, & Morris, 2014; Kirschner, Sweller, & Clark, 2006; Vincent & Torres, 2015). Additionally, struggling programs will need to make adjustments to compete well. Some models for new and rebuilding agricultural education programs are beginning to reject CDEs for other community based work. This work advocates for consistency in CDEs, however, we do not dis-support the idea of agricultural education without CDE. The role of CDE is to support critical thinking and vocational learning. CDE consistency actually supports these components of education by giving a reliable structure to the contests, but does not adhere to the idea that CDEs are the only effective method to offer such education support. Therefore, certain schools may focus on specific CDEs, others vary from year to year by student population, while others have no emphasis on CDEs. This work supports schools focus on their strengths and consistencies between states would allow for an even playing field in their strong areas. Do not mistake these two ideas about forming new agricultural education models and our advocacy for CDE consistency as conflicting ideas.

CDEs are only a portion of establishing footing as a program, but are an integral portion for student opportunity and achievement. Therefore, to avoid disparities between programs CDEs must be evaluated to be implemented in an equitable way. Beyond the scope of this study, this CDE evaluation must be accompanied by ideological and philosophical shifts that must occur in Agricultural Education to make this happen.

Convergence of the Literature

Given changes of agriculture and the socio-political history that has shaped agricultural education, it is important that agricultural education gives account for what it does. The perpetual existence of FFA is federal legislation, giving it more responsibility and accountability to rightfully educating the entire nation equitably about agriculture. Therefore, the current lack of evaluation is dissatisfying and must begin somewhere. We are beginning with CDEs because it is a good barrier to break for urban students, new programs, and struggling programs. However, we highly recognize a need for holistic evaluation beyond CDE evaluation.

Agriculture education despite its hand in government pocket and legislation is ultimately accountable to itself hence it limited regulation and evaluation. Their annual reports to the public are incoherent, self-referential, and follow no static form. Report consist of various highlights from the year. This is called propaganda. Evidence based programming is stressed throughout U.S school systems and many professional fields. Starting points to employ assessment include comparing the three ring model theory to current literature surrounding evidence based pedagogy to confirm its efficacy. From this we can answer questions such as 1.) Should new, struggling, urban programs adopt the model? 2.) Does the model embody the true and broadest definitions agricultural education? 3.) Should we adopt models based off evidence from studies that rely solely on student and community's needs (Brown & Kelsey, 2013) when that means leaving out one of the three rings? How does it fit in urban programs? 4.) What connections are there between these findings and CDE administration?

This review of literature urges that agricultural education creates some systems of monitoring so that it does not destroy itself from within. The agricultural education "family model" will not work to educate the 21st century agriculturalists needed. As the agriculture climate changes and becomes more pertinent to the survival of people, the regulations will come and it is better to have systems of evaluation than to be given some. This can start with CDE monitoring, but may need to be extended to the rest of what agricultural education does. The current and historical systems, demography, and culture are not

likely to suffice. It has even been the suggestion of agricultural education themselves; however, the implications have become more salient and far-reaching in today's world.

Chapter 3: Methods

Data Collection

The findings relied on data from the National FFA archives. The archived data provided winners of all national CDE competitions in the form of New Releases for each competition during the seven-year span of 2009 through 2013. Top ranking teams (1st through 10th place) for each competition were extracted, coded, and entered into spreadsheets by state. Point values were assigned to each earned win. Figure 1 provides a key for codes that will be used in referencing specific CDE areas.

