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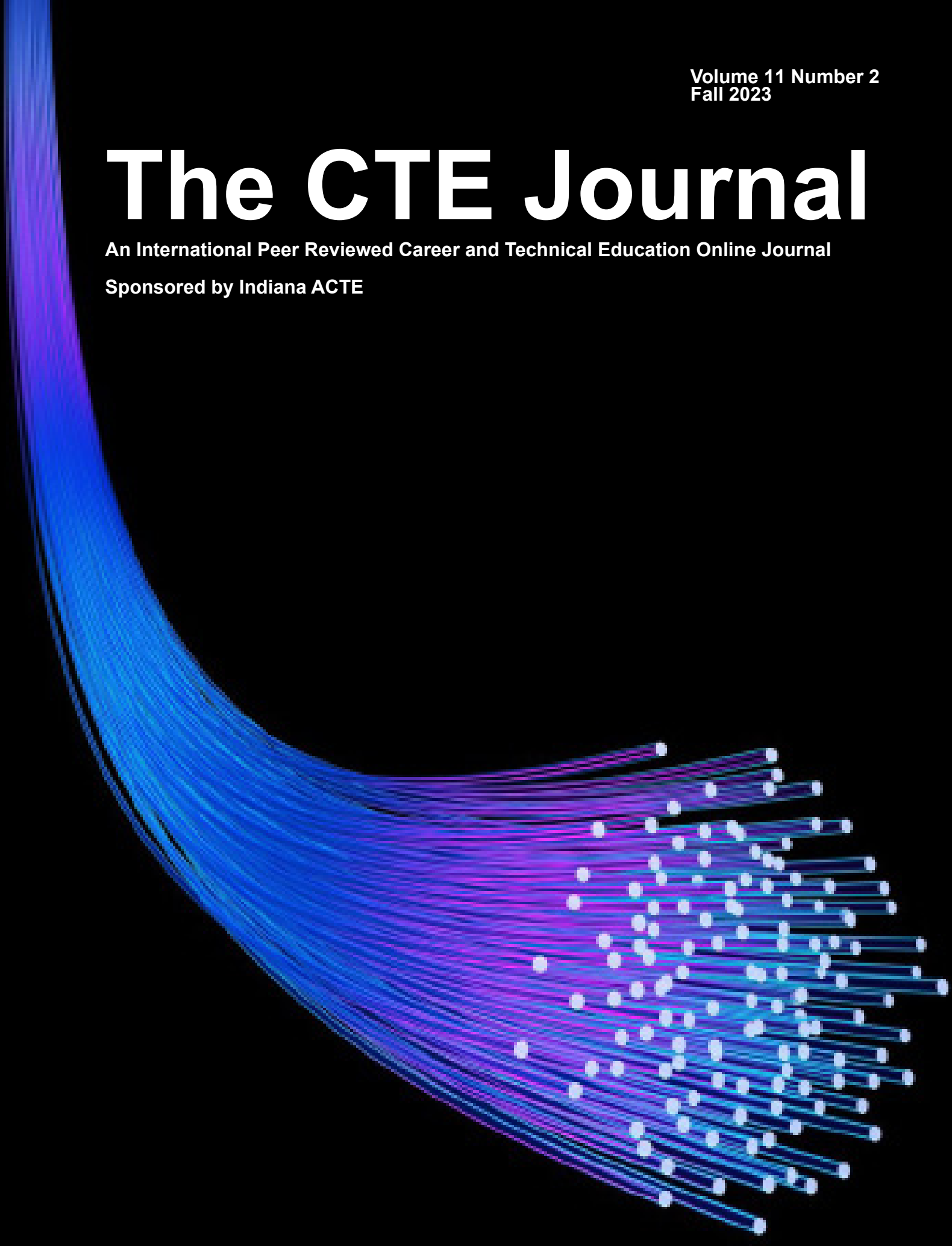

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Agricultural Education Teachers Competence to Teach Agricultural Mechanics: A Gender Comparison

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Abstract
Gender equality in agricultural education has been achieved in most areas of agricultural education, except in agricultural mechanics (Johnson, 1991). This study sought to examine the self-perceived competence to teach agricultural mechanics skills and the amount of training received at the university level in relation to gender by Iowa agricultural education instructors. We found differences in self-perceived levels of competence to teach agricultural mechanics skills and the amount of training received at the university level in relation to gender. We also found that males enjoyed teaching agricultural mechanics skills, whereas females did not enjoy teaching agricultural mechanics skills. Even though female agricultural education teachers did not enjoy teaching agricultural mechanics skills, they identified agricultural mechanics as important to the state curriculum. We recommend that university faculty adopt strategies that will help strengthen the confidence of female preservice teacher education candidates to teach agricultural mechanics skills. It is also recommended that university faculty provide opportunities for preservice teacher education candidates to observe exemplary female agricultural education teachers teaching agricultural mechanics.

Introduction

The profession of teaching at the secondary level is often considered a female dominated career, although in agricultural education it previously appeared to be male dominated (Rocca & Washburn, 2008). However, recently research by Smith, et al. (2022) indicated that the percentage of women in agricultural education has been increasing. According to the latest national study on the supply and demand of secondary agricultural education teachers, female teachers occupied the majority of the teaching positions (Smith, et al., 2022). Furthermore, the Smith et al. study noted that females made up 76% of the newly qualified agricultural education teachers.

As the agricultural education teaching profession continues to become more gender-balanced in most areas of agricultural education, historically agricultural mechanics is an area where sex-equality has not been achieved (Cole, 1985; Johnson, 1991; Kelsey, 2006) and needs to be revisited. Dillingham, et al. (1993) stated that only 9.5% of women agricultural education teachers preferred to teach agricultural mechanics over other agricultural education courses.

Conversely, 52.4% of women would rather teach agricultural education courses other than agricultural mechanics. The other 38.1% of women did not have a preference between agricultural mechanics and other agricultural education courses. However, Foster, et al., (1991) found that women did enjoy teaching agricultural mechanics courses. Women teachers identified one factor capable of deterring women from becoming agricultural education teachers--a lack of knowledge within agricultural subject areas. One of the subject areas within agricultural education that requires a sound and structured program to obtain competence in order to teach is agricultural mechanics (Hubert & Leising, 2000).

Agricultural mechanics has been defined as a laboratory-based instructional area where additional time is needed to effectively prepare teachers (Hubert & Leising, 2000). Osborne (1992) stated that agricultural mechanics has the greatest potential to address many teaching objectives when compared with any other segment of the agricultural education curriculum. The wide range of agricultural mechanics skills taught can have a lasting impact on a student's life by molding future life skills (Farrell, 1984) and a student's ability to work with technology (Harper, 1990). Byrd et al. (2015), found that most agricultural education teachers were not prepared well enough to teach agricultural mechanics, however they still enjoyed teaching agricultural mechanics skills.

Nonetheless, learning the required competencies to effectively teach agriculture can be a daunting task for males and females alike. Eccles et al. (1993), indicated that differences emerge in an individual's perceived competence in gender-based activities. Male teachers may exhibit higher levels of perceived competency in an agricultural mechanics course due to the appearance of being a male-dominated activity. Ensuring and maintaining a high level of competence to teach agricultural mechanics requires dedication from both the agricultural education preservice teachers and post-secondary teacher education faculty. The task of preparing preservice teachers in agricultural mechanics has become increasingly difficult in recent years. Harrison, et al., (1993) found that university level agricultural mechanics programs have been marked by declining enrollments and less financial support despite expansion of the agricultural mechanics industry sector. This has also been seen by critics who have stated that agricultural mechanics is non-essential; however, it remains popular in secondary programs (Hubert & Leising, 2000).

Effectively preparing teachers starts for the preservice candidate by enrolling in courses within the teacher education program and culminates during the student teaching process as students develop the skills to become successful teachers (Krysher, et al., 2012). Ingersoll (1996) stated that subject-specific training at the postsecondary level is one of the most important characteristics of a qualified high school teacher. When a program is missing vital skill development in its' coursework, it can negatively impact the candidate. Krysher et al. (2012) claimed that "the lack of potential learning experiences could lead to lower levels of student proficiency, which then can diminish teachers' levels of confidence or self-efficacy" (p. 29). Teaching self-efficacy has been defined as a "person's beliefs on his or her own capability to organize and execute courses of action required to successfully accomplish a specific teaching task in a particular context" (Tschannen-Moran et al., 1998, p. 233). Therefore, an individual's self-efficacy can affect their ability to teach (Krysher et al., 2012).

Theoretical Framework

The theoretical framework for this study is Bandura's (1977) social cognitive theory. Social cognitive theory relates to a person's self-efficacy. A person's judgments on his or her own beliefs to execute a plan of action for a performance are defined as self-efficacy (Joet et al., 2011). Through the cognitive process, human behavior is purposive or regulated by thought (Bandura, 1994). A human's personal efficacy beliefs therefore helps to shape one's own thoughts prior to acting (Bandura, 1994). When one has a high level of self-efficacy, she/he can visualize personal success in performance. Those with a low level of self-efficacy visualize failure scenarios and dwell on many issues that go wrong (Bandura, 1994). Within social cognitive theory, individuals attend to four sources of efficacy expectations which include mastery experiences, vicarious experiences, physiological and emotional states, and social persuasion (Joet et al., 2011).

An experience where success in one setting causes a belief there will be success in the future is described as a mastery experience. If one achieves success, efficacy will be built, while failures will decrease a person's mastery experiences. If agricultural education teachers had previous successes with developing competencies to teach agricultural skills, a high self-efficacy will most likely be developed (Bandura, 1994). Hoy (2000) believed that the most powerful source of efficacy expectations is mastery experiences. Developmental skills that are modeled for the agricultural teachers by someone else are defined as vicarious experiences. Vicarious experiences allow an individual to observe a modeled behavior and follow that same pattern (Hoy, 2000). Bandura (1977) indicated that the more closely an observer mirrors the modeled actions the stronger the impact of self-efficacy. Physiological and emotional states include the various emotions that agricultural education teachers face when attempting to master a specific skill. Various emotions that teachers face may play a role in how competent teachers teach. Lastly, social persuasion involves a 'pep talk' regarding a specific performance; this may include feedback from supervisors or from students to the teacher. If a teacher is verbally told that agricultural standards are met then the result would be a high self-efficacy rating. Hoy (2000) indicated individuals may experience setbacks during social persuasion, especially when the feedback or 'pep talk' is not positive. A participant's actions, feelings, and communication with others about a specific skill can have an effect on how participants rated personal competency in agricultural mechanics. With reduced coursework in agricultural mechanics in post-secondary programs would that lead to lower self-efficacy in teaching?

Purpose and Objectives

As there is an increase in the number of female agricultural education teachers (Smith et al., 2022) it is necessary to understand teacher efficacy concerns of both male and female teachers. This study aligns with the American Association for Agricultural Education's National Research Value: Increasing Prosperity through innovation in Agricultural, Food, and Natural Resource Systems by connecting STEM content aligned to agricultural mechanics curriculum (AAAE, 2023). With these purposes in mind, the following research objectives were identified

1) Identify the demographic characteristics of the male and female agricultural education teacher in Iowa.

2) Determine the self-perceived competence to teach; the amount of training and skills received at a secondary school; and the amount of training and skills received at a post-secondary school in agricultural mechanics by gender.
3) Identify differences between the self-perceived competence of agricultural mechanics skills by gender.
4) Identify differences of self-perceived amount training in agricultural mechanics received at the post-secondary level by gender.

Methods

A descriptive research methodology was used to summarize the characteristics of agricultural education teachers' perception of their level of competence of agricultural mechanics skills. This study specifically analyzed participants' competency related to 54 agricultural mechanics skills condensed into five constructs. A modified, paper-based questionnaire was utilized by the researchers for the purposes of this study. The paper-based instrument contained three sections. The first section contained 54 selected agricultural mechanics related skills by construct. The construct areas included Mechanics Skills, Structures/Construction, Electricity, Power and Machinery, and Soil and Water. Utilizing a five-point summated rating scale respondents were asked to rate the 54 agricultural mechanics skills in regards to their perceived competence to teach each skill. The options for selection ranged from 'no-need' to 'very strong'. The second section contained 15 demographic questions related to the agricultural education teacher. The third section consisted of nine questions related to the demographics of the agricultural education teacher's program and school.

A team of five university faculty members with expertise in the fields of agricultural mechanics and agricultural education determined that the content within the instrument was valid for measuring the objectives of this study. Following the suggestions of Dillman, et al., (2009), the initial electronic version of the instrument was pretested through a pilot study with a group of twelve agricultural education teachers in a nearby state. Suggestions from the pilot study led researchers to adopt a paper-based, rather than electronic instrument. *Post-hoc* reliability was estimated following the suggestions of Gliem and Gliem (2003) and resulted in acceptable reliability coefficients for competency per construct. Construct coefficients are displayed in Table 1.

Table 1

Post-hoc Reliability Coefficients for Competence, Appropriateness, Amount of Training at High School, and Amount of Training at a Post-secondary School by Construct Area

Construct Area	Mechanics	Structures/ Construction	Electricity	Power and Machinery	Soil & Water
Competence	0.95	0.96	0.95	0.98	0.85
Appropriateness	0.95	0.92	0.94	0.97	0.87
Amount of Training at High School	0.96	0.97	0.91	0.97	0.82
Amount of Training at Post-secondary School	0.97	0.98	0.96	0.97	0.91

Data were collected from secondary agricultural education teachers who attended the Iowa agricultural education teachers' conference and served as the population for this study (N=130). The population was a convenience sample because of the ease of having respondents' in one place for a given amount of time and the teachers' likelihood to be involved in annual professional development activities (Ary, et al., 2014). During the conference a print-based survey was distributed to the participants. Each participant was offered a power tool institute safety curriculum as an incentive for completing and returning the questionnaire. This yielded a response rate of 79.2% as 103 of the 130 surveys were returned. With 103 completed questionnaires, the researchers deemed that the convenience sample size was large enough to yield some stability in the results (Ferber, 1977). However, to avoid non-response bias and other sampling problems the researchers elected to address non-response error by following the suggestions of Miller and Smith (1983). A Pearson's $\chi 2$ analysis yielded no significant differences ($p > .05$) for gender, age, highest degrees held, years of teaching experience, or size of school community between respondents and the general population of agricultural education teachers in Iowa. However, due to the convenience sample, data from this study should be interpreted with care so as not to extrapolate beyond the target population. Data was analyzed using PASW Statistics 18.0, a software program for statistical analysis. Descriptive statistics and a *chi-square* (χ^2) test were used to compute differences in the perceived competency by gender. To determine the effect size Cramer's *V* was calculated.

Findings

Identifying the characteristics of the average male and female agricultural education teacher in Iowa was the purpose of objective one. In the current study, the average male agricultural education teacher ($n = 69$) was 42 years old, held a bachelor's degree, and had taught for 18 years. The average male teacher completed two agricultural mechanics courses at a four-year university through a traditional teacher training program. High levels of enjoyment and importance of teaching agricultural mechanics were perceived by the average male agricultural mechanics teacher. The average male teacher also trained an agricultural mechanics team for the state FFA Career Development Event.

The average female agricultural education teacher in this study ($n = 34$) was 30 years old, had obtained a bachelor's degree, and had taught for 6 years. The average female teacher completed one agricultural mechanics course in a traditional four-year university teacher training program. The level of enjoyment of teaching agricultural mechanics by the average female was somewhat to moderate enjoyment. However, female respondents felt that agricultural mechanics was important to teach, but on did not train a team to compete at the state FFA CDE. Table 2 identifies demographic frequencies by gender and Table 3 identifies demographic perceptions by gender.

Table 2

Iowa Secondary Agricultural Teachers Demographic Characteristics

	Males		Females	
Demographic Characteristics	*f*	%	*f*	%
Age				
20-29	16	23.5%	18	52.9%

30-39	16	23.6%	14	41.2%
40-49	8	11.7%	0	0%
50-59	23	33.8%	2	2.9%
60-69	4	5.9%	0	0%
70+	1	1.5%	0	0%
Years taught				
0-9	22	31.9%	27	79.4%
10-19	16	23.2%	6	17.7%
20-29	13	18.8%	1	2.9%
30-39	17	24.7%	0	0%
40+	1	1.4%	0	0%
Alternatively Certified				
Yes	17	25.0%	16	48.5%
No	51	75.0%	17	51.5%
Highest Level of Education				
Bachelor's	42	60.8%	22	64.7%
Master's	27	39.2%	12	35.3%
Trained an Ag Mechanics CDE team				
Yes	33	48%	10	30%
No	36	52%	24	70%

Table 3

Iowa Secondary Agricultural Teachers Perceptions of the Amount of Courses Taken at the Post-Secondary Level, Enjoyment, and Importance of Agricultural Mechanics

	Males		Females	
Demographic Perception	*M*	SD	*M*	SD
Ag Mechanics Courses Completed				
Four-year University	1.98	2.40	1.15	1.65
Enjoy Teaching Ag Mechanics	4.30*	0.89	2.85*	1.32
Feel Ag Mechanics is Important	4.33**	0.98	4.32**	0.72

Note: *Based on a scale of 1: Not Enjoyable, 2: Somewhat unenjoyable, 3: Neutral, 4: Somewhat enjoyable, and 5: Very Enjoyable. **Based on a scale of 1: Not Important, 2: Somewhat Important, 3: Neutral, 4: Somewhat Important, and 5: Very Important.

Objective two sought to determine the self-perceived gender differences in competence in the five agricultural mechanics construct skill areas. Table 4 identifies the construct grand means and standard deviations of self-perceived gender differences and agricultural mechanics skill constructs by gender. For each construct, males indicated a higher self-perceived competence than did females. The power and machinery construct had the largest difference between males (M = 3.50) and females (M = 2.27). Furthermore, males had received more training at the post-secondary level than females. The construct with the largest difference in regards to the training received at the secondary level between males (M = 2.65) and females (M = 1.79) was the structures/construction construct.

Table 4

Grand Means of Iowa Secondary Agricultural Teachers Perceived Level of Competence, Importance and Training received at a Post-Secondary School to Teach Agricultural Mechanics by Gender by Construct Area

	Males		Females	
Construct	*M*	*SD*	*M*	*SD*
Competence				
Mechanics	3.15	1.02	2.28	1.06
Structures and Construction	3.76	0.97	2.78	1.24
Electricity	3.04	1.08	2.07	1.13
Power and Machinery	3.50	1.04	2.27	1.23
Soil and Water	2.85	0.95	2.38	1.11
Training at the University				
Mechanics	2.32	1.02	1.77	0.79
Structures and Construction	2.65	1.15	1.79	1.18
Electricity	2.44	1.08	1.70	0.92
Power and Machinery	2.19	0.95	1.39	0.59
Soil and Water	1.81	0.77	1.50	0.95

Note: *Based on a scale of 1: No Need, 2: Some, 3: Moderate, 4: Strong, and 5: Very Strong.

