CAREER DEVELOPMENT EVENTS AS A PREDICTOR OF FALL-TO-FALL RETENTION OF FIRST-YEAR COLLEGE STUDENTS

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By

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and hereby certify that, in their opinion, is worthy of acceptance.

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DEDICATION

This dissertation is dedicated to my family, especially my wife Cathy, for without her love, support, and words of encouragement, I would not have been able to accomplish this goal. To my mom and dad, thanks for instilling perseverance in me, no matter the circumstances. To my sons, Chayse and Spencer, you are role models in determination and dedication and I am forever grateful for your commitment to one another.

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TABLE OF CONTENTS

LIST OF TABLES

Tables

LIST OF FIGURES

Tables

ABSTRACT

Career development events (CDEs) play an essential role in agricultural education programs and the National FFA Organization. The competitive events are promoted as tools to develop career and college readiness of high school students. This study examined whether participation and performance in agricultural education CDEs in high school can predict retention of first-year, first-time, full-time college students enrolled in agricultural sciences at a regional, Midwest, public university. For the quantitative study, the predictive correlation design utilized chi-square tests and binomial logistic regression analyses. The study results indicate that a significant relationship exists between participation in CDEs and college retention. Also, results signal performance in CDEs has a minimal impact on student retention. Recommendations for further research include conducting the same study on a larger scale, including additional states and universities, examining the effect of CDEs on degree program selection, and the impact of non-traditional predictors for student retention.

Keywords: agricultural education, career development events, CDE, FFA, retention

SECTION ONE

Introduction to the Dissertation in Practice

Traditional studies regarding first-year student retention have shown that admissions exams and high school grade point average (GPA) can be valid predictors of college success (ACT, 2014; Hoffman & Lowitzki, 2005; Richardson, Abraham, & Bond, 2012). However, studies on fall-to-fall retention of first-year college students have not examined the impact of student participation and performance in experiential learning activities while in high school. This study investigates the association of the involvement and performance of high school agricultural education students in career development events (CDEs) and retention of first-year, first-time, full-time university students. This section provides an overview of 1) the background of the study, 2) the statement of the problem, 3) the purpose statement, 4) research questions, 5) hypotheses, 6) the identification of the variables, 7) theoretical and conceptual frameworks, 8) the design of the study, and 9) the significance of the study.

Background of the Study

For professional doctorates in education, the Carnegie Project on the Education Doctorate (CPED) recommends utilizing a multi-frame approach to analyze complex problems (CPED, 2007). Furthermore, CPED (2007) acknowledges that solutions should be grounded in practical and research knowledge where practice and theory enrich the outcomes. Creswell (2009) offers that the selection of research design is based on the research problem to investigate, the researcher's personal experiences, and the study participants.

Survey results of the Higher Education Student Data Warehousing Forum identify student success and predictive analytics as two of the top issues facing higher education (Childers, 2017). Picciano (2012) describes predictive analytics as the science of examining data to develop prediction models that can help decision-makers determine courses of action. The use of predictive analytics uncovers patterns and denotes relationships in data (Gandomi & Haider, 2015). Studies by Cai and Zhu (2015) and Denley (2014) suggest that predictive analytics positively impacts student success.

Pusser and Tinto (2006) state that retention is a measure of student success and Crosling, Heagney, and Thomas (2009) recognize retention as a critical indicator of performance for a higher education institution. Despite greater focus by higher education institutions on retention in recent years, rates have changed very little (Pusser & Tinto, 2006). Data from ACT, Inc. indicate that 25.9 percent of first-year students at four-year universities do not return to school the following year (Berger & Lyon, 2005). Due to the economic environment and decrease in higher education funding, and significant increases in consumer loan debt and default rates, there is an increased focus on improving retention rates at colleges and universities (Tinto, 2007). Not only does student retention benefit the university, but college retention is beneficial to students as well. Compared to high school graduates, individuals graduating from college increase their employment opportunities and have higher career lifetime earnings (United States Bureau of Labor Statistics, 2017; United States Social Security Administration, 2015).

This study focused on clarifying the relationships between participation and performance in agricultural education CDEs in high school and the subsequent impact on fall-to-fall retention rates for first-year, first-time, full-time students enrolled in

agricultural sciences at a regional, four-year, public, American university. If participation and performance impact retention, this may show the possibility that prediction models might be developed to effectively predict student retention. Such predictive models would be impactful and highly valued in contemporary higher education. According to Murtaugh, Burns, and Schuster (1999), pre-college characteristics can be an asset in forecasting student retention. Predictive analytic models have been used at universities to improve student success (Campbell, DeBlois, & Oblinger, 2007; Denley, 2014; Dietz-Uhler & Hurn, 2013; Gagliardi, 2018) but much of the early retention work focused on the transition from high school to the first year of college (Tinto, 2007). This study focused on pre-high school graduation career-specific events that may impact the retention of first-year, first-time, full-time students.

Statement of the Problem

In the School of Agricultural Sciences at Northwest Missouri State University, from 2012 through 2017, the fall-to-fall retention rate for the first-time freshman was 72.4 percent (Northwest Missouri State University Institutional Research, n.d.). Although significant effort and focus has been placed on student retention, including the establishment of an academic living community and changes to academic advising, data show little to no change in retention rates. Current data from 2019 indicate that only 56.8 percent of the students graduate with a degree from Northwest Missouri State University in the School of Agricultural Sciences within six years (Northwest Missouri State University Institutional Research, 2020).

Prediction models with a variety of data, including personal, social, psychological, and other variables, can assist in effectively predicting student retention

(Yadav, Bharadwaj, & Pal, 2012). Existing research indicates that traditional predictors, such as standardized test scores and high school rank, are most commonly used in predicting student success (Krumrei-Mansuso, Newton, Kim, & Wilcox, 2013; Robins et al., 2004). However, much of the data available to administrators, including non-traditional measures, remains underutilized in creating student success prediction models (Kabakchieva, 2012).

Several studies show pre-college characteristics, such as high school GPA and ACT or SAT score, have a moderate predictive factor related to college retention (Kuh, Cruce, Shoup, Kinzie, & Gonyea, 2008; Lotkowski, Robbins, & Noeth, 2004; Noble, Flynn, Lee, & Hilton, 2007). However, there is limited empirical evidence on how student characteristics other than standardized test scores or high school GPA can be used to predict retention within a university. Results from a study by Rouse (2012) show evidence of a strong correlation between participation in high school leadership activities and future educational attainment. Research by Lipscomb (2006) and Leeds, Miller, and Stull (2007) indicate a positive relationship between participation in extracurricular activities and academic achievement. Without expanding the knowledge base of factors impacting student retention in universities, efforts to improve students' retention will be limited.

According to Bangser (2008), high school experiences do not adequately prepare students for college, but little is known about the impact of CDEs on college success. Consequently, even though research results are mixed regarding student characteristics in high school with college retention, participation, and performance in agricultural CDEs may play a role in predicting fall-to-fall retention of first-year students in agricultural

sciences. Developing prediction models is particularly important, given the pressure placed on higher education to improve student success. The use of predictive analysis of student characteristics and experiences could help identify students at risk of not being retained after their first-year of college. This study adds to the body of work by analyzing longitudinal data to develop a prediction model to forecast retention at a regional, four-year, public university in the Midwest.

Purpose of the Study

The purpose of this study was to develop a predictive model utilizing participation and performance of high school agricultural education students in CDEs as predictors of retention of first-year, first-time, full-time college students in agricultural sciences at a regional, Midwest, public university utilizing a predictive correlational design to examine Kolb's Experiential Learning Theory (ELT) (1984). While evidence of predictive analytics' relationship to predict student success exists, the relationship between participation and performance in CDEs and college retention has yet to be thoroughly investigated. There is a lack of information about how student participation and performance in CDEs in high school impacts student success at universities. The data provided could also help first-year college students in the School of Agricultural Sciences at Northwest Missouri State University by identifying potential academic strengths and challenges. Additionally, data may provide information to high schools regarding how to best prepare students for college while supporting student engagement.

Research Questions

The research questions guiding this study are:

R_1: Does participation in agricultural education CDEs in high school predict retention of first-year, first-time, full-time college students enrolled in agricultural sciences at a regional, Midwest, public university?

R_2: Does performance in agricultural education CDEs in high school predict retention of first-year, first-time, full-time college students enrolled in agricultural sciences at a regional, Midwest, public university?

Hypotheses

The study hypothesizes that:

H_1: Participation in agricultural education career development events has a statistically significant impact on fall-to-fall retention of first-year, first-time, full-time students.

H_2: Performance in agricultural education career development events can be a predictor for fall-to-fall retention of first-year, first-time, full-time students.

Identification of Variables

The independent variables for the study include participation and performance in agricultural education CDEs. Career development events are competitive events in the agricultural education curriculum designed to develop individual responsibility while gaining comprehensive knowledge in specific areas of agricultural education (National FFA Organization, n.d.a). The dependent variable for the investigation was fall-to-fall retention for first-time college students. Retention is defined as “a measurement of

students enrolled in the fall of the prior year that continues enrollment in the fall of the current year for first-time bachelor's degree-seeking students" (National Center for Education Statistics, 2018). ACT score and high school GPA were confounding variables included in the study. Confounding variables that were not considered in the study include the quality of the agricultural education program at the high school level, factors related to the positive engagement of first-year, first-time, full-time students, and barriers resulting in the lack of commitment of first-year college students.

Theoretical Framework

Experiential learning in an authentic context is a foundational concept of career and technical education and agricultural education (Knobloch, 2003). Experiential learning theory is defined as "the process whereby knowledge is created through the transformation of experience" (Kolb, 1984, p. 41). The origin of the theory is built upon the foundation of philosophical pragmatism, according to Dewey, social psychology, according to Lewin, and cognitive-developmental developmental genetic epistemology, according to Piaget (Kolb, 1984). Through an engaging and transforming experience, knowledge is created (Smith, 2001). Concrete experiences and abstract conceptualization stimulate learning to occur (Kolb, Boyzatzis, & Mainemelis, 2001). Rather than merely a thought process, experiential learning involves a direct learning activity where the student is actively engaged in a learning event (Borzak, 1981).

Experiential learning activities promote problem-solving, critical thinking, the synthesis of knowledge, and applying skills in real-world situations (Ormrod, 2000). Also, Knobloch (2003) associates higher-order thinking, depth of knowledge, and connections to the world beyond the classroom as tenants of authentic learning. Career

development events in agricultural education expand the student's knowledge gained in traditional classroom and laboratory settings. CDEs answer the question, "When will I use this knowledge in the real world?" (Texas FFA Association, n.d.). CDEs allow students to demonstrate problem-solving and performance skills in a variety of agricultural career pathways. Career pathways, agricultural education courses, and CDEs for Missouri are shown in Table A1 in Appendix A. Due to the experiential and authentic nature of CDEs, it can be inferred that they prepare students for their future endeavors after high school (National FFA Organization, n.d.a) Research supports the idea that CDEs are beneficial in preparing students for their future in college and career endeavors (Lundry, Ransey, Edwards, & Robinson, 2015; Rose et al., 2016).

Although Himelstein (1992) recognized that students with a high degree of career interest was a predictor of student retention, little is known about the impact of CDEs on retention of first-year, first-time, full-time college students. Therefore, the purpose of this study is to develop a predictive model utilizing participation and performance of high school agricultural education students in CDEs as predictors of retention of first-year, first-time, full-time college students in agricultural sciences at a regional, four-year Midwest university. For the study, participation was defined as the number of district CDEs a student participates in high school. The performance was measured by scores achieved in each of the CDEs. The study examined the development of a prediction model to forecast college retention using participation and performance in CDEs as indicators. Data and predictive analytics can help colleges and universities predict retention and college success (Campbell, DeBlois, & Oblinger, 2007; Elias, 2011).

Design of the Study

The predictive correlation designed quantitative study utilized chi-square tests and binomial logistic regression analyses. A predictive study provides:

> (1) the content to which a criterion behavior pattern can be predicted, (2) data for developing a theory about the determinants of the criterion behavior or pattern, and (3) evidence about the predictive validity of the test or tests correlated with the criterion behavior pattern. (Gall, Gall, & Borg, 2007, p.342)

The investigation focused on the premise that participation and performance in CDEs can be used as a predictor of fall-to-fall retention of first-year, first-time, full-time students. Warner (2013) and Gall et al. (2007) describe correlation as the statistical relationship or association between variables. Correlation allows the researcher to make predictions regarding the criterion variable when considering predictor variables (Lodico, Spaulding, & Voeglte, 2006).

Setting

A non-probability convenience sample of students enrolled in the School of Agricultural Sciences made up the study sample. The study population included first-year, first-time, full-time students, who enrolled at Northwest Missouri State University, majoring in a degree in the School of Agricultural Sciences in the fall semesters in 2015, 2016, 2017, and 2018. District CDE participation and performance data in archives at judgingcard.com from 2012 through 2017 were used for the study. A request to utilize the CDE data was obtained from the Director of the Agricultural Education Division of the Missouri Department of Elementary and Secondary Education.

University data from students enrolling in the School of Agricultural Sciences in 2015, 2016, 2017, and 2018 was obtained from Institutional Research at Northwest Missouri State University regarding agricultural science program area CIP codes, fall-to-fall retention data, composite ACT scores, and high school cumulative GPA. All information was de-identified during the collection, storage, and analyses of the data to protect students' identity and confidentiality. Institutional Review Board approval was obtained from the University of Missouri-Columbia and the Northwest Missouri State University Institutional Review Board.

Instrumentation

Student CDE participation and performance data were retrieved from archives at judgingcard.com. Student retention, composite ACT score and high school GPA data were obtained through the office of Institutional Research at Northwest Missouri State University. All scores were normalized for comparisons used to analyze student performance. Microsoft Excel was utilized for tabulating the data. All statistical analyses were executed using IBM SPSS 9 (version 25).

Procedures

Queries were developed to collect participation and measured performance data. Additional queries were designed to identify agricultural science students in four cohorts: 1) fall 2015, 2) fall 2016, 3) 2017, and 4) fall 2018. Field (2018) recommends the significance level for two-tailed tests be a value of 0.05. Power analysis for a logistic regression using benchmarks from Lipsey and Wilson (2001) and G*Power 3.1.7 (Faul, Erdfelder, Buchner, & Lang, 2013) recommend a sufficient sample size using an alpha of 0.05, a power of 0.80, a medium effect size (odds ratio = 1.72), and a two-tailed test. As

the study met the assumptions, the minimum sample size recommended was 177 (Statistics Solutions, 2016). With four years of data, the study's sample size was 386 students, which exceeds the recommendation. Data from the queries were cross-referenced and coded to de-identify students by office personnel. Processed data was stored in password-protected spreadsheet files for the duration of the study and retained for ten years for further potential analysis. All data will be erased and destroyed after ten years.

Data Analyses

Regression analysis is commonly used to test hypotheses in educational research (Stolzenberg, 2004). The quantitative study was a predictive correlation design using chi-square tests and logistic regression analyses. Regression analyses are widely used in educational research (Cobb-Clark & Nguyen, 2012; Field, 2018; Lodico, Spaulding, & Voeglte, 2006). In this study, first-year college student retention was the outcome variable to be measured to develop accurate prediction models of the impact of non-traditional predictors of college success.

Initial analysis was conducted utilizing the chi-square test of homogeneity. A Pearson chi-square test (Fisher, 1922; Pearson, 1900) shows a relationship between two categorical variables (Field, 2018). The test determines if there is a difference between the binomial proportions of two independent variables on the dichotomous dependent variable (Laerd Statistics, 2016).

The data analysis of participation in CDEs and retention utilized binomial logistic regression. Binomial logistic regression uses continuous and/or categorical independent variables to predict whether an observation falls into one of two dichotomous dependent

variables (Laerd Statistics, 2017). According to Frey (2018), "logistical regression is a predictive analysis where a model is tested to find out whether the value of one variable or the combination of values of multiple variables, can predict the value of another variable" (p. 994). In this study, the researcher used chi-square tests and logistical regression to determine the probability of using participation and performance in CDEs, as predictors of retention in first-year, first-time, full-time college students in the School of Agricultural Sciences. Table 1 outlines the research questions, predictor variables, outcome variables, and analyses of the study.

Table 1

Research Questions, Variables, and Analyses

Research Questions	Predictor Variable	Outcome Variable	Analyses
R1: Does participation in agricultural education CDEs in high school predict retention of first-year, first-time, full-time college students enrolled in agricultural sciences at a regional, Midwest, public university?	*Number CDEs participated in during high school*	*Fall-to-fall retention measured by census date enrollment status*	*Chi-square* *Binomial logistical regression*
R2: Does performance in agricultural education CDEs in high school predict retention of first-year, first-time, full-time college students enrolled in agricultural sciences at a regional, Midwest, public university?	*Level of performance in CDEs in high school*	*Fall-to-fall retention measured by census date enrollment status*	*Chi-square*

All statistical analyses were executed using IBM SPSS 9 (version 25). Descriptive statistical tests included frequencies, calculations of means and standard deviations, and evaluations of the normal distributions. Analytical results using chi-square tests and binomial logistical regression reported the relationship between participation in CDEs and retention. ACT score and high school GPA were examined as confounding variables in the binomial regression analysis. A chi-square test was used to determine the relationship between performance in CDEs and student retention. Table 2 presents a list of relevant variables for the study.

Table 2

List of Relevant Variables

Variable name	Variable type	Research variable	Value
CDEs participated in high school	*Categorical*	*Predictor (H_1)*	*Numerical*
Performance in CDEs in high school	*Categorical*	*Predictor (H_2)*	*Percentile*
Fall-to-fall retention rate	*Categorical*	*Outcome*	*Dichotomous*
ACT score	*Continuous*	*Confounding*	*Numerical*
High school GPA	*Continuous*	*Confounding*	*Numerical*

Limitations

This study was limited to students enrolling in the School of Agricultural Sciences at Northwest Missouri State University in 2015, 2016, 2017, and 2018. The study focused on the participation and performance in CDEs at the district level in the State of Missouri.

As a result, only students from Missouri high schools were included in the study and the findings of this study should not be generalized to a larger population (Privitera, 2017). Confounding variables were limited to ACT score and high school cumulative GPA. Other student characteristics are not considered in this study. Size of school, numbers of teachers in the agricultural education programs, years of teaching experience of agricultural educators, and agricultural education programs are not within the scope of this study. In addition, no consideration was given to other demographic variables of the students or the high schools from which they graduated. Caution should be taken in generalizing the findings to other populations due to the limitations of the study.

Assumptions

The assumptions of this study focused on the data available in archives at judgingcard.com and from the Institutional Research Office at the institution. It was assumed that all data used in the study was valid and reliable. Creswell (2009) and Field (2018) identify validity as a measurement of accuracy and reliability as a measurement of consistency over time.

Design Controls

The research design for this study included first-year, first-time, full-time college students in the School of Agricultural Sciences at Northwest Missouri State University enrolling in 2015, 2016, 2017, and 2018 to ensure adequate sample size for the study. ACT score and cumulative high school GPA were confounding variables accounted for in the analysis of the data. Confounding variables can have a potential impact on dependent variables if not considered by the researcher (Creswell, 2009).

Definition of Key Terms

Agricultural Education: "Agricultural education is a systematic program of instruction available to students desiring to learn about the science, business, and technology of plant and animal production and/or about the environmental and natural resources systems." (National FFA Organization, n.d.b).

Career and Technical Education (CTE): Instruction of specific career skills to students at the secondary and post-secondary levels (Association for Career & Technical Education, n.d.).

Career Development Events (CDEs); Competitive events designed to emulate real-world situations in order to develop college and career readiness skills as a result of instruction in secondary agricultural education programs (National FFA Organization, n.d.a).

Experiential learning: Student learning experiences supervised by the agriculture educator that take place outside of a normal classroom setting (National Association of Agricultural Educators, n.d.).

National FFA Organization: An intra-curricular student organization developing leadership and preparing students for careers in the science, business, and technology of agriculture (National FFA Organization, n.d.c).

First-year student: Students entering directly from high school who enrolled for the first time at Northwest Missouri State University in the School of Agricultural Sciences.

Missouri Joint Staff on Agricultural Education: A collaborative think-tank for agricultural education in the State of Missouri including secondary and post-secondary

agricultural educators, pre-service teacher educators, and Department of Elementary and Secondary Education staff

Participation in CDEs: Involvement through participation in a CDE at the district level in the state of Missouri

Performance in CDEs: Percentile rank of participant in CDE at the district level

Retention: First-time degree seeking students who enroll in the fall of the prior year that enroll in the fall of the next year (National Center for Education Statistics, 2018)

Significance of the Study

As the financial environment in higher continues to tighten due to limited state funding, there is an increased focus on improving the retention rates at colleges and universities (Tinto, 2007). Furthermore, many states include institutional retention rates as part of accountability programs linked to performance funding (Crosley, Heagney, & Thomas, 2009; Dougherty et al., 2006). Improving college retention rates has significant implications in improving time to degree completion for students and reducing the costs of student dropout for institutions (Lotkowski, Robbins, & Noeth, 2004). It is essential to recognize a variety of factors that influence student success in higher education. Utilizing non-traditional predictors of college success, other than high school GPA and admission test scores, can assist educators in increasing retention and graduation rates. By using variables stemming from CDE participation and CDE performance, experiential learning theory may provide educators with a valuable tool to improve college retention rates. In addition to demographic and psychosocial factors traditionally used to predict college success including retention, experiential learning theory may offer an alternative way to conceptualize considerations affecting college success.

Furthermore, this study addresses the gaps in the literature about the effectiveness of CDEs and the use of alternative predictors to forecast fall-to-fall retention of first-year, first-time, full-time college students pursuing a degree in agricultural sciences. During the late 1990s, Ransdell (2001) and Berger and Milem (1999) first identified the lack of existing prediction models using participation in high school activities to provide data forecasting the retention of first-year university students.

As well, there is a lack of research showing the impact of experiential learning in agricultural education (Roberts, 2006). However, research indicates that more than two-thirds of students participating in FFA CDEs at the national level plan to attend college following high school graduation (Croom, Moore, & Armbruster, 2009) and the number of students participating in CDEs is growing steadily (Russell, Robinson, & Kelsey, 2009). The study has the potential to provide educators valuable information to assist in promoting student success. Results from this study will aid in identifying students that may be at a higher risk of not being retained after their first year of college. A prediction model may assist high school agricultural educators in better preparing students for continuing education in an agricultural field. Likewise, a prediction model may assist universities in early identification of students at risk of not being retained. Institutions utilizing early identification models are better able to provide student support (Hopkins, 2008; Raju & Schumacker, 2015).

Summary

The quantitative study is a non-probability convenience predictive correlation design utilizing chi-square tests and logistic regression analyses. For the study, analysis

of the data used logistic regression to determine the relationship between participation and measured performance in CDEs and first-year college retention.

To improve fall-to-fall retention in first-year college students, educators need to utilize a multitude of strategies to address the contemporary issues facing students in today's higher education environment (Bowen, et al, 2018). The study provides an opportunity to fill an existing gap in the literature regarding the utilization of experiential learning activities as predictors for retention of first-year college students. Scarcity of research indicating the use of predictive analytics in forecasting student retention in regional, four-year universities provides an excellent opportunity for expanded exploration of the issue. By determining the predictive relationship between participation and measured performance of high school students in CDEs and retention of first-year university students in agricultural sciences, this study adds to the base of knowledge and allows educators and institutions to have a more significant impact on student success by improving student services and academic policies.