Figure 2. Key for codes used to reference

Contest	Code	Contest	Code
Agricultural Communications	AC	Food Science and Technology	FST
Agricultural Issues Forum	AIF	Forestry	For
Agricultural Sales	AS	Horse Evaluation	HE
Agricultural Technology and Mechanical Systems	AM	Job Interview	JI
Agronomy	Agr	Livestock Evaluation	LE
Creed Speaking	CS	Marketing Plan	MP
Dairy Cattle Evaluation and Management	DCE	Meats Evaluation and Technology	MET
Dairy Cattle Handlers Activity	DHA	Nursery/Landscape	NL
Dairy Foods	DF	Parliamentary Procedure	PP
Environmental/Natural Resources	ENR	Poultry Evaluation	PE
Extemporaneous Public Speaking	EPS	Prepared Public Speaking	PPS
Farm Business Management	FBM	Veterinary Science	VS
Floriculture	Flor		

Raw and RAS Calculations

Raw scores for each state were calculated by taking a weighted summation of every contest won per state within the time period of interest. A relative achievement score (RAS) was calculated for each state by normalizing state placements with respect to its population representation in the FFA organization (proportion of 1st placements/ proportion of national membership), creating an expected normal achievement score of 1. Descriptive data was compiled for individual states and totals for their number of wins in each contest was covered and compared to their leading industries in the state.

To justify our usage of RAS as a primary tool of comparison, we determined correlations between state FFA populations and winning among the middle 100%, 75%, and 47% of scoring states via a simple linear regression.

Statistical Analysis

The study was designed to determine trends of CDE winning throughout the states. Following data collection, data were entered into SPSS for Windows. The following data pieces will be input for statistical analysis: CDE competition rank and raw score; Trends of central tendency and correlational relationships among variables will be explored using statistical analysis software. ANOVA was run to assess for regional difference between RAW and RAS scores. Turkey test post hoc analyses were performed where ANOVA revealed significant differences between means.

Figure 3. Point values for weighted score calculations for placing one through ten.

Placement	First Place	Second Place	Third Place	Fourth Place	Fifth Place	Sixth Place	Seventh Place	Eighth Place	Ninth Place	Tenth Place
Point Value	1	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1

Chapter 4: Results

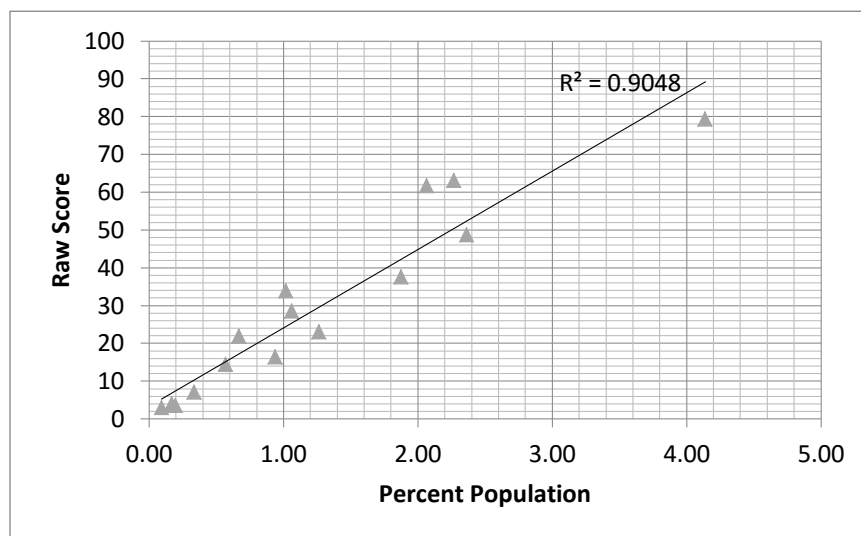
Results summary: Raw calculations are shown to be less reliable and less resilient than RAS scores as an evaluation method due to its lack of resistance to population variations. Utilizing RAS as an evaluative tool we demonstrate problems with equitable distribution of CDE placements throughout the states.

Variations in RAS among states are not directly driven by geographic trends but our values show that competition structures are a determining factor in RAS scores. Finally, the figures variables utilized in the study %FFA population, contest schedule, region along with a few outside variables are utilized to construct a prediction model to help teachers and states guide their strategies for CDE preparations.