Objective three sought to determine the difference between gender and the specific self-perceived competence to teach agricultural mechanics skills. Statistically significant differences were found in all the constructs between male and female respondents. The critical value for χ^2 (*df** = 4) in this study was 9.49. Statistically significant differences between males and females determined by skill area were found if the critical value was over 9.49. To determine the effect size Cohen (1988) proposed standards to interpret Cramer's *V*: (.10) small effect, (.30) medium effect, and (.50) large effect. Table 5 indicates the mean, standard deviation, *chi-square*, and Cramer's *V* for the competencies that were found to be statistically significant by gender for the construct of mechanics skills. The mechanics construct consists of skills related to metal working, welding, fencing, plumbing, and computer aided design. The competency with the largest difference was oxy-acetylene cutting χ^2 (4, n = 99) = 30.82, $p < .05$.

Table 5

Statistically Significant Differences Between Teacher Competence and Mechanics Skills by Gender

Competency Area	*n*	*M*	*SD*	χ^2	*V*
Oxy-Acet. Welding	99	3.25	1.12	25.68	.509
Oxy-Acet. Cutting	99	3.51	1.09	30.82	.558
Oxy-Propylene Cutting	85	2.44	1.24	10.89	.358
Plasma Cutting	92	3.20	1.17	19.12	.456
SMAW Welding (arc)	98	3.65	1.07	19.51	.446

GMAW Welding (mig)	96	3.51	1.17	20.95	.467
Welding Safety	98	3.98	1.13	13.31	.369
Metallurgy & Metal Work	85	2.51	1.03	14.13	.408
Hot Metal Work	85	2.29	0.99	10.29	.348
Cold Metal Work	84	2.36	1.01	13.33	.398
Tool Conditioning	83	2.52	1.07	17.87	.464
Oxy-Acet. Brazing	91	2.81	1.22	19.67	.465
Soldering	89	2.64	1.13	17.28	.441
Pipe Cut. & Thread	82	2.49	1.14	18.79	.479
Plumbing	86	2.62	1.11	15.68	.427
Mechanical Safety	91	3.37	1.24	30.44	.578

Note: *df* =1* df* is calculated by taking (Row-1) or (Column-1), whichever is smaller. $p < .05$

Within the structures/construction construct, statistically significant differences were found in eight of nine competencies. This construct encompasses skills that include operating woodworking equipment to planning of woodworking projects. The competency with the largest difference χ^2 (4, n = 88) = 36.01, $p < .05$ and the largest effect size (V = .640) was concrete as shown in Table 6.

Table 6

Statistically Significant Differences Between Teacher Competence and the Construct Structures/Construction by Gender

Competency Area	*n*	*M*	*SD*	χ^2	*V*
Woodworking Hand Tools	94	3.70	1.12	12.91	.371
Woodworking Power Tools	94	3.74	1.04	13.88	.384
Concrete	88	3.19	1.24	36.01	.640
Selection of Materials	90	3.37	1.10	21.24	.486
Bill of Materials	92	3.62	1.10	20.85	.476
Fasteners	88	3.11	1.21	29.53	.579
Construction Skills (Carpentry)	92	3.38	1.22	23.70	.508
Construction and Shop Safety	93	3.84	1.15	15.52	.409

Note: *df* =1* df* is calculated by taking (Row-1) or (Column-1), whichever is smaller. $p < .05$

The electricity construct competencies were related to safety, residential wiring, and electrical motors. Statistically significant differences were found between genders in electricity controls χ^2 (4, n = 89*)* = 28.0, $p < .05$, (*V = 0.56)* wiring skills χ^2 (4, n = 91*)* = 24.4, $p < .05$ (*V = 0.51)*, and electrician tools χ^2 (4, n = 90) = 23.9 (*V = 0.51)*. Statistically significant differences were also found in types of electrical motors χ^2 (4, n = 86) = 23.9), $p < .05$ (*V = 0.45)*, cleaning motors χ^2 (4, n = 81) = 11.39), $p < .05$ (*V = 0.37)*, and electrical safety χ^2 (4*,* n = 88) = 12.9, $p < .05$(*V = 0.38)* as displayed in Table 7.

Table 7

Statistically Significant Differences Between Teacher Competence and the Construct Electricity and Gender

Competency Area	*n*	*M*	*SD*	χ^2	*V*
Electricity Controls	89	2.58	1.11	28.02	0.56
Wiring Skills	91	2.98	1.28	24.48	0.51
Electrician Tools	90	2.89	1.27	23.98	0.51
Type of Electrical Motors	86	2.43	1.06	18.13	0.45
Cleaning Motors	81	2.35	1.02	11.39	0.37
Electrical Safety	88	3.08	1.32	12.94	0.38

Note: *df* =1* df* is calculated by taking (Row-1) or (Column-1), whichever is smaller. $p < .05$

The power & machinery construct included competencies related to small engines, tractors, machinery, and safety. Statistically significant differences between genders were found in all 15 competencies of this construct. The competencies with the largest and strongest difference included small engine services – 4 cycle χ^2 (4, n = 90) = 37.98, $p < .05$ ($V = 0.65$) *as* shown in Table 8.

Table 8

Statistically Significant Differences Between Teacher Competence and the Construct Power & Machinery by Gender

Competency Area	*n*	*M*	*SD*	χ^2	*V*
Small Engine Services – 2 cycle	88	3.10	1.08	25.67	.540
Small Engine Services – 4 cycle	90	3.27	1.19	37.98	.650
Small Engine Overhaul	88	3.14	1.24	32.28	.606
Small Engine Safety	90	3.37	1.23	27.13	.549
Tractor Service	87	3.02	1.25	28.69	.574
Tractor Maintenance	86	3.07	1.30	26.42	.554
Tractor Overhaul	85	2.65	1.17	21.34	.501
Tractor Selection	83	2.77	1.10	24.84	.547
Tractor Operation	85	3.19	1.28	20.61	.492
Tractor Safety	87	3.36	1.32	16.61	.437
Tractor Driving	86	3.34	1.35	21.50	.500
Service Machinery	86	3.01	1.29	25.38	.543
Machinery Selection	85	2.89	1.21	25.28	.545
Machinery Operation	87	3.03	1.24	23.24	.517
Power & Machinery Safety	89	3.26	1.36	21.72	.494

Note: *df* =1* df* is calculated by taking (Row-1) or (Column-1), whichever is smaller. $p < .05$

The soil and water construct encompasses competencies related to precision agriculture, surveying, and legal land descriptions. Three of the five competencies in this construct exhibited a statistically significant difference between…and is indicated by Table 9. The three areas included global positioning systems, χ^2 (4, n = 91) =10.96, $p < .05$ ($V = xx$), use of survey

equipment χ^2 (4, n = 90) = 10.51, p <. 05 (V = *xx)*, and legal land descriptions χ^2 (4, n = 93) = 13.12, p < .05 (V = *xx)*.

Table 9

Statistically Significant Differences Between Teacher Competence and the Construct Soil and Water and Gender

Competency Area	*n*	*M*	*SD*	χ^2	*V*
Global Positioning Systems	91	2.89	.924	10.96	.347
Use of Survey Equipment	90	2.67	1.060	10.51	.342
Legal Land Descriptions	93	3.39	1.207	13.12	.376

Note: *df* =1* df* is calculated by taking (Row-1) or (Column-1), whichever is smaller. p < .05

Identifying any relationship between the competence of agricultural mechanics skills received at the university and gender was the purpose of objective four. In the mechanics skills construct, seven of 19 skills showed a significant relation with gender. The tool conditioning skill χ^2 (4, n = 97) = 18.57, p < .05 (V = 0.47) exhibited the largest statistically significant relationship with gender. The majority of the skills that had a statistically significant relationship with gender were related to metal work. In the structures/construction construct, eight of nine agricultural mechanics skills exhibited a statistically significant relationship with gender. The two skills with the largest statistically significant relationships were selection of materials χ^2 (4, n = 88) = 21.94, p < .05 (V = 0.50) and bill of materials χ^2 (4, n = 89) = 22.90, p < .05 (V = 0.51). Refer to Table 10.

Five of six agricultural mechanics skills in the electricity construct exhibited statistically significant relationships. Types of electrical motors had the largest statistically significant relationship χ^2 (4, n = 85) = 19.27, p < .05 (V = 0.48) in the electricity construct. Within the power and machinery construct all the agricultural mechanics skills had a statistically significant relationship with gender. The largest statistically significant relationships were between gender and small engine overhaul χ^2 (4, n = 86) = 23.86, p < .05 (V = 0.53) and small engine safety χ^2 (4, n = 86) = 23.79, p < .05 (V = 0.53). The soil and water construct had three of five agricultural mechanics skills with a statistically significant relationship with gender. The skill with the largest statistically significant relationship was legal land descriptions χ^2 (4, n = 86) = 15.53, p < .05 (V = 0.43). Refer to Table 10.

Table 10

Statistically Significant Differences Between the Amount of Training Received at the Post-secondary Level of Agricultural Mechanics Skills by Gender

Competency Area	*n*	*M*	*SD*	χ^2	*V*
Welding Safety	97	2.99	1.53	10.04	.322
Metallurgy & Metal Work	86	2.19	1.27	10.99	.358
Hot Metal Work	85	2.12	1.18	11.57	.369
Cold Metal Work	86	2.14	1.22	14.24	.407
Tool Conditioning	85	2.16	1.17	18.57	.467

Oxy-Acet. Brazing	92	2.46	1.30	11.69	.357
Mechanical Safety	89	2.45	1.37	10.28	.340
Woodworking Power Tools	93	2.52	1.36	17.82	.438
Drawing and Sketching	85	2.14	1.19	15.62	.429
Concrete	87	2.33	1.32	17.53	.449
Selection of Materials	88	2.36	1.33	21.94	.499
Bill of Materials	89	2.48	1.34	22.90	.507
Fasteners	87	2.14	1.18	18.03	.455
Construction Skills (Carpentry)	91	2.45	1.35	16.77	.429
Construction and Shop Safety	92	2.77	1.41	15.97	.417
Electricity Controls	87	2.13	1.12	13.41	.393
Wiring Skills	89	2.30	1.18	14.22	.400
Electrician Tools	89	2.24	1.14	12.34	.372
Type of Electrical Motors	85	2.07	1.12	19.27	.476
Cleaning Motors	81	2.00	1.10	10.86	.366
Small Engine Services – 2 cycle	85	2.28	1.20	13.35	.388
Small Engine Services – 4 cycle	86	2.42	1.29	18.87	.468
Small Engine Overhaul	86	2.41	1.31	23.86	.527
Small Engine Safety	86	2.42	1.37	23.79	.526
Tractor Service	82	1.79	1.01	13.49	.406
Tractor Maintenance	81	1.81	1.07	11.82	.382
Tractor Overhaul	80	1.68	0.93	10.14	.356
Tractor Selection	79	1.71	0.97	11.94	.389
Tractor Operation	80	1.74	0.97	10.93	.370
Tractor Safety	83	1.87	1.11	10.17	.350
Tractor Driving	81	1.73	1.00	10.22	.355
Service Machinery	80	1.72	0.95	17.09	.462
Machinery Selection	81	1.86	1.05	11.54	.377
Machinery Operation	82	1.84	1.03	11.69	.378
Power & Machinery Safety	85	2.01	1.19	17.38	.452
Global Positioning Systems	84	1.70	0.94	9.94	.344
Use of Survey Equipment	84	1.87	1.06	14.65	.418
Legal Land Descriptions	86	2.16	1.26	15.53	.425

Note: *df* =1* df* is calculated by taking (Row-1) or (Column-1), whichever is smaller. $p < .05$

Conclusions

The findings from this study have led to several conclusions. First, it can be concluded that the majority of female participants are new to the profession with less than six years of experience; whereas the male teachers who participated in this study have been teaching for over 17 years. This aligns with the findings in Smith et al. (2022) that identified 76% of beginning teachers are female. This might also have an effect on the perceived competence level because the majority of male teachers have had ample time to learn agricultural mechanics skills by this stage in their

careers. Current findings support Burris et al. (2005) observation that perceived competence improves with the experiences gained through years of teaching.

It can further be concluded that there are differences in competence when considering gender. This research is consistent with Eccles et al., (1993) which indicated that perceived competence levels differ by gender-related activities. Male teachers perceived themselves competent whereas, female teachers perceived themselves as somewhat competent to teach agricultural mechanics skills. This supports the notion of Cole (1985) and Johnson (1991) that agricultural mechanics has not achieved gender equity in terms of competency to teach. Female teachers perceived themselves as somewhat competent to teach agricultural mechanics in this study which supports the findings of Hubert and Leising (2000) that additional time is needed to effectively teach and prepare teachers in agricultural mechanics. Another possibility is that female teachers might be more modest about their abilities than male teachers.

It was found that males enjoyed teaching agricultural mechanics, which supports the concept that agricultural mechanics seems to be a male dominated area (Eccles, 1987). This is in line with the notion that agricultural mechanics is a content area that still needs to work on creating gender equality (Cole, 1985; Johnson, 1991). It can also be concluded that female teachers did not enjoy teaching agricultural mechanics skills as much as their male counterparts. This contradicts the findings from Dillingham et al. (1993) where female teachers indicated that they enjoyed teaching agricultural mechanics skills. Recent evidence (Burris et al., 2010) indicated many agricultural education teachers (particularly early-career teachers) felt less comfortable teaching agricultural mechanics than other agricultural content areas. However, these comfort levels seemed to change over time. This would support the findings of Foster et al. (1991) who stated one possible deterrent of female teachers to teach agricultural education was the lack of knowledge in agricultural subjects. One possible reason for this is the reduced amount of required agricultural mechanics courses in teacher education programs, which reduces the amount of mastery and vicarious learning experiences to which the teachers were exposed. Could this be changed if there were more time for repetition in their post-secondary agricultural mechanics courses? If female teachers believe themselves as not competent enough to teach agricultural mechanics their self-efficacy will decrease in that area (Bandura, 1994).

It can also be concluded that there is a relationship between the amount of training received at the post-secondary level and gender. One possible reason for this is that the older male participants may have had the opportunity to take more post-secondary agricultural mechanics courses because of older degree programs with more required credit hours and the possibility of additional courses due to the quarter system formerly utilized by the institution that produces the most agricultural education teachers in Iowa. In addition to the fact that female agricultural education teachers perceived themselves as somewhat competent to teach, this supports Ingersoll's (1996) statement that one of the most important characteristics of a successful teacher is the training received in college. This confirms the statement by Hubert and Leising (2000) stating that agricultural mechanics requires additional time to learn. This also supports the conclusions of Wells et al. (2013) who state more course work in agricultural mechanics is needed to address the changing student interests in agricultural mechanics. Although males were more confident in their ability to teach agricultural mechanics, they were only of average competence of the subject matter. Are teachers with average competence in agricultural

mechanics in need of future professional development opportunities? Some might suggest that if these teachers are going to train an agricultural mechanics CDE team for competition at the state level that more competence is needed to ensure the team would be competitive.

Recommendations

The conclusions from this study have led to several recommendations; first, professional development activities should be offered for agricultural education teachers within Iowa because of the low levels of perceived competence identified from this study for both female and male agricultural education teachers alike. Perhaps offering workshops and other professional development opportunities for beginning teachers and even women-only events could aid in the growth of new or beginning teachers. It is also recommended to consider other opportunities to enhance learning during teacher preparation programs. Can student organizations, teacher preparation programs, and teacher associations find opportunities to prepare future teachers outside of the traditional classroom time?

It is recommended that post-secondary faculty in agricultural education teacher preparation programs adopt strategies that help motivate all pre-service agricultural education students to increase confidence in teaching agricultural mechanics skills. It is important for university faculty to also instruct preservice teachers on how to show real-life applications of agricultural mechanics to both female and male students. Teacher education faculty should provide opportunities for preservice teachers to observe exemplary female agricultural education teachers teaching agricultural mechanics skills. This opportunity to observe female agricultural education teachers could be offered during early field experiences within the teacher education program. This will provide vicarious learning opportunities which will in turn help increase pre-service teacher candidate's self-efficacy (Bandura, 1994) in regard to agricultural mechanics.

It is further recommended that post-secondary faculty work with veteran teachers to host agricultural mechanics CDE training sessions for early career teachers. Furthermore, holding training sessions at the state level CDE after the contest has completed could further help in increasing the teaching efficacy of both female and male teachers alike. To further encourage female agricultural teachers to learn agricultural mechanics skills and content it is suggested that workshops should be led by veteran female teachers. Learning from another female teacher may have a positive impact on the ability to learn agricultural mechanics through vicarious experiences (Bandura, 1994) and then leading to mastery experiences.

Further research is recommended to identify potential discrepancies between teachers' ability to teach agricultural mechanics and their perceived competence. This further research could eliminate any machismo effect that may have occurred as well as identify and gaps in content mastery where professional development can be implemented. Further research should be conducted to determine if there is a difference in competency among early career teachers whereas this study focused on all teachers. We also recommend colleting longitudinal data that tracks teacher's competency prior to entering student teaching, after student teaching, and each of the first five years of teaching to identify if and when teachers reach higher levels of self-efficacy to teach agricultural mechanics. This data could also be used to determine if there are any relationships between competency to teach and teachers' intentions to leave the profession.

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Work-based Learning Infrastructure for Using Drones in Real Estate

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Abstract
The recent appearances of moderately low-cost technologies have greatly expanded the possibilities for high school students to engage in high-tech work-based learning opportunities. The recent availability of moderately priced, high-quality, off-the-shelf drones presents itself as one such learning opportunity. Once only within reach of top-tier professional photographers with large equipment budgets, today's remotely controlled drone flight technology—with its high-quality cameras and powerful video editing software—is uniquely positioned to place professional grade equipment in the hands of students. The ability to match interested students with businesses that need high-quality videography—real estate sales companies specifically—presents a new opportunity to develop rich between schools and businesses that simultaneously provide an important learning environment for students and provide a valuable service to the community. Considerations for partnering with real estate companies include the need for students to: obtain FAA remote piloting licenses, develop precision flight skills, acquire and maintain drones adequate to the task, use digital video editing software, and implement entrepreneurial business skills.

Keywords: *work-based learning, business education, drone technology, aviation certification, real estate, digital video*

Introduction

In recent years, there has been a resurgence of career and technical education programs taking advantage of the expertise and learning opportunities available through local businesses. Known widely as *work-based learning*, these programs leverage partnerships between schools and local commercial businesses (Alfeld, Charner, Johnson, & Watts, 2013; Cahil, 2016). The essence of work-based learning programs is to connect classroom learning with the modern workplace (RTI International, N.D.). In doing so, students acquire first-hand, on-the-ground experience alongside professionals authentically working in a particular vocational domain. Although this can take a variety of forms, the most common described by Showalter and Spiker (216) can be summarized as: internships, apprenticeships, community service activities, and job shadowing. Perhaps most importantly, when done well, these programs have been long shown to enhance student knowledge, attitudes, and perseverance in completing high school graduation requirements (Wonacott, 2002). Given the need to do well, necessary infrastructure components have been identified for successfully using drones include: earning a FAA Remote Pilot Part 107 license; purchase and maintaining drone equipment; developing precision flight skills; acquiring photography and videography skills; learning digital video editing; and employing business acumen.