SECTION TWO

PRACTITIONER SETTING FOR THE STUDY

Agricultural Education in the United States serves a twofold purpose: 1) preparation for a career in agriculture, and 2) agricultural literacy. Roberts and Ball (2009) recommend combining a content-based model with a context-based model for teaching and delivering of curriculum in agricultural education. Combining education in and about agriculture promotes learning and understanding. (Phipps, Osborne, Dyer, & Ball, 2008). Due to the ever-changing nature of today's agricultural industry, secondary agricultural education curriculum must continually transform to meet workforce development demands for our country and beyond (Talbert, Vaughn, Croom, & Lee, 2014). By utilizing the three-circle model of instruction (shown in Figure 1),

Figure 1. Agricultural Education Three-Circle Model

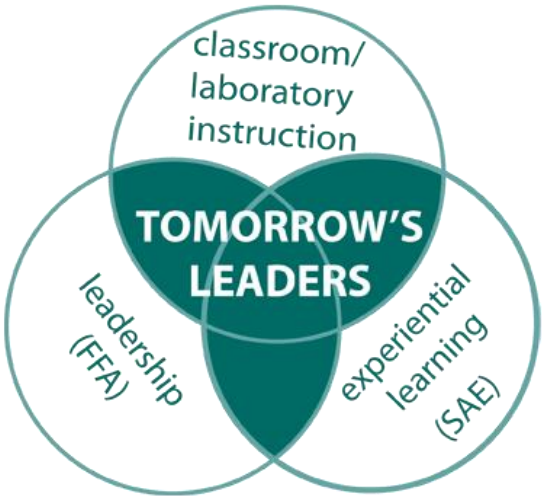


Figure 1. Three-circle model utilized in high school Agricultural Education. (National Association of Agricultural Educators, n.d.)

classroom and laboratory instruction, leadership development, and experiential learning, agricultural education prepares individuals to be successful leaders in agriculture (National Association of Agricultural Educators, n.d.).

Prosser and Allen (1925) presented sixteen theorems that serve as the foundation and provided influence in the development of vocational education. The assumptions serve as foundational building blocks for vocational education (Gordon, 2014; Wang & King, 2009). According to Talbert, Vaughn, Croom, and Lee (2014), Prosser's sixteen theorems for vocational education fit into seven major categories when applied to agricultural education::

1. Authentic instruction
2. Authentic self-evaluation
3. Higher-order thinking skills
4. Agricultural education curriculum
5. The agriculture teacher
6. FFA and agricultural education
7. Planning for change in the agricultural education program.

The categories provide relevance to the theorems advanced by Prosser and Allen in the current delivery of agricultural education programs in secondary high schools in the United States.

Although Dewey's principal goal of individual fulfillment is in contrast to Prosser's focus of meeting societal needs, career and technical education and agricultural education have been strongly influenced by both educational philosophers. Not only has career and technical education and agricultural education been shaped by Dewey and

Prosser's principles, the impact of federal legislation has been evident throughout history as well.

History of Agricultural Education

Agricultural instruction succeeded in the 19th century in private schools and through agricultural societies (Moore, 1987/2017). During the late 1800s into the early 1900s, the demand for skilled labor in the United States of America increased substantially due to rapid industrial growth. As a result, leaders recognized the need for agricultural, mechanical, and military education (Talbert, Vaughn, Croom, & Lee, 2014). According to the United States Department of Agriculture (1908), the subject of agriculture was required to be taught in rural schools in eleven states, outlined as part of the course of study in an additional twenty states, and encouraged to be included in the curriculum in twenty-three other states. In 1912, agriculture classes were taught in nearly 2,000 high schools nationwide, with 167 high schools in Missouri offering instruction in agriculture (United States Department of Agriculture, 1913). Although the Morrill Act of 1862 and the Morrill Act of 1990 establishing land-grant colleges expanded the opportunities for education in agriculture, the Smith-Hughes Act passed in 1917, provided federal funding for vocational education and initiated the beginning of legislative action on the national level.

Federal Legislation Impacting Agricultural Education

Throughout the 20th century, several pieces of federal legislation have had an impact on agricultural education. This section will address the Smith-Hughes Vocational Education Act of 1917, the Vocational Education Act of 1963, Vocational Education

Amendments of 1968 and 1976, and the Carl D. Perkins Acts 1984, 1990, 1996, 2006, and 2018.

Smith-Hughes Vocational Education Act of 1917. With the passage of the Smith-Hughes Vocational Education Act of 1917, instruction in the United States shifted from a focus on liberal education to the purpose of vocational preparation. Also, state involvement in education expanded to the federal level (Roberts, 1957). Camp and Crunkilton (1985) advocate that the Smith-Hughes Act has been the most significant event in the history of vocational and agricultural education. Provisions of the Smith-Hughes Act are shown in Table 3. They include funding for vocational education, the establishment of state boards for vocational education, and the creation of the federal board for vocational education (Talbert, Vaughn, Croom, & Lee, 2014).

Table 3

Provisions of Smith-Hughes Act for Agricultural Education

Local	State	Federal
Funds for salaries for vocational agriculture teachers	Creation of State Board for Vocational Education	Creation of Federal Board of Vocational Education
Funds for equipment for vocational agriculture	Funds for salaries for state vocational agriculture state supervisors	Federal Board of for Vocational Education to conduct studies, investigations, and reports concerning agriculture and agricultural processes and requirements of agricultural workers
Directed or supervised practice in agriculture, either on a farm or a school farm	Funds for teacher preparation for vocational agriculture	
Requirement of vocational experience for vocational agriculture teachers	Requirement of vocational experience for vocational agriculture supervisors	

Note: Smith-Hughes Vocational Education Act, 1917

Without the passage of the Smith-Hughes Act and subsequent legislation based on the Smith-Hughes model, Moore (2017) suggests the following might have occurred: 1) reduction in agricultural productivity, 2) increased school dropouts, 3) reduced enrollment in post-secondary education in agriculture, 4) non-existence of the FFA, 5) fewer educational opportunities for adult farmers, 5) a lack of other vocational programs, 6) other federal legislation regarding education would not exist, 7) prevailing in World War II would have been more difficult, and 8) living conditions in rural America would have been negatively affected. The passage of the Smith-Hughes Act promoted the educational system in the United States (Poole & Rubenstein, 2017) and provided the framework for current agricultural education in the United States (Camp, 1987/2017; Martin, 2017). As a result of the federal legislation, the Federal Board for Vocational Education wrote in its annual report, “The movement for vocational education is progressing so rapidly that no complete account of the schemes that are being proposed and adopted can be given within a limited space” (1917, p. 11). The relevance of the passage of the Smith-Hughes Act resonates yet today in the agricultural education program. Since the federal legislation adopted in 1917, experiential learning has been a foundational pillar of the agricultural education curriculum.

Following the passage of the Smith-Hughes Act, a series of federal legislation increased vocational education funding. Still, they did not substantially alter the status of vocational education in the United States. Legislation included the George-Reed Act of 1929, the George-Ellzey Act of 1934, the George-Deen Act of 1936, and the George-Barden Act of 1946 education (Talbert, Vaughn, Croom, & Lee, 2014).

Vocational Education Act of 1963. According to the United States Department of Health, Education, and Welfare (1965), the Vocational Education Act of 1963 was passed because the Smith-Hughes Act of 1917 "was not broad enough, or flexible enough, or rich enough, to meet the needs of today, much less the needs of tomorrow" (p. 1). As shown in Table 4, the scope of vocational education in the United States in the early 1960s was limited.

Table 4

Survey of High School Vocational Education in the United States in 1962

	Population Under 2,500	2,500 to 30,000	Over 30,000
	Percent	*Percent*	*Percent*
Trades and industry	2	14	31
Homemaking	42	56	39
Agriculture	49	50	16
Distributive occupations	0	5	27

Note: United States Department of Health, Education, and Welfare, 1965

The Vocational Education Act of 1963 focused on addressing and improving the accessibility and quality of vocational education in the United States by increasing federal appropriations to the states. The legislation broadened the scope of agricultural education. It allowed for instruction to expand to non-farm production areas of agriculture including, agribusiness, agricultural mechanics, food processing, horticulture, and natural resources (Phipps, Osborne, Dyer, & Ball, 2008; Talbert, Vaughn, Croom, & Lee, 2014; United States Department of Health, Education, and Welfare, 1965). Also, the act provided funding for training for students with disabilities, construction of area vocational schools, and the creation of work-study programs (Talbert, Vaughn, Croom, &

Lee, 2014; United States Department of Health, Education, and Welfare, 1965). The Vocational Educational Act of 1963 stated, “Students no longer will be required, as they were formerly, to have supervised or directed practice on the farm” (Vocational Education Act of 1963, 1963). Although intended to expand supervised agricultural experiences for students, some states' interpretation abolished the requirements of supervised experiences altogether. As a result, state supervisors in vocational agriculture shifted from a supervisory role to a consulting role, and their power diminished (Moore, 2006). However, impacts from the legislation positively changed and expanded the agricultural education curriculum increasing the availability and course offerings to an expanded population. Areas of instruction added as a result of the Vocational Education Act of 1963, such as horticulture, agribusiness, agricultural mechanics, and food science, continue to be an integral part of the agricultural education curriculum.

Vocational Education Amendments of 1968 and 1976. The Vocational Education Act of 1963 was amended in 1968 and 1976. The amendments focused on increased federal appropriations and promoted significant aspects of vocational education. Key components of the 1968 amendment aimed to improve existing programs, establish new programs, and expand vocational counseling and guidance (Phipps, Osborne, Dyer, & Ball, 2008). The 1976 amendment established a framework to prevent gender discrimination (Talbert, Vaughn, Croom, & Lee, 2014). They emphasized advisory committees, innovative programs, and special programs for students with disadvantages (Phipps, Osborne, Dyer, & Ball, 2008).

Carl D. Perkins Acts. Cark Perkins, representing Kentucky as a member of the United States House of Representatives from 1949 until 1984, was instrumental in

advocating legislation to improve the quality of vocational education. Table 5 displays the significant themes and outlines the impact of Carl Perkins Acts to agricultural education. The Carl D. Perkins Vocational Education Act of 1984 (1984) was enacted to improve work readiness and increase student access to high-quality vocational programs, especially for underrepresented populations (Lynch, 2000).

Table 5

Summary of Perkins Legislation

Legislation	Legislative Themes	Impact to Agricultural Education
Carl Perkins Act of 1984	Funding for special student populations in vocational education	Increased funding to states for vocational education Modern agricultural arts (agricultural mechanics) were specified in legislative language.
Perkins II (1990)	Contextual learning Development of both academic and occupational skills	Integration of mathematics and science into the curriculum Emphasis on program accountability
Perkins III (1998)	Development of academic, vocational, and technical skills States required to provide data on core performance indicators.	Development of articulation agreements between secondary and post-secondary institutions
Perkins IV (2006)	Uses the term career and technical education instead of vocational education Programs of study Accountability requirements	Requirements of programs of study that link academic and technical content Development of programs of study that include coordinated, non-duplicative courses Measurement of technical skills attainment and industry-recognized credentials.
Perkins V (2018)	Flexibility Responsibility	Divided CTE students into concentrators and participants

	Focus on quality and industry alignment

Note: Carl D. Perkins Vocational Education Act of 1984, (1984); Carl D. Perkins Vocational and Applied Technology Act Amendments of 1990 (1990); Carl D. Perkins Vocational and Applied Technology Education Amendments of 1998 (1998); Carl D. Perkins Career and Technical Education Act of 2006, (2006); Strengthening Career and Technical Education for the 21st Century Act (2018).

Perkins II (Carl D. Perkins Vocational and Applied Technology Act Amendments of 1990 (1990) and Perkins III (Carl D. Perkins Vocational and Applied Technology Education Amendments of 1998 (1998) addressed the topic of educational reform to improve student achievement. Perkins II concentrated on developing educational programs to enhance student achievement for both academic and occupational competencies (Carl D. Perkins Vocational and Education and Applied Technology Amendments of 1990). For the first time in the history of vocational education, emphasis was placed not only on developing occupational skills but also on academics (Lynch, 2000; Phipps, Osborne, Dyer, & Ball, 2008). The outcomes for agricultural education from Perkins II included a more concentrated effort to integrate science and mathematics into the agricultural education curriculum and more emphasis on program accountability and evaluation.

The reauthorization of Perkins III focused on curriculum integration and the development of articulation agreements between secondary and post-secondary institutions (Carl D. Perkins Vocational and Education and Applied Technology Amendments of 1998). Two critical requirements of Perkins IV (Carl D. Perkins Career and Technical Education Act of 2006, (2006) included the establishment of programs of study and defined accountability requirements incorporating defined performance measures (Dortch, 2012). From 2009 until 2018 in all areas of career and technical

education (CTE), technical skill attainment improved from 64.29% to 73.46% (United States Department of Education, 2019). Intended to advance CTE in the United States further, Strengthening Career and Technical Education for the 21st Century (Perkins V) (2018) was signed into law in July of 2018. The legislation gives states more flexibility in using federal funds in promoting career and technical education to middle school students and allows states to determine performance goals for student academic attainment (Perkins Collaborative Resource Network, n.d.).

Recent Perkins legislation focuses on four core principles to improve the quality of CTE and agricultural education, 1) alignment, 2) collaboration, 3) accountability, and 4) innovation (Brand, B., Valent, A, & Browning, A., 2013). Balfanz, Bridgeland, Bruce, and Hornig Fox (2013) suggest that engaging and relevant education at the secondary level helps transition to post-secondary education. The series of Carl D. Perkins legislation has stimulated agricultural education in the state of Missouri and nationwide by focusing on academic rigor, developing career-focused programs of study, and promoting greater accountability.

***Understanding Agriculture – New Directions for Education*.** In response to the Nation at Risk report released in 1983, the National Research Council Board on Agricultural Education conducted a study regarding agricultural education in secondary schools in the United States. The *Understanding Agriculture - New Directions for Education* (National Research Council, 1988) report expanded the focus of agricultural education to include agricultural literacy. Recommendations from the *Understanding Agriculture - New Directions for Education* report are shown in Appendix C, Table C1. In response to the report, agricultural education has utilized a dual-pronged approach,

education in agriculture and education about agriculture, to modify the secondary agricultural education curriculum. The dual-pronged approach and the principles promoted by Prosser, Dewey, and Kolb are foundational building blocks for successful secondary agricultural education programs in the United States.

Strategic planning in agricultural education. Following the *Understanding Agriculture - New Directions for Education* (National Research Council, 1988), stakeholders in agricultural education held the National Summit on Agricultural Education in 1990 to develop a strategic plan. The goals of the project included: 1) developing a science-based agricultural curriculum, 2) expanding opportunities for women and minorities, 3) integrating agriculture into the educational mainstream, and 4) focusing on agricultural literacy (Lawton, 1990).

In 1996, the National Council for Agricultural Education initiated a second strategic planning effort for agricultural education. Entitled *Reinventing Agricultural Education (RAE) 2020*, the purpose of the initiative was to develop a unified vision and framework for agricultural education in the 21st century (Phipps, Osborne, Dyer, & Ball, 2008; Talbert, Vaughn, Croom, & Lee, 2014). According to *RAE 2020*, "agricultural education envisions a world where all people value and understand the vital role of agriculture, food, fiber, and natural resources industries in advancing personal and global well-being" (National Council for Agricultural Education, 2000, p. 2). Figure 2 shows the goals of *RAE 2020*.

Although *RAE 2020* was developed in 2000, the four goals remain relevant, and the dialogue to promote a unified vision for agricultural education continues within the profession. The organizational structure within agricultural education at the local, state,

and national levels promotes the growth and development of agricultural education programming in the United States.

Figure 2. *Reinventing Agricultural Education 2020*

GOAL 1 – An abundance of highly motivated, well-educated teachers in all disciplines, pre-K trough adult, provide agriculture, food, fiber and natural resources education.

GOAL 2 – All students have access to seamless lifelong instruction in agriculture, food, fiber and natural resources systems through a wide variety of delivery systems and educational settings.

GOAL 3 – All students are conversational in agriculture, food, fiber and natural resources systems.

GOAL 4 – Partnerships and strategic alliances ensure a continuous presence of education in and about agriculture, food, fiber and natural resources systems.

Figure 2. Four goals of *Reinventing Agricultural Education for 2020* strategic plan (National Council for Agricultural Education, 2000).

Organization and Structure of Agricultural Education

Over 800,000 students participate in agricultural education programs in one of more than 8,600 local programs throughout the 50 states and three U.S. territories (National FFA Organization, n.d.d). The objective of local, community-based agricultural education programs in school is to develop appreciation, knowledge, and skills in agricultural sciences, agribusiness, and the production of food and fiber (Newcomb, McCracken, Warmbrod, & Whittington, 2004). The three major components of agricultural education include classroom and laboratory instruction, supervised

agricultural experience, and FFA (National Association of Agricultural Educators, n.d.; Phipps, Osborne, Dryer, & Ball, 2008; Talbert, Vaughn, Croom, & Lee, 2014). Experiential learning methods utilized in the agricultural education classroom allows students to practically apply their education in real-world situations (Retallick & Martin, 2008).

Scope and Status of Agricultural Education in Missouri

School-based agricultural education is offered in middle schools and high schools at the local school district level in state-approved programs. Table 6 displays annual enrollment data for the state of Missouri from 2014 through 2018. Enrollment in school-based programs is at an all-time high in the state of Missouri. The local school board of education and school administration establishes policies and procedures for individual programs. At the local level, agricultural education teachers, school administration, and advisory committees guide curriculum decisions.

Table 6

Missouri Agricultural Education Enrollment and Number of Programs

Year	Number of Departments	Secondary Enrollment	Junior High Enrollment	Total Enrollment
2014-15	339	28,644	12,874	41,518
2015-16	342	28,285	11,036	39,321
2016-17	344	27,395	13,289	40,684
2017-18	343	27,104	13,375	40,479
2018-19	347	27,977	14,193	42,170

Note: Missouri Department of Elementary and Secondary Education, 2019

Missouri Joint Staff on Agricultural Education

The Missouri Joint Staff on Agricultural Education serves school-based agricultural education by providing leadership focusing on promoting action to support the development of agricultural education in the state. The mission of the Joint Staff on Agricultural Education is to lead the future of school-based agricultural education by 1) identifying opportunities and resources, 2) providing a forum for thought and direction, and 3) focusing on academic and career success for all students (Missouri Joint Staff on Agricultural Education, n.d.)

The Joint Staff on Agricultural Education fosters collaboration between wide varieties of stakeholders in agricultural education in Missouri. It is made up of the following representatives:

- State Director of Agricultural Education (Department of Elementary and Secondary Education)
- State Supervisors of Ag Education (Department of Elementary and Secondary Education)
- Teacher Educators
    - College of the Ozarks
    - Missouri State University - Springfield
    - Northwest Missouri State University - Maryville
    - Southeast Missouri State University Cape Girardeau
    - University of Central Missouri - Warrensburg
    - University of Missouri – Columbia
- Missouri’s Adult Education Coordinator

- Missouri's Professional Development Coordinator
- Missouri Agricultural Education Division of the Association for Career and Technical Education (MOACTE)
    - High school teachers
    - Two-year post-secondary level instructors

The Joint Staff on Agricultural Education provides a mechanism where agricultural leaders in the state can meet, plan, and initiate action for the continuous improvement of agricultural education in the state of Missouri.

Organizational Analysis

Bolman and Deal (2013) recognize that well-defined objectives, roles, and sufficient plans are requirements for high performing organizations to execute successful projects. The established objectives, strategic plan, and defined roles of members aids in the efforts of the Joint Staff on Agricultural Education. However, due to the bureaucratic nature of educational institutions described by Manning (2013), progress for the Joint Staff on Agricultural Education can be awkward and slow. According to Bolman and Deal (2013), the structural form can enhance and constrain what an organization can accomplish. Careful study and analysis of the structure of agricultural education in the state of Missouri provide direction in the development of plans to assist in the continuous improvement efforts for agricultural education in the state of Missouri.

Structural Frame

Individuals from the Agricultural Education Division of the Missouri Department of Elementary and Secondary Education, agricultural education pre-service teacher educators, secondary and post-secondary agriculture teachers, and professional

development specialists make up the Joint Staff on Agricultural Education. The director of Agricultural Education for the Department of Elementary and Secondary Education serves as the chair of the Joint Staff on Agricultural Education. Office support and industry stakeholders provide support to the organization. Figure 3 outlines the organization chart for the Joint Staff on Agricultural Education.

Figure 3. Joint Staff on Agricultural Education Organizational Chart

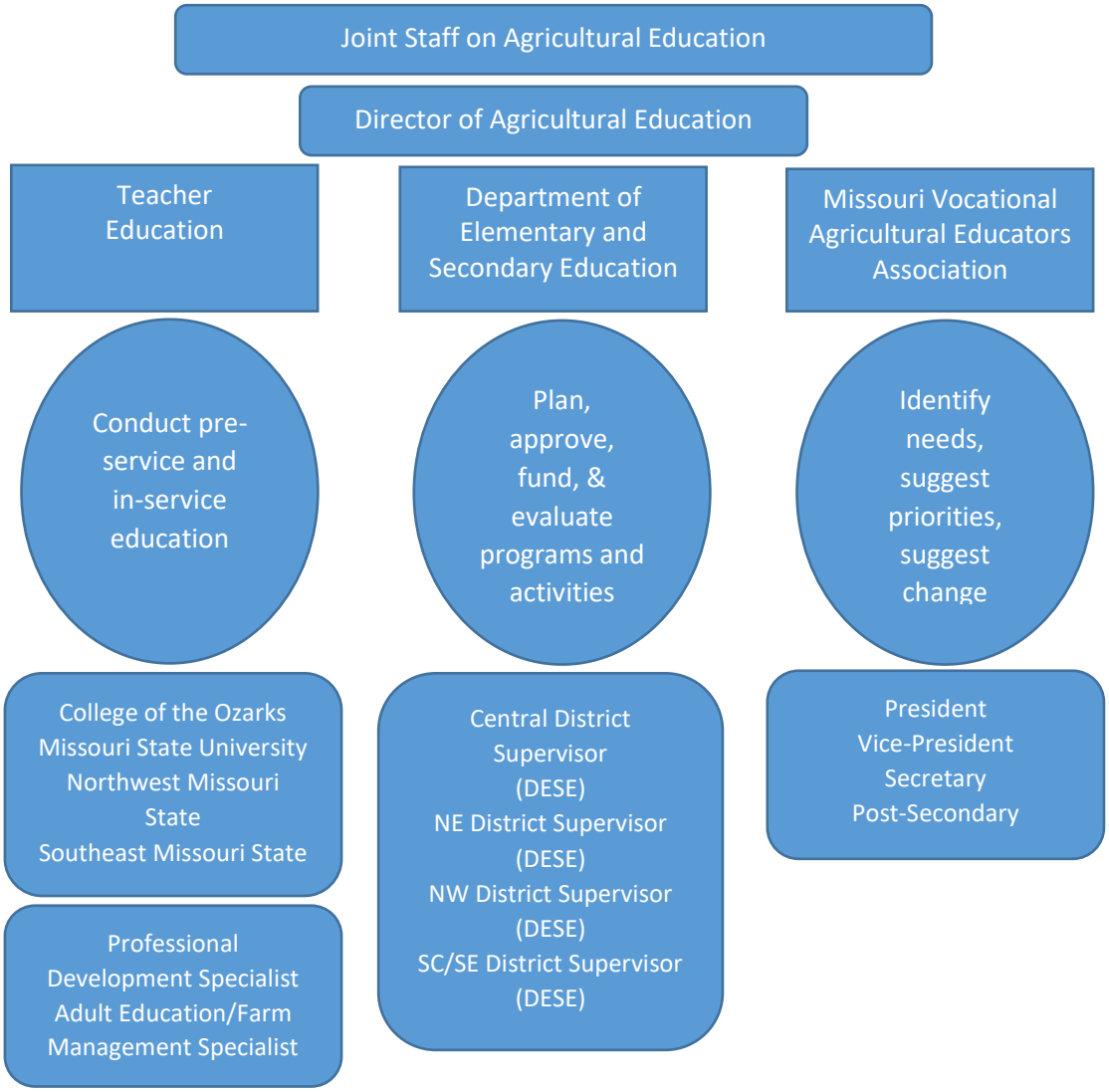


Figure 3. Joint Staff on Agricultural Education organization chart includes outlines responsibilities and members (Missouri Joint Staff on Agricultural Education, n.d.).

Examination of the structure of agricultural education in Missouri reveals Mintzberg's Professional Organization Model (1979/2005). Figure 4 displays the application of Mintzberg's Professional Bureaucracy Model to the Joint Staff on Agricultural Education in Missouri. Bolman and Deal (2013) suggest that organizations with a professional

Figure 4. Mintzberg's Professional Bureaucracy Model

Figure removed due to copyright.

Figure 4. The application of Mintzberg's Professional Model to the Joint State Staff and agricultural education in Missouri.