Correlations between Raw Scores and Size of Student FFA Pool

Raw score is shown to be in direct correlation with the size of the FFA student pool in each state while RAS scores show no correlation. A simple linear regression shows a very strong correlation of raw score (y) as a function of population size of the middle 50% of state scores ($R^2 = 0.90$). The middle 75% of state scores shows a moderately strong correlation ($0.61 = R^2$). This is in comparison to $R^2 < 0.05$ for regressions analyzing RAS scores as a function of the population pool (data not shown).

Figure 4. Graph of correlations between state populations and raw accumulations for the middle 50% of scores in National CDE placements.



Top Placements by Raw and RAS Scores

The following data compares state achievement by Raw and RAS methods to look for parallels and incongruities in these methods of evaluation. As shown in Table 1, top states such as Texas and California disproportionately win in raw calculations of placements. However, states Missouri, Kansas, and Washington rank highly by raw accumulations and highly in proportion to their FFA representation (RAS). Connecticut and Alabama are in the top 5 states in terms of their RAS score only, while Illinois, Georgia, and Minnesota demonstrate above average raw accumulations but achievement at or below the expected RAS of an evenly distributed population of wins (data not shown).

Table 1

Raw and RAS Scores for the Top 10 Placing Teams by Each Method of Measurement

State	Raw Score	Placement	RAS Score	State
Kentucky	37.5	10	2.585	Maryland
North Carolina	37.6	9	2.748	Idaho
Illinois	37.7	8	2.844	Kansas
Georgia	43.2	7	3.054	Washington
Minnesota	48.7	6	3.235	Alabama
Washington	61.6	5	3.338	Wyoming
Kansas	63.0	4	3.406	North Dakota
Missouri	76.6	3	5.752	Missouri
California	79.3	2	7.146	Connecticut
Texas	95.5	1	18.984	Virginia

Shifts in Rankings between Raw and RAS

Here we toggle between the two methods and demonstrate that that they each are very distinct metrics. Raw score calculations consistently measure how many wins a state has. While RAS consistently measures these wins in comparison to population. The difference between the two metrics' evaluative utility are demonstrated in the rank shifts in tables 1 and 3. Table 2 shows the most dramatic ranking changes by state when toggling between the two methods. Table 3 displays the ranking changes for all 50 states. A positive change represents a state increasing in ranking from raw to RAS score calculations. A negative score represents a decrease in ranking from Raw to RAS score calculations.

Table 2

State Rankings Most Altered by Shifting between Raw and RAS Calculations

State Rank Shift	Loss in Rank			Gain in Rank					
	TX	OK	IL	WY	CT	MA	NV	NH	AL
	-31	-19	-18	+15	+20	+23	+23	+28	+35

When toggling between the two scoring methods, as shown in Table 3, shifts in ranking range from 0 – 35 places. About 60% of the states moved in placements 10 spots or less. However, only 5 (15%) were top 10 placing teams of interests. The remaining were low ranking teams exchanging low ranking placements. The remaining 40% of ranking shifts of 11 places or more 5 (25%) of them were teams that are well overachieving by RAS but were overlooked in the raw count. For example, Alabama, who takes home 3 times as many awards for every student involved in FFA but was ranked 41 of 50 by raw scoring calculations. Teams such as Illinois, California, and Texas were ranked highly by raw calculations, but are achieving in small proportion to their student population and some beneath the 1:1 ratio expected.

Table 3

Rank Shift for all 50 U.S States When Toggling Between Raw and RAS Calculations.

State	Rank Shift	State	Rank Shift	State	Rank Shift	State	Rank Shift	State	Rank Shift
AL	+35	HI	+0	MA	+23	NM	+6	SD	+1
AK	0	ID	+8	MI	-4	NY	0	TN	-13
AZ	+5	IL	-18	MN	-7	NC	-13	TX	-31
AR	-5	IN	-8	MS	-2	ND	+9	UT	0
CA	-13	IA	-8	MO	0	OH	-14	VT	1
CO	-1	KS	-4	MT	+4	OK	-19	VA	+14
CT	+20	KY	-4	NE	-10	OR	+3	WA	-2
DE	+13	LA	-11	NV	+23	PA	-6	WV	-11
FL	-17	ME	0	NH	+28	RI	0	WI	+5
GA	-14	MD	+15	NJ	+6	SC	+1	WY	+15

Further, seven states show no rank movements. Statistical analyses show a weak parabolic correlation between population and the number of places a state moves in rank (data not shown). States with populations below 0.9% may have a slight, if any, arithmetic advantage by using RAS calculations.