Literature Review

The importance for schools to provide work-based learning opportunities for students is being further buoyed up by federal legislation, sometimes providing tremendous financial support to participating schools. In particular, the use of work-based learning for teaching students has been emboldened and made actionable through federal legislation including: the *Strengthening Career and Technical Education for the 21st Century Act* (Perkins V, 2006); the *Every Student Succeeds Act of 2015* Sections 1112, 2103 and 4203 (ESSA, 2015); and the *Workforce Innovation and Opportunity Act of 2014* Sections 148, 159, 418 and 422 (WIOA, 2014). Each year, schools across the country work hand-in-hand with their state departments of education to widely distribute funds for career and technical education in programs that are targeted to work for local communities. Without such supporting federal funds, it seems unlikely that equipment-extensive career and technical education programs could flourish given the scarcity of public-school funding sources.

Work-based learning programs can and do appear across a vast range of business and entrepreneurial settings. As but one example, consider that residential and commercial real estate is a business that exists in nearly every community across the United States. Real estate businesses are often locally owned and operated, making them uniquely flexible for working with local schools. One reason is that the number of real estate businesses scale with the size of the community's population—more people in the community equates to more real estate businesses available for high school CTE programs to partner with. Another reason that real estate businesses make great partners is because their inventory is constantly changing, providing a wide diversity of marketing projects for students to engage with. Finally, real estate agents themselves are well acquainted with the educational process because they themselves are well aware of knowledge testing procedures, continuing education requirements, and licensure systems because they themselves must be periodically educated and licensed (McGrath, Wang, Jackson, Kämpf-Dern, Malone, Funk, & Geurts, 2020).

Real estate businesses can only be successful if they utilize contemporary business acumen. Such craft knowledge includes contemporary approaches to marketing, engaging in social media, conducting market analysis, working directly with customers, accounting and billing, and producing high quality products—in the present scenario, narrative, photographic, and cinematography-based marketing products. These are all things CTE students need to learn to successfully operate businesses.

Using remotely controlled drones to capture aerial photos and videos is a learned skill that applies in a number of different career fields. Drones are being successfully used by students to capture data in domains including agriculture (Saiful Iskandar, Noor Afiza, & Noor Atiqah, 2020), environmental sciences (Slater & Biggs, 2022; Smith & Mader, 2018), civic tourism (Slater, Biggs, & Sanchez, 2021), and digital arts journalism (Slater, 2020). Similarly, drones can be used by students to make photos and videos that highlight the characteristics of properties for sale from unique perspectives to support real estate marketing. In this way, the inclusion of drones is particularly ripe for students participating in career and technical education programs.

Necessary Components

Although modern drones are far easier to obtain and fly than off-the-shelf drones just a few years ago, preparing students to work alongside real estate agents requires more preparation than simply handing a student a drone. Figure 1 lists the required skills and certifications needed for students to fly drones in partnership with a real estate company. These components include at a minimum: earning a FAA *Remote Pilot Part 107* License; purchasing & maintaining drone equipment; developing precision flight skills; acquiring photography & videography capture skills; learning digital video editing; and, of course, learning to deftly employ business acumen in a collaborative environment. These are each described in more detail in the subsections that follow.

Figure 1. Drones in Real Estate Checklist.

- ☐ Earn FAA *Remote Pilot Part 107* License
- ☐ Purchase & Maintain Drone Equipment
- ☐ Develop Precision Flight Skills
- ☐ Acquire Photography & Videography Skills
- ☐ Learn Digital Video Editing
- ☐ Employ Business Acumen

While one might initially think that such a long list of diverse learning needs a drone-oriented work-based learning program in real estate might represent an unexpectedly large portfolio of skills to be learned, the portfolio of skills learned in such a program are likely readily transferrable by the student to a wide range of careers and entrepreneurial enterprises. Such a rich scenario represents a powerful work-based learning opportunity, especially if the student can work in an apprenticeship mode with a real estate company already deeply engaged in using drone technology.

1. Part 107 Licensure

Because drones are officially considered to be aircraft by the Federal Aviation Administration (FAA), all pilots working in a professional commercial capacity—those individuals that are earning money or participating in a venture that earns money—must have a FAA *Remote Pilot Part 107* license (Slater & Sanchez, 2021a). Students 16-years or older can make an appointment to take a 60-item multiple choice test over a 2-hour period at an official testing center, usually at a relatively large airport. The fee is approximately $175. The test itself queries specialized aviation knowledge that requires a considerable amount of preparation. Illustrative examples of what drone license seeking pilots must memorize are listed in Figure 2.

There are numerous sites on the Internet—far too many to list—that provide test preparation and practice test questions. The test itself covers the domains: loading and performance; controlled airspace; aviation charts; airport operations and procedures; weather; risk management; and federal regulations. A *Part 107* drone license is good for 24-months and can be renewed online by taking a relatively straightforward online test. For anyone involved in flying drones with commercial implications, this certification is not optional. For hobbyists who wish only to fly for personal entertainment or educators who are flying for purposes of teaching, earning an online FAA *T.R.U.S.T. Safety Certificate* is now required (Slater & Sanchez, 2021a).

2. Equipment Choices

The number of professional drones available for less than $2,000 (even less than $750) has skyrocketed in the past few years. At the time of this writing, the dominant brand name in the

Figure 2. Numbers Licensed Drone Pilots Know.

- ✓ 0.55 lbs to <55 lbs. The legally allowable range of drones that must be registered.
- ✓ 100 MPH (87 KT). Maximum drone speed legally allowed.
- ✓ 400 feet. The maximum height you can fly (or above a taller building within a 400-foot radius).
- ✓ 500 feet. Minimum number of feet below a cloud you must fly.
- ✓ 2,000 feet. Minimum number of feet horizontally from a cloud you must fly.
- ✓ 2,000 feet. The distance you should operate from a tower to avoid hitting tower securing guy wires.
- ✓ 3 miles. The minimum visibility to be flying.
- ✓ 3 miles. The distance your anti-collision lights must be visible from when flying during twilight.
- ✓ 30 minutes. The twilight zone before sunrise or after sunset when you can still fly WITH collision lights visible from 3 statute miles.
- ✓ 8 hours. The time that must pass since you have had alcohol and less than 0.04 blook alcohol level.
- ✓ 10 days. The maximum time you can take to file an FAA accident report.
- ✓ 30 days. The time you have to notify the FAA if you move.
- ✓ 90 days. The lead time required when requesting an FAA waiver.
- ✓ 1 year. Time that must pass after a final, felony narcotics conviction before you can fly again.

Adapted with permission from Slater & Sanchez, 2021a.

drone market is DJI and their Chinese-made products are far less expensive than most equivalent US-made drone products. Many schools have invested in the *DJI Mavic Mini 3* (<$1,000), shown in Figure 3, or ones of similar size and cost, including the increasingly popular *DJI Avanta* (<$1,600) with included VR Goggles.

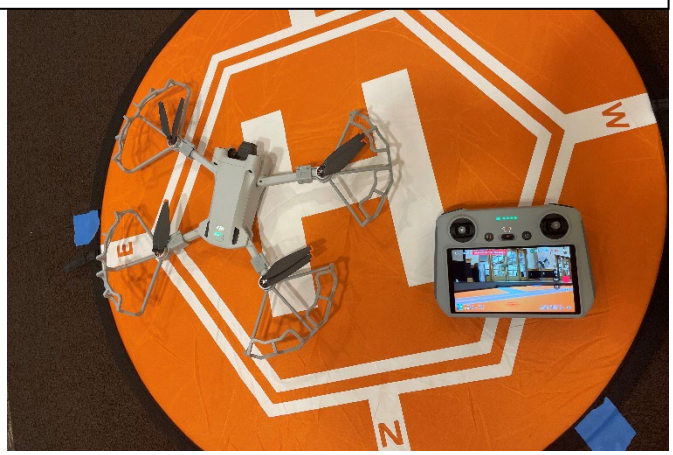

Figure 3. DJI Mavic Mini 3. *Photo Credit:*

Typical of many drones in this category, these drones weigh about 249 grams, have a battery life of about 25-minutes, have a high-quality 4K or better digital video

camera, and have onboard flight computers that allow the drones to automatically hover in place during flight, even in winds up to about 20 mph. In addition to acquiring drones appropriate to the task at hand, a student pilot benefits from having extra batteries and extra replacement propellers immediately on hand.

For training purposes, some schools find other drones to be a better option. The most commonly used indoor drone for *SkillsUSA* UAV drone competitions seems to be the *Ryze Tello* quadcopter drone with a 13-minute battery life, a 100-foot range, and available for about $125. One advantage this lower cost drone has over others is that it is programable using standard block coding software programs, for those schools that emphasize computer science. Unfortunately, although excellent for indoor flight training and basic videography practice, the *Tello* itself doesn't work well for real estate applications that require outdoor flight in windy conditions.

Drones require maintenance, and students engaged in learning how to use drones professionally need to be able to keep a drone in working condition. The most common tasks are (1) keeping the drone and remote-control unit batteries charged appropriately; (2) conducting frequent software and firmware updates; and (3) perform calibrations of the compass and inertial measurement unit (IMU). The most common physical repairs drones need is the frequent and informed replacement of propellers. A drone's propeller blades are not identical or universal.

3. Precision Flight Skills

Concomitantly important to earning drone pilot certification and having a well-maintained drone is learning how to fly a drone precisely, safely, legally, and ethically. Although high school students who grew up playing modern video games seem to learn how to fly remotely controlled drones far faster than adults with less video game experience, students do need considerable practice to learn to fly with precision.

The experience of many teachers is that one of the best ways to encourage students to acquire considerable "stick-time"—time devoted to flying a drone—and systematically improve their flight skills is to devise flight mission challenges of increasing difficulty and complexity. Examples of precision flight mission challenges are listed in Figure 4. The possibilities for devising challenging flight missions are nearly limitless and experienced teachers often help students create precision flight mission challenges for one another.

Figure 4. Illustrative Precision Flight Mission Challenges.

- Knock down a pyramid of stacked plastic cups
- Land on an elevated, narrow shelf
- Fly by only using the drone's camera
- Land on an obscured target X
- Fly under a table, through its legs
- Minimize time to fly through an obstacle course
- Blow *Ping-Pong* balls along the ground to a target

Another promising instructional strategy for increasing students' precision flight skills is to provide opportunities for students to competitively improve their skills by using timed races around obstacle courses (*viz*., Slater & Sanchez, 2021b). Obstacles of varying sizes

and heights can be quickly created using ½" PVC connectors and pipes cut to 30". Obstacles can then be quickly arranged into an obstacle course gates to serve as a timed obstacle course, as illustrated in Figure 5. Experience suggests that the best courses often have two different sections: (i) one complicated section that reveals a pilot's precision flight skills and (ii) a second straightaway section that reveals a pilot's ability to fly controlled at high speeds.

Figure 5. Sample Racetracks & Obstacle Gates Created with ½" PVC.

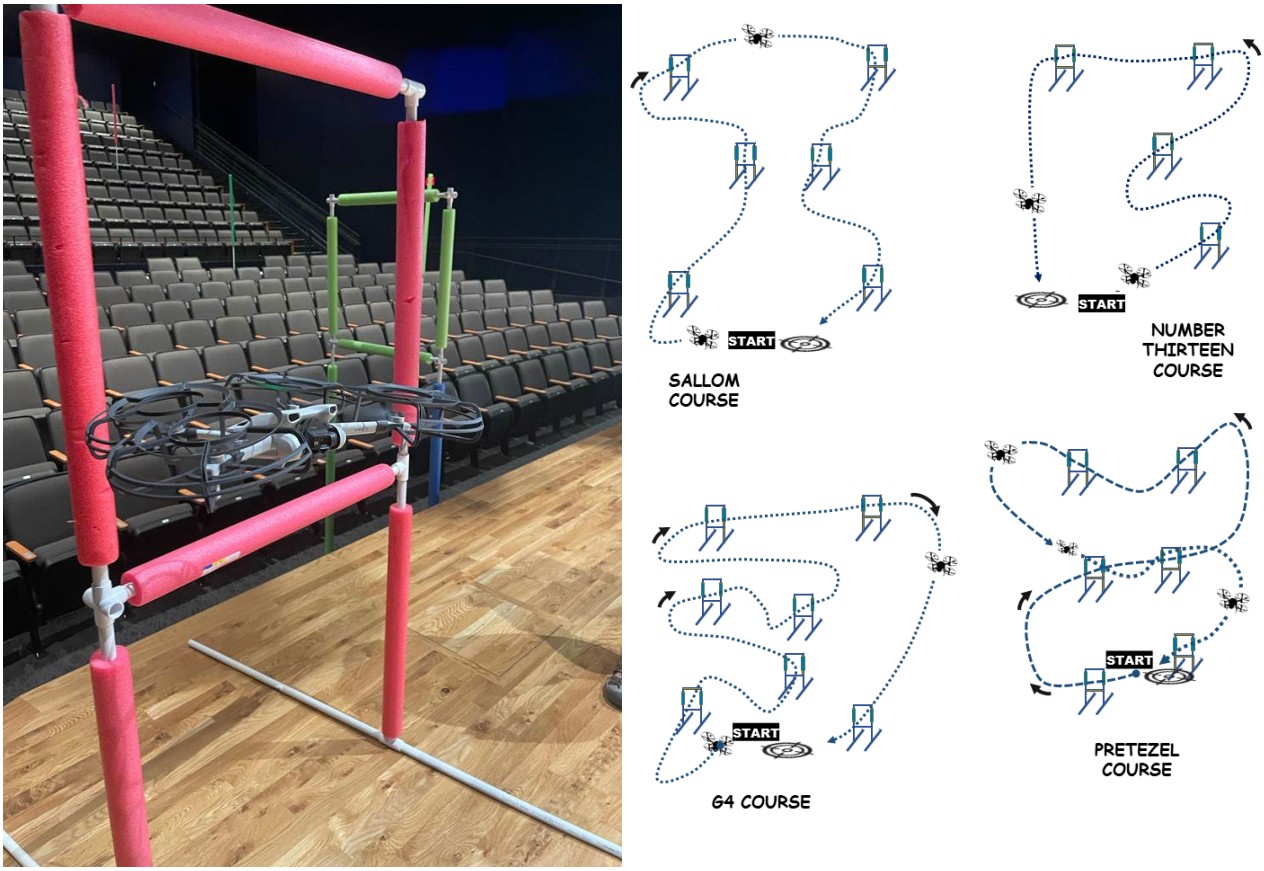

Photo & Illustration Credit: Timothy F. Slater, Ph.D.

Moreover, students can practice their flight skills without taking a drone outside using drone flight simulators. When using a drone simulator, students can practice flying through and around obstacles simply by using their haptic-enabled phone screens or by attaching a typical drone remote controller to a computer. The number of drone simulators available at present for smart phones, low processing power computers and tablets, and high-end, graphics capable gaming computers is far too extensive to list here. However, the most widely used drone flight simulator is *Velocidrone* (≅ $35). Many international, virtual drone races use the *Velocidrone* software as their platform, because of its low cost and great flexibility and customizability (Slater & Sanchez, 2021b). It is worth emphasizing that this software only works on computers and gaming laptops that have high-speed video cards, and it does not work well on low-end, cloud-based computers, such as the most typical Chromebooks found in U.S. schools.

4. Photography Composition & Cinematography Capture Skills

Composing well regarded photographs and creating captivating videos is a learned skill (Cheng, 2015). The components that make a drone image or drone-based video of interest require a combination and artful knowledge and combination of lines, shapes, texture, patterns, colors, lighting, and shadows. To be worth the cost and time required to use a drone to capture pictures and videos from unique perspectives and angles, students must allocate some learning time to developing knowledge of what constitutes "good" digital images—a learning domain typically far from the existing knowledge realm of most CTE teachers. Online courses and YouTube tutorials of varying quality are available for students to access across the Internet for low or no cost.

In the domain of creating unique photographs and videos that are of most of marketing use to partnering real estate companies, a shared understanding of what aspects of a property for sale are most important is ultimately important. In other words, the drone pilot creating useful digital resources requires information from the collaborating realtor about what needs to be highlighted, emphasized, and, naturally, deemphasized.

5. Digital Photo & Video Editing Skills

Acquiring high-quality, inflight drone video in accordance with safe, legal, and ethical constraints represents only ½ of the needed intellectual effort. These images and videos need to be "processed" to make them as attractive and useful as possible. Using software such as the industry-standard *Adobe Premier* package—or the no-cost but surprisingly similarly powerful Microsoft *ClickChamp* or IOS *iMovie*—to edit and enhance images or video already captured is known as "post-production" work. These largely intuitive programs are not difficult for students to learn and, like many technology packages, numerous online resources exist to teach students how to use them. It is in post-production where students stich together shorter video clips into a continuous presentation, change lighting and contrast using digital filters, add test and symbols such as arrows, and even royalty-free music when desired (*viz*., Slater, 2020). It is worth noting that a drone might capture a cumulative hour of video in order to create a compelling 60-90 second final product for a collaborating real estate partner.

6. Business Acumen, Marketing, Entrepreneurship, and Accounting Skills

Smith (2017) eloquently argues that the most successful high school CTE programs do more than teach vocational trade skills: He maintains that students benefit from learning business acumen and entrepreneurship skills so that students can eventually create their own businesses. This life-long learning view is consistent with the modern push for work-based learning programs where students and schools are emboldened to create revenue generating businesses that are needed by their communities (Cahil, 2016; Haviland & Robbins, 2021; Showalter & Spiker, 2016).

When it comes to providing business-to-business contracted photographic and video services to a community, the ever-lowering cost of drones is going to bring about more competition among potentially competing drone pilots. This means a successful drone piloting business working for real estate companies will be best served if they can develop their own marketing, hiring, outsources, and accounting skills innate to entrepreneurship. In the end, a complete work-based learning program will be best served if there is an intentional effort to teach students not just how

to fly drones and make videos, but also to learn all aspects of running a successful business. Coming full circle to what was described earlier as motivating this work, a meaningful partnership with a local real estate company will likely best be built around internship and apprenticeship models where students can learn all aspects of running a business.

Discussion & Conclusions

Few CTE high school teachers are well positioned to teach students all of the diverse skills needed for a successful work-based learning program that uses drones to partner with local real estate companies: earning federal licensure, knowledgeably purchasing appropriate drone equipment, acquiring precision flight skills with considerable practice time, learning digital video editing, and deploying the business acumen particular to real estate practices. This is where a solid partnership under a work-based learning model makes all of the difference. A solid real estate partner can carry much of the load of interning and apprenticing an interested student, relieving much of the burden on already very busy CTE teachers. Even though the list of required components seems long, it is well within the capabilities of interested student drone pilots if partnered with an engaged real estate professional. Moreover, implementing a drone-based real estate work-based learning program carries abundant gravitas for a school district and has real 'curb appeal' for recruiting future students into robust CTE programs.