A. Strategic Apex - Director of Agricultural Education
B. Supporting staff - Support staff
C. Middle Line - Joint Staff on Agricultural Education
D. Techno-structure - Industry partners
E. Operating core - Local school-based agricultural education programs

From: The Structuring of Organizations, (p. 20), by H. Mintzberg, 1979, Upper Saddle, N. J.: Prentice Hall. Copyright 1979 by Prentice Hall.

organizational bureaucracy tend to respond to external change, which can be the case with agricultural education in the state of Missouri.

Allocation of tasks is the underpinning of structure within organizations (Bolman & Deal, 2013). The effectiveness of the Joint Staff on Agricultural Education is reliant upon the members of the organization. The health of agricultural education Missouri is dependent upon the rapid and flexible responses to internal and external change. Manning (2013a) suggests that individuals rarely act and perform in new and inventive ways. Instead, they utilize what has worked in the past and examples of acceptable behaviors.

Furthermore, Serrat (2012), suggests that creative organizations that continually evolve in the areas of direction, efficiency, concentration, proficiency, learning, cooperation, and competition have the most impact. The defined roles of the members aids in the success of the Joint Staff on Agricultural Education. Research by Anderson, Barrick, and Hughes (1992), Darling-Hamond (2006), and Graham and Edwards (2018) indicates that collaboration between state supervisors, pre-service agricultural educators, and teacher organization leaders has a positive impact on the quality of education.

Political Frame

According to Bolman and Deal (2013), coalitions form because members need each other. Those coalitions are easier to maintain due to shared values and beliefs. Members of the Joint Staff on Agricultural Education recognize that the organization can do more together than the members can do individually. By establishing strategic priorities, the Joint Staff on Agricultural Education has created the capacity to make things happen. The strategic priorities for the organization are 1) communication – telling our story, 2) connections – bringing people together, and 3) quality agricultural education

programs – preparing career-ready graduates (Missouri Joint Staff on Agricultural Education, n.d.). Table 7 outlines the strategic priorities for the Joint Staff on Agricultural Education.

Table 7

Strategic Priorities and Action Plan for Joint Staff on Agricultural Education

Strategic Priorities	Action Plan
Communication-Telling Our Story	Raise public interest in agriculture and education. Increase the number of communication sources and channels.
Connections-Bringing People Together	Fostering connections with people, partners, issues, challenges, and opportunities. Serve broader audiences
Quality Agricultural Education Programs-Preparing Career-Ready Graduates	Secure funding. Improve the public perception of agriculture and education. Identify external uncontrollable threats. Encourage efforts to reduce the teacher shortage.

Note: Missouri Joint Staff on Agricultural Education, n.d.

Rather than working individually, team members of the Joint Staff on Agricultural Education have built collective power. According to Levi (2017), power is the capacity to change the beliefs, attitudes, and behaviors of others. By following the Three P's of Change, patience, persistence, and process (Bolman and Gallos, 2011a), the Joint Staff on Agricultural Education and agricultural education are influential in the political arena. Issues addressed include twelve-month contracts, teacher certification, and curriculum

development. By following the suggestions of Bolman and Deal (2013) by 1) starting slowly, 2) clarifying the agenda, and 3) establishing relationships and alliances, agricultural education has a strong political identity.

A dynamic, multi-frame approach to organizational analysis promotes successful change efforts in organizations. Individuals cannot neglect or focus only on structural or political elements when examining organizations (Bolman & Deal, 2013). Additionally, utilizing a multi-frame approach aids in organizational understanding and is associated with enhanced effectiveness of leaders (Bolman & Deal, 2013; Kundin, 2010).

Leadership Analysis

Focus on operational leadership development is necessary to ensure the future success of educational institutions (Catalfamo, 2010). With the challenges in the educational landscape, leadership continues to be an area where educational leaders, described by Schultz (2010) as scholar-practitioners, can hone their craft. Although consideration of leadership is significant, and past research is vast, a wide array of questions still exist on the subject (Levi, 2017). Northouse (2016) offers that by focusing on leaders' actions, a broad assessment of leadership frameworks can occur.

Analyzing the leadership styles within a broad-reaching and diverse group is a challenging task. Each of the groups represented in the Joint Staff on Agricultural Education, state staff, pre-service teacher educators, and public school agricultural education teachers faces different challenges. The Joint Staff on Agricultural Education works collaboratively to improve the quality of agricultural education within the state. As Northouse (2016) recognizes, leadership has multiple dimensions and is sophisticated and

complex. The application of a multi-lens approach to leadership is a requirement or the organization to be successful.

Northouse (2016) offers that by focusing on the actions of leaders, a broad assessment of leadership frameworks can take place. The following section includes an analysis of the Joint Staff on Agricultural Education using situational leadership theory, adaptive leadership theory, and leader-member exchange theory.

Situational Leadership Approach

Situational leadership theory (SLT) implies that effective leadership requires different responses depending on the situation (Graeff, 1997; Grint, 2011; Northouse, 2016). SLT evolved from task-oriented versus relationship-oriented leadership (Bass, 2008; Lorsch, 2010). To meet the need of followers, leaders must alter the degree to which they are directive or supportive, depending on their needs (Northouse, 2016). Hersey and Blanchard (1969; 1979; 1996), the original developers of SLT, focused on matching the leadership style to the maturity of the followers. Being an organization that provides leadership for agricultural education in the state, the Joint Staff on Agricultural Education works with a multitude of stakeholders. Ranging from first-year teachers to teachers with over thirty years in education, the development level of followers varies vastly.

The Situational Leadership ® II (SLII®) developed by Blanchard (1985) and Blanchard et al. (1985; 2013) recognizes two significant dimensions: leadership style and development level of followers. Leadership style includes directive behaviors and supportive behaviors (Blanchard, 1985; Northouse, 2016). The directive behaviors of the Joint Staff on Agricultural education provide followers with objectives, directions,

timelines, and evaluation for agricultural education activities throughout the state. The Director of Agricultural Education offers formal communication to the state's teachers regarding issues of importance facing agricultural education. The SLII® recognizes four directive and supportive behaviors: directing style, coaching style, supporting style, and delegating style. Depending on the situation, the members of the Joint Staff on Agricultural Education provide support to agricultural education stakeholders. Leaders within agricultural education may take a high-supportive-high directive or a high supportive-low directive approach with beginning teachers. In contrast, a low-supportive-low directive approach can be utilized with experienced teachers. Effective organizational leaders use a combination of leadership behaviors (Graeff, 1997; Northouse, 2016; Yukl, 2011).

Adaptive Leadership Approach

Adaptive leadership requires flexibility and the ability to respond to ever-changing environments. (Yukl & Mahsud, 2010). Effective leaders can diagnose situations and develop solutions and solve problems. Mintzberg (1973) recognized that different tasks require different responses for different people. Designed from the work of Heifertz (1994), adaptive leadership theory focuses on how leaders encourage people to deal with the challenges they face. An intention of the Joint Staff on Agricultural Education is to assist agricultural educators by offering support and helping individuals learn and grow. Examples include professional development for all teachers and the induction teaching program for beginning teachers. Activities such as these are examples of the Heifetz (1994) traits of adaptive leadership: mobilization, motivation, organization, orientation, and focusing the attention of others.

Northouse (2016) offers a model of adaptive leadership outlining three situational challenges: 1) technical challenges, 2) technical and adaptive challenges, and 3) adaptive challenges. Technical challenges are defined as problems clearly defined with known solutions, whereas technical and adaptive challenges are clearly defined issues with no straightforward answers. Adaptive challenges are described as situations where the difficulties are not easily recognized or identified. An example of an adaptive challenge facing the Joint Staff on Agricultural Education is the shortage of qualified agricultural educators. By implementing expanded recruitment efforts, examining certification and alternative certification requirements, implementing a Teach Ag Ed campaign, and selecting agricultural education student ambassadors, the Joint Staff on Agricultural Education has demonstrated adaptive leadership behaviors.

Much of the organization's work follows the six leader behaviors of adaptive leadership identified by Heifetz (1994) and Heifetz & Laurie (1997). They include: 1) getting on the balcony, 2) identifying adaptive challenges, 3). regulating distress, 4). maintaining disciplined attention, 5) giving the work back to the people, and 6) protecting leadership voices from below. Uhl-Bien, Marion, and McKelvey (2007) suggest that interaction with groups outside of immediate work-groups promotes the organization's overall effectiveness. The work of the Joint Staff on Agricultural Education supports the theory advanced by DeRue (2011). It describes contemporary organizations as those where leadership promotes leading-following binary interactions that allow anyone to participate. Much of the success within agricultural education in the state can be attributed to the adaptive leadership and flexibility demonstrated by the Joint Staff on Agricultural Education. Finding innovative ways to deal with new problems and

opportunities defines leadership in today's highly effective organizations (Yukl & Mahsud, 2010).

Leader-Member Exchange Approach

The leader-member exchange (LMX) theory focuses on the premise that particular unique relations between leaders and followers result in advancing and meeting the leader's goals, the followers, and the organization (Gerstner & Day, 1997; Northouse, 2016). LMX is characterized by the dyadic relationship between leaders and followers (Dansereau, Cashman & Green, 1975; Graen, 1976; Graen & Cashman, 1975; Graen & Uhl-Bien, 1995).

Research conducted by Gerstner and Day (1997) suggests that the effectiveness of LMX be measured from both leader and member viewpoints. Several studies (Atwater & Carmeli, 2009; Harris, Wheeler, & Kacmar, 2009; Ilies, Nahrgang, & Morgerson, 2007) illustrate the benefit of positive relationships between leaders and followers. High quality exchanges between the Joint Staff on Agricultural Education and exchanges with followers outside the organization prove to be beneficial to agricultural education throughout the state. Examples include the collaborative efforts of pre-service training institutions in addressing teacher certification concerns and offering an induction teaching program specifically designed for first and second-year agricultural educators. Research by Liden, Wayne, and Stilwell (1993) found that leader-member exchange quality is determined early in dyadic relationships. Early positive exchange promotes positive, stable relationships, whereas delayed LMX intervals hurt relationships.

Northouse (2016) suggests that successful organizations are those where leaders and followers interact in ways beyond the traditional hierarchical defined relationship.

Partnerships between leaders and followers allow organizations to be more productive. New and different interactions promote mutual respect and trust, leading to transformational leadership tendencies (Kuhnert, 1994). Social exchange relationships evolve as mediators or intervening variables, producing positive results within organizations (Cropanzano & Mitchell, 2005). Interactions between the Joint Staff on Agricultural Education and agricultural education stakeholders, teachers and students, results in progressive and upbeat attitudes.

Because dyadic relationships are the centerpiece of LMX theory, fairness issues, and the development of privileged groups can negatively impact organizations (Northouse, 2016). Strategic planning efforts initiated by the Joint Staff on Agricultural Education focuses on developing leader-member exchanges with all agricultural education stakeholders. The organization recognizes the importance of building leadership networks throughout agricultural education throughout the state. The leadership network provides organizations opportunities to call on people to assist in resolving problems and advancing organization goals (Graen & Scanduar, 1987). LMX theory informs us that how leaders relate to followers impacts organizations' effectiveness (Northouse, 2016).

Implications for Research in Practitioner Settings

This study could lead to more research on developing prediction models forecasting student success for first-year college students by utilizing Kolb’s experiential learning theory and predictive analytics regarding performance in agricultural education career development events (CDEs) in high school. The information gained may not only

have an impact on predicting student success but may be able to provide university leaders with valuable information to make data-driven decisions.

Experiential Learning Theory

Since the inception of agricultural education in public schools, experiential learning has played an essential role in student learning. Traditionally, supervised experiences have been one of the foundational core pillars in agricultural education. By studying the influence of experiential learning theory on student success, this study may provide insight into what the impact of experiential learning in high school settings has on success measures in college. Experiential learning theory could be examined in other academic disciplines where students are actively involved in learning events to determine their impact on desirable student success measures. The study is focused on whether participation and performance in CDEs in high school are associated with student success in agricultural sciences at a regional, four-year, public university and. If participation and performance are related to retention, this will show the possibility that prediction models could be developed to predict student success.

Predictive Analytics

As more and more data becomes available, predictive analytics is becoming more common at universities. Pre-college characteristics have long been used to predict college success but have been limited in scope. Using predictive analytics can help decision-makers recognize patterns and relationships (Gandomi & Haider, 2105; Picciano, 2012). The utilization of predictive analytics can positively influence college student success (Cai & Zhu, 2015; Denley, 2014). Interviews conducted by the National Association of Student Personnel Administrators of 25 colleges and universities in 2017 revealed that all

utilized or planned to use predictive analytics to focus on student retention efforts (Burke, Parnell, Wesaw, & Kruger, 2017). This study strives to broaden existing prediction models using a non-traditional approach using data other than high school grade point average and ACT/SAT scores. If participation and performance are significantly correlated to student success measures, this will show that prediction models could be created to predict student retention and performance in introductory agricultural science coursework. Taking a proactive approach to student retention efforts, results from this study will help identify students at risk of becoming a student attrition casualty. Additional research should be conducted to develop additional prediction models that could improve other desirable student outcomes at both the high school and college levels.

Agricultural Education

This study's results could be beneficial to a wide range of stakeholders in education, including high school students, college students, high school agricultural educators, university faculty and administration, and the Joint Staff on Agricultural Education. This study has potential benefits for both researchers and practitioners (high school and university), including showing the impact of experiential learning in agricultural education, improving retention rates, and improving student performance in introductory agricultural science courses within universities. Further analyses should be conducted to analyze the impact of participation in local, state, and national activities in student leadership organizations such as the National FFA Organization and their relationship to student success measures in colleges and universities.

Summary

Having a keen awareness of agricultural education provides a strong foundation for the study. According to Bolman and Deal (2013), organizations can be exciting and challenging for organization leaders. The chapter provides a philosophical and historical overview of agricultural education, an organizational analysis of agricultural education from the structural and political lens, and a leadership analysis of the Joint Staff on Agricultural education from the perspectives of situational theory, adaptive theory, and leader-member exchange theory. Using a multi-frame approach when conducting organizational and leadership analyses can initiate successful change within the organization.

SECTION THREE

SCHOLARLY REVIEW

Introduction to the Problem

College retention remains at the forefront of issues facing higher education and is a crucial measurement of university performance (Crosling, Heagney, & Thomas, 2009). The purpose of this study is to develop a predictive model utilizing participation and performance of high school agricultural education students in CDEs as predictors of retention of first-year, first-time, full-time university students in agricultural sciences at a regional, Midwest, public university utilizing a predictive correlational design to examine Kolb's Experiential Learning Theory (ELT) (1984). This literature review examines the evolution of experiential learning theory from Dewey to Kolb, the application and utilization of experiential learning in agricultural education, and the role of predictive analytics in forecasting retention as a student success measurement.

Experiential Learning Theory

Experiential learning allows individuals to learn from placement in situations similar to real-life experiences, whereas traditional education comes from a classroom setting or reading (Itin, 1999; Shapiro & Levine, 1999). Experiential learning theory (ELT) is defined as “the process whereby knowledge is created through the transformation of experience, [and] knowledge results from the combination of grasping and transforming experiences” (Kolb, 1984, p. 41). Kolb’s Experiential Learning Theory integrates the philosophical pragmatism of John Dewey, the social psychology of Kurt Lewin, and the cognitive-developmental genetic epistemology of Jean Piaget (Kolb, 1984). For concrete learning to occur, individuals must apply new knowledge (Beard &

Wilson, 2006; Borzak, 1981), and the experience solidifies learning and serves as the permanent reference (Dewey, 1938).

Early writings of John Dewey (1897, 1899, 1916) recognized the experiential philosophy of education and laid the groundwork for Kolb's Experiential Learning Theory. Dewey was a strong proponent of experience in learning. According to Dewey (1938), the processes of actual experience and education are necessary for learning to occur. Dewey recognized the need for student-centered learning opportunities, rather than the traditional, one-way, teacher-centered delivery methods commonly used in education (Roberts, 2003; Kliebard, 2004). Although Dewey recognized the importance of experiences in the education process, there is little evidence he used the terminology "experiential learning" (Seaman, Brown, & Quay, 2017).

The six tenants of Kolb's Experiential Learning Theory (1984) include:

1. Learning is best conceived as a process, not in terms of outcomes. To improve learning …, the primary focus should be on engaging students in a process that best enhances their learning - a process that includes feedback on the effectiveness of their learning efforts.
2. All learning is relearning. Learning is best facilitated by a process that draws out the students' beliefs and ideas about a topic so that they can be examined, tested, and integrated with new, more refined ideas.
3. Learning requires the resolution of conflicts between dialectically opposed modes of adaptation to the world. Conflict, differences, and disagreement are what drive the learning process. In the process of learning, one is called upon

to move back and forth between opposing modes of reflection and action and feeling and thinking.

4. Learning is a holistic process of adaptation to the world. Not just the result of cognition, learning involves the integrated functioning of the total person - thinking, feeling, perceiving, and behaving.
5. Learning results from synergetic transactions between the person and the environment.
6. Learning is the process of creating knowledge. ELT proposes a constructivist theory of learning, whereby social knowledge is created in the personal knowledge of the learner (Kolb & Kolb, 2005, p. 194).

Kolb posits that learners gain new knowledge and skills through a cycle that contains tension and conflict (Fenwick, 2001). The ELT model (see Figure 5) is conceptualized as a four-stage cycle with four adaptive learning modes: 1) Concrete Experience (CE), 2) Abstract Conceptualization (AC), 3) Reflective Observation (RO), and 4) Active Experimentation (AE) (Kolb 1984; Kolb & Kolb, 2005). The "process is portrayed as an idealized learning cycle or spiral where the learner "touches all the bases" – experiencing, reflecting, thinking, and acting – in a recursive process that is responsive to the learning situation and what is being learned" (Kolb & Kolb, 2005, p 194). Although individual learners can enter the cycle at any stage, the stages are followed in sequence (Akella, 2010; Kolb, 2015). Learners must confront the conflict between the two dialectically connected modes of grasping experience – Concrete Experience (CE) and Abstract Conceptualization (AC) – and the two dialectically connected modes of

Figure 5. Model of Kolb's Experiential Learning Cycle

Figure removed due to copyright.

From: Experiential Learning: Experience as the Source of Learning and Develpoment, p. 51, by D. A. Kolb, 2015. Upper Saddle, N.J.: Pearson, Copyright 2015 by Pearson Education, Inc.

transforming experience – Reflective Observation (RO) and Active Experimentation (AE) (Kolb & Kolb, 2005). According to Kolb (2015), learning requires four abilities. To be effective, learners must be able to:

- immerse themselves in a new experience (CE)
- use a multi-perspective approach to reflect on and observe their experience (RO)
- integrate observations and reflections to draw conclusions and create theories (AC)

- use theories to act and create new experiences (AE)

Zuber-Skerritt (1992) describes Kolb's experiential learning process as planning, acting, observing, and reflecting. The continuous process creates a spiral of learning where knowledge creation occurs (Kolb, 2015).

The strength of experiential learning is that it provides an underpinning philosophy that acts as a thread uniting other learning theories together as a unified whole (Beard & Wilson, 2006). The combination of experiential learning and contemporary educational reform is maximizing the ideology with educators and the general public (Seaman, Brown, & Quay, 2017). Although several scholars have found shortcomings in Kolb's Experiential Learning Theory (De Ciantis & Kirton, 1996; Holman, Pavlica, & Thorpe, 1997; Hopkins, 1993; Miettinen, 2000; Reynolds, 1997), a multitude of studies show experiential learning to be highly effective in today's educational society (Beaumie, Willams & Datillo, 2002; Blake, 1990; Dedeke, 1999; Gentry, Iceton, & Milne, 2001; Premi & Shannon, 2001; Specht & Sandlin, 1991).

Experiential Learning in Agricultural Education

Agricultural education programs are available to secondary students throughout the United States. The curriculum incorporates classroom instruction, leadership development, and experiential learning opportunities. Pathways of instruction include Agribusiness Systems, Animal Systems, Biotechnology Systems, Environmental Services Systems, Food Products and Processing, Natural Resource Systems, Plant Systems, and Power, Structural and Technical Systems (National Council for Agricultural Education, 2015). Table A1 in Appendix A outlines the agricultural education curriculum for high school programs in Missouri.

CDEs allow students to apply knowledge and skills in the practical application of classroom instruction outside of traditional in-class instruction (Ewing, Clark & Threeton, 2014; National FFA, n.d.). The role experiential learning plays in agricultural education is nothing new (Wulff-Risener & Stewart, 1997). 'Learning by doing' has been utilized in agricultural education since the early 1900s (Connors & Mundt, 2001; Knobloch, 2003; Roberts, 2006; Stewart & Birkenholz, 1991). Rufus Stimson (1919), a forefather of agricultural education, promoted experiential learning by promoting activities outside of the school setting. Also, the Smith Hughes Vocational Education Act (1917) required supervised practice in agriculture as a condition for enrollment in vocational agriculture courses. Today, experiential education plays a vital role in agricultural education by connecting knowledge and skill development to instruction (Connor & Mundt, 2001).

Supervised agricultural experiences (SAE) in agricultural education have been traditionally associated with experiential learning. However, experiential learning pertains to a greater context in the agricultural education curriculum (Baker, Robinson, & Kolb, 2012; Knobloch, 2003). Knobloch (2003) recognizes experiential learning as "learning in real-life contexts that involve learners in doing tasks, solving problems, or conducting projects" (p. 26). Although targeting SAE, Randall, Arrington, and Cheek (1994) posit experiential learning as practicing in real-life and applying knowledge to new situations. The types of experiential learning outlined by Knobloch and Randall et al. are consistent with CDEs in agricultural education at the local, state, and national levels. In the state of Missouri, there are fifteen different CDEs. Each event has clear objectives and well-established guidelines. Events include assessment activities that

incorporate identification, placing classes, evaluation/grading tasks, and a written exam. Table B1 in Appendix B outlines the components and descriptions of each of the CDEs that take place in Missouri.

Experiential learning requires a direct activity and the thought process necessary for learning (Borzak, 1981). Combining cognitive, affective, and psychomotor domains of learning promotes knowledge and skill attainment of students. Research by Paulsen and Anderson (2018) show that active learning promotes the motivation to learn, critical thinking skills, and improves attitudes toward learning.

CDEs have gained popularity, and student involvement has increased in recent years (Connors & Mundt, 2001; Ewing et al., 2014). They provide students opportunities to apply knowledge and skills in a competitive environment (Croom, Moore, & Armbruster, 2009) and develop entry-level agricultural career-readiness competencies (Connors & Mundt, 2001). CDEs play an essential role in developing students' skills and abilities for career preparation (Phipps, Osborne, Dyer, & Ball, 2010: Talbert & Balschweid, 2006). Also, CDEs require participants to reflect, think, feel and do in an experiential learning context (Clark, Clark & Threeton, 2014; Ewing, Clark, & Threeton, 2014). Research by Lundry, Ramsey, Edwards, and Robinson (2015) indicates that participation in CDEs improves self-motivation and substantiates findings by Baker and Robinson (2017) that experiential learning positively impacts student motivation. Rather than using a teacher-centered instructional approach, CDEs provide experiential learning opportunities that allow students to gain knowledge. Huba and Freed (2000) recognize that student-centered learning, rather than teacher-focused strategies, positively impacts student learning.

With the experiential focus of secondary agricultural education, a wide array of literature exists regarding the application of Kolb's Experiential Learning Theory (1984, 2015) to agricultural education (Baker & Robinson, 2017; Cano, 2005; Clark, Threeton, & Ewing, 2010; Ewing et al., 2014; Knobloch, 2003; Roberts, 2006). Experiential Learning Theory has increased in popularity in traditional educational subjects in recent years. However, ELT has been an integral component of career and technical education, and even more so in agricultural education for more than a century. According to Ewing et al. (2014), integrating Kolb's Experiential Learning Theory into strategies in student preparation for CDE might enhance learning and promote success after high school, either in post-secondary education or in their career. Students participating in CDEs utilize the four modes of Kolb's Experiential Learning Cycle:

- Feeling (Concrete Experience - CE)
- Watching (Reflective Observation – RO)
- Conceptualizing (Abstract Conceptualization – AC)
- Doing (Active Experimentation – AE)

to think critically, solve real-life problems, and develop occupational, technical skills. Research by Croom et al. (2009) and Lundry et al. (2015) show that CDEs improve student's knowledge and career preparation. The application of Kolb's Experiential Learning Theory (Kolb, 1984, 2015; Kolb & Fry, 1975) to CDEs in agricultural education can support the primary purpose of agricultural education. The purpose of agricultural education at the high school level is to prepare students for future endeavors in the agricultural industry (Roberts & Ball, 2009; Terry, 2004).