Regional Rankings

The percentage of raw winnings and an average RAS score was calculated for each region. The average raw score is 17% with a standard deviation of 7%. The average RAS score of all regions is 1.96 with a standard deviation of 0.88.

Figure 5. Regional groupings of states as determined by the National FFA Organization.



The values in Table 4 demonstrate some variations when considering averages and the standard deviation. However, a one-way single factor ANOVA reports that there is no statistically significant effect of geographical region on RAS or Raw scores at $p < 0.05$ [$F_{\text{raw}}(5, 44) = 2.2$; $p = 0.068$ and $F_{\text{RAS}}(5, 44) = 0.47$; $p = 0.79$]. At $\alpha = .05$ we cannot reject the null hypothesis that regions have equal means raw and RAS scores. However, at $\alpha = .1$ regional variations in raw scores are in fact statistically significant but RAS calculations remain statistically insignificant.

Table 4

Regional Averages of Raw and RAS Scores

	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6
% of Total Raw Wins	16%	24%	18%	25%	13%	6%
Mean RAS Score	3.23	1.1	1.61	1.83	.96	3.03

State Distribution of RAS Scores

The following data uses only RAS to evaluate the equitable distribution of CDE placements throughout the states. The distribution of scores throughout the 50 states has a mean of 1.3, standard

deviation of 1.3, and range of 17. When grouped by descending RAS score, there is a clear linear decline in score from the top placing states to the lowest placing states. Arithmetic means for each quintile is displayed below the chart.

A one-way single factor ANOVA reports that there statistically significant difference among the RAS scores of the quintiles [$F(4, 45)=8.5$; $p=0.000033$]. Post hoc pair-wise analyses showed that quintile 1 is outscoring every other quintile. Quintile 2 averages a significantly higher RAS score than Quintile 5. Noteworthy differences are present even between the closest scoring quintiles. Although, statistical analysis does not allow us to reject the notion that quintiles 3, 4, and 5 indeed have even distributions of RAS scores, there is notable variation in the scores. For example, Quintile 3 score is 10x better than quintile 5. This means a student in a state in quintile 3, such as Pennsylvania is 10 times more likely to experience success than one in quintile 5, such as South Carolina or West Virginia. State RAS Scores ranked by quintile are shown in Table 5.

Table 5

States Grouped into Quintiles by Descending RAS Scores

Quint. 1 <i>m</i> = 4.9		Quint. 2 <i>m</i> = 1.7		Quint. 3 <i>m</i> = 0.89		Quint. 4 <i>m</i> = 0.57		Quint. 5 <i>m</i> = 0.08	
State	RAS	State	RAS	State	RAS	State	RAS	State	RAS
VA	17	NH	2.2	GA	1.1	OK	0.69	LA	0.37
CT	6.6	NV	2.0	NC	1.0	TX	0.67	WV	0.26
MO	5.3	MN	1.9	AR	1.0	FL	0.66	SC	0.06
ND	3.1	KY	1.9	MT	0.90	CO	0.61	VT	0.04
WY	3.1	CA	1.8	DE	0.89	SD	0.60	MS	0.03
AL	3.0	OR	1.7	IL	0.87	NF	0.58	NY	0.01
WA	2.8	MA	1.7	AZ	0.86	UT	0.52	AK	0.00
KS	2.6	WI	1.6	OH	0.80	MI	0.49	HI	0.00
ID	2.5	IA	1.2	IN	0.80	NE	0.44	ME	0.00
MD	2.4	NM	1.2	PA	0.74	TN	0.41	RI	0.00