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Analyzing Student Experiences and Career Pathways for Healthcare Student Volunteers Participating in a Disaster Response Drill: A Mixed-Methods Study

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Abstract
The NSF-funded CareDEX Team, in conjunction with a partner Senior Living Community (SLC), University of California Irvine student volunteers, and several local First Responder agencies, conducted a disaster response exercise and experiment. In this study, the participating volunteer students were surveyed regarding their drill experience and the efficacy of that experience related to their chosen career path. A qualitative and quantitative analysis of this questionnaire data is presented. The results of the experiment and coded response data indicate that the participants, overall, viewed the exercise as a positive learning and career experience; specifically, they noted gaining an appreciation for the challenges older adults face with technology use and disaster response.

Introduction

On July 22, 2022, the CareDEX researchers performed a live disaster response exercise at The University of California, Irvine (UCI) with participation from local first responders and a Senior Living Community in Anaheim, California. This drill aimed to test and evaluate a technology called CareDEX in the context of an earthquake-induced fire and evacuation while recording anonymized volunteer health professional student data pertaining to ideas, experiences, and deeper career themes related to the disaster response exercise. At UCI, a mock SLC (Sunnyvale Homes) was deployed on the 2nd floor of the Bren Hall building. Sunnyvale Homes was based upon a partner, real SLC in Anaheim CA where the CareDEX team previously conducted disaster response experiments. Volunteer student participants served as actors and casualties in the drill. This research article provides insight into these students' experience as it relates to future career directions and employment.

Purpose and Methodologies

The purpose of this mixed-methods (triangulation) study is to describe and understand surveyed healthcare professional students' attitudes and experiences in the context of volunteering for a disaster response drill involving older adult residents in a simulated skilled nursing facility. In the quantitative portion of this study, a survey instrument and descriptive design are used. The descriptive statistics and frequencies of healthcare students' experiences will be presented. In the qualitative portion, the emerging themes of healthcare students' attitudes and perspectives will be presented based on open-ended questions included in the survey tool. A phenomenological design is used in the qualitative portion of this study.

Literature Review for Career Pathways in Disaster Response for Healthcare Students

Health-related Disaster Response at SLCs

Disaster preparedness and recovery in senior living facilities are high-demand practices due to the increasing vulnerabilities of elderly residents during emergencies (Kenary, 2023). With the most frail and medically complex older adult population often residing in senior living facilities, ensuring their safety and well-being during natural disasters, medical emergencies, and other crises is critical. This literature review explores the existing drills and procedures that SLCs practice and the laws and regulations in place to safeguard the residents.

Involving student volunteers and future health professionals in actual disaster drills within senior living communities offers a dual benefit. First, it provides valuable hands-on experience for these aspiring healthcare workers, allowing them to apply this knowledge in real-world scenarios. Second, the presence of skilled individuals during these drills enhances emergency preparedness and recovery strategies within senior living facilities. By practicing these health-related disaster responses, student volunteers and future health professionals gain practical and useful skills, while the SLCs receive expert assistance during these mock situations, ultimately ensuring that during the real disasters, better care and safety for the elderly in the SLC are enhanced significantly.

Having a set of rules and regulations that are in place and used frequently in an SLC is a crucial step toward ensuring the safety of the elderly. For the state of California, "the need for formal emergency preparedness in Residential Care Facilities for the Elderly (RCFEs) was addressed by AB 749, which was signed into law in 2008 and added Section 1569.695 to the California Health and Safety Code" (California Assisted Living Association (n.d.), para 2).

Section 1569.695 states that RCFEs must have an emergency plan that includes evacuation procedures, plans for the community to be self-reliant for at least 72 hours immediately following any emergency disaster, transportation needs, and evacuation procedures to ensure that the facility can communicate with emergency response personnel or can access the information necessary to check the emergency routes to be used at the time of evacuation and relocation. A contact information list that includes emergency response personnel and the responsible party and physician for each resident, a resident medication list for each resident, plus more is also required as stated in Section 1569.695 (FindLaw Staff (n.d.)) Section 87212 of Title 22 regulations, which predates section 1569.695 of the Health and Safety Code, "requires each community to have a disaster and mass casualty plan of action in writing and made readily available" (Cal. Code Regs. tit. 22 § 87212. Section 8721).

As stated in the *State of California - Health and Human Services Agency Department of Social Services,* which became effective on July 1, 2019, Assembly Bill No. 3098 added additional requirements for emergency and disaster preparedness in RCFEs and licensed RCFEs operating as Continuing Care Retirement Communities (CCRCs). These requirements include that the licensees must "provide training on the emergency and disaster plan to all staff upon hire and annually thereafter and this training must include the staff responsibilities during an emergency or disaster" (Dickfoss, 2018, p.1)). The law also required that the licensees must conduct a drill at least quarterly for each shift. The term "drill" is defined as "a type of operations-based exercise that is a coordinated, supervised activity usually employed to test a single specific operation or function in a single agency. (FEMA Glossary. (n.d.), para. 47). Drills are commonly used because they promote emergency preparedness, ensure residents' safety, and enable staff to practice and refine their response procedures during critical situations.

In this study, the researchers sought to conduct a trial drill of an SLC deploying student volunteers to act as residents from a synthetic resident database. The aims were 1) to help create a scenario-driven disaster drill toolkit for SLCs; 2) to test the CareDEX platform in a drill involving first responders interfacing with the platform in a simulated disaster; and 3) to engage health professional students to act as SLC residents from the synthetic resident database, so students would use this drill as a unique learning opportunity in older adult disaster preparedness and resilience.

Employment Possibilities for Disaster Response

According to the U.S. Bureau of Labor Statistics (2018) disaster relief work can be split into four phases, (1) preparedness, (2) response, (3) recovery, and (4) mitigation (Torpey, 2018). Each of these four phases works together to create emergency management agencies' primary responsibility of providing disaster relief within a community. Looking to the second category of response, occupations like Emergency Medical Technician, Paramedic, Firefighter, Medical Assistant, and Registered Nurse are possibilities for employment.

Emergency Medical Technicians (EMTs) and Paramedics are typically responsible for providing medical assistance and transport to individuals in need in the field (U.S Bureau of Labor Statistics, 2018). The main difference between these occupations is that paramedics have the ability to provide more pre-hospital care and administer a large range of emergency medications (U.S Bureau of Labor Statistics, 2018). With personal emergencies happening every day, EMTs and Paramedics are valuable occupations that help others in need. According to the U.S. Bureau of Labor Statistics, the overall employment of EMTs and Paramedics is expected to grow by 7% from 2021 to 2031.

Firefighters are responsible for responding to fire-related emergencies and aiding in identifying and evacuating individuals in an emergency situation (U.S Bureau of Labor Statistics, 2019a). When responding to an emergency, Firefighters may be expected to provide medical care to individuals on the scene. The Firefighting occupation is only expected to grow by 4% from 2021 to 2031 (U.S Bureau of Labor Statistics, 2019a).

ER and RN Career Pathways.

Emergency and Trauma Registered Nurses (RNs) assume a critical role in disaster response, delivering specialized medical care and aid to those impacted by emergencies. Their proficiency in managing critical injuries, orchestrating patient care, and collaborating within interdisciplinary teams ensures the efficacy of response and recovery endeavors. With their advanced expertise and clinical importance, these RNs play an indispensable role in stabilizing patients, prioritizing treatment, and upholding seamless healthcare provision amidst high-stress scenarios. Anticipated job growth extends across various healthcare settings, encompassing hospitals and outpatient care centers that offer immediate services, such as chemotherapy, rehabilitation, and surgery (U.S. Bureau of Labor Statistics 2022a). Projections indicate around 203,200 annual openings for registered nurses over the decade, largely driven by replacements for workers transitioning to other fields or exiting the workforce, notably due to retirement (U.S. Bureau of Labor Statistics 2022a).

For pre-medical students specializing in Emergency and Trauma Medicine, engaging in disaster response presents a distinctive avenue to acquire practical experience and profound insights into emergency care (Tortum et al., 2023). Amidst the projected growth of 3 percent in overall employment for physicians and surgeons from 2021 to 2031—a pace relatively slower than the average across all professions (U.S. Bureau of Labor Statistics 2022b)—an estimated 23,800 annual openings are foreseen within this decade (U.S. Bureau of Labor Statistics 2022b). This projection reflects the anticipated need to fill positions due to occupational transitions or workforce exits, including retirements.

Pay and Benefits.

As stated earlier, disaster relief work can be split into four phases, (1) preparedness, (2) response, (3) recovery, and (4) mitigation. Understanding that these four phases must work together to provide and produce the complete responsibility of providing disaster relief within a community, each phase, employment opportunity, pay, and benefits may differ. According to the U.S Bureau of Labor Statistics (2018), Disaster Relief Emergency Management Directors produce a median annual wage of $87,400 as reported in 2017. In contrast, Emergency Medical Technicians, or EMT's make a median annual salary of $36,930 as reported by the U.S Bureau of Labor Statistics in 2021 (2018). Referencing other disaster relief careers, Medical Assistants earn an annual median salary of $37,190 while Physicians earn an estimated $208,000 and Registered Nurses (RNs) are earning $77,600 (U.S Bureau of Labor Statistics, 2019b, 2022a, 2022b).

Job Outlook.

Careers in disaster relief and emergency medicine present a unique blend of challenges and rewards, enabling individuals to directly contribute to the well-being and recovery of communities affected by emergencies. According to the U.S. Bureau of Labor Statistics (2018), the employment prospects for healthcare occupations are projected to grow by 13% from 2021 to 2031, generating over 2 million new jobs. In line with this growth, employment opportunities in emergency and other relief services are expected to rise, contributing to a total of 180,600 jobs for individuals to fill (Torpey, 2018).

In the context of the emergency medicine workforce, a study by Holliman et al. (2008) underscores the complexity of estimating attrition and retirement rates among emergency physicians (EPs). Their research demonstrates that the American Board of Emergency Medicine (ABEM) recertification data indicates a range of attrition rates, potentially exerting significant influence on the workforce over time. It is projected that the number of retiring EPs might surpass the number of new graduates, creating a need for a consistent influx of new EM residency graduates to maintain workforce equilibrium (Holliman et al., 2008).

The study by Holliman et al. (2008) concludes by calling for the acquisition of more dependable and comprehensive information concerning the quantity and distribution of EPs, as well as attrition and retirement rates, to enhance workforce forecasting accuracy. Furthermore, the authors suggest that the field of emergency medicine may experience a staffing shortage, even if the number of EDs decreases due to changes in the healthcare system (Holliman et al., 2008). This research emphasizes the necessity of reliable data for making informed decisions about the future of the emergency medicine workforce as well as highlighting the impending shortage of EPs.

Healthcare Students' Experiences in a Disaster Drill

Overview of the Drill Exercise

The premise of the exercise was an earthquake and subsequent fire at an SLC named Sunnyvale Homes Sunnyvale Homes was modeled upon an existing SLC partner in Anaheim CA. First responders and other parties such as Facility Operations, and Community Emergency Response Team (CERT), were present during the drill. Student participants were required to act as casualties for this drill.

One of the outcomes of this drill was technology testing. The NSF-funded CareDEX technology that provides local and regional situational awareness was tested during this experiment. The data used in this study was acquired through surveying the individual student volunteer participants (i.e., actors in the drill).

Student participant subjects were assembled at the University site at 0900 hours. Subjects were given an IRB briefing, a Study Information Sheet, and informed that they could opt-out of the drill or survey. They were also informed that they could stop participating in the drill at any time; and were free to not answer or skip any portions of the post-drill survey. Those consenting were provided a resident information card based on the synthetic resident database. They were assigned a resident name, medical profile, location in the SLC, role in the drill, and details regarding any injuries or challenges. For example, ten participants were assigned to the Memory Care Unit, with specific conditions (limited hearing, vision, mobility, and speech) and were given roles to perform (anxiety, refusal to leave the unit, confusion). These volunteers were strategically placed throughout Sunnyvale Homes (e.g., dining room, fitness area, Covid isolation) to model typical SLC resident behavior.

Residents from the actual SLC partner in Anaheim were brought to the simulated Emergency Operations Center (EOC) and invited to observe the drill. These participants were surveyed specifically on the CareDEX technology and those results will be published in a future research article. In the EOC, a projector displayed the CareDEX Regional View (Orange County

California and the surrounding area) that provided information on the fire, smoke, and air quality as well as information regarding local mutual-aid facilities such as hospitals and other care facilities. A second projector displayed the local view of the situation which included each floor of the SLC as well as occupancy and resident information (mocked-up, e.g., synthetic data, for privacy preservation but based on a representative sample population of SLCs).

The occupant information at Sunnyvale Homes was based on a Synthetic Resident Database built by the CareDEX team and reviewed by the UCI medical and nursing research team. The partner SLC provided realistic non-identifiable information about the number of visitors, staffing, and residents as well as some general, base-line information for populating the resident table in CareDEX. The CareDEX medical team, based on the drill details, constructed scenarios for the residents grounded on their health challenges and realistic casualty information.

The first part of the Synthetic Resident data included key demographics including age and gender distribution, forming the background for the profiles. Then, health conditions and chronic diseases most commonly found in this population were added (for example, congestive heart failure, oxygen-dependent chronic obstructive pulmonary disease, and dialysis requiring end-stage renal disease). Functional and physical limitations were assigned to the digital residents based on prevalence within this population. Two board-certified geriatricians were consulted and confirmed that realistic medical data was created for each resident based on representative conditions for residents living in the SLC. One geriatrician specializes in SLC-based medical care and was instrumental in this review. COVID-19 prevalence was based on current epidemiologic data for Orange County, and residents were assigned covid-positive or covid-negative status in the database. Random names were generated from a database and then anonymized so as not to have any real personal identification information in the system. From that anonymized starting point, the CareDEX team created casualty cards and assigned them to the student volunteers. The volunteers were then positioned throughout the simulated facility (Sunnyvale Homes), based on the drill scenario.

The Orange County Fire Authority (OCFA) was on hand to run the drill. OCFA provided 1 Engine Company, 1 Truck, and 2 Battalion Chiefs in support of the exercise. The Incident Commander (a Battalion Chief) was brought into the simulated EOC and was provided with all CareDEX situational awareness dashboards. The Chief would radio CareDEX-provided information to the firefighters as the drill progressed.

At the start of the drill, with the volunteers in place, the OCFA first responders deployed. The drill script was an earthquake that precipitated a kitchen fire at Sunnyvale Homes. There were two casualties that required evacuation and the student volunteers were all residents requiring evacuation to the assembly area. The OCFA first knocked down the fire and then evacuated the facility, tending to casualties as required. At the end of the exercise, the various groups were provided separate de-briefings.

Methods

In this section, the authors will discuss the data collection and analysis methodology used in this research study. In the quantitative, descriptive research design portion of this section, the authors will present and discuss the descriptive statistics that resulted from the quantitative

portion of the survey. Then, the qualitative methodology will be described and the results will be presented.

Instrument

The instrument used to survey the students consisted of four quantitative questions on a Likert scale and two qualitative questions that were open-ended and allowed for a free-form written response. The four quantitative questions are presented in this article's Discussion section.

When analyzing the quantitative data, the data was re-coded into discrete, ordinal values. Coding for the above question set is as follows: Great/Strongly Agree = 5, Good/Agree = 4, Neutral/Neutral = 3, Poor/Disagree = 2, Very Poor/Strongly Disagree = 1. This re-coding into a numeric Likert Scale allows for statistical analysis. The authors employed IBM's SPSS software package for this analysis.

For the qualitative analysis, two broad open-ended questions were included on the instrument to elicit participant's experiences and perspectives:

1. Please share any specific lessons that you learned.
2. Provide any additional comments or suggestions.

Ample writing space and time was provided for the open-ended written responses. Authors JR and CP conducted a thematic analysis of the response data. The team based initial themes on the comments and structured open-ended questions, while also recording emergent themes. The research team met to discuss their initial findings and received feedback from the team. Based on the research team's input, they developed a more comprehensive thematic guide, and again reviewed and coded the data to reach consensus on final themes.

Subject Recruitment, Sampling and Sample Set

Student volunteers were recruited through the UCI research team's contacts. The social network of professors and faculty scientists provided enough marketing inertia to bring in sufficient volunteers. The volunteers were asked to serve as casualties during the disaster response exercise. The casualties were given casualty cards that contained their synthetic (i.e., mock) medical information and any injuries they sustained, based on a medically representative synthetic resident database in CareDEX. It is important to note that these volunteers were not directly compensated for their participation, and they had no student, professional or personal relationship with any of the researchers on the CareDEX project. The volunteers were a mixture of graduate and undergraduate health sciences students.

Upon completion of the drill, the students were gathered in a large conference room and given their After Action Review (AAR). Following that discussion, they were given the written Study Information Sheets. The participants were reminded that the surveys were optional, and they could skip any question or stop answering questions at any time. After that, they were provided with a survey instrument and pencils, and given ample time to complete the survey as they wished.

There were 19 total student volunteers and each one provided a completed survey instrument to the research team. These surveys were then anonymized and then, the research team statistically and qualitatively analyzed the results. The findings from this analysis are provided and described in the next section.

Human Subjects Protection

The human subjects research performed by the CareDEX team is covered under the University of California, Irvine IRB Protocol Number 1005. The research protocol was granted Exempt status (approved: 18 MAR 22) as no personal identification information will be collected or used as part of the CareDEX research.

Results

In this section, the authors will present the results of the data analysis. The authors used the SPSS software package to statistically analyze the data. In general, the results indicate that a Good/Agree (i.e., 4 on the Likert Scale) was the most commonly selected response.

Statistical Analysis

Overall Descriptive Statistics.

The data analysis of the 19 subjects indicates that the overall experience had a central tendency of Good/Agree; that being the most descriptive of the experience (see Tables 1 and 2). The overall Mean of all questions was 4.02. The standard deviations ranged from .964 to .692. There were no missing data values in the entire sample.

Power Analysis.

Descriptive research and statistical analysis of this sort would typically call for a power analysis. Cresswell and Guetterman (2019) define a power analysis as a statistical procedure that determines the appropriate sample size as a subset of the group that is being studied in relation to the desired alpha significance. A power analysis was not performed in this case as the entire population (19 subjects) of the group under study was surveyed.