Predictive Analytics in Higher Education

As the competition in higher education continues to rise at an intense pace, pressures from current trends are expanding. Institutions that respond to these pressures are more likely to succeed. Survey results of the Higher Education Student Data Warehousing Forum identified predictive analytics and student success as two of the top matters facing higher education (Childers, 2017). Although there is no consensus for the definition of predictive analytics, Barneveld, Arnold, and Campbell (2012) propose the definition for predictive analytics to be "an area of statistical analysis that deals with extracting information using various technologies to uncover relationships and patterns within large volumes of data that can be used to predict behavior and events" (p. 8). The analysis of data can reveal relationships to assist institutions in developing prediction models forecasting future events.

Challenges facing organizations regarding the properties of data include the volume of data, the velocity of data production, and the variety of data available (Douglas, 2001). Also, institutions must master three stages of data management: 1) collection, 2) analysis and 3) visualization to reveal the significance of the information (Daniel, 2015). Data collection involves identifying, filtering, and storing useful data. Data analysis includes rendering the data into usable and actionable forms. Data visualization consists of presenting and interpreting the data to direct decisions (Evergreen, 2017).

Predictive analytic models have been used at universities to improve student success (Cai & Zhu, 2015; Campbell, DeBlois, & Oblinger, 2007; Denley, 2014; Dietz-

Uhler & Hurn, 2013; Gagliardi, 2018). Successful examples of the use of predictive analytics in higher education include:

- Degree Compass at Austin Peay University – individualized recommendations on courses that promote success and shorten time to degree (Denley, 2013)
- University of Phoenix – identifies students at-risk of failing classes in real-time (Barber & Sharkey, 2012)
- Course Signals at Purdue University – allows instructors to provide real-time feedback as an early intervention solution (Arnold & Pistilli, 2012)
- Graduation and Progression Success at Georgia State University - identifies students that have gone off-track for graduation (Ekowo & Palmer, 2016).

As the economic environment in higher education continues to tighten, there is an increased focus on improving the retention rates at colleges and universities (Gagliardi, 2018; Tinto, 2007). Data from ACT indicates that nationwide, 25.9 percent of first-year students at four-year universities do not return to their previous school the following year (Berger & Lyon, 2005). For the university, institutional retention rates can impact accountability programs linked to performance funding (Dougherty et al., 2006). For the student, the implications for dropping out of college result in lower lifetime career earnings (National Center for Educational Statistics, 2018). Developing prediction models to forecast potential success and improve student retention is warranted.

Much of the data available to administrators, including non-traditional measures, remains underutilized in creating student success prediction models (Kabakchieva, 2012).

The development of practical tools and solutions to common challenges are necessary. Predictive analytics and the expanded use of data provide institutions valuable tools to adapt to the ever-changing higher education landscape. Research indicates a gap exists in organizations between access to available data and the ability to use the right data to make decisions (MIT SMR Solutions, 2019). Closing the data gap is essential for institutions of higher education to succeed.

More than two-thirds of students participating in FFA CDEs at the national level plan to attend college following high school graduation (Croom et al., 2009). CDE participation and performance data are vast resources available for institutions to take advantage of. Questions remain about the influence of pre-college experiences and their impact on first-year college success. A variety of studies have investigated the relationship of enrollment in high school agricultural education courses and success at the college level (Ball, Garton, & Dyer, 2001; Dyer, Lacey, & Osborne, 1996; Moore, & Braun, 2005; Garton, Kitchel, & Ball, 2005). However, results from research by Riesenberg and Lancaster (1990) regarding the impact of youth organizational involvement on college retention are contradictory to the findings of Smith, Garton, & Kitchel (2010). Although the prior research examined participation in agricultural education at the secondary level, the studies above did not individually examine the impact of participation and performance in CDEs in high school and their relationship to first-year college retention.

College Retention

Student retention has been an area of research for decades, however, very few universities have been successful in substantially improving retention rates (Park, Perry,

& Edwards, 2011; Shelpler & Woosley, 2012). Tinto's model is the most recognized for analyzing college student retention (Lobo, 2012). Tinto's findings show the common factors affecting students not being retained in college: financial obligations, social/emotional issues, curriculum, faculty and administration, and school policies (Tinto, 2001).

Although colleges and universities focus on improving student retention rates, most institutions do not do enough to promote the retention of first-year students (Tinto, 1999). However, programs designed to target first-year students positively impact student success (Conner & Colten 1999; Noble, Flynn, Lee, & Hilton 2007; Tinto, 2005). Traditional studies have shown that admissions exams and high school grade point average (GPA) can predict college success (ACT, 2014; Hoffman & Lowitzki, 2005; Richardson, Abraham, & Bond, 2012). Several studies show pre-college characteristics such as high school GPA and ACT or SAT score have a bearing on college retention (Kuh, Cruce, Shoup, Kinzie, & Gonyea, 2008; Lotkowski, Robbins, & Noeth, 2004; Noble, Flynn, Lee, & Hilton, 2007). Additional research by Lau (2003) indicates that students lacking fundamental skills in math and writing as predictors forecasting retention.

Pusser and Tinto (2006) ascertain that retention is a measure of student success, and Crosling, Heagney, and Thomas (2009) recognize retention as a critical indicator of performance for higher education institutions. Despite greater focus by higher education institutions on retention in recent years, rates have changed very little (Pusser & Tinto, 2006). Data from the National Center for Education Statistics (2019) indicates only 62% of students pursuing a degree at a four-year institution, beginning in 2012, graduated at

the same institution within six years of enrollment. Due to the necessity of financial stability for institutions, there is an increased focus on improving the retention rates at colleges and universities (Fike & Fike, 2008; Tinto, 2007; Veenstra, 2009). Students that choose not to return to college results in lost revenue for institutions. Not only does student retention benefit the university, but college retention is beneficial to students as well. There is a long-term impact on students' lifetime earnings, not earning a bachelor's degree (Murdock, 2004; Tinto, 1987).

A review of existing research indicates that traditional predictors, such as standardized test scores and high school rank, are most commonly used in predicting student success (Krumrei-Mansuso, Newton, Kim, & Wilcox, 2013; Robins et al., 2004). However, much of the data available to administrators, including non-traditional measures, remains underutilized in creating student success prediction models (Kabakchieva, 2012). Veenstra (2009) identifies pre-college characteristics impacting the retention of first-year college students (Table 8). Clark and Halpern (2003) suggest that pre-college traits can help design intervention strategies to improve retention rates.

Table 8

Pre-college Characteristics Impacting Retention

Pre-college Characteristic	Measured By
High school academic performance	H.S. G.P.A., H.S. rank, SAT total, or ACT composite
Quantitative skills (math and science skills)	ACT math and/or SAT math, ACT science reasoning
Confidence in quantitative skills	Confidence indicator and self-ratings
Study habits	High school hours per week studying
Commitment to career/degree	Indicator such as highest degree sought
Commitment to college the student is attending	Indicator whether this college was first choice
Financial needs not met	Survey indicator
Family support	Parents' level of education
Social engagement	Survey indicator of social engagement in high school

Note: Veenstra, 2009

Although a wide range of studies has been conducted attempting to identify retention risk factors (Hoyt & Lundell, 2007; DeBerard, Spielmans, & Julka, 2004, Ishitani & Snider, 2006; Kessler, Greenberg, Mickelson, Meneades, & Wang, 2001; Laskey & Hetzel, 2011) findings have been mixed and inconsistent. Much of the early retention work focused on the transition from high school to the first year of college. (Tinto, 2007). Additional retention work focused on enrichment programs ranging from orientation to seminars to extracurricular activities were designed to enhance the first-year experience (Upcraft, Gardner, & Barefoot, 2005). Little research has been dedicated

to utilizing predictive analytics using non-traditional predictors to aid in identifying students at risk of being retained by universities. In addition to reacting to students' needs during the first year of college, universities might benefit from taking a proactive approach by developing prediction models using alternative data. There is a lack of information regarding the use of alternative data in predicting student retention rates.

Summary

Although Veenstra (2009) reported that pre-college characteristics could be useful predictors of student retention, very little is known on how experiential learning, such as participation and performance in CDEs while in high school, might impact student success in college. The use of predictive analytics may prove to be a valuable tool in forecasting the potential for student success. "As the field of predictive analytics continues to evolve and the diversity of the data sources increases, there will be an associated rise in the number of predictive models for student performance" (Lockyer, Heathcote, & Dawson, 2013, p. 1455). Developing models that demonstrate connections between CDEs and retention offers the opportunity for higher education institutions to impact student success positively.

SECTION FOUR

CONTRIBUTION TO PRACTICE

Plan for Dissemination of Practitioner Contribution

Who: Attendees at the National Association of Agricultural Educators (NAAE) Annual Convention

When: December 2021; proposal deadline is June 1, 2021

How: Through a professional development workshop presentation (30 minutes) at the NAAE Annual Convention. Submit a proposal to NAAE at, https://www.naae.org/profdevelopment/convention.cfm

Type of Document

The primary document will be a PowerPoint presentation that will be presented at a professional development workshop at the NAAE Annual Convention. The presentation will address the practical and theoretical considerations regarding participation and performance in agricultural education CDEs and their ability to predict college success.

Rationale for this Contribution Type

The NAAE is an organization serving agricultural educators from middle school, high school, and post-secondary levels, as well as leaders in agricultural education at the state and national levels. Serving more than 7,800 agricultural educators nationwide, the NAAE advocates for agricultural education and provides professional development for members of the organization. During the annual NAAE Convention, more than 60 workshops provide agricultural educators with an opportunity for high quality, professional development.

Outline of Proposed Contents

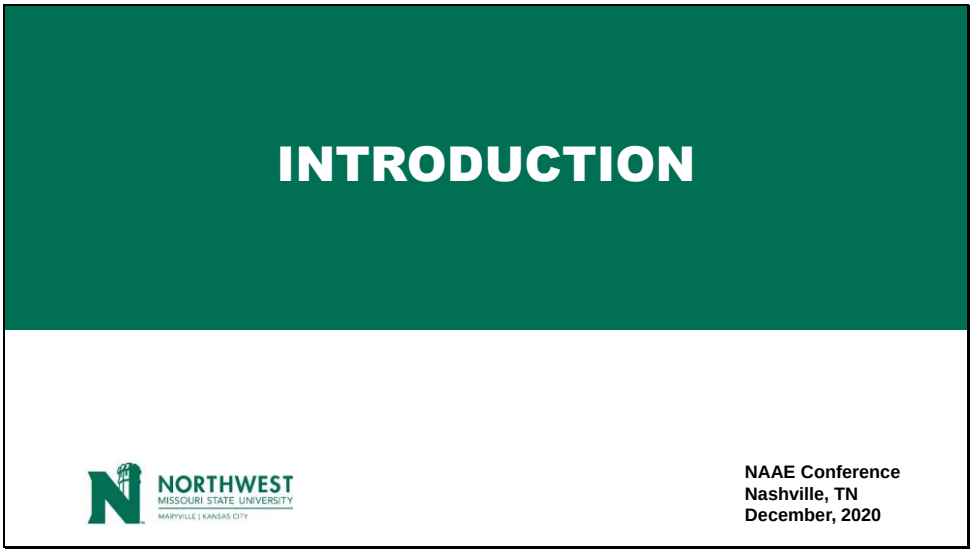
- Introduction
    - Purpose
    - Research questions
    - Theoretical framework
- Methodology
    - Setting
    - Analysis
- Findings
- Summary
- References

Slide 1

Introduction
- Who I am
- Experience

Overview of Study
- There is a lack of research showing the impact of experiential learning in agricultural education (Roberts, 2006).
- However, research indicates that more than two-thirds of students participating in FFA career development events at the national level plan to attend college following high school graduation (Croom, Moore, & Armbruster, 2009) and t
- The number of students participating in CDEs is growing steadily (Russell, Robinson, & Kelsey, 2009).
- A prediction model may assist high school agricultural educators in better preparing students for continuing education in an agricultural field. Likewise, a prediction model may assist universities in identifying students at risk of not being retained.

Slide 2



Survey results of the Higher Education Student Data Warehousing Forum identify student success and predictive analytics as two of the top issues facing higher education (Childers, 2017).

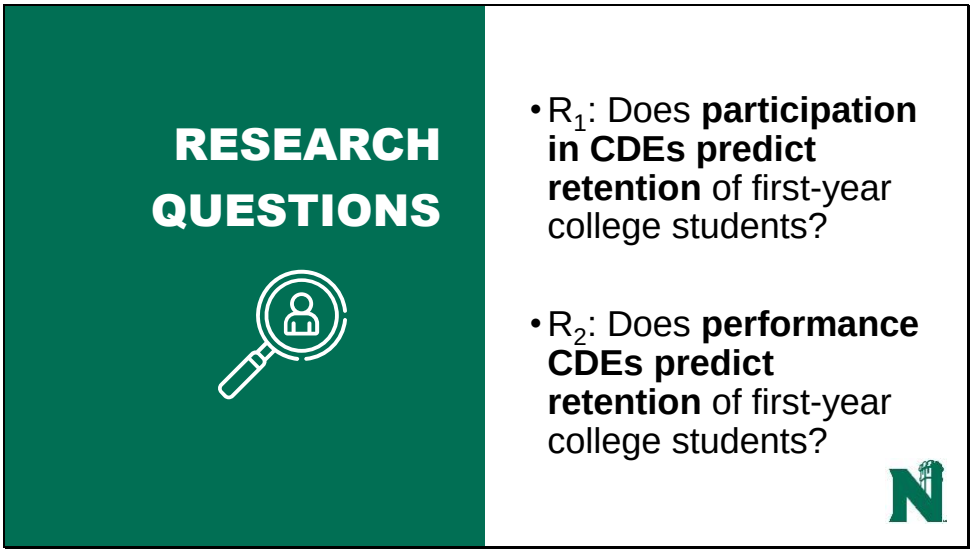
Picciano (2012) describes predictive analytics as the science of examining data to develop prediction models that can help decision-makers determine courses of action. Predictive analytics has a positive impact on student success. (Denley, 2014)

Pusser and Tinto (2006) state that retention is a measure of student success, and Crosling, Heagney, and Thomas (2009) recognize retention as a critical indicator of performance for a higher education institution.

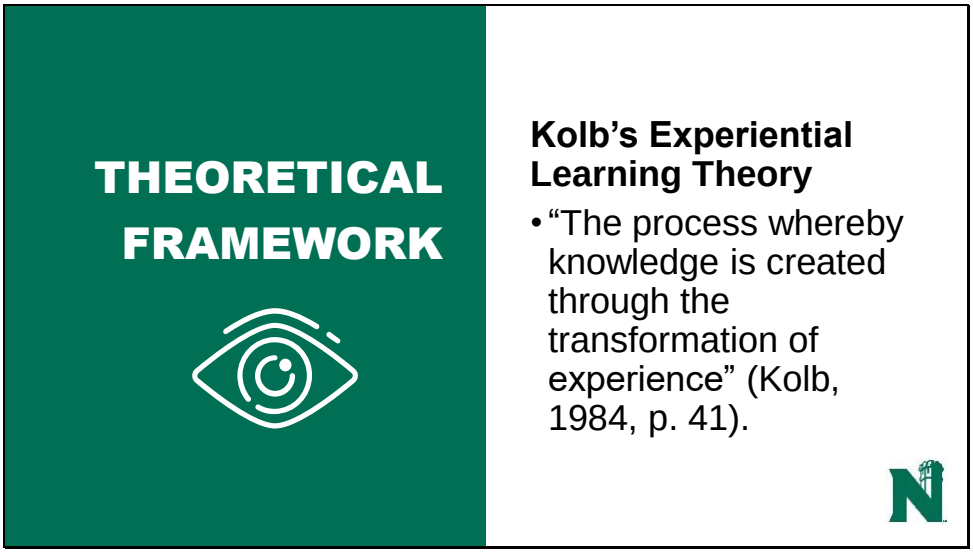
Slide 3


PURPOSE
Develop a predictive model utilizing **participation and performance in CDE's** as a predictors for **college retention**

Slide 4


RESEARCH QUESTIONS
• R_1: Does **participation in CDEs predict retention** of first-year college students?
• R_2: Does **performance CDEs predict retention** of first-year college students?

Slide 5



Experiential learning in an authentic context is a foundational concept of career and technical education and agricultural education (Knobloch, 2003).

Rather than merely a thought process, experiential learning involves a direct learning activity where the student is actively engaged in a learning event (Borzak, 1981).

Experiential learning activities promote problem-solving, critical thinking, the synthesis of knowledge, and applying skills in real-world situations (Ormod, 2000).

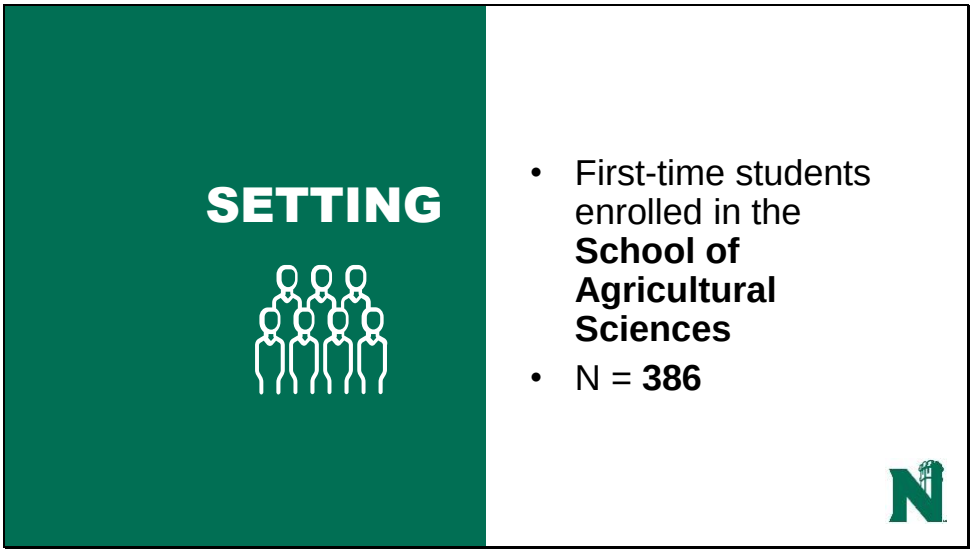
Career Development Events in agricultural education expand the student's knowledge gained in traditional classroom and laboratory settings. CDEs answer the question, "When will I use this knowledge in the real world?" (Texas FFA Association, n.d.).

CDEs allow students to demonstrate problem-solving and performance skills in a variety of agricultural career pathways.

Due to the experiential and authentic nature of CDEs, it can be inferred that they prepare students for their future endeavors after high school (National FFA Organization, n.d.)

Research indicates that CDEs are beneficial in preparing students for their future college and career endeavors (Lundry, Ransey, Edwards, & Robinson, 2015; Rose et al., 2016).

Slide 6



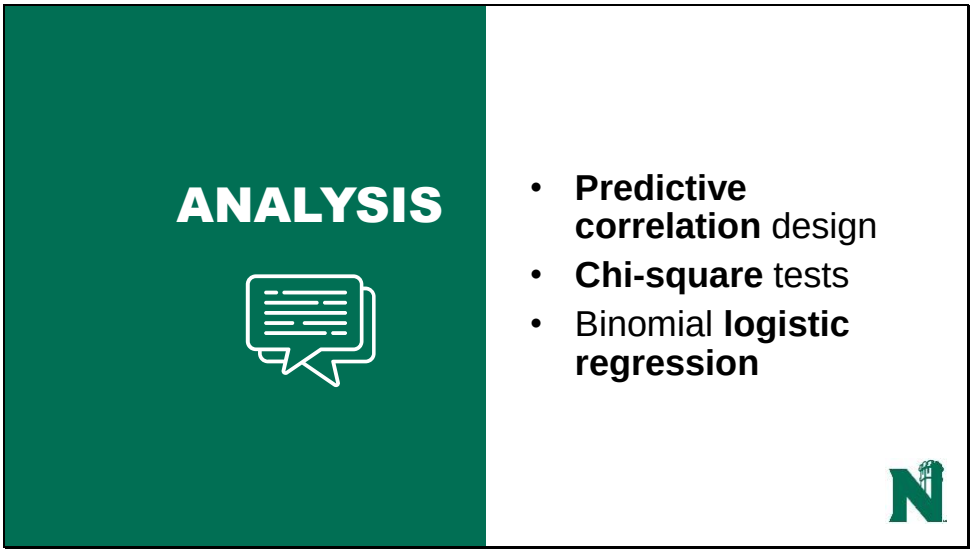
A non-probability convenience sample of students enrolled in the School of Agricultural Sciences made up the study sample.

The study population included first-year, first-time, full-time students, who enrolled at Northwest Missouri State University, majoring in a degree in the School of Agricultural Sciences in the fall semesters in 2016, 2017, and 2018.

District CDE participation and performance data in archives at judgingcard.com from 2012 through 2017 were used for the study.

University data from 2015, 2016, 2017, and 2018 was obtained from Institutional Research at Northwest Missouri State University regarding agricultural science program area CIP codes and fall-to-fall retention data. All information was de-identified during the collection, storage, and analyses of the data to protect students' identity and confidentiality.

Slide 7



The quantitative study was a predictive correlation design using logistic regression analyses.

The data analysis of participation and measured performance in CDEs and retention utilized chi-square tests and binomial logistic regression. Logistical regression is used to predict categorical outcomes from categorical and continuous predictors (Field, 2018).

In this study, the researcher used logistical regression to determine the probability of using participation, the number CDEs during high school and performance in CDEs, the level of scores, as predictors of retention in first-year, first-time, full-time college students in the School of Agricultural Sciences.

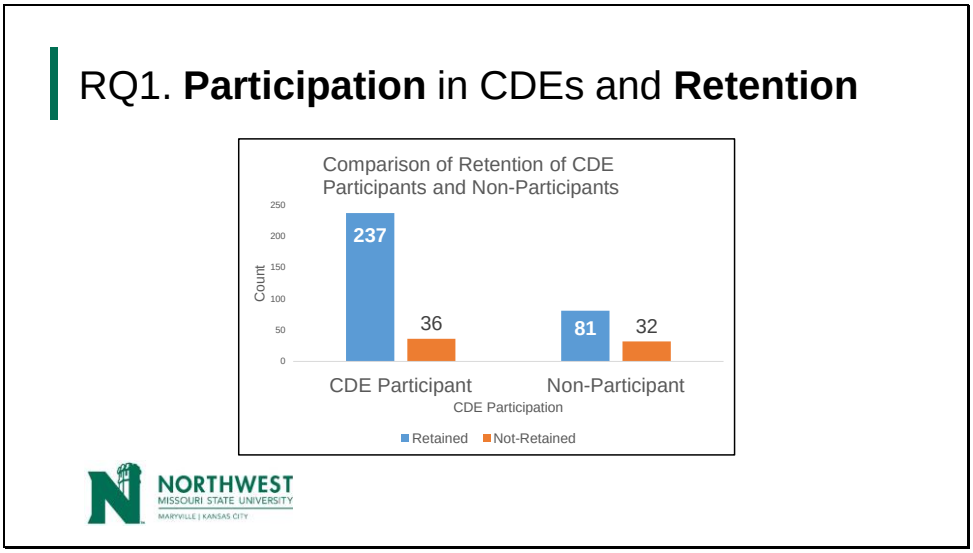
Slide 8

The analysis of the data provided by the chi-test showed a significant association between CDE participation and retention.

A chi-square test was conducted between CDE participation and retention. All expected cell frequencies were greater than five.

There was a statistically significant association between CDE participation and retention, $\chi2(1) = 12.609$, $p = .000$.

Slide 9



The analysis of the data provided by the chi-test showed a significant association between CDE participation and retention.

A chi-square test was conducted between CDE participation and retention. All expected cell frequencies were greater than five.