State RAS scores and Contest Schedules

Table 6 shows RAS scores for the middle scoring 75% of states group by their contest schedule. A consolidated schedule is any state that holds 80% of more of its state competition in a single window of time, such as a competition weekend, and disallows students to compete in multiple competitions. A

dispersed schedule denotes states that holds 20% or more of its contests in two or more windows of time throughout a given contest year. RAS consolidated is 2.4 and dispersed 1.6 for the middle 75% of states. At $\alpha = 0.05$ we can reject the null hypothesis that consolidated and dispersed schedules have equal RAS scores [$F(1, 17)=6.7$; $p=0.02$].

Table 6

Scores for States with Normal to Moderately High RAS Scores Grouped by Contest Type

Contest Type	State Score										Mean
Consolidated	0.91	1.16	1.88	1.88	2.14	2.16	2.61	2.99	3.13	3.24	2.24
Dispersed	0.98	0.99	1.02	1.12	1.51	1.65	1.65	1.82	2.1	2.83	1.57

Chapter 5: Discussion and Conclusions

Summary: Raw and RAS scores each have evaluative utility and can be used together to gain insights about CDE competitions results and their interpretations. When used together, we can identify states, regions, and other categorical divisions that have heightened successes in CDEs. Upon being able to identify those groups that outperform others, we must consider the social and academic implications this has for students in low performing states and how we can facilitate equity in these CDE competitions that have been assumed to already be equitable for years? What does this mean for new programs that will predominately arise in urban areas as agricultural education grows?

Interpreting and Utilizing RAS and Raw scores

It could be easily deduced that states with larger FFA populations would have higher frequencies of CDE winnings. However, since each state sends their single-most exceptional team and not a number of teams in proportion to a given population, then, if the quality of programming is the same throughout the nation, raw accumulations of CDE successes at the National Competition should be distributed evenly across states. This notion of equity will be discussed further in the subsequent section, however it is important to preface that even distributions of CDE successes point toward equity in programming and subsequent opportunities for student agriculturalists beyond secondary school. The even distribution of student capacities throughout the nation is demonstrated by standardized test scores, such as the SAT, being distributed evenly throughout the nation (collegeboard.org, 2016). Additionally, research about human intellect has traditionally described intellectual capacity as normal distribution.

The current study confirms that the FFA population of a state is a direct contributor to the number of raw competitions won. This relationship also makes sense, because a higher population pool offers more selectivity in choosing national competition teams. While this observation seems to have an easily understandable explanation, the dependence of scores on student population pools produces false perceptions of achievement by state, due to the advantages of states with large FFA populations. However, this is not often considered in the agricultural education community when talking about

strengths in CDEs of various states. Unofficial reports float around the agricultural education community with compilations of raw scores (Parker, 2016, unpublished data), students at the convention notice that some teams from a handful of states continuously win, and traditional perceptions of “good states” are used for making decisions about winningest states, programs, and regions. In terms of evaluating state FFA programming quality, frequencies are simply not useful since it is merely a reflection of population, not a reflection of quality in comparison to other states. RAS is desperately needed to lend more objectivity to examination and discussion of CDEs and agricultural education students’ futures depend on it.

Despite the potential of false perceptions of success or lack thereof, both raw accumulations and relative achievement calculations give valuable insights on CDE successes. The frequencies of success provided by raw scores can give insights about geographical and other categorical divisions. RAS is a rate of success that gives account to numerical contexts of population proportions and is resistant to state population changes and variations. Therefore, this measure can be used comparatively and is a more accurate analytical tool. State to state comparisons of CDE success and quality programming is most accurately measured by RAS.