Table 1
Overall Student Responses

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
OverallExp	19	2	5	4.11	.809
LearnNewInfo	19	3	5	4.05	.780
MorePrepared	19	2	5	3.53	.964
DoMoreDrills	19	3	5	4.42	.692
Valid N (listwise)	19				

Table 2
Overall Student Frequencies

Statistics

		OverallExp	LearnNewInfo	MorePrepared	DoMoreDrills
N	Valid	19	19	19	19
	Missing	0	0	0	0
Mean		4.11	4.05	3.53	4.42
Median		4.00	4.00	4.00	5.00
Mode		4	4	4	5
Std. Deviation		.809	.780	.964	.692
Variance		.655	.608	.930	.480
Minimum		2	3	2	3
Maximum		5	5	5	5

Discussion

In this section, the authors will discuss the results of the data analysis. Implications for healthcare student employment will be considered as well.

Overall Experience

The first question on the instrument asked the students to rate their overall experience in participating in the CareDEX drill. The responses were quantified on a five-point Likert scale from Great to Very Poor with Neutral in the middle.

The majority of students responded that their experience was good or great. As indicated in Table 3, 84% of the students fell into that range. Only 1 student reported a Poor experience. This would indicate that participating in a disaster response drill was of value to the healthcare students.

Table 3
Overall Student Experience

OverallExp

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	1	5.3	5.3	5.3
	3	2	10.5	10.5	15.8
	4	10	52.6	52.6	68.4
	5	6	31.6	31.6	100.0
	Total	19	100.0	100.0	

Implications for Healthcare Student Employment

Learning New Information

The second question on the instrument pertained to the learning experiences of the healthcare students. The question asked if the students learned new information regarding disaster response and the unique challenges that seniors face in such an event. The responses were quantified on a five-point Likert scale from Strongly Agree to Strongly Disagree with Neutral in the middle.

Within the sampled population of healthcare students, 73% responded that they agreed or strongly agreed that the exercises did provide them with new information on the subject. There were no students selecting Disagree or Strongly Disagree on the survey instrument (see Table 4). The implication is that the drill scenario did provide a learning experience for the participating healthcare students.

Table 4

Learning New Information on Disaster Response and Senior Challenges

LearnNewInfo

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	5	26.3	26.3	26.3
	4	8	42.1	42.1	68.4
	5	6	31.6	31.6	100.0
	Total	19	100.0	100.0	

More Prepared to Assist Learning New Information

The third question on the instrument asked the healthcare students if they felt more prepared to assist at-risk communities during crisis response events as a result of participating in the CareDEX drill. The responses were quantified on a five-point Likert scale from Strongly Agree to Strongly Disagree with Neutral in the middle.

The results of the survey instrument indicated that over half of the respondents do feel more prepared to assist at-risk communities during an emergency response event. While there were several Neutral answers (approximately 30% of the subjects) there were only 2 Disagree and 0 Strongly Disagree responses (see Table 5). Of all the responses on the instrument, this question appears to have the least amount of impact on the surveyed population. It is not clear, based on this question, if the students feel more prepared in this area.

Table 5
Students Feel more Prepared to Assist At-Risk Communities during a Crisis

MorePrepared

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	3	15.8	15.8	15.8
	3	6	31.6	31.6	47.4
	4	7	36.8	36.8	84.2
	5	3	15.8	15.8	100.0
	Total	19	100.0	100.0	

Interest in Further Participating in Future Drills

The final quantitative question on the instrument asked the healthcare students if they would be interested in participating in future drills/exercises with the research team. The responses were quantified on a five-point Likert scale from Strongly Agree to Strongly Disagree with Neutral in the middle.

The results of this question indicate a large interest in future participation among the healthcare student volunteers. Close to 90% of the students Agree or Strongly Agree that they have an interest in participating in future CareDEX drills. For this question, there were no Disagree or Strongly Disagree responses (see Table 6).

Table 6
Students' Interest in Future Drill Participation

DoMoreDrills

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	2	10.5	10.5	10.5
	4	7	36.8	36.8	47.4
	5	10	52.6	52.6	100.0
	Total	19	100.0	100.0	

In general, the healthcare student responses to the drill were positive. The healthcare students that participated in the CareDEX disaster response drill appear to receive value for their time and efforts committed to the event. Most students report having a good experience, learning new information, and would participate in future drills with the research team.

Qualitative Data Analysis
In analyzing the qualitative data through comments and remarks provided by the volunteer participants, some consistent themes emerged. Following their participation in the drill, participants were directly asked on the survey tool to provide any insights they gained from the experience and to write down any additional comments or suggestions regarding the drill.

Participants reported that they gained a better understanding that the elderly are disproportionately impacted by natural disasters and their insights clustered into the following themes: difficulties in logistics in evacuating; accessibility and mobility barriers; impact of the chronic health conditions on evacuation and relocation; and challenges for older adults and technology. Participants identified how health factors and disabilities complicate the process of evacuation and disaster preparedness for older adults. These themes are congruent with the statistical analysis and support the statistical results in this study such as learning new information and many students being better prepared to assist the elderly in evacuation and emergency response.

Volunteer participants discussed the way health conditions contributed to older adults' and communities' response during natural disasters. One volunteer noted, "Older communities face a much wider array of challenges due largely to the vast amount of health conditions they face." In their assigned roles as older adults with assigned health challenges, a participant stated: "I learned how people with chronic illnesses (dementia, arthritis, etc.) may have limitations when having to follow directions and being able to safely evacuate during an emergency." The need for health-dependent specific resources for older adults was consistently discussed throughout the data. Several participants described learning the importance of knowing patient information from diagnoses, medications, to required treatments when responding to a disaster. One pre-health volunteer described, "I didn't realize that certain populations wouldn't have access to needed medications in [disaster] situations." Against the backdrop of the COVID-19 Pandemic, one participant astutely identified the problem of "keeping COVID positive and negative residents separate" during evacuations. Participants reported gaining a greater understanding of the importance of accounting and tracking those who are oxygen dependent, and require timely medications or specific treatments, such as dialysis in re-locating individuals.

Many described having had no prior experience with older adults and having gained an awareness of the disabilities and physical limitations found in this population. A volunteer described their surprise in considering how the presence of service animals used by some to manage physical disabilities might impact evacuations. Volunteering as older adults living in an Assisted Living facility, some gained an understanding of the problems of accessibility and how this impacts safety in an evacuation. Participants noted that specific conditions in disasters exacerbated older adults' ability to evacuate, describing how stairs and crowds were difficult for those with mobility limitations; how visibility limitations with fire and smoke would further challenge those with visual impairments; or how loud sounds and directions would challenge those with hearing loss.

Participants specifically highlighted the complications in evacuating those with dementia or other cognitive challenges due to their reduced ability to follow directions and the dangers of wandering in hazardous conditions. Through assuming the role and profile on the Memory Care unit of Sunnyvale Homes, one participant shared an understanding of how "the cognitive incapacities can prohibit the efficiency" of evacuations. Another shared more specific lessons: "I learned that dementia patients have to leave in a group, walk slowly, and wander if left alone, and it might be hard to convince them to leave the room." Having to assume the role of a person with dementia, one participant learned "how overwhelming these sorts of situations are for the elderly, especially if they are dealing with conditions like dementia or hearing loss." One

volunteer recognized the risks of agitation and panic attacks for those with cognitive challenges when routines were disrupted, and stress increased during disaster situations. In sum, the qualitative analysis indicates the student volunteers gained valuable insights into disaster preparedness and resilience for older adults. This triangulates well with the findings from the quantitative analysis.

Another theme in the participants' remarks centered around the adoption and implementation of technology in older adult populations. Some highlighted the limitations in technology use among older adults, and others described the difficulty of older adults having the skills to use available technologies. One volunteer explained, "I'm not sure how realistic using Apple Watches is on elderly" given that older adults struggle with technology. They explained that some older adults may take watches and wearables off during an evacuation and others might be sensitive to having devices on their wrists.

Additional comments on the survey were centralized around the theme of desiring to learn more and to engage in further drill participation, which exemplifies and supports the statistical analysis and results. A participant described the drill as "A fun yet informative drill that should be duplicated in many other places." One enthusiastically remarked, "It was a very awesome experience," and another wished it had been a longer drill. One described learning how older adults are at increased risk during emergencies, and thus, felt "glad I got to participate in a drill to help." Participants expressed their willingness to be involved in further drills as well as other research opportunities involved with CareDEX. Several remarked that they wished to help reduce the high casualty rate of older adults in disasters and to use technology to reduce this disparity. One stated, "I learned that the older community is more at risk in natural disasters, and how there are not many people out there to care for them." In witnessing the paramedics and firefighters in the drill, participants gained an appreciation of "the challenges faced by first responders." These remarks reinforce the outcome of the statistical analysis regarding the students' experiences and desire to participate in future drills (Table 3 and Table 6).

Through participating in a multi-faceted, real-time disaster drill, the volunteer students gained insights into older adults living in Assisted Living facilities and Memory Care Units. They had an immersive experience in physical limitations, chronic medical conditions, and how these factors directly impact older adults during evacuations. Engaging in disaster preparedness and resilience technology design, the volunteers directly faced the need for efforts to reduce the dire outcomes seen across disasters for older adult populations. The research team hopes the drill experience will inspire future health professionals and computer/information scientists to contribute to CareDEX and the urgent need to improve older adults' safety and preparedness during disasters.

Study Limitations

The study was conducted in Southern California using graduate and undergraduate healthcare student volunteers from the University of California, Irvine. The sample size was relatively small and a convenience sample. As such, the statistical generalizability to larger groups, such as engineering majors or students outside of the geographical area is limited. In addition, data was collected from a single disaster drill and the data would be more robust with multiple drills in several sites.

Conclusion

The escalating demand for healthcare professionals paves a promising path toward emergency response occupations, drawing the attention of both students and aspiring workers. With the expanding scope of healthcare needs, specialized training becomes imperative to excel in this field, often involving the pursuit of a bachelor's degree in fields like nursing, public health, and pre-medicine. Within these areas, diverse subcategories await those seeking healthcare-related emergency response roles, spanning from 911 operators who manage critical calls to multifaceted positions like emergency medical technicians and paramedics who provide life-saving aid on the ground.

The field of disaster response medicine offers ample room for skill diversification, allowing individuals to broaden their horizons through cross-training initiatives. These initiatives encompass a spectrum of roles, ranging from managing teams coordinating disaster response protocol to assuming positions of leadership and guidance in allopathic or osteopathic medicine. Amidst this landscape of opportunities, the fusion of healthcare expertise and disaster response unveils a compelling trajectory for future professionals to contribute to a community of safety and well-being as well as meeting the demand for skilled public safety professionals (Bureau of Labor Statistics, 2022) as outlined in the literature review.

Concomitant with disaster response training is the concept of immersive learning through drills and exercises. In this research article, 19 healthcare student volunteers were part of a large-scale emergency response scenario that included an SLC, first responders, and other response professionals. These students served as actors who portrayed residents and casualties during the exercise. The students were surveyed after the exercise on their experience.

The majority of the students felt the experience was a positive experience and that they learned more about the needs of seniors during a crisis event. Most students felt that they were more prepared to assist older adults during a disaster as a result of participating in the drill. They gained an increased interest in geriatric care and awareness of the challenges of caring for complex older adults with chronic diseases and physical limitations. Almost all students expressed a clear desire to participate in more drills with the CareDEX research team.

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Education and Innovation Requirements for Design Thinking Jobs

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Abstract
Design thinking is a problem-solving approach based on design theory, design-cognition, social constructivism, and reflection. Since business and industry are seeking employees with design thinking knowledge and skills in order to infuse products and services with innovation, the purpose of the study was to understand the educational qualifications and innovation skills related to design thinking that are sought by employers seeking undergraduate business majors. Content analysis of a nationwide dataset of LinkedIn job descriptions was performed to discover attributes such as educational level, years of required experience in design thinking, and type of bachelor's degree sought. Findings showed an anomaly between the skills-first hiring trend and the results of the study which found that employers want hires to have a bachelor's degree, although not necessarily require a business degree. Additionally, innovation skills are important to employers hiring employees for design thinking positions. Management programs need to make the case that they are prepared to teach innovation and other skills that help students obtain jobs in design thinking.

Introduction

It seems like pursuing a bachelor's degree is not the American dream it used to be (Lanahan, 2022). Global corporations like IBM, Accenture and Google are reportedly removing some bachelor's degree requirements and turning to skills-based hiring. LinkedIn recently reported that the number of job postings not requiring a four-year degree increased from 15% to 20% (Anderson, 2022). Similarly, the Burning Glass Institute analyzed 51 million U.S. job postings and reported a skills-first hiring trend. For example, IBM has stripped degree requirements from many IT job postings, now only requiring 29% of its IT postings to require a degree, and emphasizing skills over degrees (The Burning Glass Institute, 2022). Similarly, Accenture's postings requiring a degree have decreased from 54% in 2017 to 43% in 2021 (The Burning Glass Institute, 2022).

Part of the reason companies have reduced educational requirements is because of the current shortage of workers, accelerated by the COVID-19 pandemic, which forced companies to drop degrees as requirements (Lanahan, 2022). Enrollment in many bachelor's degree programs had already been decreasing and accelerated with the pandemic. Carnevale et al. (2010) predicted that the demand for college graduates in the United States would fall short of supply by 3 million individuals by 2018. The Society of Human Resource Management (SHRM) (2003) reported that

large numbers of employers in the early 2000s were preparing for a labor shortage predicted to occur by 2010. Their predictions came true, and as of March 2022, the United States unemployment rate is 3.6% with sales, office occupations, and service occupations leading the categories of highest unemployment (Bureau of Labor and Statistics, 2022). The shift from hiring based on degree attainment to hiring based on skill sets has come to be called *skills first hiring*, and is a new hiring trend (Roslansky, 2022).

There is evidence that design thinking has emerged as a high-priority skill to be attained by employees (Matthews & Wrigley, 2017; O'Keefe, 2017; Nakata, 2020). This creates a labor market for post-secondary graduates with business acumen to have design thinking skills. Design thinking is "a human-centered problem-solving method that mostly leads to radical innovative solutions in terms of the feasibility, desirability and viability of products or services" (Efeoglu et al., 2013, p. 241). While there are several approaches used to facilitate design thinking (Beckman & Barry, 2007; Design Council, 2023; Glen et al., 2015; Lawson, 2006), the Stanford Design Thinking Framework (Plattner, 2007) has emerged as the leader in business and academia. The five stages that define the Stanford Design Thinking Framework are Empathize, Define, Ideate, Prototype, and Test.

There are existing research studies showing how design thinking is embraced by educators because it offers students an innovative problem-solving approach that fosters the development of 21st-century skills (Callahan, 2019; Matthews & Wrigley, 2017). In addition to academia, design thinking has frequently been recognized for contributions to business and industry practices (Panke, 2019). Airbnb, PepsiCo and IBM are just some of the companies who are using design thinking in various areas of operations (O'Keefe, 2017; Nakata, 2020). Design thinking is becoming not only a new product or new service design approach (Utterback et al., 2006) but a part of business strategies (Camillus, 2008; Verganti, 2006, 2008). Companies have recognized the potential impact of design thinking's contribution to successful business practices (Matthews & Wrigley, 2017). Unfortunately, research shows a gap between what higher education teaches and the skills employers see in their new hires (Denning-Smith, 2020).

Use of Design Thinking in Business and Industry

Global companies such as IBM and others are using design thinking to improve their internal processes and design products and services more closely tied to customer needs. IBM has seen a huge impact on its return on investment by using design thinking. IBM sought to determine the return on investment realized by using design thinking practices. Key findings showed that design and execution speed doubled when using the IBM Design Thinking process, and this resulted in a projected $20.6 million in value. Using design thinking also helped cut design defects in half which saved an estimated $153,000 per major project. Additionally, unquantified benefits were that the workforce was more engaged and felt more empowered, and internal processes in HR and sales departments improved. Overall, IBM was able to report a return on investment of 301% over three years (Forrester, 2018).

Other organizations have also used design thinking in a variety of ways. Toyota used design thinking to redesign a customer service center to be a better experience for customers (Liedtka, 2014). IBM prototyped a new trade show model with real customers (Liedtka, 2014). The city of Dublin, Ireland, used design thinking to get input from the city's residents for how to improve its

urban spaces (Liedtka, 2014). Samsung used design thinking to become a more innovative culture and increase their strategic thinking and even created a Corporate Design Center in the mid-1990s to centralize innovation efforts (Elsbach & Stigliani, 2018). Siili provides data analytics, design, and technology services to corporations. Among the consulting products they have done using design thinking were a pharmaceutical company that needed a service innovation and an insurance company that needed a new model for its wholesale business (Kuula et al., 2019).

There is a strong connection between design thinking and innovation, and, in fact, innovation is considered to be the core of design thinking (Brown, 2008). According to Luka (2019), "the growing popularity of design thinking in higher education in the last decade is usually explained by the fact that its tools are associated with innovation—a significant 21st-century skill" (p. 501). Applying design thinking to higher education curriculum develops skills that can be applied to solve complex real-world problems and also develops creativity, empathy for the end-user (Dam & Siang, year) critical thinking, collaboration, problem finding, problem framing, and problem-solving skills (McLaughlin, 2022). Empathy, the first stage in the Stanford design thinking process, has been called "the starting point of innovation and creativity" (Lor, 2017, p. 60).

Intuit incorporated new design thinking processes beginning in 2007 (Martin, 2020). In order to increase innovation in its organizational processes, the company took a more structured and organized approach to design. Ten people were asked to become innovation catalysts-people who would help managers across the organization use design thinking approaches to work on new initiatives. The innovation catalysts had to have good people skills and coaching skills, the desire to talk with customers, and the ability to influence others. The innovation catalysts helped managers and teams create prototypes, run experiments, and find ways to learn from customers. Two of the innovation catalysts developed a "painstorm" (Martin, 2020, p. 67) process where they would work to find out customers' biggest pain points by observing and talking to customers. Intuit was so pleased with the work of the innovation catalysts that it hired and trained more of them to keep the design and innovation work going. Intuit credits the launch of several mobile apps leading to increased revenue and profits to their design and innovation initiatives.

Use of Design Thinking in Business Schools and Programs

Currently, post-secondary business students wanting to learn about design thinking can do so in a variety of business schools and programs. Coursework is part of degrees, a short course, or a certificate. Individual corporations such as IBM, Cooper Professional Education, IDEO U, and LinkedIn Learning also offer training in design thinking ("Design Thinking", n.d.) In the United States, the focus of this research study, approximately one million associate's degrees and two million bachelor's degrees were awarded in 2019-2020. At both levels, business was the most common field of study for all racial/ethnic groups (National Center for Education Statistics, 2022). At the same time, fewer students are enrolling in undergraduate programs, as enrollment in undergraduate programs decreased by 9.4% from 2019-2021 (Camera, 2022). The COVID-19 pandemic, questions about the affordability of college, and the rise of alternative credentials are contributing to the enrollment decline. According to the World Economic Forum (2022), only 11% of business leaders believe that students are graduating from college with the skills they

need for employment. This is one reason why many employers seem to be reducing the focus on degrees in their hiring criteria and increasing their focus on skills.