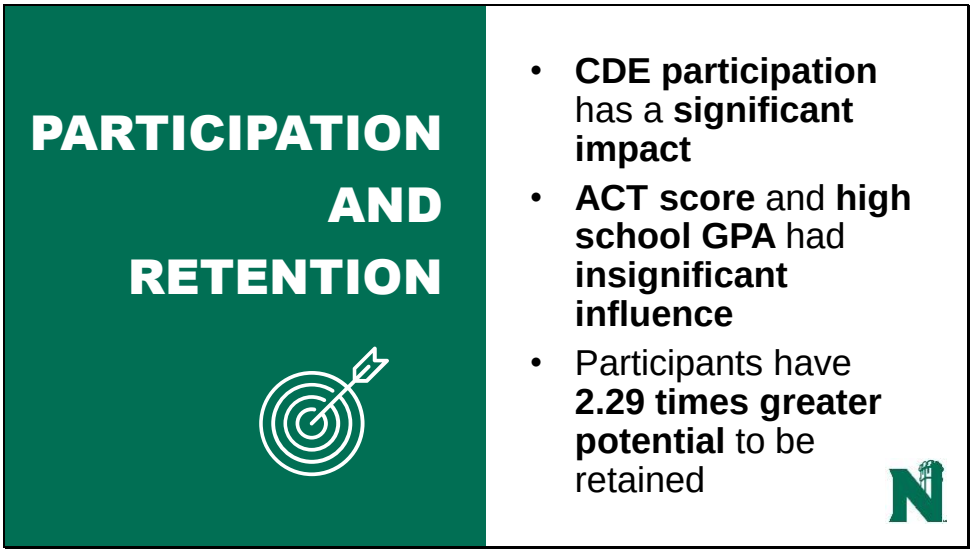
There was a statistically significant association between CDE participation and retention, $\chi2(1) = 12.609$, $p = .000$.

The retention rate for students participating in CDEs was 86.8% compared to 71.7% for those not participating in CDEs.

Analysis of the data of CDE participants retained in college shows the mean for the number of events participated in to be 2.49 with a standard deviation of 1.051.

The data suggest that participation in less than two career development events in high school has a significant impact on the potential for fall-to-fall retention in college.

Slide 10



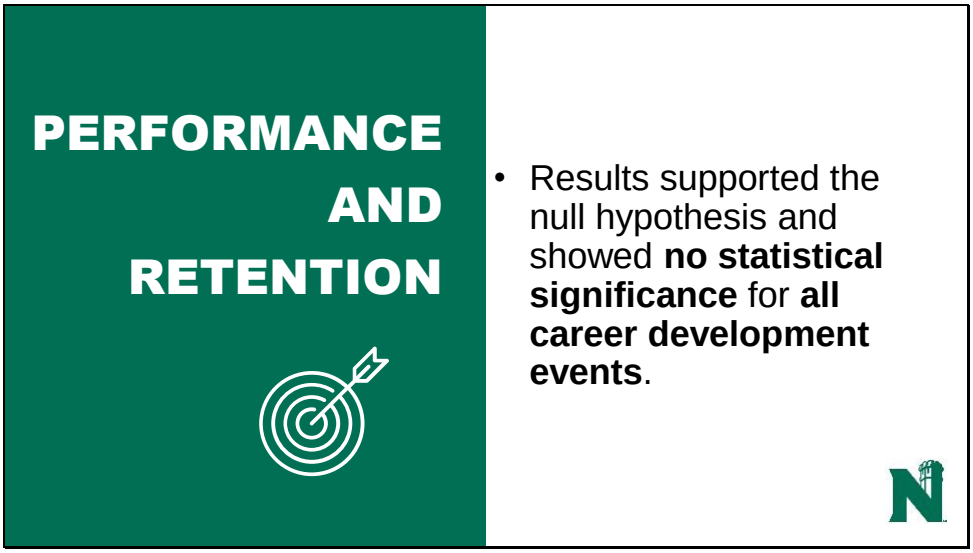
Results from a binomial logistic regression examining the effects of CDE participation, ACT score, and cumulative high school grade point average on the likelihood that students are retained showed that only CDE participation has a significant impact.

Both composite ACT score and cumulative high school grade point average were found to have an insignificant influence on retention rates for the study population.

The analysis of the results from a separate binomial logistic regression determining the effects of the individual CDEs on showed little influence on retention.

Odds ratio data shows that participants have 2.32 times greater potential to be retained over non-participants.

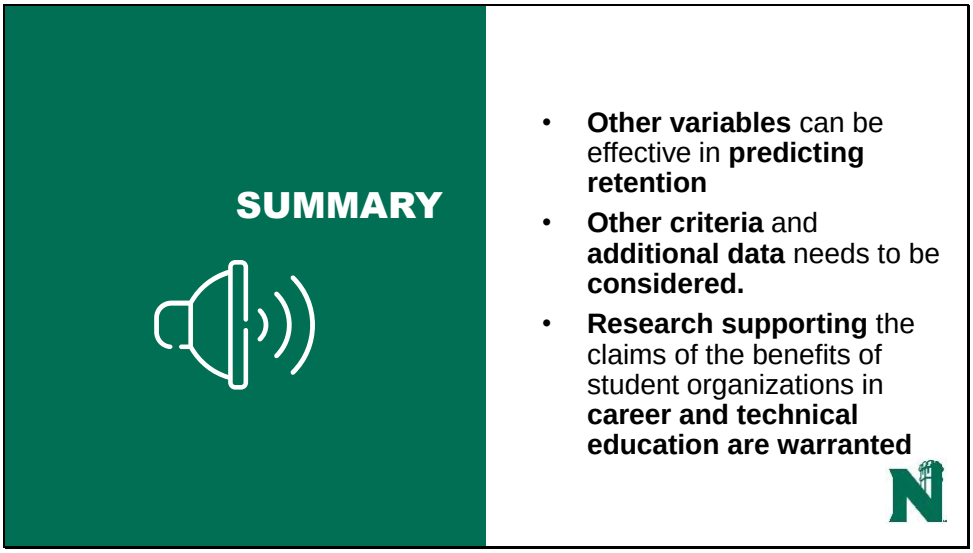
Slide 11



The data analysis of participation and measured performance in CDEs and retention utilized chi-square tests and binomial logistic regression.

Analyses of data revealed no statistical significance between student performance in CDEs and student retention.

Slide 12



These results build on existing evidence (Dyer, Breja, & Wittler, 2002; Smith, Garton, & Kitchel, 2010; Koon, Frick, & Igo, 2009) that show variables other than ACT score and high school grade point average can predict the success of college students pursuing undergraduate degrees in agriculture.

Many universities focus on traditional measures, ACT scores, and high school grade point average, in predicting student success.

When assessing students' ability to succeed in college, other criteria and additional data need to be considered. If colleges want to improve retention rates, data mining, and predictive analytics may prove beneficial.

While there is considerable research regarding retention and attrition little has been done regarding agricultural education and college students pursuing degrees in agriculture (Koon, Frick, & Igo, 2009).

Based on the findings of this study, it is recommended that further research be conducted.

Recommendations for further research include conducting the same study on a larger scale, including additional states and universities, examining the impact of CDEs on degree program selection, and non-traditional predictors for student retention.

Slide 13

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Slide 14

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Slide 15

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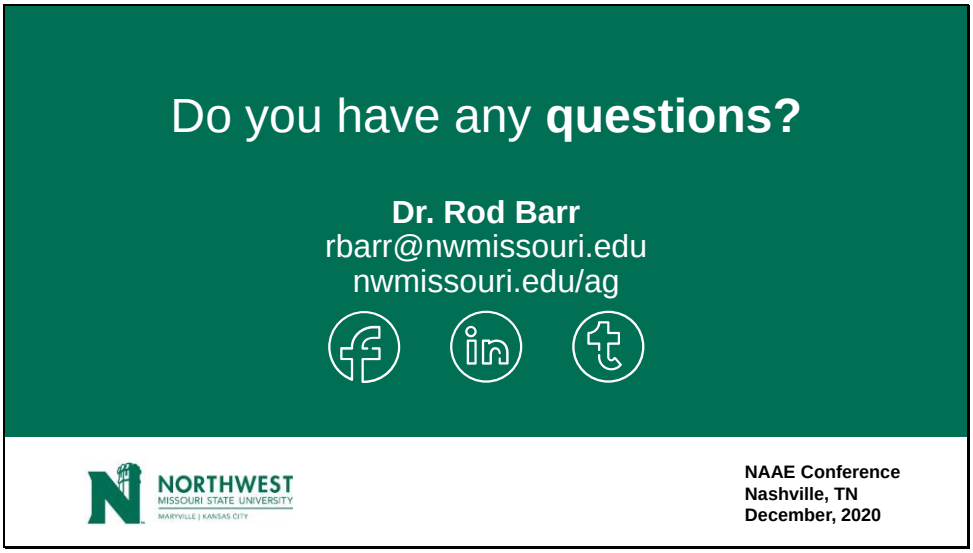
Do you have any **questions?**
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Nashville, TN
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SECTION FIVE

CONTRIBUTION TO SCHOLARSHIP

Target Journal

The target journal for publication is the *North American Colleges and Teachers of Agriculture (NACTA) Journal.* The *NACTA Journal* focuses on the scholarship of teaching and learning in agricultural-related disciplines.

Rationale for this Target

The primary purpose of the *NACTA Journal* is to strengthen college and adult teaching in the vast discipline of agriculture. Submitted articles undergo a double-blind review by a minimum of three reviewers of the NACTA Editorial Board. Published quarterly, the journal content focuses on practices advancing teaching to promote competence in post-secondary faculty, supervisors, and administrators in agricultural colleges and universities.

Outline for Proposed Manuscript

- Title (brief and precise description, 10-12 words
- Title page
- Abstract (200-word limit)
- Introduction
- Methods
- Results and discussion
- Summary
- Literature cited
- Tables (on separate pages at end of manuscript)

Plan for Submission

Who: *North American Colleges and Teachers of Agriculture (NACTA) Journal*

When: Summer 2020

How: Submit electronically to http://nacta.expressacademic.org/

Manuscript

Title

Career development events (CDEs) as a predictor of fall-to-fall retention of first-year college students

Abstract

Career development events (CDEs) play an essential role in agricultural education programs and the National FFA Organization. The competitive events are promoted as tools to develop career and college readiness of high school students. This study examined whether participation in agricultural education CDEs in high school can predict of retention of first-year, first-time, full-time college students enrolled in agricultural sciences at a regional, Midwest, public university. For the quantitative study, the predictive correlation design utilized chi-square tests and binomial logistic regression analyses. The study results indicate that a significant relationship exists between participation in CDEs and college retention. Recommendations for further research include conducting the same study on a larger scale, including additional states and universities, examining the impact of CDEs on degree program selection, and non-traditional predictors for student retention.

Keywords: agricultural education, career development events, CDEs, FFA, retention

Introduction

Traditional studies regarding first-year student retention have shown that admissions exams and high school grade point average (GPA) can be valid predictors of college success (ACT, 2014; Hoffman & Lowitzki, 2005; Richardson, Abraham, & Bond, 2012). However, studies on fall-to-fall retention of first-year college students have not examined the impact of student participation and performance in experiential learning activities while in high school.

Survey results of the Higher Education Student Data Warehousing Forum identify student success and predictive analytics as two of the top issues facing higher education (Childers, 2017). Picciano (2012) describes predictive analytics as the science of examining data to develop prediction models that can help decision-makers determine courses of action. The use of predictive analytics in higher education uncovers patterns and denotes relationships in data (Gandomi & Haider, 2015). Making use of predictive analytics promotes a cross-functional team approach, a system-wide data warehouse, real-time response strategies, and improved communication and training (Burke, Parnell, Wesaw, & Kruger, 2017). Studies by Cai and Zhu (2015) and Denley (2014) suggest that predictive analytics positively impacts student success.

Pusser and Tinto (2006) state that retention is a measure of student success, and Crosling, Heagney, and Thomas (2009) recognize retention as a critical indicator of performance for a higher education institution. Despite greater focus by higher education institutions on retention in recent years, rates have changed very little (Pusser & Tinto, 2006). Data from ACT indicates that 25.9 percent of first-year students at four-year universities do not return to school the following year (Berger & Lyon, 2005).

This study focused on clarifying the relationships between participation in agricultural education career development events (CDEs) in high school and the subsequent impact on fall-to-fall retention rates for first-year, first-time, full-time students enrolled in agricultural sciences at a regional, four-year, public, American university. If participation impacts retention, this may show that prediction models might be developed to effectively predict student retention. Such predictive models would be impactful and highly valued in contemporary higher education. According to Murtuagh, Burn, and Schuster (1999), pre-college characteristics can be an asset in forecasting student retention. Predictive analytic models have been used at universities to improve student success (Campbell, DeBlois, & Oblinger, 2007; Denley, 2014; Dietz-Uhler & Hurn, 2013; Gagliardi, 2018) but much of the early retention work focused on the transition from high school to the first year of college (Tinto, 2007). This study focused on pre-high school graduation career-specific events that may impact the retention of first-year, first-time, full-time students.

Existing research indicates that traditional predictors, such as standardized test scores and high school rank, are most commonly used in predicting student success (Krumrei-Mansuso, Newton, Kim, & Wilcox, 2013; Robins et al., 2004). However, much of the data available to administrators, including non-traditional measures, remains underutilized in creating student success prediction models (Kabakchieva, 2012). Several studies show pre-college characteristics such as high school GPA and ACT or SAT score have a moderate predictive factor related to college retention (Kuh, Cruce, Shoup, Kinzie, & Gonyea, 2008; Lotkowski, Robbins, & Noeth, 2004; Noble, Flynn, Lee, & Hilton, 2007). However, there is limited empirical evidence on how student characteristics other

than standardized test scores or high school grade point average can be used to predict retention within a university. Results from a study by Rouse (2012) show evidence of a strong correlation between participation in high school leadership activities and future educational attainment. Research by Lipscomb (2006) and Leeds, Miller, and Stull (2007) indicate a positive relationship between participation in extracurricular activities and academic achievement. Without expanding the knowledge base of factors impacting student retention in universities, efforts to improve students' retention will be limited.

According to Bangser (2008), high school experiences do not adequately prepare students for college, but little is known about the impact of CDEs on college success. Consequently, even though research results are mixed regarding student characteristics in high school with college retention, participation in agricultural CDEs may play a role in predicting fall-to-fall retention of first-year students in agricultural sciences. Developing prediction models is particularly important, given the pressure placed on higher education to improve student success. The use of predictive analysis of student characteristics and experiences could assist in the early identification of students being at risk of not being retained after their first year of college.

Theoretical Framework

Experiential learning in an authentic context is a foundational concept of career and technical education and agricultural education (Knobloch, 2003). Experiential learning theory is defined as “the process whereby knowledge is created through the transformation of experience” (Kolb, 1984, p. 41). The origin of the theory is built upon the foundation of philosophical pragmatism, according to Dewey, social psychology, according to Lewin, and cognitive-developmental developmental genetic epistemology,

according to Piaget (Kolb, 1984). Rather than merely a thought process, experiential learning involves a direct learning activity where the student is actively engaged in a learning event (Borzak, 1981).

Experiential learning activities promote problem-solving, critical thinking, the synthesis of knowledge, and applying skills in real-world situations (Ormod, 2000). Also, Knobloch (2003) associates higher-order thinking, depth of knowledge, and connections to the world beyond the classroom as tenants of authentic learning. Career development events in agricultural education expand the student's knowledge gained in traditional classroom and laboratory settings. CDEs answer the question, "When will I use this knowledge in the real world?" (Texas FFA Association, n.d.). CDEs allow students to demonstrate problem-solving and performance skills in a variety of agricultural career pathways. Due to the experiential and authentic nature of CDEs, it can be inferred that they prepare students for their future endeavors after high school (National FFA Organization, n.d.). Research supports the idea that CDEs are beneficial in preparing students for their future college and career endeavors (Lundry, Ransey, Edwards, & Robinson, 2015; Rose et al., 2016).

Purpose of the Study

The purpose of this study was to develop a predictive model utilizing participation of high school agricultural education students in CDEs as a predictor of retention of first-year, first-time, full-time university students in agricultural sciences at a regional, Midwest, public university utilizing a predictive correlational design to examine Kolb's Experiential Learning Theory (ELT) (1984). While evidence of predictive analytics'

relationship to predict student success exists, the relationship between participation in CDEs and college retention has yet to be thoroughly investigated.

Materials and Methods

The predictive correlation designed quantitative study utilized chi-square tests and binomial logistic regression analyses. A non-probability convenience sample of students enrolled in the School of Agricultural Sciences made up the study sample. The study population included first-year, first-time, full-time students, who enrolled at Northwest Missouri State University, majoring in a degree in the School of Agricultural Sciences in the fall semesters in 2015, 2016, 2017, and 2018. District CDE participation data contained within archives at judgingcard.com from 2012 through 2017 was used for the study.

Students graduating from a Missouri high school seeking a degree in the School of Agricultural Science, enrolling as a first-year, first-time, full-time students at Northwest Missouri State University in the fall of 2015, 2016, 2017, and 2018 were included in the study (n = 386). Fifty-one percent of the study population were females compared to 49% males. The increase in percentages in the study population for each year reflects enrollment growth in the School of Agricultural Sciences. Total undergraduate enrollment for the School of Agricultural Science grew from 573 in the fall of 2016 to 644 of 2019 (Northwest Missouri State University Institutional Research, 2020).

Results and Discussion

Research question 1. Does participation in agricultural education CDEs in high school predict retention of first-year, first-time, full-time college students enrolled in

agricultural sciences at a regional, Midwest, public university? A chi-square test was conducted between CDE participation and retention. All expected cell frequencies were greater than five. The analysis of the data provided by the chi-test showed a significant association between CDE participation and retention, $\chi^2(1) = 12.609$, $p = .000$. The retention rate for students participating in CDEs was 86.8% compared to 71.7% for those not participating in CDEs (shown in Figure 1). Analysis of the data of CDE participants retained in college showed the mean for the number of events participated in to be 2.49 with a standard deviation of 1.051. The data suggest that participation in less than two CDEs in high school has a significant impact on the potential for fall-to-fall retention in college.

A binomial logistic regression was performed to ascertain the effects of participation in CDEs, ACT score, high school GPA. The logistic regression model was statistically significant, $\chi^2(3) = 14.100$, $p < .005$. The model explained 5.9% (Nagelkerke R^2) of the variance in student retention and correctly classified 82.4% of the cases. Of the three predictive variables, only CDE participation was statistically significant, $p < .005$. Participants in CDEs had 2.21 times higher odds to be retained than non-participants.

Summary

One of the most challenging problems facing higher education is student attrition (Gansemer & Schuh, 2006). For institutions, retention places burdens on recruitment, enrollment planning, and financial budgeting. For students, leaving a university before earning a degree reduces their lifetime earning capacity (Gansemer-Topf & Schuh, 2006; Mannan, 2007). Essential predictor variables may be identified to enhance research

leading to new theories regarding student retention (Delen, 2012). The data suggest that CDEs may be utilized to predict student retention.

The results show that non-traditional predictors of student success are capable of predicting student retention in college. These results build on existing evidence (Dyer, Breja, & Wittler, 2002; Smith, Garton, & Kitchel, 2010; Koon, Frick, & Igo, 2009) that show variables other than ACT score and high school GPA to be useful in predicting the success of college students pursuing undergraduate degrees in agriculture. Many universities focus on traditional measures, ACT score, and high school GPA, in predicting student success. When assessing students' ability to succeed in college, other criteria and additional data need to be considered. If colleges want to improve retention rates, data mining, and predictive analytics may prove beneficial.

Caution should be taken in generalizing the findings to other populations due to the limitations of the study. Only students from Missouri enrolling in the School of Agricultural Sciences were included in the study. Also, no consideration was given to other demographic variables of the students or the high schools from which they graduated.

While there is considerable research regarding retention and attrition, little has been done regarding agricultural education and college students pursuing degrees in agriculture (Koon, Frick, & Igo, 2009). Based on the findings of this study, it is recommended that new research be conducted. Recommendations for further research include conducting the same study on a larger scale, including additional states and universities, examining the impact of CDEs on degree program selection, and the effect of non-traditional predictors for student retention.

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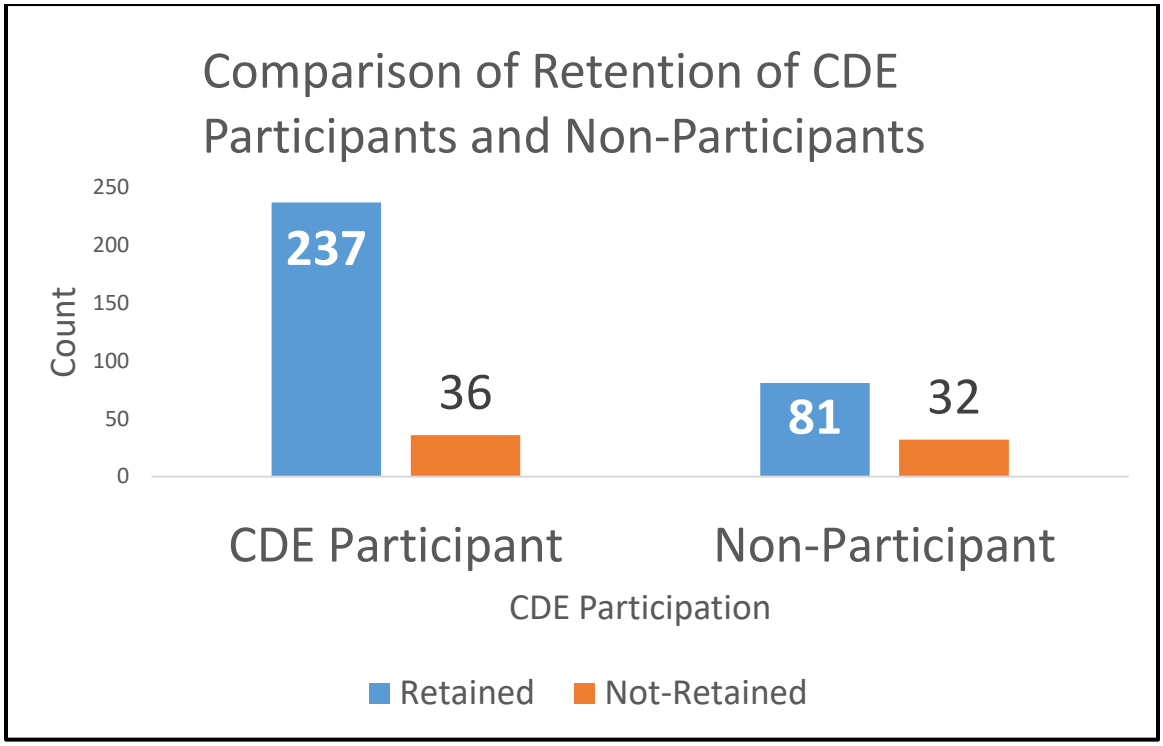
Figure


Comparison of Retention of CDE Participants and Non-Participants
Count
250
200
150
100
50
0
237
36
81
32
CDE Participant
Non-Participant
CDE Participation
Retained
Not-Retained

SECTION SIX

SCHOLARLY PRACTITIONER REFLECTION

Although scholarly activity and research on leadership are vast, misunderstanding surrounds the subject of leadership (Levi, 2017). Northouse (2016) posits "leadership as a complex process having multiple dimensions" (p. 1). Combining leadership practice and leadership theory in the educational environment promotes organizational learning and guides future practice (Schultz, 2010). The future sustainability of higher education hinges on active leadership development to improve individual, interpersonal, and organizational capacity within institutions (Catalfamo, 2010). The ever-changing world in post-secondary education forces leaders and organizations to adapt, foster new approaches, and operate differently to succeed (Heifetz & Laurie, 1997/2011). Depending on the situation, rather than relying on one leadership style or method, the utilization of various leadership tactics can be more useful in resolving issues within the organization. (Levi, 2017; Northouse, 2016). The purpose of this section is to examine the knowledge gained during the Educational Leadership doctoral (EdD) program in the areas of 1) leadership theory and practice, 2) organizational analysis, 3) policy analysis, and 4) content and context for learning.