This study demonstrated that there are key differences between the two measurements, however, it is not always necessary to choose between raw and RAS. Given the parabolic relationship of RAS scores and population, there is an inherent weakness of RAS evaluation alone. States with an FFA population below .9% have a slight arithmetic advantage in RAS calculations. Mathematically, the advantage is slight, but present nonetheless. As well, this weakness is a major statistical improvement from raw scores as an evaluative tool alone. This is primarily due to the very considerable disadvantage raw scores lend to small states. Together, raw and RAS supplement one another, offset weaknesses, and strengthen the evaluative merit of both. Therefore, a multimodal approach is recommended, using both measures can offer the strongest insights to the true nature of strengths in state programs and systems.

Utilizing RAS and Raw Scores for Comparative Efforts

States like Missouri, Washington, and Kansas which display above average achievement by both raw and RAS measures show undeniable strengths of programming and competition. This implies state systems implemented are effective for students. States listed in the results section with large differences between their raw and RAS rankings are interesting. The ranking shifts imply strong systems in low populated states or population advantages in states with mediocre systems. These two groups of states are a great place to begin examination toward making comparisons of systems in exploration of effective administrative trends.

A normal distribution of national successes would present a 1:1 ratio of wins to population. Therefore, RAS tells us how many times over or under its representation a state achieves success. Using RAS we can investigate above average achievement (RAS above one) and underachievement (RAS below one). For example, Arkansas is on par with expectations. With a RAS of 1.0, Arkansas is on average winning one percent of national championships (or the equivalent in weighted points) for every 1% of its representative population during the duration of this sampling. Illinois and North Carolina, two top ten ranking states by raw accumulations, have a RAS of 1.1 and .95 respectively and are achieving on par with Arkansas who is 18th in raw rankings. Texas, the number one raw ranking, is well underachieving in comparison to other states only taking home .7% of awards for every student 1% of representation. With a RAS of 0.7 and RAS ranking of 31, 62% of states in our data set have a higher rate of winning (RAS) than this number one raw state.

These numbers prove that looking at the rankings through any single lens may be myopic when making evaluations. Evaluative decisions should include considerations of both raw and RAS, independent of the intention of the assessment. However, when forced to choose a method of evaluation, raw rankings alone eliminate context and is a very weak tool, if having any value at all. Based on the findings of this study, it appears that choosing RAS or some other method that considers raw scores as parts of a whole is a more objective means for analysis and comparison.

CDE Equity and Program Development

Regional and state by state comparison paint a grim picture for the reality of all students having an equal shot at CDE success. Unlike previous reports that demonstrate a single Midwestern region outperforming others (Franklin & Armbruster, 2012), our regional comparison of CDE scores did not report any single region significantly outscoring another. However, to assume equity among regions would be a mistake. We can only deduce from these numbers that inequity is not mediated by geographic factors. Descriptive statistics in each region shows significant variation between scores within each group, with standard deviations being relatively high. A closer look indicates that each region has an anchor state or states with significantly larger RAS or raw scores to balance out the averages and variation within each group. For example, without Texas Region 1 would have had a dismal score. So for an individual student in any given region, if they are not a member of the elite state or two, then the likelihood of their chances to succeed in National CDE competition is subpar.

This inequity is best displayed in our quintile groupings. We do not know the drivers; however, this organization of the same data makes it clear that equity is not evenly distributed across the states. If a student is not in the one of the 20 states in the upper two quintiles, their chances of having successful CDE competition is very low. For equity to be demonstrated, there should be equal distribution no matter what groupings, organizations, or analyses of state scores are utilized. The significant difference between the upper quartile and lower quartile is disturbing for the success of agricultural education and the agriculture sector. It is important that the entire nation is being prepared for agricultural work, despite their class, race, urbanity, or geographic background. This raises a question regarding practices and systems occurring in Quintile 1 facilitating an ability to consistently outscore the 40 other states.