Design thinking has permeated the curriculum in some higher education management programs. For example, one Midwestern, private university uses design thinking in its business communication course. The course content was expanded to integrate the design thinking process in alignment with essential tenets of business communication. Discussions surrounding "wicked problems" in the workforce included effective communication, developing professional messages, credibility, employment messages, career development, and persuasion. The design thinking process was incorporated to expand student's understanding of career readiness and professional development.

An American undergraduate business department used design thinking to teach empathy, which is one of the stages of the Stanford Design Thinking Process. Empathy helps to understand the customers' needs so their problems can be solved. A 90-minute in-class exercise asked students to interview a class partner, write and rewrite a problem statement, prototype a solution, and receive feedback (Armstrong, 2016). An entrepreneurship unit was revised in a Portuguese undergraduate business course to use the design thinking process. Students used the process to solve the problem of 'How can I improve the quality of life of our campus?'(Daniel, 2016). Additionally, a Norwegian university's master's level Corporate Entrepreneurship course used design thinking to solve a real company's problem. It was found that students were able to embrace empathy, develop teamwork skills, improve their communication skills, and learn how to better handle ambiguity (Lynch et al., 2021).

Pedagogical Philosophy of Design Thinking

Traditional teaching methods used in management education such as case studies, lecture, and guest speakers have been criticized for failing to address complex problems that do not have a clearly defined solution, and spoon-feeding information to students in order to help them solve a problem (Garbuio et al., 2018; Schoen, 1993). Design thinking uses both project-based learning and design education to uncover and solve problems and is based, in part, on theories such as design theory, design-cognition theory, social constructivism, and reflection. Teaching design thinking should embrace a problem-solving perspective, where real-world problems are grappled with by students using an experiential, hands-on approach. Previous research confirms that using traditional lecturing pedagogy should be limited to teaching concepts and principles, and most of the pedagogy should be experiential in nature. "Business schools integrating design thinking into their curricula should switch from traditional lecturing methods to more practice and project based, experiential pedagogy approaches" (Çeviker-Çınar et al., 2017, p. S985).

Also lending to design theory is the wicked problems approach (Buchanan, 1992) which was formulated by German Horst Rittel in the 1960s. He believed that the linear way design was being taught was too simplistic. Rittel argued that most design problems are wicked problems, defined as a "class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing" (Churchman, 1967, p.141-142).

While management education has focused on teaching design thinking tools such as brainstorming, journey mapping, and prototyping, design-cognition research adds cognitive tools such as framing, analogical and abductive reasoning, and mental simulation (Garbuio, 2018) to a design thinkers' toolkit. Design-cognition research consists of four cognitive acts: framing, analogical reasoning, abductive reasoning, and mental simulation. Framing refers to finding various ways to define the problem based on different users and situations (Dorst, 2011). Analogical reasoning is the act of "identifying and carrying over knowledge from prior situations to support the current one" (Garbuio et al., 2018, p. 47). The third cognitive act is abductive reasoning, where a hypothesis is used to explain observations. Design thinking professionals are encouraged to invent surprising hypotheses to explain user behavior, in order to challenge the status quo and expand on existing preconceptions of a solution (Garbuio et al., 2018). The fourth cognitive act is mental simulation, which is "imitative cognitive constructions of hypothetical events or reconstructions of real events" (Sanna, 2000, p. 1). Mental simulations involve thinking about what could happen in the future and what happened in the past in order to mentally try out strategies and tactics before making decisions.

It is recommended that design-cognition be used in a team-based, multidisciplinary, project-learning environment (Garbuio, 2018), which fits well with Vygotsky's (1978) theory of social constructivism. In social constructivism, learning is a social process that takes place in groups of people collaborating to construct knowledge from meaning. Instruction should be designed so that people can increase their knowledge from where they can solve problems with help to solving problems independently, and that gap is the zone of proximal development (Vygotsky, 1978).

Critical reflection is important in management education (Schon, 1983) as it has been shown to improve students' cognitive skills. Reflection is embedded into each stage of the design thinking process and is a core part of design thinking curriculum (Kolb, 1994; Schon 1987; Wickam et al., 2022). In the design thinking process, reflection can be student-led, such as writing or presenting, or teacher-led, such as facilitating a class discussion. Whether student or teacher-led, reflection helps students process the new knowledge that has been learned (Gagnon & Collay, 2001).

Purpose of the Study

There is evidence that design thinking has emerged as a high-priority skill to be attained by employees (Matthews & Wrigley, 2017; Nakata, 2020; O'Keefe, 2017). This creates a labor market for post-secondary graduates with business acumen to have design thinking skills. Since business and industry are seeking employees with design thinking knowledge and skills, it is important to understand whether universities are preparing business graduates with the knowledge and skills employers need. Specifically, since some corporations are reducing degree requirements for positions, it is important to know what corporations are advertising as the academic qualifications for open positions where design thinking is required. Additionally, because innovation is a significant 21st-century skill (Luka, 2019), and a core skill for design thinking, it is important to know whether employers hiring employees for design thinking jobs place a high priority on innovation skills.

The purpose of the study was to understand the desired qualifications related to design thinking that are sought by employers seeking undergraduate business majors. The research questions were:

1. For job postings that state design thinking in the job description, what is the preferred educational level (i.e. bachelor's degree or master's degree) and/or previous design thinking experience requirement of the applicant?
2. For job postings that state design thinking in the job description and require at least a bachelor's degree, what percentage requires a business degree?
3. For job postings that state design thinking in the job description, to what extent do they also state "innovation" in the job description? (The word innovation must be in the job description not in the company description.)
4. For job postings that state design thinking in the job description, to what extent do they state one or more of the design thinking stages?

Methodology

This study used a nonexperimental, descriptive research design. The methodology was quantitative conceptual content analysis using external data analysis of one existing dataset. LinkedIn was chosen as the dataset because it reports to have more than 600 million users worldwide (LinkedIn, 2020), has a national database of job openings, is widely used by job-seekers (Smith & Watkins, 2020) and is available free to job candidates. Additionally, LinkedIn has emerged as a useful dataset in several other research studies, including studying social capital attributes (Li et al., 2018), journalism skills (Marta Lazo et al., 2018), the impacts of higher education ads (Atkinson, 2021), and an analysis of the human resources analytics role (Kashive et al., 2022).

The search criteria for the dataset were as follows. Job descriptions needed to be in the United States, within the past week (as of February 2, 2022), and be full-time. The filters "entry level" and "associate-two years' experience" were chosen, and this returned 1,927 results. Exclusion criteria filters were set for job titles for instructional designer and senior instructional designer. Sometimes the same job title for the same company appeared more than once in the results because the same job was open in multiple geographic locations. In that case, the job was saved only the first time it appeared in the results. In the results, each job that was chosen to analyze had to have the words "design thinking" in the title. The job descriptions that met all of these criteria were saved, and after about 50, the job descriptions were becoming duplicative. At that point, five more job descriptions were collected, and then data collection was stopped. During the coding process, seven job descriptions were discarded because it turns out they were duplicative, resulting in a dataset of 48 job descriptions.

The researchers used the U.S. Bureau of Labor and Statistics to organize the job descriptions into nine occupation profiles. The top three occupation profiles for our job descriptions were the business and financial operations profile (44%), computer and mathematical occupations (15%), and office and administrative support occupations (10%) (see Table 1). The job descriptions were spread quite evenly across the United States, with 27% of the job descriptions coming from the Midwest, 27% from the West, 25% Remote, 13% from the Northeast, and 8% from the

South. The state with the most job descriptions was California, with 17%. A master codebook was created to collect the data needed to answer the research questions. The three researchers collected the data from the job descriptions together and agreed on how to code each job description. Institutional Review Board approval was obtained from all three researchers' universities.

Table 1
Occupations

U.S. Bureau of Labor and Statistics' Occupation Groups	n	%
Business and Financial Operations	21	43.75
Computer and Mathematical	7	14.58
Office and Administrative Support	5	10.42
Healthcare Support	4	8.33
Not Listed	3	6.25
Production	3	6.25
Sales and Related	2	4.17
Architecture and Engineering	1	2.08
Education Instruction and Library	1	2.08
Personal Care and Service	1	2.08
Total	48	100

Results

The first research question asked, "For job postings that state design thinking in the job description, what is the preferred educational level (i.e. bachelor's degree or master's degree) and/or previous design thinking experience requirement of the applicant?" Data analysis found that the preferred educational level is bachelor's degree or higher (71%) while 14 (29%) job descriptions did not state the educational requirements. We are unsure whether not stating the educational requirements meant that a degree was not required or if the employer just preferred not to state a degree requirement. None of the job descriptions required only a master's degree even though sometimes a master's degree was preferred. A majority of the time, a bachelor's degree was the minimum educational level of job postings that were hiring someone for a job that includes design thinking. Additionally, most job descriptions (85%) did not state the required number of years of experience in design thinking, even though design thinking was somewhere in the job description. Instead of requiring a specific number of years of experience, job descriptions were more likely to state something like, "Champion the importance of User-Centered Design and Design Thinking throughout the company" or "familiarity with design thinking methodology".

The second research question asked, "For job postings that state design thinking in the job description and require at least a bachelor's degree, what percentage requires a business degree?" For the 71% of job postings where a bachelor's degree or higher was required, 40 (83%) did not require a business degree and 17% required a business degree. These results were unexpected, as even though these were all corporations who were hiring, they did not expect to hire people with

business degrees. Although many postings required knowledge of business sub-disciplines such as behavioral economics, business administration, entrepreneurship, market research, marketing, advertising, and project management, few postings required a business degree. Companies could be shifting to in-house training on business acumen and skills such as design thinking.

The third research question asked, "For job postings that state design thinking in the job description, to what extent does the job description also mention "innovation" somewhere in the description?" Because innovation is so linked with design thinking, we wanted to know to what extent job postings that had design thinking in the job description also included the need for innovation somewhere in the job description. As was anticipated, the majority (56%) of job descriptions had "innovation" somewhere in the job description that confirms that employers are seeking skills in innovation.

The fourth research question asked, "To what extent do the job descriptions state one or more of the design thinking stages?" The stages of the design thinking process we considered in our analysis were from the well-known Stanford Design Thinking Process: Empathize, Define, Ideate, Prototype, and Test (Gallagher & Thordarson, 2020). A majority, (75%), mentioned one or more stages of the design thinking process in the job description. This may show that having knowledge of the specific stages of design thinking is important to employers. The prototype (38%) and testing (23%) stages were mentioned the most, with the definition (7%) stage mentioned the least (see Table 2). This may be because the prototype and testing stages may need specific skill sets whereas the problem definition stage would need less specific skill sets.

Table 2
Design Thinking Stages Per Mention

Design Thinking Stage	n	%
Prototype	27	38.03
Test	16	22.54
Ideate	12	16.90
Empathize	11	15.49
Define	5	7.04
Total	71	100.00

Findings

There are two findings that emerged from the results. First, there is an anomaly between the skills-first hiring trend and the results of the present study which found that employers want new hires to have a bachelor's degree. While these are businesses that desire a minimum of a bachelor's degree, they do not usually require a business degree. But, they do desire many skills that are taught in business degrees. For example, one employer that did not require a business degree asked for candidates that could "work regularly with function owners to support product strategy, product development, strategic growth of new business and capabilities using creative design thinking methods". Product strategy, product development and strategy are typically business-related skills. If people did not earn a business degree, they likely would not have the academic qualifications for these jobs.

Given overlapping demand for employees with bachelor's degrees and employees with design thinking skills, there is an opportunity for business and business education to partner together to teach design thinking skills. The literature review identified that there are business degrees and design degrees that are teaching design thinking, but they are not widespread, and many business schools and programs are not including design thinking in their curricula. Wickam et al. (2022) surveyed post-secondary business educators who were members of the National Business Education Association and found that 58% used design thinking in at least one course. For those business educators who reported that they did not use design thinking, the major reason reported was that they had a lack of knowledge about design thinking. Therefore, there is a disconnect between the needs of business and industry and the ability for post-secondary educators to respond to those needs because of their lack of knowledge about design thinking. A recommendation is for four-year degree programs to partner with employers who need employees with skills in design thinking to offer those skills. This study focused on bachelor's degrees but, it may also be that a two-year degree will replace a four-year degree for some jobs (Lanahan, 2022). A second recommendation is for two-year community and technical colleges to partner with employers to teach design thinking knowledge and skills to their students. Pathways such as short-term certifications and/or certificates would provide immediate and necessary skills.

The second finding is that innovation skills are important to employers hiring employees for design thinking positions. This has implications for university business schools and programs. Innovation is an important skill for employers hiring employees who can perform jobs using design thinking, so it is important to consider whether those skills are being taught in business courses that are preparing students for roles in design thinking. Nakata et al. (2020) researched innovation managers with job titles like chief executive officer and chief innovation officer and found that design thinking leads to successful new products and services. They suggested that as a result of this finding, managers should implement the approach in order to reduce innovation failure. They also recommended employee training on design thinking, especially training on the mindset that failure is necessary and acceptable (Nakata et al., 2020).

Limitations and Opportunities for Future Research

A review of existing literature found several examples of how design thinking is being used in business and industry, but it is likely that there are other design thinking activities happening that have not been formally documented. Similarly, the list of business schools and programs offering curricula in design thinking is not exhaustive. Such a list does not exist, although it would be helpful for researchers and prospective students to have such a list. Using business schools and programs with specialized business accreditations such as AACSB and/or ACBSP to search course catalogs for design thinking programs would be useful to future researchers wanting to conduct research on design thinking in business education.

Additionally, LinkedIn was chosen as the data source for job descriptions because of its comprehensive database of job openings, wide use by job-seekers, and free availability (LinkedIn, 2022; Smith & Watkins, 2020). There are other online job boards such as Glassdoor and Indeed that contain job descriptions for jobs involving design thinking. As a result, readers should be cautioned to generalize findings to other job boards. Replicating this study using other

electronic job boards would allow for comparisons. Also, since there is not a clear indication whether employers hiring employees with design thinking skills prioritize skills or degrees, it would be insightful to conduct qualitative and/or quantitative research asking corporate hiring managers to define how they determine those priorities. Finally, while this investigation reports current uses of design thinking in universities and the desire for design thinking, degrees and innovation skills by employers, future research should outline an agenda for business schools and programs to follow in designing new design thinking curricula that aligns with employers' needs.

Conclusion

The purpose of the study was to understand the desired skills related to design thinking that are sought by employers seeking undergraduate business majors. Content analysis of job descriptions found on LinkedIn and containing *design thinking* in the title was the chosen methodology to answer the research questions. Based on the results, there were two findings. First, there is an anomaly between the skills-first hiring trend and the results of our study which found that employers want new hires to have a bachelor's degree. This has implications for employers. Employers who desire to hire employees for business-related design thinking positions and potential employees seeking those positions now know that most businesses do require a bachelor's degree, but not specifically a business degree. Management programs will have to make the case that they are prepared to teach skills that help students obtain jobs in design thinking so that business students will find value in enrolling in design thinking courses. In addition to post-secondary degrees, business programs have opportunities to create certifications and certificates in design thinking, since the literature review revealed that a hiring trend is to prioritize skills over earning a bachelor's degree.

The second finding is that innovation skills are important to employers hiring employees for design thinking positions. Innovation requires a broad range of skills in a workforce (Tether et al., 2005) such as creativity, empathy, open-mindedness, experimentation, communication, and collaboration (Lee & Benza, 2015). Design thinking fits well with learning to use these skills; for example, empathy for users is the empathize stage, experimentation is key to the prototyping and testing stages, and using design thinking in communication and collaboration are key components to each stage. Furthermore, the study's results found that business acumen is listed in job descriptions seeking employees with design thinking skills. This creates a labor market for post-secondary graduates with business acumen.

Employers also now know that including the stages of the design thinking process in job descriptions is something their competitors are doing, and experience with the prototype and testing stages are the most requested. Employers are not being specific in the number of years of design thinking experience required, and just having employees who are familiar with design thinking seems to be enough. Design thinking skills are trending as desired qualifications for employers seeking potential candidates that have developed design thinking skills. As design thinking becomes a key component in higher education management curriculum, graduates are now better prepared to meet the skills-first hiring movement, but more work needs to be done that better prepares a workforce to use design thinking skills.

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School-Based Agricultural Education Teachers' Importance to Teach Agricultural Mechanics: A Gender Comparison

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Abstract
Agricultural mechanics is one of the most widely taught courses in School-Based Agricultural Education programs and is considered among the most useful courses taught (Herren, 2015). Although trends towards female equity are present with mid-career teachers (Burris, et al., 2010; Blackburn, et al., 2015), this study sought to identify if differences in the perceived importance in agricultural mechanics curriculum by male and female instructors existed. A census study of Iowa SBAE teachers was implemented at a statewide annual conference using a written questionnaire to ascertain the study's objectives. The purpose of this study was to determine Iowa SBAE teachers' perceived level of the importance of teaching agricultural mechanics by gender. Of the five constructs presented on the questionnaire, the least important construct identified by men rated higher than the most important construct identified by women. Findings support that previously reported gender inequalities in agricultural mechanics still seem to exist. However, similarities for highly rated constructs such as safety skills and traditional welding skills were identified by both male and female SABE teachers. It is interesting to note that tractor overhaul was rated as one of the least important skills in the power & machinery skills construct. This is particularly interesting considering the popularity of the FFA tractor restoration competitions at the county and state fairs in Iowa. Is there a correlation between high-school agricultural mechanics instructors' importance to teach the power and machinery construct and the popularity of the FFA tractor restoration project area? Further research is warranted in this and related areas. Considerations for specific gender-based training is worth consideration.

Introduction

A study by Dailey et al. (2001) reported that school-based agricultural education (SBAE) teachers believe students transfer and apply knowledge gained from formal learning experiences to their day-to-day lives. Much of this knowledge is gained through hands-on learning in classroom and laboratory-facilitated learning. According to Shinn (1987) and Byrd, et al. (2015), approximately one-third to two-thirds of agricultural mechanics instruction is spent in agricultural mechanics laboratories.

The majority of agricultural mechanics content is taught in both classroom and laboratory settings of school-based agricultural education programs. Agricultural mechanics is one of the most widely taught courses and has also been identified among the most useful(Herren, 2015) in school-based agricultural education programs. Shoulders and Myers (2013) found 76.8% of SBAE teachers in the United States had access to a mechanics laboratory facility and were utilizing the available facility 90.6% of time. A large portion of agricultural mechanics

instruction takes place in the agricultural mechanics laboratory (Johnson, et al., 1990). Thus, students are spending a greater portion of their agricultural mechanic instruction in laboratories than the classroom setting.

According to Watson, et al. (2015), an agricultural mechanics laboratory allows tremendous opportunities for educational adult-youth partnerships. Students are more likely to be engaged and build a relationship with their instructor while working in an agricultural mechanics laboratory if the relationship is student-led (Watson, et al., 2015). Additionally, Mart (2013) indicated that teachers, regardless of subject, found commitment as one of the most critical factors for continued success in students' education; and additionally, teachers who are passionate believe in the importance of their job. Further, teachers can play a pivotal role in the transfer of knowledge to students (Mart, 2013) which begs the question, does a teacher's perceived importance of the content taught positively impact students' learning?