Leadership Practice and Theory

An investigation by Asplund, Harter, Agrawal, and Plowman (2016) shows a positive correlation between organizational performance and activities designed to develop its employees' strengths. Clifton Strengths is an instrument used to discover one's strengths to maximize and develop talent (Clifton, Anderson & Schreiner, 2006). As part of the initial coursework in the EdD program, StrengthsQuest identified my signature themes to be Maximizer, Significance, Activator, Relator, and Achiever (Clifton, Anderson, &

Schreiner, 2006). Leadership assessment questionnaires designed by Northouse (2016) identified similar themes. According to Goleman (1996/2011), self-awareness, and emotional intelligence are ingredients of strong leadership. The development of a broader understanding of leadership strengths through multiple leadership approaches is beneficial to both the institution and me.

As the director of an academic unit, I work diligently to recognize areas where individuals can excel and empower them to act. Drucker (2004/2011) recommends leaders "put their best people on opportunities rather than problems" (p. 33). During the past three years in the EdD program, I have focused on delegating tasks to young faculty members within our unit. Examples include turning over a faculty search committee to a junior faculty member and relinquishing all of our summer academy duties to two beginning instructors. According to Clifton et al. (2006), Maximizers emphasize excellence and capitalize on others' talents within the organization. Findings from the Path-Goal Leadership Questionnaire (Northouse, 2016) suggest achievement-oriented and supportive leadership styles. Furthermore, results from the Leadership Behavior Questionnaire (Northouse, 2016), reveal both task and relationship leadership behaviors substantiating the Maximizer signature theme.

An area of attention during the past three years has been our fundraising efforts for a new academic building for our unit. O'Leary (2005) recognizes the need to build relationships with various stakeholder groups in solving real-world problems. Although StrengthsQuest identified one of my signature themes to be Relator, the findings of the Authentic Leadership Self-Assessment Questionnaire (Northouse, 2016) and the Leadership Trait Questionnaire (Northouse, 2016) show this as an area for growth and

development. Being able to articulate and communicate effectively with stakeholders and followers is an area that has improved during my time as director. However, as a result of the EdD program, I am more aware that this is a development area needing consideration. Overcoming being a natural introvert, is a challenge I face, especially when meeting with stakeholders during the fundraising endeavors. The recognition and understanding of my limitations and shortcomings allow me to focus on relational skills with internal and external organizational stakeholders. According to Goffee and Jones (2011), effective leaders "show us who they are" (p. 80) by selectively exposing their weaknesses. Trust is built within the organization by doing so. Developing an environment of trust improves the culture and is the foundation for successful organizations (Buckingham & Clifton, 2001; Lencioni, 2002).

Additional talents and strengths identified in my profile include Activator, Achiever, and Significance. Characteristics of Activators include having enthusiasm, being action-oriented, and learning from results (Clifton et al., 2006). Additionally, Clifton et al. (2006) recognize passion, dedication, and gaining satisfaction from completing tasks as talents of Achievers. Likewise, Clifton et al. (2006) identify traits of Significance to be independent individuals focused on success and recognition. Results from the Leadership Trait Questionnaire (Northouse 2016) revealed diligence, determination, and self-confidence to be essential leadership qualities. The Path-Goal Leadership Questionnaire (Northouse, 2016) indicated the predominant leadership style to be achievement-oriented.

Furthermore, transformational leadership tendencies were identified by the Multifactor Leadership Questionnaire (Northouse, 2016). The common threads revealed by StrengthsQuest and the questionnaires resonates with me in my role as an educational

leader at our institution. As a result, I am more aware of needing to balance intrinsic and extrinsic motivations in my work as a scholarly practitioner. According to George, Sims, McLean, and Mayer (2007/2011), “the key is to find a balance between your desires for external validation and the intrinsic motivations that provide fulfillment in your work” (p. 171).

The EdD program's curriculum, along with StrengthsQuest and the leadership questionnaires presented by Northouse, has provided me the opportunity to have a better understanding of who I am as an educational leader. Various leadership theories allow for different perspectives, depending upon the situation (Bolman & Deal, 2013; Levi, 2017; Northouse, 2016). Furthermore, the topic of leadership is a complex subject having different meanings to different individuals and various organizations (Northouse, 2016). It is apparent leadership will stand the test of time, and no one has all of the answers. The self-assessments helped me recognize my strengths, but it has also provided me the opportunity to identify areas of improvement to grow as an educational leader. Being aware of leadership strengths and leadership deficits will benefit me in my role as director of the School of Agricultural Sciences. Individual leaders willing to improve self-awareness can become transformational leaders within organizations (Rooke & Torbert, 2011). Kezar, Carducci & Contreras-McGavin (2006) best represents the recognition of my leadership qualities, “leadership is a human process filled with ambiguity and contradiction and driven by values and ethics” (p. 26).

Organizational Analysis

The analysis of complex problems using a multiple frame approach is a guiding principle for professional doctorates in education (Jones, 2016). Also, the use of a multi-

frame approach aids in organizational understanding and is associated with enhanced effectiveness of leaders (Bolman & Deal, 2013; Kundin, 2010). Due to the external pressure from stakeholders, institutions in higher education must be responsive to change. (Manning, 2013; Newcomer, Hatry, & Wholey, 2015; Pusser & Marginson, 2012). According to the Carnegie Project on the Education Doctorate (n.d.), solutions to problems should be grounded in research and practical knowledge combining practice and theory to enrich the outcome. Also, leaders must recognize the importance of the ethics of social justice to remove obstacles that oppress marginalized individuals (Schultz, 2010).

An area of professional growth that has occurred as a result of participating in the EdD program is strengthening my ability to use an integrated approach in the analysis of dilemmas within our academic unit. Bolman and Deal (2013) indicate an overall improvement in organizations occurs when a multi-frame method is applied. Utilizing the four P approach outlined by Datnow and Park (2014) has caused me to improve in making data-driven decisions. Concurrent with my enrollment in the doctoral program, fundraising efforts to raise money for the proposed Agricultural Learning Center for the School of Agricultural Sciences have been ongoing in the Forever Green capital campaign. As the campaign has advanced, stakeholders, both internal and external, have presented multitudes of questions causing implications to surface regarding impact to students and faculty, design, location, traffic patterns, function, and cost of the proposed facility. As the dilemma has evolved and changed, my ability to utilize the multi-lens approach has proven to be very beneficial. Examining both quantitative and qualitative data provides valuable information to assist in formulating a functional action plan. With

data, individuals and organizations will make better choices and function more effectively. (Datnow & Park, 2014).

As Jansson (2013) and Manning (2013) noted, change within organizations is challenging. During my time in the EdD program, I have come to realize this more than ever. As enrollment in the School of Agricultural Sciences and the number of faculty members in the unit have expanded, the leadership demands have increased. Along with the capital campaign, an enormous amount of change has occurred within the School of Agricultural Sciences, including relocation to a new academic building, revision of existing educational programs, creation of new programs in the curriculum, expanding faculty, reestablishing an active professional advisory committee, and reconnecting with alumni. According to Manning (2013), individuals act based on things that have been used in the past that are proven. Due to the bureaucratic nature of higher education expressed by Manning (2013), progress in our unit has sluggish and exhausting at times. However, integrating the multi-frame approach of organizational analysis (Bolman & Deal, 2013), with the principles of program evaluation presented by Newcomer, Hatry, and Wholey (2015), and the four P framework (Datnow & Park, 2014) for data use has made me a more effective data-informed educational leader.

Since the capital campaign for the Agricultural Learning Center has been a focal point for our unit during the past three years, many of the principles in the EdD program have assisted me in my role as director. “Structural form both enhances and constrains what an organization can accomplish” (Bolman & Deal, 2013, p. 47), and this has been realized during our fundraising efforts. In addition to clearly defining roles and tasks,

employing an all-channel structural network (Bolman & Deal, 2013) has resulted in a successful capital campaign.

Furthermore, the use of the symbolic frame has been instrumental in reconnecting with agricultural alumni. Bolman and Deal (2013) recognize the tribal aspect of organizations in today's society. Levi (2017) describes loyalty and belongingness as collectivism, which can positively affect an organization. Engaging our alumni has proven to impact the capital campaign favorably.

The three P's of change: patience, persistence, and process (Bolman & Gallos, 2011b) describe the use of the political lens. Bolman and Deal's (2010) suggestions of starting slowly, clarifying the agenda, and establishing relationships and alliances have been ongoing with state and federal legislators during the past three years. As a result of our diligent efforts, we have made considerable gain in the political arena during the past three years.

Surprisingly, viewing our fundraising efforts through the human resources frame is proving to be the most challenging. Although the faculty recognize the importance of the Agricultural Learning Center, the pressure of change during the past three years has made an impression. As a director, I have known this and worked to improve in developing a people-centered organization. People-centered organizations focus on empowering employees by providing information and support, encouraging autonomy and participation, redesigning work, fostering self-managing teams, and promoting egalitarianism (Bolman & Deal, 2013).

Program planning and evaluation require a combination of theory and situational context (Cervero & Wilson, 2006; Kundin, 2010). On several occasions throughout the

past three years, I have engaged in practical program evaluation, especially surrounding the activities associated with our unit involvement in the capital campaign. According to Newcomer, Hatry, and Wholey (2015), functional program evaluation can be used “as a valuable learning strategy for enhancing knowledge” (p. 8). Utilizing the conceptual framework for practice decisions (Kumar, 2010) has helped analyze stakeholders' engagement in the agricultural learning center project. Combining situational awareness, practical reasoning, and reflection in action, along with knowledge, experience, and judgment, is vital in making meaningful decisions (Kumar, 2010). Moreover, the leadership principles utilized during the capital campaign have been strongly influenced by my values and beliefs. The demonstration of authentic leadership occurs when “values are translated into action” (George, Sims, McLean, & Mayer, 2007/2011, p. 170).

The ethical use of data is fundamental throughout the evaluation process (Caffarella & Dafron, 2013). Although “data will not and should not tell us everything” (Datnow & Park, 2014, p. 19), data-informed leaders ask the right questions and use multiple lenses to examine data. Program evaluation of the capital campaign has been ongoing, utilizing both quantitative and qualitative data. According to Creswell (2009), quantitative data examines the relationship between variables, whereas qualitative data provides an understanding of the problem. The four-P approach: people, policies, practices, and patterns (Datnow & Park, 2014) to data use have helped me develop as a data-informed scholarly practitioner focused on improving the organization's culture.

Culture is the combined beliefs of how the organization should function to accomplish its objectives and tasks (Levi, 2017; Shein 1993/2005). Furthermore, Bolman and Deal (2013) recognize culture as both process and product. According to Tierney

(2012), the organization's culture is more than a bureaucratic action or segmented choice. Developing positive organizational learning throughout the organization is a key to success (Bolman & Deal, 2013; Levi 2017; Rooke & Torbert, 2005/2011). Combining theory with practice has been beneficial to me as an educational leader.

Policy Analysis

Successful leaders in education provide tactical leadership and clear direction for their organizations (Bryman, 2007). Change within educational bodies is driven by data use and analysis (Datnow & Park, 2017; Zettelmeyer & Bolling, 2014). By developing a data-driven culture throughout the organization, meaningful change and growth can occur for both the organization and the individual leader. Additionally, Jansson (2013) suggests "taken-for-granted practices" be challenged in practices for organizations to be effective. When developing policy, research by Burnette (2010) recommends that leaders develop sustained networks, develop parallel structures, and find common ground in negotiating diverse socio-political interests. Also, Schultz (2010) recognizes that democratic leadership is directly correlated to the values of social justice and equity when developing solutions to problems.

According to Levi (2017), the nature of the problem affects the decision-making process. The analysis of the problem determines if decisions can be made individually or if a group decision is warranted. Whether I, as an individual, or our team makes decisions, the combination of qualitative and quantitative data analysis is necessary to act positively for our academic unit. A second role data play for scholar-practitioners is providing the basis for new knowledge. Producing new knowledge through the practice of inquiry guides future endeavors and provides needed resources to the educational

community (Dirkx, 2006; Jones, 2016; Schultz, 2010).). Since beginning the EdD program, this idea is becoming more and more evident to me. As I continue throughout the process, I feel this will be a development area for me in the future.

When utilizing data as an educational leader, I need to recognize the problem needing to be solved. Bardach and Patashnik (2016) identify the definition of the problem as the first step in their Eightfold Path of policy analysis. One of the keys to effective leadership is realizing the situation, and the method of inquiry needed to solve the problem of practice in question (Levi, 2017). According to Northouse (2016), a characteristic of team leaders is the facilitation of decision making. As the school director, the only way for me or my team to make an effective decision is to utilize the data while considering the effects on all populations ethically. Making the right decisions is critical to the success of the organization (Drucker, 2004/2011).

Step two of the Eightfold Path (Bardach & Patashnik, 2016) suggests assembling evidence and data. Fowler (2013) states that materials provide support concerning the claims made about a problem. A critical lens is required when analyzing data and designing innovative solutions to practice (Carnegie Project on the Educational Doctorate, n.d.). As a director, it is vital to focus on meaningful data to solve problems facing the School of Agricultural Sciences. The ongoing challenges from transitioning from a department to a school, planning and conducting a move to a new location on campus, and welcoming nearly one-third of our faculty and staff to our team in the past three years have had a tremendous impact on our academic unit and reinforce the importance of Mintzberg's organizational framework (Mintzberg, 1979/2005). The change for our academic group is proving to be challenging but rewarding as well. The

analysis of data implementing a multi-frame approach using human resources, political, structural, and symbolic lenses, has proven to be beneficial.

Practical policy analysis requires a balanced approach considering both individuals within the institution and the institution (Stone, 2012). Effective leaders consider issues of inequality during practical inquiry (Schultz, 2010). Constructing alternatives, step three of the Eightfold Path (Bardach & Patashnik, 2016) reveals alternative solutions to mitigate problems. When developing potential solutions to the ongoing issue of late resignations at our university, a variety of best practices were explored. Anderson (2015) and Fowler (2013) suggest that policy judgments are influenced by evidence, and ideology and values. Establishing criteria to evaluate the impact of projected outcomes is a vital step in the Eightfold Path (Bardach & Patashnik, 2016).

When evaluating viable options for the issuance of faculty contracts at the university, quantitative and qualitative metrics were utilized. The utilization of data identifies trends to assist leaders in projecting outcomes and assists in the comparative analysis of potential policy decisions (Bardach & Patashnik, 2016). Fairness in decision-making is a requirement when identifying the best possible solution to a problem (Bolman & Deal, 2013). Trade-offs in the policy analysis on the timing of contract issuance revealed different effects to individuals compared to the institution. The dilemma illustrates Stone's (2012) concept of the polis versus the market society. Although the university has yet to implement the recommendation of shifting the date of contract issuance from early July to the proposed date of April 1, the analysis has been presented to the upper administration at the university, and a change will be forthcoming.

Using the Eightfold Path outlined by Bardach and Patashnik (2016) identifies a systematic process to determine tasks and choices to make quality decisions regarding policy in my role as director of an academic unit.

Policy analysis plays an essential role in providing direction to an organization, but practical policy analysis is also vital to the success of the educational leader. Bolman and Deal (2013) recognize how practice and outcome impact the culture of the organization. When carried out, the recommended policy change for contract issuance timing will have a positive impact on the university environment.

Content and Context for Learning

Merriam and Bierema (2014) recognize that "… learning can emphasize the cognitive as in gaining knowledge of something, psychomotor as learning a new skill, or affective, having to do with emotions and attitudes" (p. 25). As an individual learner, for me, learning is about the experience. The constructivist worldview stems from the work of Piaget, Vygotsky, Dewey, Bruner, Gardner, and Goodman (Fosnot & Perry, 2005; Merriam & Bierema, 2014). Hein (1991) and Creswell (2009) define constructivism as the idea that learners develop meaning as they learn. Furthermore, Kofman and Senge (1993) describe learning as a result of performance and practice. For me, exploring the meaning and living the experience as I resolve problems of practice solidifies learning.

Gill (2010) recognizes the development of technical abilities, relationship abilities, and learning-how-to-learn abilities as being the principal tenants of learning. According to Mezirow (2009), “learning occurs in one of four ways: by elaborating existing meaning schemes, learning new meaning schemes, transforming meaning schemes, and transforming meaning perspectives” (p. 22). By reflecting and critiquing

myself, I am more apt to have a transformative learning experience. Merriam and Bierama (2014) suggest transformative learning as the process of making meaning of one's experience. With my history of practice in Career and Technical Education (CTE), the constructivist worldview provides the foundation for my active acknowledgment of Kolb's (1984, 2015) Experiential Learning Cycle. However, before the EdD program, I failed to fully consider the effect of my actions on marginalized populations. This has been an area of considerable growth in the past three years. I have come to realize my actions have a direct impact on diversity and influence the opportunity for success for underrepresented populations. This is true not only for students served by our academic unit but also for the faculty within our school.

"Promoting diversity comes down to focus and persistence" (Bolman & Deal, 2013, p.157). According to Levi (2017) and Northouse (2016), diversity is a consideration for all organizations to consider. Successful organizations recognize the impact of demographic, psychological, and organizational diversity (McGrath, Berdahl, & Arrow, 1995). As suggested by Levi (2017), increasing my self-awareness transforms my ability to succeed in my leadership role. This recognition has led to building a diverse faculty team within our academic unit.

According to Kolb (1984), experiential learning theory (ELT) is "the process whereby knowledge is created through the transformation of experience" (p. 41). As referenced in Kolb (1984), the origin of the theory builds upon the foundation of philosophical pragmatism, according to Dewey, social psychology, according to Lewin, and cognitive-developmental genetic epistemology, according to Piaget. For me to learn, I need to go through the four stages of learning in the experiential learning process. The

four steps include concrete experience (CE), reflective observation (RE), abstract conceptualization (AC), and active experimentation (AE) (Kolb, Boyzatzis, & Mainemelis, 2001). Kolb, Boyzatzis, & Mainemelis (2001) suggest that concrete experiences and abstract conceptualization stimulate learning to occur, whereas Brookfield (1983) suggests that experiential learning involves gaining knowledge by reflecting on daily life experiences. Combining experimentation, reflection, and conceptualization with active involvement, I am better able to acquire and solidify my knowledge and understanding. As I continue to experience and learn, the principles of ethical leadership: respect, service, justice, honesty, and community (Northouse, 2016) provide a strong foundation for me as a leader in our organization and as a scholarly practitioner.

Summary

Reframing institutional change requires leaders to combine the structural, human resources, symbolic, and political frames to succeed (Bolman & Deal, 2013). Utilizing the multi-faceted approach in organizational and policy analysis aids me to develop as an effective educational leader. Additionally, diversity and ethics are topics at the forefront, guiding my actions in my day-to-day role as the director for the School of Agricultural Sciences. Through self-examination and active self-reflection of who I am as a learner, who I am as a leader, and who I am as a change-agent, I continue to develop my leadership skills and abilities. “Success is not a matter of mastering subtle, sophisticated theory, but rather of embracing common sense with uncommon levels discipline and persistence” (Lencioni, 2002, p. 220).

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APPENDIX A

Table A1

Agricultural Education Curriculum for High School Programs in Missouri

Agriculture, Food, and Natural Resources Career Clusters in Missouri					
High School Core Career Education (sequential order)					
Traditional Foundation Courses			CASE Foundation Course		
Agricultural Science 1 Agricultural Science 2			Intro to Agriculture, Food & Natural Resources		
Courses within the designated Career Pathway (non-sequential order)					
Agricultural Business & Management Systems	Agricultural Mechanics & technology Systems	Plant Science/ Horticulture Systems	Food Science Systems	Natural Resources Systems	Animal Science Systems
Core Courses	Core Courses	Core Courses	Core Courses	Core Courses	Core Courses
Agricultural Management & Economics Agricultural Sales & Marketing Agricultural Communications	Agricultural Structures Agricultural Power 1 Agricultural Power 2 Agricultural Machinery Agricultural Construction	Crop Science Floriculture Landscaping Greenhouse Operations and Management Nursery Operations and Management Turf Management	Food Science & Technology	Conservation of Natural Resources Forestry Management	Animal Science Biotechnology Equine Science Veterinary Science
	CASE	CASE	CASE	CASE	CASE
	Ag Power & Technology	Principles of Ag Science: Plants Animal & Plant Biotechnology	Food Science & Safety	Natural Resources * Ecology	Principles of Ag Science: Animals

					Animal & Plant Biotechnology
Career Development Events by Career Pathway					
Farm Management	Agricultural Mechanics	Agronomy	Dairy Foods	Forestry	Dairy Cattle
Agricultural Sales		Entomology	Meats	Soils	Horse
		Floriculture	Poultry		Livestock
		Nursery/ Landscaping			Meats
		Soils			Poultry

Note: CASE – Curriculum for Agricultural Science Education. Data from Missouri Department of Elementary and Secondary Education, n.d.a

APPENDIX B

Table B1

Components of Career Development Events for Agricultural Education in Missouri

Components of Career Development Events		
Career Development Event	Event Component	Description
Agricultural Mechanics	Written Exam	This objective exam will cover information related to each of the six (6) Ag Mechanics Systems.
	Skill Tests in: Electrical Systems Metal Fabrication Systems Structural Systems Ag Machinery Systems Small Engines Environment and Natural Resource (including Precision Agriculture) Systems	Each contestant will complete a Skills Test in each of the Ag Mechanics Systems.
	Team Activity	Each team will be expected to complete a number of activities based on a provided scenario that may include multiple areas from each of the Ag Mechanics Systems.
Agricultural Sales	Product Sales Presentation	Each participant will conduct a product sales presentation. The product sales presentation should be conducted as a one-on-one interactive sale to a prospective consumer.
	Sales Situation Practicum	Each participant will compete in the same sales

		situation. B. The Sales Situation Practicum will be a Customer Relations Situation.
	Objective Written Test	The objective test is designed to evaluate a participant's knowledge of the professional sales process, the role that selling plays in the marketing of agricultural products and the knowledge possessed by students relative to the content areas of advertising and promotion, customer relations, product displays, telephone skills, market analysis and customer prospecting, and applying and interviewing for jobs.
Agronomy	Seed Identification	Contestants will identify 50 crops & weeds by seed samples from the Plant Identification List. The life cycle for each seed will be identified as Winter Annual, Summer Annual, Biennial, or Perennial.
	Plant Identification	Contestants will identify 50 crops & weeds by plant samples from the Plant Identification List. The life cycle for each plant will be identified as Winter Annual, Summer Annual, Biennial, or Perennial.
	Seed Judging	Contestants will place one, four-sample class on its value as seed for marketing or planting. Either wheat OR soybeans will be the

	crop utilized in seed judging. Reasons will be given by checking the evaluation factors present in each sample. The following will be considered judging factors in determining reasons for placing samples: a. Freedom from mixtures (other varieties and other crops) b. Freedom from inert material. (Includes stems, dirt, chaff, etc.) c. Freedom from weed seeds (prohibited, noxious, common) d. Soundness (weathering, disease, immature seed, insect damage, sprouted kernels, etc.)
Hay Judging	Hay judging will cover alfalfa only. A four-sample class will be judged on the basis of final placing only. The student should be encouraged and taught to understand the quality factors used in judging hay. The quality factor breakdown should include leafiness (50%), color (25%), and foreign material (25%).
Plant Disorders Practicum	Ten samples will be identified according to category, causal agent and damage location.
Written Test	A 50 question objective type test covering well established production practices and information contained in the references

		will be used. Hay analysis scenario questions may be included in the written test.
	Problem Solving	Two (2) problem solving questions will be completed by the contestants. Each problem will have 10 questions valued at 5 points each for a total of 50 points. Problems will be included as part of the written test and must be from the following categories: 1. Fertilizer Calculations 2. Chemical Tank Mix 3. Hay Analysis 4. Grain Pricing.
Dairy Cattle	Live Animal Evaluation	Contestants will judge five (5) classes of animals selected from the five (5) major dairy breeds. Only the final placing will be scored. No more than two (2) of the five (5) classes to be judged will be heifers. Four (4) animals shall constitute a class.
	Oral Reasons	Each team member will present oral reasons on at least two classes. The reasons presentation will be limited to two minutes per class. Notes may be used to prepare for each contestant's oral reasons presentation, but may not be referred to when presenting reasons to the official judge.
	Dairy Management Written Exam	A Dairy Management Written Test will consist of 50 questions involving

		dairy management practices.
Dairy Foods	Milk Flavor	Ten (10) milk samples will be scored on flavor (taste and odor). Samples will be prepared from pasteurized milk and will score 1-10. Contestants are to use whole numbers when scoring "Flavor" of milk. Check only the one most serious defect in a sample even if more than one flavor is detected. If no defect is noted, check "No Defect."
	Milker Units	Five (5) sets of milker unit parts will be scored based on defects present. The flexible plastic parts are to be scored as rubber parts, and rigid plastic or glass parts are to be scored as metal parts.
	Cheese Identification	Ten (10) cheese samples for identification will be selected from those listed: Blue, Brie/Camembert, Cheddar (mild), Cheddar (sharp), Cream/Neufchatel, Edam/Gouda, Feta Cheese, Havarti , Monterey (Jack), Mozzarella/Pizza, Munster, Processed American, Provolone, Romano, Swiss. Cubes of cheese will be available for tasting.
	Milk Fat Identification	Students will identify five (5) dairy products distinguished by their milk fat content.