Answering this question is of heavy concern as the emphasis on urban agricultural education programs grow. These new programs need access to guidance in program development and information about how to identify successful programs. So do we look at California who has high numbers, but mediocre rates of winning? Conversely, should we study Connecticut who takes home wins in high

proportion to students? Do we unconditionally look for both? These are questions teachers and states will need to answer as they model their developing programs after existing programs and state administrative guidelines. New and underachieving programs need to “see the ball go into the hole” to sustain interest and success. This is of utmost interest for urban programs and developing agriculturalists in more metropolitan areas. There is not a chance of this for students in states in the lower quintiles, which deters the urban agriculturalist who will be key to the vitalization of and sustenance of the changing agricultural sector. As new programs in urban areas spring up, they can look to effective states and particular programs identified in this thesis for a prototype by which to design their programs.

It has been suspected that states whose system of scheduling force students to focus on a single competition by concentrating the state competitions in a short period of time (such as a weekend) have higher achieving students at nationals. The assumption is that students’ time and attention becomes stretched in too many directions in states that have disparate state competitions throughout the school year, allowing students to compete at the state level in many different areas. Our data supports, but does not confirm this thinking. States with higher achieving students at nationals are most often those with a single competition weekend where 80% or more of the competitions happen concurrently. This is only a single, but possibly significant factor in CDE equity. Centralized criteria for state competitions, though difficult to implement, are likely to even out the playing field for national competitors.

Further work will need to be implemented to learn about specific features of effective programs and state structures are useful. State assessments of each individual contest would be useful as well as a compilation of a single assessment for each contest in a single state would make our understanding of the mediators of inequity more complete. The basic prediction model developed by this study can help guide designs of new and developing programs, but will need to be readily adapted as new research-based evidence (not merely agricultural education beliefs) about the features of effective state CDE programming and administration and individual program management surfaces. Currently, it has great utility for helping determine how to strengthen programming despite its limited number of variables.

Challenging Social Norms of CDEs

The rigid idea of all programs modeling themselves after one another and loyalty to the espoused three-ring model for agricultural education could be a hindrance to program development, especially in urban and non-conventional programs. It is important to note that new and developing programs may choose to not participate in CDEs and FFA at all, which would be a deviation from tradition (Croom, 2008) not an overt pedagogical detriment. A wide variety of factors including limited ability of teachers or students to connect culturally to FFA, preparation time, and agriculture teacher burnout rates may impose a barrier for student participation in CDEs (Henry et al., 2014; Lemons, Brashears, Burris, Meyers, & Price, 2015; M. J. Martin & Kitchel, 2014, 2015; M. Martin & Kitchel, 2013). Therefore, it is important to note that this work does not suggest directly mimicking the identified states, rather finding strengths of a program and tying them to strengths, resources, and needs of the programs at hand. One strength of the three-ring tradition has been that it gives the agricultural education community an underlying and unifying set of basic assumptions from which to build. However, these assumptions may or may not represent the realities of the growing demographic and needs of agricultural education. Teachers in some programs may need to develop their programs accordingly or deviate from the three-ring model tradition. This is allowable though not culturally popular in agricultural education. Therefore, CDE evaluation and increasing CDE scores may not be relevant for these new programs and many others.

CDEs and FFA awards are not inherent pedagogical metrics of success, rather they are traditional measures infused with cultural value (Croom, 2008; M. Martin & Kitchel, 2013) and limited (but useful) pedagogical merit. These are not the only avenues for students to see success, but a program that disconnects from CDEs would be jeopardizing students' connections to agricultural networks. Philosophically, it is possible, and arguably necessary in light of the current programming, to build our own urban agriculture networks designed to offset deficits in equitable programming. However, construction of this new network will come at some cost. Programming components that are ineffective for student development would either be dismissed or re-situated within these networks and

programming. In many cases, there is no need to expend energy and resources that would be required to recreate the effective practices already embedded in agricultural education. The reality of a completely resituated agricultural education model is unreasonable and untimely. Instead, we suggest needing equitable practices in CDE administration for the well-being of the students.