Of the nine construct areas of agricultural mechanics investigated by Burris, et al. (2005) agricultural mechanics teacher educators from each of the 88 agricultural teacher education certifying institutions in the United States reported that electricity, metal fabrication, hand/power tools, agricultural power, building construction, project planning and materials selection, plumbing, concrete, and machinery and equipment, were considered *Important* on a 5-point scale. More recently, Schultz et al. (2014) reported that Iowa SBAE teachers rated 34 of 54 agricultural mechanics skills as *Important* or *Very Important* on a 5-point Likert-type scale.

A demographic profile study of female SBAE teachers in the United States reported 39.6% of their time was spent on agricultural mechanics subject matter (Foster, 2003). Female SBAE teachers in Georgia reported being neutral about their gender as a barrier in regards to acceptance by others in the profession. Further, it was found that females were satisfied with their careers and felt accepted by students, administrators, parents of students, and the community (Ricketts, et al., 2006). Kelsey (2007) found 64% of women experienced gender bias but were able to overcome gender bias with high self-efficacy in teaching secondary agricultural education.

Agricultural education instructor population in the United States until recently has been predominately male with a ratio of just under 3:1 (Lawver, 2018) with a trend moving towards more female SBAE teachers entering the profession.. More women are seeking to enter the profession, although according to Foster (2003), "...artificial barriers based on attitudinal bias often prevent qualified women from reaching their potential" (p. 384). Dillingham, et al. (1993) indicated equity had not been achieved between male and female agricultural mechanics instructors, but the number of women who chose to teach agricultural mechanics over other agricultural education courses started to trend towards equity with male instructors. Overcoming gender-role stereotypes continue to be a challenge for female SBAE teachers (Baxter et al., 2011); however, despite barriers, women have created a trend towards equity in agricultural education teaching positions by entering the profession. Whittington and Raven (1995) indicated 42% of students majoring in agricultural education in the Northwest United States were female. Burris, et al. (2010) reported fifth year SBAE teachers in Texas were 2:1 between male and female teachers. Further, Burris, et al. (2010) reported first year SBAE teachers were nearly equally distributed between genders. However, in the past five years, the number of female teachers entering the profession has increased from 61% (Foster, et al., 2015) to 74% (Foster et al., 2019). Although recent trends suggest female equity in SBAE is being achieved, are there

differences in perceived importance between male or female teachers when considering their perceived level of the importance of agricultural mechanics coursework in the curriculum?

Theoretical Framework

The theoretical framework guiding this study is Ajzen's (1991) Theory of Planned Behavior—an extension to Ajzen's (1975) Theory of Reasoned Action. The theory suggests that a person's behavioral attitude, environmental subjective norms, and perceived behavioral controls influence their behavioral intention resulting in the performance of an actual behavior. Specifically, one's perceived importance is shaped based on attitudes, subjective norms, and perceived behavioral control towards a subject.

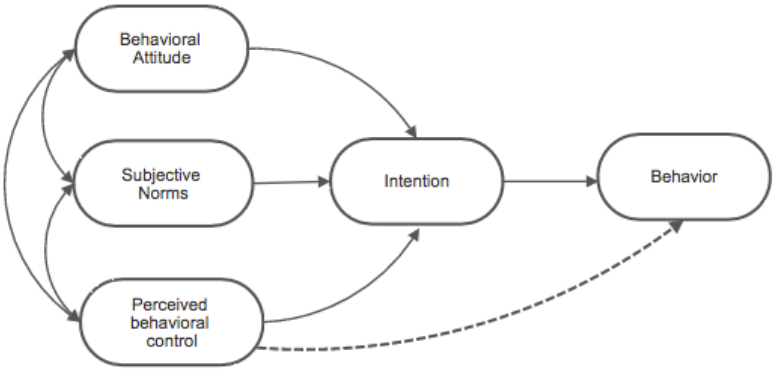

Figure 1. Theory of Planned Behavior, (Ajzen, 1991)

Defined by Ajzen (2006), attitude is measured as a level or degree of how the behavior is positively or negatively valued; it is determined by behavioral beliefs; and attitudes vary by person. Subjective norms are influenced by environmental social pressure and determined by normative beliefs (Ajzen, 2006). The third influential component is the perceived behavioral control. This is in regard to an individual's belief of available resources and opportunities needed to carry out the behavior (Madden, et al., 1992). Behavioral intentions are comprised of attitudes, subjective norms, and perceived behavioral control. Together these intentions represent the ability or capability to perform the actions (Ajzen, 2006).

The Theory of Planned Behavior can be contextualized as the SBAE teacher's behavioral attitude towards agricultural mechanics as their perceived level of importance. The theory explains that behavioral actions are reflected by the behavioral attitude, subjective norms, and perceived behavioral control. These foundational pieces, as suggested by the theory, are what create or evolve the perceived importance of an instructor to teach agricultural mechanics. Importance may be influenced in behavioral attitude and how it is positively or negatively valued by the instructor. Importance may also be determined by behavioral beliefs and may vary by person, or as in this study, may vary by gender.

Purpose and Objectives

The purpose of this study was to describe differences between SBAE teachers' perceived level of importance of teaching agricultural mechanics by gender. This study aligns with Priority Area 3: Sufficient Scientific and Professional Workforce That Addresses the Challenges of the 21st Century of the American Association for Agricultural Education's (AAAE) National Research

Agenda (NRA) (Roberts, et al., 2016) which described the priority for evaluation of competencies "needed to effectively educate, communicate, and lead" (p. 31). Further, Roberts, et al. (2016) inquired in priority number three: "[w]hat competencies are needed for an agriculture and natural resource workforce" (p. 31). When considering recent equity gains by females populating SBAE (Foster et al., 2019) questions of programmatic implementation remains, and as such, guide the following objectives of this study:

1) Determine the self-perceived importance of school-based agricultural education teachers to teach agricultural mechanics by gender.
2) Identify gender differences associated with the school-based agricultural education teachers' perceived importance to teach agricultural mechanics.

Methods

A descriptive research methodology was used to summarize the characteristics of SBAE teachers' perception of the importance to teach agricultural mechanics. This study specifically analyzed participants' perceived level of importance to teach 54 agricultural mechanics skills condensed into five constructs. The researchers utilized a modified, paper-based, questionnaire for the purposes of this study. The paper-based instrument contained three sections. The first section contained 54 selected agricultural mechanics related skills by construct. The construct areas included Mechanics Skills, Structures/Construction, Electricity, Power and Machinery, and Soil and Water. Utilizing a five-point summated rating scale, respondents were asked to rate the 54 agricultural mechanics skills in regard to their perceived level of importance to teach each skill. The options for selection ranged from 'no-need' to 'very strong need'. The second section contained 15 demographic questions related to the agricultural education teacher. The third section consisted of nine questions related to the demographics of the agricultural education teacher's program and school.

A team of five university faculty members with expertise in the fields of agricultural mechanics and agricultural education determined that the content within the instrument was valid for measuring the objectives of this study. Following the suggestions of Dillman, et al. (2009), the initial electronic version of the instrument was pretested through a pilot study with a group of twelve SBAE teachers in a nearby state. Suggestions from the pilot study led researchers to adopt a paper-based, rather than electronic instrument. Instrument reliability was established following the suggestions of Gliem and Gliem (2003) and resulted in acceptable reliability coefficients for competency per construct. *Post hoc* analysis was conducted to examine the construct validity of the instrument. From the analysis, the reliability coefficients were determined for the mechanics, structures/construction, electricity, power and machinery, and soil and water. Overall, the findings show that all the constructs were reliable. Mechanics, r=0.95; structures, r=0.93; electricity, r=0.94; power and machinery, r=0.97, soil and water, r=0.87. Four of the constructs had an excellent reliability ($r > 0.9$); whereas one construct has a good reliability ($r > 0.8$). Construct coefficients are displayed by construct in Table 1.

Table 1

Reliability Coefficients for Importance by Construct Area

Construct Area	Mechanics	Structures/ Construction	Electricity	Power and Machinery	Soil & Water

Importance	0.95	0.93	0.94	0.97	0.87

Note: >.9 – excellent, >.8 – good, >.7 – acceptable, >.6 – questionable, >.5 – poor, <.5-unacceptable (Gliem & Gliem, 2003)

Data were collected from SBAE teachers who attended the Iowa agricultural education teachers' conference through a census study (*N*=130). This audience was purposely targeted because of the ease of having respondents in one place for a given amount of time and the teachers' likelihood to be involved in annual professional development activities. During the conference a print-based survey was distributed to the participants. Each participant was offered a power tool institute safety curriculum as an incentive for completing and returning the questionnaire. This yielded a response rate of 79.2% as 103 of the 130 surveys were returned. With 103 completed questionnaires, the researchers deemed that the census study was large enough to yield some stability in the results (Ferber, 1977). However, to avoid non-response bias and other sampling problems the researchers elected to address non-response error by following the suggestions of Miller and Smith (1983). A Pearson's $\chi 2$ analysis yielded no significant differences ($p > .05$) for gender, age, highest degrees held, years of teaching experience, or size of school community between respondents and the general population of SBAE teachers in Iowa. Data were analyzed using SPSS Statistics 24.0, descriptive statistics (frequencies, percentages, and grand means) were calculated for each of the five constructs. However, due to the nature of this census study, findings should be interpreted with care so as not to extrapolate beyond the target population.

In this study, the average male SBAE teacher (n = 69) was 42 years old, held a bachelor's degree, and had taught for 18 years. The average male teacher completed two agricultural mechanics courses at a four-year university through a traditional teacher training program. The average female SBAE teacher in this study (n = 34) was under 30 years old, had obtained a bachelor's degree, and had taught for less than nine years. The average female teacher completed one agricultural mechanics course in a traditional four-year university teacher training program. Table 2 identifies demographic frequencies by gender.

Table 2

Iowa Secondary Agricultural Teachers Demographic Characteristics

	Males		Females	
Demographic Characteristics	*f*	%	*f*	%
Age				
20-29	16	23.5%	18	52.9%
30-39	16	23.6%	14	41.2%
40-49	8	11.7%	0	0%
50-59	23	33.8%	2	2.9%
60-69	4	5.9%	0	0%
70+	1	1.5%	0	0%
Years taught				
0-9	22	31.9%	27	79.4%
10-19	16	23.2%	6	17.7%
20-29	13	18.8%	1	2.9%
30-39	17	24.7%	0	0%

40+	1	1.4%	0	0%
Alternatively Certified				
Yes	17	25.0%	16	48.5%
No	51	75.0%	17	51.5%
Highest Level of Education				
Bachelor's	42	60.8%	22	64.7%
Master's	27	39.2%	12	35.3%
Trained an Ag Mechanics CDE team				
Yes	33	48%	10	30%
No	36	52%	24	70%

Results

Objective one sought to determine if Iowa SBAE teachers' perceived level of importance to teach agricultural mechanics differed by gender. Table 3 identifies the construct grand means and standard deviations of the perceived level of importance of agricultural mechanics skill constructs by gender. For each construct, males indicated a higher perceived level of importance than did females. The power and machinery construct had the largest mean difference (*MD* = 1.23) between male (*M* = 3.50) and female teachers (*M* = 2.27).

Table 3

Grand Means of Secondary Agricultural Teachers Perceived Importance by Gender by Construct Area

	Males		Females	
Importance Construct	*M*	*SD*	*M*	*SD*
Mechanics	3.15	1.02	2.28	1.06
Structures and Construction	3.76	0.97	2.78	1.24
Electricity	3.04	1.08	2.07	1.13
Power and Machinery	3.50	1.04	2.27	1.23
Soil and Water	2.85	0.95	2.38	1.11

Note. Scale 1 = not important, 2 = slightly important, 3 = moderately important, 4 = important, 5= very important.

Objective two sought to identify the difference between gender and perceived level of importance to teach agricultural mechanics skills within each construct. For example, the mechanics construct consisted of skills related to metalworking, welding, fencing, plumbing, and computer aided design (Table 2). The largest difference was in the skill area of fencing (Table 4) shows female teachers (*M* = 3.15) rating the importance higher than male teachers (*M* = 3.67). The second highest competency difference was in: oxy-acetylene welding with males (*M* = 3.94) ranking importance higher than females (*M* = 3.65); male teachers ranked GTAW welding (TIG) higher than female teachers, (*M* = 3.60 to *M* = 3.89, respectively); while the difference in computer-aided design, saw male teachers (*M* = 3.47) ranking the skill higher than females (*M* = 3.18). Female SBAE teachers identified Oxy-propylene, TIG, Metallurgy, Tool Conditioning, Soldering, and Mechanical Safety as more important than their male counterparts.

Table 4

Means of Secondary Agricultural Teachers Perceived Importance by Gender by Mechanics Skills

	Male			*Female*		
Competency Area	*n*	*M*	*SD*	*n*	*M*	*SD*
Oxy-Acet. Welding	68	3.94	0.896	31	3.65	1.253
Oxy-Acet. Cutting	68	4.21	0.839	32	4.03	0.999
Oxy-Propylene Cutting	54	3.19	1.375	27	3.26	1.163
Plasma Cutting	59	4.15	0.943	30	4.07	1.143
SMAW Welding (Arc)	67	4.34	0.827	31	4.29	1.039
GMAW Welding (MIG)	64	4.34	0.859	31	4.23	1.055
GTAW Welding (TIG)	57	3.60	1.100	27	3.89	1.121
Welding Safety	67	4.75	0.682	32	4.63	0.976
Metallurgy & Metal Work	58	3.17	1.078	28	3.25	1.110
Hot Metal Work	56	3.09	1.164	27	2.89	1.050
Cold Metal Work	56	3.13	1.161	27	2.96	1.126
Tool Conditioning	55	3.25	`1.265	28	3.36	1.193
Oxy-Acet. Brazing	63	3.44	1.147	31	3.19	1.108
Computer-Aided Design	53	3.47	1.137	28	3.18	1.124
Soldering	61	3.34	1.138	29	3.41	1.086
Pipe Cut. & Thread	54	3.20	1.188	28	3.11	1.197
Plumbing	56	3.46	1.235	29	3.31	1.039
Fencing	55	3.15	1.325	27	3.67	1.240
Mechanical Safety	63	4.25	1.031	28	4.29	1.150

Note. Scale 1 = not important, 2 = slightly important, 3 = moderately important, 4 = important, 5= very important.

The structures/construction construct encompasses skills that include operating woodworking equipment to planning of woodworking projects (Table 5). The competency with the largest mean difference (*MD* = 0.52) between male (*M* = 4.12) and female teachers (*M* = 3.83) was the woodworking hand tools competence. The second highest mean difference (*MD* = 0.25) was in woodworking power tools between males (*M* = 4.32) and females (*M* = 4.07). Female SBAE teachers identified Selection of Materials, Bill of Materials, and Construction and Shop Safety as more important than their male counterparts.

Table 5

Means of Secondary Agricultural Teachers Perceived Importance by Gender by Structures/Construction Skills

	Male			*Female*		
Competency Area	*n*	*M*	*SD*	*n*	*M*	*SD*
Woodworking Hand Tools	66	4.12	0.937	30	3.83	0.913
Woodworking Power Tools	66	4.32	0.947	30	4.07	0.828

Drawing and Sketching	60	3.90	1.003	27	3.67	0.784
Concrete	61	3.72	1.051	27	3.56	0.934
Selection of Materials	63	3.98	0.907	28	4.21	0.738
Bill of Materials	65	4.20	0.971	28	4.21	0.833
Fasteners	62	3.77	1.093	27	3.63	1.006
Construction Skills (Carpentry)	64	4.03	1.054	28	3.86	0.803
Construction and Shop Safety	65	4.40	0.844	29	4.59	0.682

Note. Scale 1 = not important, 2 = slightly important, 3 = moderately important, 4 = important, 5= very important.

The electricity construct competencies were related to safety, residential wiring, and electrical motors is displayed in Table 6. The competency with the largest mean difference (*MD* = .51) between males (*M* = 4.03) and females (*M* = 3.52) was with the wiring skills competency. The second highest competency mean difference (*MD* = .33) was in electrician tools between males (*M* = 3.85) and females (*M* = 3.52). Female SBAE teachers identified Type of Electrical Motors more important than their male counterparts.

Table 6

Means of Secondary Agricultural Teachers Perceived Importance by Electricity Skills by Gender

	Male			*Female*		
Competency Area	*n*	*M*	*SD*	*n*	*M*	*SD*
Electricity Controls	59	3.63	1.113	30	3.50	1.167
Wiring Skills	62	4.03	1.071	29	3.52	1.090
Electrician Tools	61	3.85	1.046	29	3.52	1.090
Type of Electrical Motors	58	3.36	1.238	29	3.38	1.208
Cleaning Motors	55	3.33	1.277	28	3.32	1.156
Electrical Safety	60	4.22	1.091	29	4.14	1.093

Note. Scale 1 = not important, 2 = slightly important, 3 = moderately important, 4 = important, 5= very important.

The power and machinery construct included competencies related to small engines, tractors, machinery, and safety and is reported in Table 7. The competency with the largest mean difference (*MD* = .51) between males (*M* = 4.08) and females (*M* = 3.57) was with the small engine overhaul competency. The second highest competency mean difference (*MD* = .33) was in small engine services – 4 cycle between males (*M* = 4.11) and females (*M* = 3.79). The third highest competency mean difference (*MD* = . 28) was in small engine services – 2 cycle between males (*M* = 3.97) and females (*M* = 3.69). Female SBAE teachers identified Tractor Selection, Tractor Operation, Tractor Safety, Tractor Driving, and Power & Machinery Safety as more important than their male counterparts.

Table 7

Means of Secondary Agricultural Teachers Perceived Importance by Power & Machinery Skills by Gender

	Male			*Female*		
Competency Area	*n*	*M*	*SD*	*n*	*M*	*SD*
Small Engine Services – 2 cycle	61	3.97	0.948	29	3.69	1.228
Small Engine Services – 4 cycle	62	4.11	0.925	28	3.79	1.166
Small Engine Overhaul	60	4.08	0.996	28	3.57	1.168
Small Engine Safety	62	4.32	0.845	28	4.29	0.937
Tractor Service	59	3.69	1.087	26	3.42	1.238
Tractor Maintenance	58	3.79	1.104	27	3.63	1.149
Tractor Overhaul	57	3.33	1.155	27	3.07	1.072
Tractor Selection	55	3.31	1.120	27	3.33	1.240
Tractor Operation	57	3.42	1.133	27	3.44	1.155
Tractor Safety	59	3.90	1.155	27	4.07	1.238
Tractor Driving	58	3.47	1.203	27	3.59	1.309
Service Machinery	58	3.57	1.011	27	3.48	1.252
Machinery Selection	57	3.46	1.036	27	3.44	1.188
Machinery Operation	58	3.48	1.096	27	3.48	1.156
Power & Machinery Safety	60	3.97	1.104	27	4.04	1.344

Note. Scale 1 = not important, 2 = slightly important, 3 = moderately important, 4 = important, 5= very important.