	Real/Artificial Identification	Five (5) samples will be identified as either Real (Dairy) or Artificial (Non-Dairy). The following choices are recommended: butter/margarine, whipped cream/topping, cheese/cheese product, real milk/artificial milk, sour cream/artificial sour cream, half and half/artificial coffee creamer.
	Written Test	Participants will answer fifty (50) multiple choice questions. Questions will refer to milk production (composition and quality) and milk marketing. Participants will answer ten (10) multiple choice problems testing knowledge of Federal Order Milk Marketing.
Entomology	Insect Identification	There will be 40 adult insect specimens chosen from the six insect relatives and 109 insect groups on the FFA Insect Checklist (Form 50C). Contestants will give the name of the specimens; the order; the type of metamorphosis; and the type of mouthparts.
	Insect/Plant Diagnosis Practicum	Five (5) stations with two (2) questions per station. The following insects may be used: Aphid, Bedbug, Corn Earworm, Codling Moth, Ground Beetle, Japanese Beetle, Ladybird Beetle, Lacewing, Minute Pirate Bug, Robber Fly, Sawtooth Grain Beetle,

		Syrphid Fly, Tent Caterpillar, Termite, Wood Borer. . For each station the contestant must diagnose, from a multiple choice list, the insect, damage, or benefit presented (5 points) and chose, from a multiple choice list, the best-case Control Method (5 points). If the insect is beneficial, no control method should be used. If the insect is destructive, then biological, chemical, mechanical, or cultural control methods should be identified
	Pesticide Formulation Practicum	10 questions at five (5) points each. Questions will be based on examples found in the National Pesticide Applicator Certification Core Manual.
	Insect Biology and Control Strategies Written Test	The Pesticide Application Exam will consist of 75 true/false and multiple choice questions
Farm Management	Problem Solving Analysis Multiple Choice Test	The problem solving analysis section of the Farm Business Management CDE is designed to determine the team members' ability to apply economic principles and concepts of farm business management to the decision making process by actual problem analysis and to defend the decisions made.

		The multiple choice section of the Farm Business Management Contest is designed to test team members' understanding of economic principles in farm business management. Multiple choice questions, some related to problem situations, form the basis for testing understanding of the application rather than definition and identification of economic principles.
Floriculture	Plant Identification	Each contestant will be required to identify 60 specimens from the Floriculture Plant Identification List.
	Disorders	Each contestant will complete this practicum of five stations including diagnosing disorders and selecting the most correct remedy.
	Tool Identification	Each contestant will identify 25 items selected from the Floriculture/Greenhouse Items list.
	General Knowledge Examination	This portion of the contest will test the contestants' knowledge and understanding of production and retailing of floriculture crops and the selection, use, care, and culture of these plants in the home environment.

Food Science	Problem Solving/Math Practicum Food Safety Practicums Sensory Evaluation Practicums Written Examination	Participants will answer a series of five mathematical calculations based on common food science themes. Questions may include nutrition calculations, ingredient quantity, cost benefit analysis, estimation of cost/margin of goods sold, conversions, processing conditions, etc. Safety/Sanitation Practicum - Team members will work individually to evaluate five (5) photos. The contestant will evaluate the situations presented and select from a list of possible misuses of GMP's and HACCP. Customer Inquiry Practicum - Each participant will be given five scenarios representing general consumer inquiries. Participants must determine if the consumer inquiry reflects a quality or safety issue (two points per scenario) and determine if it is a biological, chemical or physical concern or hazard. Triangle Tests - Five different triangle tests will be conducted. Participants are expected to identify the different samples through flavor, aroma, visual cues and/or textural differences. Answers will be given on the sheet provided. No list

		will be provided for this segment of the practicum. Aromas - Each participant will be asked to identify ten different aromas from vials provided at each station and record the answer on the sheet provided. A list of potential aromas will be provided to each person. The objective questions administered during the food science and technology examination will be designed to determine each team member's understanding of the basic principles of food science and technology.
Forestry	Tree Identification	Twenty (20) unduplicated specimens from the Tree ID Contestant Reference Sheet will be displayed for contestants to identify by common names.
	Equipment Identification	Twenty (20) pieces of equipment from Equipment ID contestant Reference Sheet will be displayed for contestants to identify by proper technical name.
	Timber Cruising	Using a Biltmore tree scale stick, in the correct manner, each contestant will measure prenumbered trees on a 1/10 acre plot for DBH, 4.5 ft. from the high side of the tree, tree height to the nearest 1/2 log (8') and board foot volume.

Timber Stand Improvement	The site will be a fixed area, normally 1/10 acre or (merely designated). The student will be given the following information: a. existing number of trees per acre b. number of trees to thin (or leave) per plot c. objective or management plan for the stand. Using the information furnished on the scorecard, the student will determine whether each tree will be: a. left for growing stock or b. deadened/remove for a cull or undesirable species/harvest.
Map Reading	Contestants will be furnished a U.S. geological survey map with specific points marked for the student to identify. The student will need to know legal descriptions, size or location of no less than one 10-acre land parcel. The student must understand contour lines and be able to determine the difference in elevation between two points on the map. The student must be familiar with the map scale and be able to use it to determine the distance between two points on the map
Tree/Forest Disorders	Symptoms of ten (10) disorders from the Tree/Forest Disorders Contestant Reference List will be displayed for participants to identify by common names.

	General Knowledge Exam	This phase of the contest will test the contestant's knowledge and understanding of basic forestry and agroforestry principles. 2. Contestants will see fifty (50) objective type, multiple choice or true/false questions reflecting the contest objectives and coming from the reference list.
Horse Evaluation and Selection	Halter Evaluation	Halter Classes (3) may represent the following breeds and types. A breed/gender combination should only be used once as a halter class per contest. All horses used in a Halter Class are to be of the same gender (all mares OR all geldings). a. Quarter Horses b. Paint c. Appaloosa d. Morgan e. Arabian f. Foxtrotters g. Thoroughbred h. Saddlebred Of the three Halter Classes, two will be stock (quarter) type in breed and the third will be at the discretion of the superintendent. This would include Quarter Horses, Paint horses, Appaloosa, or grade horses that are quarter-type in conformation. The remaining Halter Class should be chosen from any other light horse breed listed above, but could also be a stock (quarter) type class if other suitable horses cannot be found.

	Performance Class Evaluation	Performance Classes (2) may include: a. Western Pleasure b. Western Riding c. Reining d. English Pleasure (Saddle Seat) e. Hunter Under Saddle (Hunt Seat) f. Ranch Riding Performance classes will be judged as presented (unsoundness to be penalized accordingly). American Quarter Horse Association reining patterns one or two will be used in the reining class as located in the AQHA Handbook. Western Discipline performance classes will consist of stock type horse breeds only.
	Oral Reasons	There will be two sets of oral reasons. One set on a halter class and one set on a performance class. Classes will be chosen by the superintendent or judges and will be announced while judging.
	Written Examination	The written exam will consist of 50 multiple choice or true/false questions over equine science, selection, management, and production.
Livestock	Livestock Placing Classes	Seven (7) Placing Classes may represent the following species and types: a. Beef cattle - bulls, heifers, market cattle, keep/cull heifers

		b. Swine - boars, gilts, market hogs, keep/cull gilts c. Sheep - rams, ewes, market lambs, keep/cull ewes d. Meat Goats – bucks, does, market goats, keep/cull does.
	Oral Reasons	Students will give 3 sets of Oral Reasons based on their placing of selected Placing Classes.
	Market Animal Grading	Estimate feeder cattle grade for a class of five (5) feeder cattle. All grading will be based on USDA market cattle grades.
Meats Evaluation	Identification of Retail Cuts of Meat	Forty (40) various retail cuts of meat and variety meats from Beef, Lamb, and Pork will be placed in a convenient manner and given an identification number. b. Contestants will identify the species, primal cut, and retail name of each cut as listed on LIST 7 – Primal/Retail Cuts Coding
	Judging Classes of Meat	Four (4) classes will be judged, each consisting of four (4) samples. Classes may be carcasses of beef or pork; primal cuts of beef or pork; retail cuts of beef or pork. Primal cuts may include fresh hams, pork loins, pork Boston shoulders (butts), pork picnic shoulders, beef ribs, beef chucks, beef loins, beef rounds, beef strip loins, and beef rib eye

		roasts. Ten questions will be required on one of the judging classes. Students will be allowed to reference their notes when answering questions.
	Meats Formulation Problem	Contestants will complete an industry-based practicum requiring them to select the lowest cost method of developing a further-processed meat product. Points will be earned for selecting the correct formulation and answering multiple choice questions relating to the data provided within the practicum.
	Written Exam	The test will consist of 20 multiple choice questions based on the test references. All questions on the meats test must relate to beef, pork, lamb, meat history, and industry history.
Nursery/Landscape	Identification	Each contestant will be required to identify 50 specimens from the Nursery/Landscaping Supplemental Information List. A specimen may be twigs, foliage, flower, fruit, or an entire plant.
	Landscape Design Problem	This practicum is designed to evaluate participants' knowledge of and ability in: (1) Evaluating a landscape design (2) Reading a landscape drawing (3) Measuring and

		calculating materials needed to execute a landscape plan (4) Evaluating factors that affect profitability of a landscape business A landscape drawing and scratch paper will be provided to the participants. There will be 20 objective questions about the landscape plan, and each correct answer has a value of 5 points. The questions may include such areas as determining how accent was provided in the public area, the form and size specified for a certain plant, the cost of fencing, the number of patio pavers required, the area of sod to be installed, the volume of mulch required and the labor cost to install a ground-cover bed.
	Practicum - Plant Disorder Diagnosis	This portion of the contest will test the ability of the contestants to identify diseases, insects, weeds, and physiological disorders based on plant systems or on the pests themselves. Contestants will be required to make diagnoses on 20 specimens drawn from the Plant Disorder Diagnosis Scorecard (Form 67).
	General Knowledge Examination	This portion of the contest will test the contestant's knowledge and understanding of the production, marketing,

		utilization, and culture of landscape plants. One (1) hour will be the maximum time allotted for the exam. It will consist of 50 multiple choice questions selected from the following: (1) Turf Grasses, (2) Shrubs, (3) Trees, (4) Pests and Pesticides, (5) Soils, (6) Planting, (7) Fertilizers, (8) Pruning, and (9) Landscaping.
Poultry	Live Bird Evaluation and Reasons	One placing class of four (4) past-production laying hens. One placing class of four (4) broilers meat birds. Oral reasons for one of the above live bird classes.
	Ready-To-Cook Poultry Product Evaluation	Ten broiler and/or turkey carcasses and/or parts for USDA Quality Grading. One placing class of four (4) ready-to-cook turkey carcasses or broiler carcasses. Oral reasons on placing class above.
	Egg Evaluation	Evaluation of Interior Quality of 10 individual eggs based on USDA Quality Standards. Evaluation of Exterior Quality of 10 individual eggs based on USDA Quality Standards. Written Factors of exterior quality eggs listed above.
	Merchandising and Further Processing Evaluation	Identification of ten (10) poultry carcass parts. Duplicate samples may not be used in any

		identification portion of the event. Evaluation of ten (10) Boneless Further-Processed poultry products. Evaluation of ten (10) Bone-In Further-Processed poultry products.
	Written Poultry Management Examination	Twenty-five multiple choice questions. Five (5) management calculation problems.
Soils	Soil Evaluation	The Soils CDE will consist of contestants evaluating and determining management practices of four (4) soil sites selected by the superintendent and judged in advance of the event. The boundaries will be marked so that each site will have some uniformity of soil profile and surface features. The most current Interpretation Help Guide will be provided to each contestant. Judging pits will be dug to a depth of more than three feet unless limited by a very rocky layer. Buckets of soil from each horizon will be provided at each judging site. Yardsticks and a water supply will be provided at each judging site. The following information regarding each site will be available to the contestants and posted on a sheet at each pit site: a. Number of the site. b. Boundary of the site marked by corner flags (100' x 100').

	c. The available water capacity of the horizons which are not judged. d. Students must determine slope using any non-electronic device (hand level, clinometer, clip board). Two stakes set at 50' or 100' will be identified for slope determination.

Note: Data from *Missouri FFA State Career Development Handbook*, Missouri Department of Elementary and Secondary Education, n.d.b

APPENDIX C

Table C1

Understanding Agriculture – New Directions for Education Findings, Conclusions and Recommendations

Agricultural Literacy	
Findings	Conclusions and Recommendations
Agricultural education in U.S. high schools usually does not extend beyond the offering of a vocational agriculture program. • Most high school students have limited or no access to vocational agriculture or agricultural literacy programs. • Minority students in urban schools have the least access to these programs.	The focus of agricultural education must change. Beginning in kindergarten and continuing through twelfth grade, all students should receive some systematic instruction about agriculture.

Vocational Agriculture	
Findings	Conclusions and Recommendations
Vocational agriculture programs have had a positive effect on tens of thousands of people: students, their families, and residents of local communities. White males have mainly made up enrollment in vocational agriculture programs in the past and continue to do so. • Female enrollment has concentrated in a limited number of specialized vocational agriculture programs.	The success of reform in vocational agriculture programs relies on innovative programmatic leadership at the state and national levels. Major revisions are needed within vocational agriculture. The quality of vocational agriculture programs must be enhanced, in some cases substantially. The establishment of specialized magnet high schools for the agricultural sciences

- Enrollment of minorities in vocational agriculture programs is disproportionately low.

Much of the focus and content of many vocational agriculture programs is outdated.

- Production agriculture farming still dominates most programs.

- Traditional vocational agriculture programs and the students' organization, the FFA, are not meeting the broader needs for agricultural education generated by changes in the food and fiber industries and society as a whole.

- SOE programs often do not reflect the broad range of opportunities in today's agricultural industry.

Vocational agriculture programs are uneven in quality.

- Excellent programs need to be sustained and built upon. Some programs warrant in-depth study and replication as model programs.
-
- Those that do not meet educational needs should be upgraded, consolidated, or, as a last resort, phased out.

Vocational agriculture programs in secondary schools are currently conducted as part of the federal and state systems of vocational education.

- Restrictions on the use of federal and state funds for vocational education apply to vocational agriculture programs.

in major urban and suburban areas should be encouraged.

Teachers should seek out and share high-quality computer software and instructional materials and media for agricultural management and planning and for instructional application.

As a goal, all students enrolled in vocational agriculture pro-grams should participate in worthwhile SOEs.

The FFA should change its name and revise its symbols, rituals, contests, awards, and requirements for membership consistent with all applicable federal and state laws to reflect a contemporary image of agriculture and a broadened and improved agricultural education program.

Education About and in Agriculture Conclusions and Recommendations

Programmatic and budgetary policy changes are needed at both state and federal levels if comprehensive programs of education in and about agriculture are to be implemented.

States should establish commissions, preferably appointed by the governor and the chief state school officer, to identify needs and strategies for implementing agricultural literacy pro-grams and reforming vocational agriculture programs.

Not only teachers and other specialists in agricultural education, but also legislators, school superintendents and board members, principals, and science teachers should provide leadership in the initiation of agricultural literacy efforts and the reformation of vocational agriculture.

The subject matter of instruction about agriculture and instruction in agriculture must be broadened.

Exemplary programs in local schools that have broadened the curriculum and improved the attractiveness of agricultural education programs should be identified, studied, and emulated.

Teacher preparation and in-service education programs must be revised and expanded to develop more competent teachers and other professional personnel to staff, administer, and supervise educational programs in and about agriculture.

Note: National Research Council, 1988

Appendix D

IRB Approval

Institutional Review Board
University of Missouri-Columbia
FWA Number: 00002876
IRB Registration Numbers: 00000731, 00009014

482 McReynolds Hall
Columbia, MO 65211
573-882-3181
irb@missouri.edu

February 14, 2020

Principal Investigator: Rodney Barr (MU-Student)
Department: Educational Leadership-EDD

Your IRB Application to project entitled Career Development Events as a Predictor of Fall-to-Fall Retention of First-Year College Students was reviewed and approved by the MU Institutional Review Board according to the terms and conditions described below:

IRB Project Number	2019590
IRB Review Number	259007
Initial Application Approval Date	February 14, 2020
IRB Expiration Date	February 14, 2021
Level of Review	Exempt
Project Status	Active - Exempt
Exempt Categories (Revised Common Rule)	45 CFR 46.104d(4)(ii)
Risk Level	Minimal Risk

The principal investigator (PI) is responsible for all aspects and conduct of this study. The PI must comply with the following conditions of the approval:

1. No subjects may be involved in any study procedure prior to the IRB approval date or after the expiration date.
2. All changes must be IRB approved prior to implementation utilizing the Exempt Amendment Form.
3. The Annual Exempt Form must be submitted to the IRB for review and approval at least 30 days prior to the project expiration date to keep the study active or to close it.
4. Maintain all research records for a period of seven years from the project completion date.

If you have any questions or concerns, please contact the MU IRB Office at 573-882-3181 or email to muresearchirb@missouri.edu.

Thank you,
MU Institutional Review Board

NORTHWEST
MISSOURI STATE UNIVERSITY
Institutional Review Board
Vice President for Finance
117 Administration Building
660.562.1440 office
660.562.1400 fax

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800 University Drive
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www.nwmissouri.edu

Date: 25 February 2020

IRB Project #: 1920-054

Primary Investigator: Rodney Barr

Project Title: Career Development Events as a Predictor of Fall-to-Fall Retention of First-Year College Students

The Institutional Review Board has **secondarily approved** your research proposal as **exempt**.

You may collect data according to the procedures you describe in your proposal.

You are required to submit a status report to the IRB Chair on several occasions. The status report form is available on the IRB website.

- If your methodology changes, you must file a status report within 10 days.
- If negative incidents pertaining to human participants occur, you must file a status report within 10 days.
- Upon completion of your project, you must file a status report.

Please contact us at IRBNWMS@nwmissouri.edu if you have any questions or concerns, and please include your IRB Project number in all correspondence.

Thank you for your interest in research at Northwest Missouri State University. We wish you the best with your important research.

Regards,

Dr. Bradlee W. Gamblin
Chair, Institutional Review Board AY2019-20

APPENDIX E

Methods, Findings, Discussion, and Recommendations

Methods, findings, discussions, and recommendations from this study are located in this appendix. This predictive correlation designed study examined if participation and performance in agricultural education career development events (CDEs) could be used as a predictor for retention of first-year, first-time, full-time college students enrolled in agricultural sciences at a regional, Midwest, public university. Data analysis was completed with IBM SPSS 9 (version 25).

Methods

Data collection. District CDE participation and performance data contained within archives at judgingcard.com from 2012 through 2017 were used for the study. A request to utilize the CDE data was obtained from the Director of the Agricultural Education Division of the Missouri Department of Elementary and Secondary Education. University data from students enrolling in the School of Agricultural Sciences in 2015, 2016, 2017, and 2018 was obtained from Institutional Research at Northwest Missouri State University regarding agricultural science program area CIP codes

Following a request, an Excel spreadsheet containing student names, terms of enrollment, and high school attended was supplied to the investigator by institutional research. The investigator classified high schools by the regional district by the investigator. Data from judgingcard.com were compiled into a master CDE spreadsheet.

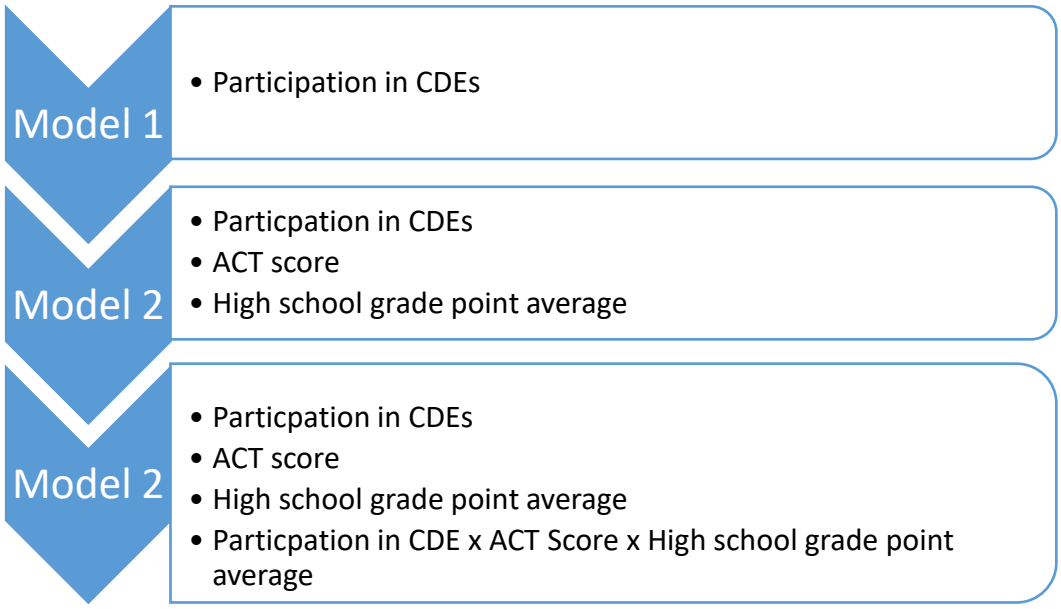
The two spreadsheets were sorted by year of graduation, the regional district, and alphabetically by the last name and combined into one document. Excel was used to compare and highlight matching names. High schools and names were analyzed to

identify and match students enrolled in the School of Agricultural Sciences. Students not enrolled at Northwest Missouri State University were removed from the spreadsheet. Participants and non-participants were coded, and data, including CDEs participated in, year of participation, multiple years of involvement, score, and rank were recorded. Information was double-checked for accuracy, and percentile rank was calculated. The data was stored in a password protected file and returned to institutional research with a request for gender, primary major, retention data, composite ACT score, and cumulative high school grade point average (GPA). Institutional research stripped the data to protect anonymity and provided the investigator with a final spreadsheet containing all of the study's needed data.

Data analyses. The Excel spreadsheet was imported into IBM SPSS and recoded for analyses. Descriptive statistics were compiled for the study population and each of the CDEs. A chi-square test was performed to determine if there was a significant statistical relationship between participation in CDEs and retention. Following the determination of statistical significance, the means of the entire study population and CDE participants were compared. Descriptive crosstabs were created to compare the means of CDE participants and non-participants,

Using the principle of parsimony (Field, 2018), multiple models of binomial logistic regression were built for the study. Figure F1 shows the models built up when considering CDE participation, ACT score, and high school GPA. A separate binomial logistic regression was run to determine the ability to predict the probability of retention when considering specific CDEs.

Figure F1. Models of Logistic Regression Used in Study



Individual chi-square tests were performed for each CDE to determine if there was a relationship between retention and CDE performance. As a result of warnings in the chi-square test results due to cells exceeding the expected counts, the performance was recoded from five categories to two, those in the 0-50th percentile and those above the 50th percentile. The chi-square test was re-run with the modification to the student performance independent variable.

Findings

The purpose of this study is to add to the current literature in the following ways:

1. Discerning the extent to which participation in high school activities, CDEs, affects college retention that is not captured by ACT scores or high school GPA. Although, prior studies have provided evidence that participation in high school activities have an impact with student success in college (Brown,

Rajasinghe, Evans, Rose, & Pilkington, 2018a Krumrei-Mancuso, Newton, Kim, & Wilcox, 2013; Mahoney, Cairns, & Farmer, 2003; Wang & Shively, 2009), the magnitude of participation in CDEs as a predictor of college retention is limited.

2. Showing the effect of student performance in CDEs as a predictor of retention of first-year, first-time, full-time university students. Prior research has not confirmed the extent to which there is a relationship between performance in CDEs while in high school with college retention of individual students.