Our conceptual model relies on the optimal usages of a student's environmental, human, and social capital and is particularly salient in our discussion of equity. Environmental capital determines students' practice time and real world experience. Human capital in the case of this study refers to scheduling that potentially causes restraints on mental and physical health and performance. In reference to social capital, proper scheduling allows the students a significant agent of social capital time to prepare appropriately and teachers to coach appropriately. This capital may or may not be conducive to the three-ring model but could provide the most useful experience for students. It will be up to systems at national, state, and local levels to reinvent themselves to meet student needs or teachers' discretion to re-envision or recreate agriculture programs that work for all students and prepare for the country a critical, skilled, productive society of agricultural practitioners.

Implications and Impact on Profession

These holistic/comprehensive methods of evaluation will enable us to identify and understand systemic factors which impact student success at CDE competitions. Our Raw and RAS scores can be used to gain insights about various aspects of agricultural education and CDEs and possibly promote a more even playing field for students from different states and agricultural education program types. It will allow us to answer some of the questions posed in the previous section and design future agricultural education programs that fit the needs of students and not necessarily conform to traditional designs of programs.

A 1986 JAE study "demonstrate[d] the utility of contest score evaluation and the need for further evaluation...not only in the area of significant differences in contestants' scores, but also in the area of score prediction and trend analysis" (Buriak, Harper, & Gliem, 1986). Further studies from our research

group utilize the methods presented here to perform a more detailed exploration of systemic factors that may contribute to states achievement levels and analyze trends in efforts to predict how changes in structure and methods of preparation can heighten winning potentials.

Systematically, CDEs serve as not only student development but also largely determine the trajectory of a student's path in their post-secondary vocation and in higher education. Application of insights gained through CDE evaluation can translate to improvement of agricultural education programs for students nationwide through more equal access to opportunities gained by those achieving success at the National CDE level. This evaluative information can be used to increase consistency among the states in program preparations, resources, and know-how that arises from repeated success. These changes could reduce the disparity in institutional knowledge base which could disproportionately benefit well-established programs over newly-established programs. Given USDA projections of 40% of agricultural jobs being unfilled during 2015 – 2020 and the growing importance of solving global agricultural and environmental issues, making the necessary changes to CDEs and agricultural education is a serious charge. Even without such serious conditions, CDEs impact the 500,000+ members of FFA each year and should be optimized for that reason alone.

Appendix

All rankings

To disseminate information about state performance this thesis includes raw and RAS rankings for all 50 states throughout the time period of 2009 – 2015.

Figure 6. State performance levels using raw and RAS rankings 2009 – 2015

Raw State	Rank	RAS State
Texas	1	Virginia
California	2	Connecticut
Missouri	3	Missouri
Kansas	4	North Dakota
Washington	5	Wyoming
Minnesota	6	Alabama
Georgia	7	Washington
Illinois	8	Kansas
North Carolina	9	Idaho
Kentucky	10	Maryland
Iowa	11	New Hampshire
Oklahoma	12	Nevada
North Dakota	13	Minnesota
Ohio	14	Kentucky
Virginia	15	California
Florida	16	Oregon
Idaho	17	Massachusetts
Arkansas	18	Wisconsin

Figure 6 cont.

Oregon	19	Iowa
Wyoming	20	New Mexico
Indiana	21	Georgia
Connecticut	22	North Carolina
Wisconsin	23	Arkansas
Pennsylvania	24	Montana
Maryland	25	Delaware
New Mexico	26	Illinois
Tennessee	27	Arizona
Montana	28	Ohio
Nebraska	29	Indiana
Louisiana	30	Pennsylvania
West Virginia	31	Oklahoma
Arizona	32	Texas
Colorado	33	Florida
Michigan	34	Colorado
Nevada	35	South Dakota
South Dakota	36	New Jersey
Utah	37	Michigan
Delaware	38	Michigan
New Hampshire	39	Nebraska
Massachusetts	40	Tennessee
Alabama	41	Louisiana
New Jersey	42	West Virginia
Mississippi	43	South Carolina

Figure 6 Cont.

South Carolina	44	Vermont
Vermont	45	Mississippi
New York	46	New York
Rhode Island	47	Rhode Island
Maine	48	Maine
Hawaii	49	Hawaii
Alaska	50	Alaska

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