Descriptive statistics. The study used data from Institutional Research at Northwest Missouri State University and from archival data from judgingcard.com. Students who graduated from a Missouri high school seeking a degree in the School of Agricultural Science, enrolling as a first-year, first-time, full-time student at Northwest Missouri State University in the fall of 2015, 2016, 2017, and 2018 were included in the study (n = 386). Fifty-one percent of the study population were females compared to 49% males. The increase in percentages in the study population for each year reflects enrollment growth in the School of Agricultural Sciences. Total undergraduate enrollment for the School of Agricultural Science grew from 573 in the fall of 2016 to 644 in 2019 (Northwest Missouri State University Institutional Research, 2020). Statistics show a retention rate of 82.4% for all students enrolling in the School of Agricultural Sciences compared to 86.8% for students participating in CDEs in high school and enrolling in the school of Agricultural Sciences. Table F1 provides summary statistics of the study population and descriptive statistics for variables used in the analysis.

Table F1

Descriptive Statistics of Study Population

		All Students (*n*=386)		CDE Participants (*n*=273)	
		Mean	SD	Mean	SD
Demographic characteristics	Female	51%		51%	
	Male	49%		49%	
	2015 enrollment	21.2%		19.8%	
	2016 enrollment	25.9%		28.2%	
	2017 enrollment	23.6%		26.0%	
	2018 enrollment	29.3%		26.0%	
	C District	29.3%		26.0%	
	NE District	22.8%		24.9%	
	NW District	40.9%		42.9%	
	SC District	1.8%		1.8%	
	SE District	2.1%		1.1%	
	SW District	3.1%		3.3%	
	Agricultural Business	39.7%		41.6%	
	Agricultural Education	15.5%		21.0%	
	Agricultural Science	12.6%		12.7%	
	Agronomy	8.2%		8.2%	
	Animal Science	11.1%		8.2%	
	Animal Science (Pre-Vet)	12.1%		7.9%	
	Horticulture	0.8%		0.0%	
High school achievement	Cumulative GPA	3.4818	.38735	3.5557	.34632
	ACT composite score	21.39	3.477	21.83	3.549
College success	Retention	82.4%		86.8%	
Career Development Events	Participation	70.7%			
	Number of events	1.76	1.438	2.49	1.051
	Students participating in the same event multiple years			32.2%	

The number of participants in individual CDEs varies widely with Livestock, Meats, and Dairy Cattle being the most popular among the study population. Agricultural Mechanics and Agricultural Sales had the least number of participants in the study population. Table F2 offers descriptive statistics for individual CDEs.

Table F2

Descriptive Statistics for Career Development Event Scores

	N	Minimum	Maximum	Mean	Std. Deviation
Agronomy	65	78	787	484.05	176.658
Ag Mechanics	24	111.0	317.0	243.521	50.1674
Ag Sales	17	239	394	316.78	37.042
Dairy Cattle	60	199.0	413.0	312.358	50.9612
Dairy Foods	40	109.5	226.0	182.038	23.9180
Entomology	32	148	512	384.44	92.256
Farm Management	51	58	289	151.45	50.348
Floriculture	50	150	641	442.36	129.071
Forestry	35	184.33		317.0194	64.43885
Horse	34	260	416	327.59	44.057
Livestock	83	266	516	401.00	52.713
Meats	79	106	531	394.49	80.472
Nursery Landscape	28	156	526	389.86	97.009
Poultry	31	282	607	474.29	76.192
Soils	49	166	381	250.10	35.491
Valid N (listwise)	0				

Research question 1. The study began by examining the extent to which the relationship of participation in CDEs serves as a predictor of retention of first-year, first-time, full-time university students:

R_1: Does participation in agricultural education CDEs in high school predict retention of first-year, first-time, full-time college students enrolled in agricultural sciences at a regional, Midwest, public university?

A chi-square test was conducted between CDE participation and retention. All expected cell frequencies were greater than five. There was a statistically significant

association between CDE participation and retention, $\chi^2(1) = 12.609$, $p = .000$. The results of the chi-square test are shown in Table F3.

Table F3

Career Development Event Participation and Retention Chi-Square Test Results

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	12.609[a]	1	.000		
Continuity Correction[b]	11.588	1	.001		
Likelihood Ratio	11.809	1	.001		
Fisher's Exact Test				.001	.000
Linear-by-Linear Association	12.576	1	.000		
N of Valid Cases	386				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 19.91.
b. Computed only for a 2x2 table

Logistic regression model one was performed to determine the effects of CDE participation. Results of the omnibus tests of model coefficients showed the model to be significant, $p = .000$. Based on the model (shown in Table F4), CDE participation was statistically significant in predicting retention.

Table F4

Logistic Regression Predicting Likelihood of Retention Based on CDE Participation

		B	S.E	Wald	*df*	*p*	Odds Ratio	95% CI for Odds Ratio Lower	Upper
Step 1[a]	CDE part.	-.956	.275	12.086	1	.001	3.84	2.24	6.59
	Constant	-.929	.209	19.874	1	.00	9.95		

a. Variable(s) entered on step 1: CDE participation, ACT Score, HS GPA

Logistic model two was performed to ascertain the effects of CDE participation, ACT score, and cumulative high school GPA on the likelihood that students are retained following their first year of enrolling in the School of Agricultural Sciences. The Linearity of the continuous variables with respect to the logit of the dependent variable was assessed via the Box-Tidwell (1962) procedure. A Bonferroni correction was applied using all six terms in the model resulting in statistical significance being accepted when $p < .008333$ (Tabachnick & Fidell, 2014). Based on this assessment, all continuous independent variables were found to be linearly related to the logit of the dependent variable. The model explained 5.9% (Nagelkerke *R2*) of the variance in retention and correctly classified 82.4% of cases. Sensitivity was 0.0%, specificity was 100%, positive predictive value was 100.0% and negative predictive value was 0.0%. Of the three predictor variables, only CDE participation was statistically significant (shown in Table F5). Students participating in CDEs had 2.29 higher odds to be retained than those not participating in CDEs.

Table F5

Logistic Regression Predicting Likelihood of Retention Based on CDE Participation, ACT Score, High School Grade Point Average

								95% C.I. for Odds Ratio	
		B	S.E	Wald	*df*	*p*	Odds Ratio	Lower	Upper
Step 1[a]	CDE part.	.829	.289	8.225	1	.004	2.290	1.300	4.035
	ACT Score	.038	.048	.620	1	.431	1.038	.945	1.141
	HS GPA	.304	.401	.574	1	.449	1.355	.617	2.975
	Constant	-.832	1.225	.461	1	.497	.435		

a. Variable(s) entered on step 1: CDE participation, ACT Score, HS GPA

Logistic model three shows the interaction between CDE participation, ACT score, and high school GPA. Results of the omnibus tests of model coefficients showed the model to be significant, $p = .003$. Based on the results of the model (see Table F6), neither CDE participation, ACT score, nor high school GPA were significant when considered in combination with each other.

Table F6

Logistic Regression Predicting Likelihood of Retention Combining CDE Participation, ACT Score, and High School Grade Point Average

								95% C.I. for Odds Ratio	
		B	S.E	Wald	*df*	*p*	Odds Ratio	Lower	Upper
Step 1[a]	CDE part.	.752	1.203	.090	1	.5320	2.2121	.201	22.413
	ACT Score	.017	.052	.079	1	.779	1.018	.901	1.149
	HS GPA	-.100	.426	.055	1	.814	.905	.392	2.086
	CDE part. By ACT Score by HS GPA	-.022	.017	1.832	1	.176	.978	.946	1.010
	Constant	-.752	1.794	.281	1	.596	.385		

a. Variable(s) entered on step 1: CDE participation, ACT Score, HS GPA

Binomial logistic regression was performed for each CDE to determine the effects of participating in specific events on student retention. Of all of the CDEs, only participation in the Meats CDE was shown to have a statistically significant impact on student retention (shown in Table F7).

Table F7

Logistic Regression Predicting Likelihood of Retention Based on Specific CDE Participation

								95% C.I. for EXP (B)	
		B	S.E	Wald	*df*	*p*	Odds Ratio	Lower	Upper
Step 1[a]	Agronomy	-.493	.404	1.493	1	.222	.611	.277	1.347
	Constant	2.457	.769	10.221	1	.001	11.670		
Step 1[b]	Ag Mechanics	-.897	.751	1.427	1	.232	.408	.094	1.777
	Constant	3.295	1.483	4.934	1	.026	26.980		
Step 1[c]	Ag Sales	-.559	.762	.537	1	.464	.572	.128	2.548
	Constant	2.638	1.506	3.068	1	.080	13.987		
Step 1[d]	Dairy	-.383	.406	.889	1	.346	.682	.308	1.511
	Constant	2.254	.773	8.509	1	.004	9.530		
Step 1[e]	Dairy Foods	.175	.420	.174	1	.676	1.192	.523	2.714
	Constant	1.211	.803	2.273	1	.132	3.357		
Step 1[f]	Entomology	-.777	.622	1.560	1	.212	.460	.136	1.556
	Constant	3.045	1.221	6.224	1	.013	21.017		
Step 1[g]	Farm Management	-.757	.491	2.372	1	.124	.469	.179	1.229
	Constant	2.976	.952	9.768	1	.002	19.604		
Step 1[h]	Floriculture	-.132	.411	.103	1	.748	.876	.391	1.962
	Constant	1.790	.785	5.208	1	.022	5.992		
Step 1[i]	Forestry	-.886	.619	2.045	1	.153	.413	.123	1.388
	Constant	3.253	1.215	7.162	1	.007	25.859		
Step 1[j]	Horse	-.036	.470	.006	1	.939	.964	.384	2.422
	Constant	1.612	.908	3.152	1	.076	5.012		
Step 1[k]	Livestock	.337	.308	1.199	1	.273	1.401	.766	2.563
	Constant	.947	.555	2.912	1	.088	2.577		
Step 1[l]	Meats	-1.125	.448	6.305	1	.012	.325	.135	.781
	Constant	3.623	.861	17.701	1	.000	37.460		
Step 1[m]	Nursery Landscape	.018	.513	.001	1	.972	1.018	.373	2.780
	Constant	1.508	.997	2.291	1	.130	4.519		
Step 1[n]	Poultry	-.738	.623	1.405	1	.236	.478	.141	1.620
	Constant	2.972	1.223	5.907	1	.015	19.525		
Step 1[o]	Soils	-.480	.458	1.098	1	.295	.619	.252	1.518
	Constant	2.449	7.696	7.696	1	.006	11.580		

a: Variable(s) entered on step 1: Agronomy; b. Variable(s) entered on step 1: Ag Mechanics; c. Variable(s) entered on step 1: Ag Sales; d. Variable(s) entered on step 1: Dairy; e. Variable(s) entered on step 1: Dairy Foods; f. Variable(s) entered on step 1: Entomology; g. Variable(s) entered on step 1: Farm Management; h. Variable(s) entered on step 1: Floriculture; i. Forestry; j. Variable(s) entered on step 1: Horse; Variable(s) entered on step 1:Livestock; Variable(s) entered on step 1: Meats; Variable(s) entered on step 1: Nursery Landscape; Variable(s) entered on step 1: Poultry; Variable(s) entered on step 1: Soils

Research question 2. The study then compared the relationship between student performance in CDEs and retention of first-year, first-time, full-time university students. It examined whether a prediction model could be developed:

$R_{2:}$ Does performance in agricultural education CDEs in high school predict retention of first-year, first-time, full-time college students enrolled in agricultural sciences at a regional, Midwest, public university?

For each CDE, a chi-square test was conducted between performance and retention. The performance was split into two categories, students performing from the 0-50th percentile and students performing above the 50th percentile, to meet the assumptions required for the chi-square test. Results from the analysis of the chi-square test showed there was no significant association between CDE performance and retention for any event (shown in Table F8).

Table F8

Career Development Event Performance and Retention Chi-Square Test Results

	Value	*df*	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Agronomy					
Pearson Chi-Square	.513[a]	1	.474		
Continuity Correction[b]	.108	1	.743		
Likelihood Ratio	.501	1	.479		
Fisher's Exact Test				.700	.364
Linear-by-Linear Association	.505	1	.477		
N of Valid Cases	65				
Ag Mechanics					
Pearson Chi-Square	.773[c]	1	.379		
Continuity Correction[b]	.001	1	.971		
Likelihood Ratio	1.275	1	.259		
Fisher's Exact Test				1.000	.538
Linear-by-Linear Association	.739	1	.390		
N of Valid Cases	23				
Ag Sales					
Pearson Chi-Square	.000[d]	1	1.000		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.000	1	1.000		
Fisher's Exact Test				1.000	.765
Linear-by-Linear Association	.000	1	1.000		
N of Valid Cases	18				
Dairy Cattle					
Pearson Chi-Square	1.758[e]	1	.185		
Continuity Correction[b]	.831	1	.362		
Likelihood Ratio	1.634	1	.201		
Fisher's Exact Test				.225	.179
Linear-by-Linear Association	1.729	1	.189		
N of Valid Cases	60				
Dairy Foods					
Pearson Chi-Square	.101[f]	1	.751		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.101	1	.751		
Fisher's Exact Test				1.000	.528
Linear-by-Linear Association	.098	1	.754		
N of Valid Cases	40				
Entomology					
Pearson Chi-Square	.073[g]	1	.787		

Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.075	1	.785		
Fisher's Exact Test				1.000	.644
Linear-by-Linear Association	.071	1	.790		
N of Valid Cases	32				
Farm Management					
Pearson Chi-Square	3.868[h]	1	.049		
Continuity Correction[b]	2.204	1	.138		
Likelihood Ratio	3.865	1	.049		
Fisher's Exact Test				.071	.071
Linear-by-Linear Association	3.792	1	.051		
N of Valid Cases	51				
Floriculture					
Pearson Chi-Square	.005[i]	1	.944		
Continuity Correction[i]	.000	1	1.000		
Likelihood Ratio	.005	1	.944		
Fisher's Exact Test				1.000	.659
Linear-by-Linear Association	.005	1	.944		
N of Valid Cases	50				
Forestry					
Pearson Chi-Square	1.136[j]	1	.287		
Continuity Correction[b]	.141	1	.708		
Likelihood Ratio	1.879	1	.170		
Fisher's Exact Test				.553	.397
Linear-by-Linear Association	1.103	1	.294		
N of Valid Cases	35				
Horse					
Pearson Chi-Square	.513[k]	1	.474		
Continuity Correction[b]	.063	1	.801		
Likelihood Ratio	.499	1	.480		
Fisher's Exact Test				.648	.392
Linear-by-Linear Association	.498	1	.480		
N of Valid Cases	35				
Livestock					
Pearson Chi-Square	.913[l]	1	.339		
Continuity Correction[b]	.458	1	.499		
Likelihood Ratio	.892	1	.345		
Fisher's Exact Test				.406	.247
Linear-by-Linear Association	.902	1	.342		
N of Valid Cases	83				
Meats					
Pearson Chi-Square	.776[m]	1	.378		
Continuity Correction[b]	.184	1	.668		
Likelihood Ratio	.866	1	.352		
Fisher's Exact Test				.658	.351

Linear-by-Linear Association	.766	1	.381		
N of Valid Cases	79				
Nursery Landscape					
Pearson Chi-Square	1.259[n]	1	.262		
Continuity Correction[b]	.222	1	.637		
Likelihood Ratio	2.099	1	.147		
Fisher's Exact Test				.553	.358
Linear-by-Linear Association	1.215	1	.270		
N of Valid Cases	29				
Poultry					
Pearson Chi-Square	1.155[o]	1	.282		
Continuity Correction[b]	.145	1	.703		
Likelihood Ratio	1.900	1	.168		
Fisher's Exact Test				.550	.394
Linear-by-Linear Association	1.118	1	.290		
N of Valid Cases	31				
Soils					
Pearson Chi-Square	.795[p]	1	.373		
Continuity Correction[b]	.182	1	.670		
Likelihood Ratio	.881	1	.348		
Fisher's Exact Test				.649	.351
Linear-by-Linear Association	.778	1	.378		
N of Valid Cases	49				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 3.08.
b. Computed only for a 2x2 table
c. 2 cells (50.0%) have expected count less than 5. The minimum expected count is .52.
d. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.00.
e. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 2.40.
f. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 3.60.
g. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.22.
h. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.96.
i. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 2.08.
j. 2 cells (50.0%) have expected count less than 5. The minimum expected count is .77.
k. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 2.23.
l. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.29.
m. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.97.
n. 3 cells (75.0%) have expected count less than 5. The minimum expected count is .86.
o. 2 cells (50.0%) have expected count less than 5. The minimum expected count is .77
p. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.96.

Discussion

One of the most challenging problems facing higher education is student attrition (Gansemer-Topf & Schuh, 2006). For institutions, retention places burdens on

recruitment, enrollment planning, and financial budgeting. For students, leaving a university before earning a degree reduces their lifetime earning capacity (Gansemer-Topf & Schuh, 2006; Mannan, 2007). Essential predictor variables may be identified to enhance research leading to new theories regarding student retention (Delen, 2012). The data suggest that CDE events may be utilized to predict student retention.

Research question 1. Does participation in agricultural education CDEs in high school predict retention of first-year, first-time, full-time college students enrolled in agricultural sciences at a regional, Midwest, public university? The analysis of the data provided by the chi-test showed a significant association between CDE participation and retention. The retention rate for students participating in CDEs was 86.8% compared to 71.7% for those not participating in CDEs (shown in Figure F2).

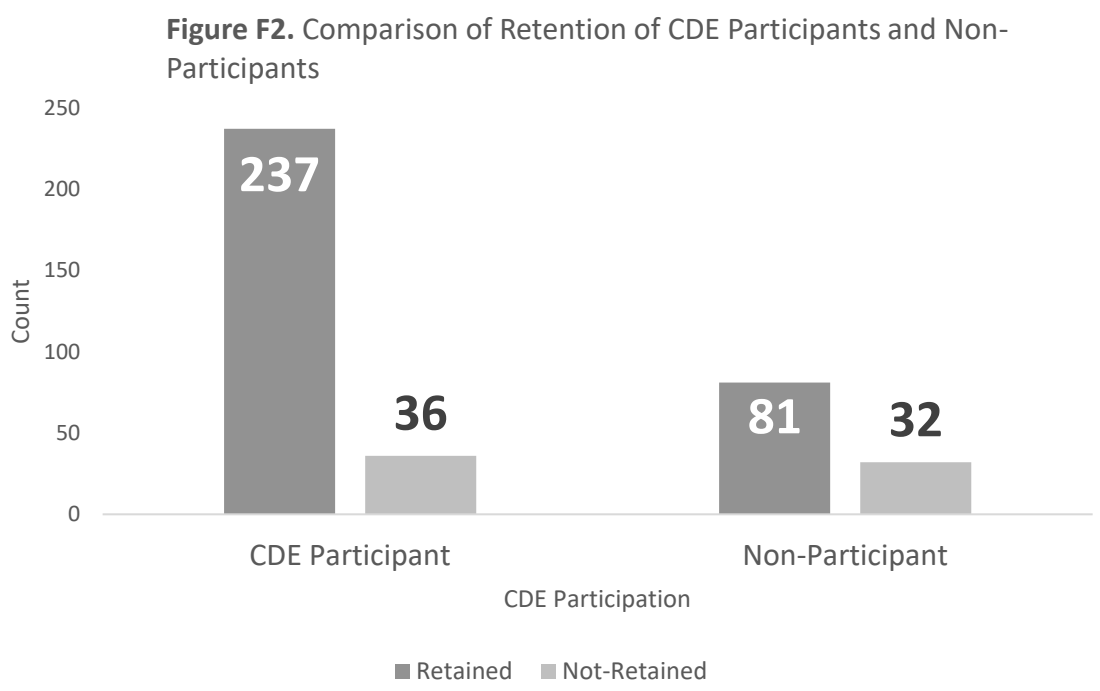


Figure F2. Comparison of Retention of CDE Participants and Non-Participants

Analysis of the data of CDE participants retained in college shows the mean for the number of events participated in to be 2.49 with a standard deviation of 1.051. The data suggest that participation in less than two CDEs in high school has a significant impact on the potential for fall-to-fall retention in college.

Results from a binomial logistic regression examining the effects of CDE participation, ACT score, and cumulative high school GPA on the likelihood that students are retained showed that only CDE participation has a significant impact. Both composite ACT score and cumulative high school GPA were found to not have a statistically significant influence on retention rates for the study population. Results showed that students participating in CDEs had 2.29 higher odds to be retained than those not participating in CDEs.

Also, the analysis of the results from a separate binomial logistic regression determining the effects of the individual CDEs showed little influence on retention. Only one CDE of the fifteen, Meats, showed significance, $p = .012$, in the results. However, although significance was achieved, the odds ratio was low at .325, which indicates a limited effect on the odds related to participation and retention.

Research question 2. Does performance in agricultural education CDEs in high school predict retention of first-year, first-time, full-time college students enrolled in agricultural sciences at a regional, Midwest, public university? Results from the chi-square test supported the null hypothesis and showed no statistical significance for any individual CDE. The results of the study indicate that participation is more critical than performance regarding predicting student retention.

Conclusion

The results show that non-traditional predictors of student success are capable of predicting student retention in college. These results build on existing evidence (Dyer, Breja, & Wittler, 2002; Smith, Garton, & Kitchel, 2010; Koon, Frick, & Igo, 2009) that show variables other than ACT score and high school GPA can be useful in predicting the success of college students pursuing undergraduate degrees in agriculture. Many universities focus on traditional measures, ACT score, and high school GPA, in predicting student success. When assessing students' ability to succeed in college, other criteria and additional data need to be considered. If colleges want to improve retention rates, data mining, and predictive analytics may prove beneficial.

Caution should be taken in generalizing the findings to other populations due to the limitations of the study. Only students from Missouri enrolling in the School of Agricultural Sciences were included in the study. No consideration was given to other demographic variables of the students or the high schools from which they graduated.

While there is considerable research regarding retention and attrition, little has been done regarding agricultural education and college students pursuing degrees in agriculture (Koon, Frick, & Igo, 2009). Based on the findings of this study, it is recommended that further research be conducted. Recommendations for new research include conducting the same study on a larger scale, including additional states and universities, examining the impact of CDEs on degree program selection, and non-traditional predictors for student retention.

Due to the lack of research supporting the claims of student organizations' benefits in career and technical education (Zirlke & Conners, 2003), more studies such as

this are warranted. Studies such as this provide an opportunity to begin the dialogue with a variety of stakeholders at the high school and college levels regarding non-traditional predictors for college success and their impact on student achievement at the college level.

VITA

Rodney ‘Rod’ K. Barr was born and raised in Southwest Iowa, graduating from Griswold Community High School. He is a graduate of Northwest Missouri State University with a Bachelor of Science degree in Animal Science and a Bachelor of Science in Education in Agricultural Education. He began his career as a vocational agriculture teacher at the Northwest Technical School in the Maryville R-2 school district. Roles included serving as the secondary agriculture instructor, FFA advisor, adult agriculture instructor, Farm Business Management coordinator, and Young Farmer advisor. Rod holds a Master’s degree in Secondary Education – Teaching Agriculture and an Education Specialist degree in Educational Leadership from Northwest Missouri State University. In 2002, he transitioned to faculty as an Agricultural Education instructor and Program Coordinator for Agricultural Education at Northwest Missouri State University. Since 2013, Rod has served as the Director of the School of Agricultural Sciences at Northwest Missouri State University. Awards include Outstanding Farm Advocate, 2025; Dean’s Award for Service, 2009; Missouri Vocational Agriculture Teachers Association Ideas Unlimited State Winner, 2002; Missouri Vocational Agriculture Teacher of the Year, 2000; Missouri State Teachers Association Northwest District Teacher of the Year, 2000.

Rod’s research interests are in agricultural education, career and technical education, career and technical student organizations, and student success in early college students. He has published in the North American College Teaching Agriculture Journal. He has presented at the ASA/SSA/CSA Annual Meeting, Missouri Vocational Agriculture Teachers Conference, and the Iowa Association of Agricultural Educators Conference.

Rod is married to Cathy, the Assistant Coordinator of Field Experience for the School of Professional Education at Northwest Missouri State University. They are the proud parents of two sons, Chayse and Spencer. Rod enjoys golf, sports photography, and landscaping.