The soil and water construct included competencies related to precision agriculture, surveying, and legal land descriptions is displayed in Table 8. The competency with the largest mean difference (*MD* = .24) between male (*M* = 4.05) and female teachers (*M* = 3.81) was with the legal land descriptions competence. The second highest competency mean difference (*MD* = .21) was in profile leveling between males (M = 3.06) and females (M = 3.27). Female SBAE teachers identified all skills except Legal Land Descriptions as more important than their male counterparts.

Table 8
Means of Secondary Agricultural Teachers Perceived Importance by Soil & Water Skills by Gender

	Male			*Female*		
Competency Area	*n*	*M*	*SD*	*n*	*M*	*SD*
Global Positioning Systems	60	4.18	0.873	30	4.33	0.959
Use of Survey Equipment	60	3.65	1.071	29	3.72	1.099
Differential Leveling	53	3.19	1.194	26	3.38	1.134
Profile Leveling	53	3.06	1.117	26	3.27	1.218
Legal Land Descriptions	61	4.05	0.939	31	3.81	1.167

Note. Scale 1 = not important, 2 = slightly important, 3 = moderately important, 4 = important, 5= very important.

Conclusions and Recommendations

Objective one sought to determine Iowa SBAE teachers' perceived level of importance to teach 54 agricultural mechanics skills through five construct skill areas by gender. We conclude that inequalities among gender in agricultural mechanics exist. We also found that male teachers identified four constructs as mostly important and one construct as somewhat important while female teachers identified all constructs as slightly important. Female SBAE teachers further identified structures and construction (M=2.78) as the most important construct whereas the least important construct identified by male teachers was soil and water (M=2.85). It is important to note that the least important construct identified by male teachers, was higher than the most important construct identified by female teachers.

This study does not answer the question of why male SBAE teachers perceive a higher level of importance than female SBAE teachers in the teaching of agricultural mechanics. Recommendations for future research include implementing qualitative studies to evaluate the perceived importance from both male and female SBAE teachers. Similar recommendations follow Harrison, et al. (1993) in promoting a positive image among colleagues to increase outcomes for the female educators in relation to the agricultural mechanics program.

Although male and female respondents in our study identified the importance of the constructs differently, the theme of safety within constructs was identified as highly important by both genders. Four out of six safety skills were identified as the highest; the remaining two safety skills were rated highly as well. These findings align with Saucier, et al.'s (2014) research supporting the conclusion that safety skills are critically important in agricultural mechanics laboratory settings. Further, we recommend pre-service and in-service SBAE education programs be used as tools for continued education in safety (Saucier, at el., 2014) so that continued support of high importance is maintained from agricultural mechanics instructors.

Objective two sought to identify the difference between gender and perceive level of importance to teach agricultural mechanics skills within each construct. In the welding construct, all respondents identified the traditional welding skill areas as the most important to teach in SBAE programs. Male teachers identified GMAW welding (MIG) the highest; closely followed by female teachers in SMAW welding (Arc). School-based agricultural educators are still dedicated to the hands-on learning approach. The emerging areas of computer-aided design and plasma cutting are behind the traditional skills. In the soil and water construct, the skill of global positioning systems was identified as the highest by both genders. Will we see a change of importance in curriculum as the agricultural mechanics industry changes with technology? Recommendations include follow-up studies in the skills related to technology in agricultural mechanics.

While both male and female SBAE teachers reported both GMAW and SMAW welding as some of the most important skills, it should be noted that one of the least important skills identified was metallurgy and metal working. This leads the researchers to ponder why SBAE teachers in this study viewed welding as important, yet tend to be leaning away from the scientific approaches by not recognizing metallurgy as important? Further, both male and female teachers identified hot and cold metal work as two of the least important skills reported. This leads the researchers to ponder if those skills are viewed as outdated or should be left to industrial technology education programs.

In the skill area of structures and construction, male SBAE teachers identified hand and power tools as highly important while female teachers identified selection and bill of materials as highly important. Male teachers identified the tools needed, where female teachers identified the planning as highly important. In the electricity construct similarities among male and female teachers occurred. Both genders identified wiring skills as highly important with electrician tools close to follow. In this construct, learning the skills was more important than learning the tools needed to perform the skills. Can school-based agricultural mechanics skills, *the doing,* be taught prior to the knowledge *of tools needed* or do the teachers view teaching tools not as important as teaching the skills because the students will learn about the tools while they learn the skills? If students do not have the proper tools, can they learn the proper skills? Further research in the discrepancy between the importance of tools and skills should be pursued (McCubbins, et al., 2016).

Both genders identified 2- and 4-cycle small engine services as highly important. Both genders also identified the small engine overhaul skill area as important. It should be interesting to note that tractor overhaul was rated as one of the least important skills in the power & machinery skills construct. This is particularly interesting considering the popularity of the FFA tractor restoration competitions at the county and state fair level in Iowa. Is there a correlation between high-school agricultural mechanics instructors' perceived level of importance to teach the power and machinery construct and the popularity of the FFA tractor restoration project area? Further research is warranted in this and related areas. The researchers recommend the findings of this study be shared with agricultural education teacher preparation programs in support that teachers continue to receive the proper education for agricultural mechanics.

Further research to determine SBAE teachers' behavioral intentions (Madden, et al., 1992) should be implemented to determine the underlying variables associated with the gender differences found in this study related to the perceived level of importance of various agricultural mechanics competencies. Once identified, specific attitudes and subjective norms that lead towards perceived behavior control could be integrated into preservice educational curriculum as well as into in-service training related to agricultural mechanics. Once in place, this should further establish gender equity into the implementation of one of the "the most useful courses taught" in agricultural education (Herren, 2015).

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Are Selection Processes Allowing Talent Diverse Members Advance Through the Leadership Ranks of FFA?

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Abstract
As a student-led organization, the National FFA Organization and the selection of student leaders is an essential element of its continuation and success. As the National FFA Organization continues to strive to provide opportunities for personal growth and premier leadership, considerations to member advancement through selection criteria at the state level ultimately increases awareness of the potential end products of these criteria - - the students. The purpose of this study was to identify the self-identified talents among state FFA officers using data collected by the National FFA Organization. All state FFA associations are provided, free of charge, the opportunity for state FFA officers to utilize the Clifton StrengthsFinder® assessment. Once a student completes the assessment, the signature top five themes of talent are recorded and made available to the National FFA Organization. This research design utilizes a convenience sample of participating state FFA officers in the Clifton StrengthsFinder® assessment tool. After compiling the themes, additional data was collected on the election process each state FFA association uses to select state FFA officers. Each selection process yielded the same top ten talents: Achiever, Restorative, Responsibility, Includer, Learner, Belief, Positivity, WOO, Input, and Communication. This indicated no differential between the type of selection process utilized and the strengths state FFA officers possessed. State and National FFA staff should consider and review each step in the selection process, and if these steps are truly effective at allowing diversely talented members to be authentically represented.

Introduction

The heart of any organization is its members. The National FFA Organization is a student-led organization, with an essential element of its success is the selection of student leaders. Research has shown that state FFA officer leadership programs provide the opportunity for professional and personal development while instilling a positive sense of self and abilities (Hoover & Bruce, 2006). Additional research highlights the necessity for leadership opportunities to continue to help each student understand oneself and how to interact with others (Horstmeier & Nall, 2007). As outlined by the American Association for Agricultural Education (AAAE, 2023) in the Agricultural Education National Research Agenda in Priority Area 3, Sufficient Scientific and Professional Workforce that Addresses the Challenges of the 21st Century, the need exists to investigate soft skill development. As the National FFA Organization continues to strive to

provide opportunities for personal growth and premier leadership, considerations of member advancement through selection criteria on the state level ultimately increased awareness of potential student outcomes.

Student leader selection and impact has been no stranger to the agricultural education community. Several articles described below report the details, importance, best practices, and impact in selection of FFA leadership teams and their function. In 1978, issue one, volume 50 of *The Agricultural Education Magazine* was dedicated to FFA Leaders. One article identified that students often have a lack of confidence and keep abilities hidden or can't identify their strengths, and FFA provides opportunities to discover themselves (Jensen, 1978). Another article in that same issue notes the value in identifying personality characteristics of leaders that may provide insight into the type of student leader they may become (Cox & McCormick, 1978). Jensen goes on to further discuss how difficult it is to measure and place a value on these leadership experiences (1978).

In November of 1991, another entire issue of *The Agricultural Education Magazine* was dedicated to the theme "Impact of FFA Leadership". Gartin (1991) discussed the benefit of students recognizing their own leadership style, the strengths and weaknesses of this style, and provided insight to appreciate the strengths of others, leading to helping groups become more effective and more productive. Various practices and tips were identified throughout this issue dedicated to FFA leadership. Peters (1991) provided discussion on the importance and success of assisting students through a mentoring program where older students or members provide support and guidance to younger ones. Types of leadership styles and their impact on students were also considered (Barrett, 1991). Further implications were noted for teachers and students to consider throughout this issue. Barrett noted how "[h]elping students develop confidence and an understanding of their strengths and weaknesses as leaders will go a long way in achieving the aim of leadership development" (1991, p. 11). Woodard and Herren (1991) discussed the leadership impact of the officer team and noted that it is necessary for advisors to help students realize the importance of being an authentic team member, willing to work and lead along with the team.

Development of state FFA officers was considered by Hoover and Bruce (2006) where they took a deeper look at the long-term consequences associated with serving as a state FFA officer in Pennsylvania. Results indicated that holding a state level FFA office engaged youth in self-exploration, discovery of strengths and weaknesses, in addition to providing an avenue to receive recognition for competence, support of positive adolescent development, transference of leadership skills, and purposeful civic and community engagement (Hoover & Bruce, 2006). Considerations for future leader development was the scope of examining National FFA officer candidate preparation where several factors were identified as important and could result in an individual's enhancement of preparation (Hoover & Atwater, 2005).

There are various leadership assessments and tools available to utilize for leadership development. One such tool is the Clifton StrengthsFinder ® web-based assessment tool, that measures the presence of 34 natural talents organized into themes (Clifton, et al., 2006). Table 1 provides a description of all 34 themes of talent. A theme is a category of talents, which are defined as recurring and consistent patterns of thought, feeling, or behavior (Buckingham &

Clifton, 2001). The intentional purpose of the assessment is to nurture personal growth through discussion with others by increasing self-awareness (Asplund, et al., 2009). Talent awareness leads to a greater understanding on one's abilities and potential strengths. Collaboration and cooperative learning can both benefit from strengths awareness. "Talking together about how your talents complement one another can lead to what is called 'synergy' – the tremendous result that occurs when a group of people discover and maximize their talents as a team, rather than simply contribute their talents as separate individuals" (Clifton, et al., 2006, p. 87-88).

Table 1

Clifton StrengthsFinder® themes of talent

Talent	Definition
Achiever®	People exceptionally talented in the Achiever theme work hard and possess a great deal of stamina. They take immense satisfaction in being busy and productive.
Activator®	People exceptionally talented in the Activator theme can make things happen by turning thoughts into action. They are often impatient.
Adaptability®	People exceptionally talented in the Adaptability theme prefer to go with the flow. They tend to be "now" people who take things as they come and discover the future one day at a time.
Analytical®	People exceptionally talented in the Analytical theme search for reasons and causes. They have the ability to think about all the factors that might affect a situation.
Arranger™	People exceptionally talented in the Arranger theme can organize, but they also have a flexibility that complements this ability. They like to determine how all of the pieces and resources can be arranged for maximum productivity.
Belief®	People exceptionally talented in the Belief theme have certain core values that are unchanging. Out of these values emerges a defined purpose for their lives.
Command®	People exceptionally talented in the Command theme have presence. They can take control of a situation and make decisions.
Communication®	People exceptionally talented in the Communication theme generally find it easy to put their thoughts into words. They are good conversationalists and presenters.
Competition®	People exceptionally talented in the Competition theme measure their progress against the performance of others. They strive to win first place and revel in contests.
Connectedness®	People exceptionally talented in the Connectedness theme have faith in the links among all things. They believe there are few coincidences and that almost every event has meaning.
Consistency™	People exceptionally talented in the Consistency theme are keenly aware of the need to treat people the same. They try to treat everyone with equality by setting up clear rules and adhering to them.
Context®	People exceptionally talented in the Context theme enjoy thinking about the past. They understand the present by researching its history.

Deliberative™	People exceptionally talented in the Deliberative theme are best described by the serious care they take in making decisions or choices. They anticipate obstacles.
Developer®	People exceptionally talented in the Developer theme recognize and cultivate the potential in others. They spot the signs of each small improvement and derive satisfaction from evidence of progress.
Discipline™	People exceptionally talented in the Discipline theme enjoy routine and structure. Their world is best described by the order they create.
Empathy™	People exceptionally talented in the Empathy theme can sense other people's feelings by imagining themselves in others' lives or situations.
Focus™	People exceptionally talented in the Focus theme can take a direction, follow through, and make the corrections necessary to stay on track. They prioritize, then act.
Futuristic®	People exceptionally talented in the Futuristic theme are inspired by the future and what could be. They energize others with their visions of the future.
Harmony®	People exceptionally talented in the Harmony theme look for consensus. They don't enjoy conflict; rather they seek areas of agreement.
Ideation®	People exceptionally talented in the Ideation theme are fascinated by ideas. They are able to find connections between seemingly disparate phenomena.
Includer®	People exceptionally talented in the Includer theme accept others. They show awareness of those who feel left out and make an effort to include them.
Individualization®	People exceptionally talented in the Individualization theme are intrigued with the unique qualities of each person. They have a gift for figuring out how different people can work together productively.
Input®	People exceptionally talented in the Input theme have a craving to know more. Often they like to collect and archive all kinds of information.
Intellection®	People exceptionally talented in the Intellection theme are characterized by their intellectual activity. They are introspective and appreciate intellectual discussions.
Learner®	People exceptionally talented in the Learner theme have a great desire to learn and want to continuously improve. The process of learning, rather than the outcome, excites them.
Maximizer®	People exceptionally talented in the Maximizer the focus on strength as a way to stimulate personal and group excellence. They seek to transform something strong into something superb.
Positivity®	People exceptionally talented in the Positivity theme have contagious enthusiasm. They are upbeat and can get others excited about what they are going to do.
Relator®	People exceptionally talented in the Relator theme enjoy close relationships with others. They find deep satisfaction in working hard with friends to achieve a goal.
Responsibility®	People exceptionally talented in the Responsibility theme take psychological ownership of what they say they will do. They are committed to stable values such as honesty and loyalty.

Restorative™	People exceptionally talented in the Restorative theme are adept at dealing with problems. They are good at figuring out what is wrong and resolving it.
Self-Assurance™	People exceptionally talented in the Self-Assurance theme feel confident in their ability to manage their own lives. They possess an inner compass that gives them confidence that their decisions are right.
Significance™	People exceptionally talented in the Significance theme want to be very important in others' eyes. They are independent and want to be recognized.
Strategic™	People exceptionally talented in the Strategic theme create alternative ways to proceed. Faced with any given scenario, they can quickly spot the relevant patterns and issues.
WOO™	People exceptionally talented in the Woo theme love the challenge of meeting new people and winning them over. They derive satisfaction from breaking the ice and making a connection with someone.

Conceptual Framework

Strengths-based leadership serves as the first piece of framework for this research. As strengths research progressed, the idea to consider how an individual's strengths impacted team dynamics and effectiveness gave way to broader groupings of strengths. From this idea Rath & Conchie (2008) identified "four distinct domains of leadership strength…. Executing, Influencing, Relationship Building, and Strategic Thinking" (p. 23) and are outlined in Table 2. The concepts behind the domains of leadership strength embraced the fact that each person is unique to their talents, and when talents were combined with team members, if spread across the domains and usually provided a more successful team experience.

Table 2

Strengths-based domains of leadership

Executing	Influencing	Relationship Building	Strategic Thinking
Achiever	Activator	Adaptability	Analytical
Arranger	Command	Developer	Context
Belief	Communication	Connectedness	Futuristic
Consistency	Competition	Empathy	Ideation
Deliberative	Maximizer	Harmony	Input
Discipline	Self-assurance	Includer	Intellection
Focus	Significance	Individualization	Learner
Responsibility	WOO	Positivity	Strategic
Restorative		Relator	

Strengths Based Leadership: Great Leaders, Teams, and Why People Follow (Rath & Conchie, 2008, p. 24).

"Leaders with dominant strength in the Executing domain know how to make things happen" (Rath & Conchie, 2008, p. 24). These types of people produce results, get things done and will work until the task or project is completed. "Those who lead by Influencing, help their team reach a much broader audience" (Rath & Conchie, 2008, p. 25). The people who are strong in the Influencing domain, will be successful in spreading the key messages and principles of the

organization both inside and out. "Those who lead through Relationship Building are the essential glue that holds a team together" (Rath & Conchie, 2008, p. 25). These types of people will bring teams and efforts together and will commonly produce a higher yield. "Leaders with great Strategic Thinking strengths are the ones who keep us all focused on what could be" (Rath & Conchie, 2008, p. 26). These types of people on a team push and stretch thinking, often leading to better team decisions and outcomes. A focus on the strengths approach is more about authenticity, not positive or negative, but truly authentic self-discovery (Welch, et al., 2014).

Authentic leadership provides the second framework of this study. Diddams and Chang (2012) discussed, "authentic leadership holds great promise for producing effective leaders who are oriented toward the service of others" (p. 600). Luthans and Avolio (2003) outlined authentic leadership in the context of an organization as "a process that draws from both positive psychological capacities and a highly developed organizational context, which results in both greater self-awareness and self-regulated positive behaviors on the part of leaders" (p. 243). A more prevalent, well-encompassed definition established in 2008, as part of the authentic leadership research agenda.

Authentic leadership is a pattern of leader behavior that draws upon and promotes both positive psychological capacities and a positive ethical climate, to foster greater self-awareness, an internalized moral perspective, balanced processing of information, and relational transparency on the part of leaders working with followers, fostering positive self-development. (Walumbwa, et al., 2008, p. 94)

One component, a leader's self-awareness, has been widely agreed upon as the beginning of authentic leadership development across these variances in interpretation of authentic leadership (Avolio & Gardner, 2005). Student leaders demonstrating true authentic leadership should begin with self-awareness of one's own abilities and skills. Avolio and Gardner's (2005) key distinction of authentic leaders was how "authentic leadership can help develop and shape a strength-based organization" (p. 334).

Purpose and Objectives

Each state association in the National FFA organization evaluates and selects state level, student leaders in varying election formats. Analyzing if there is a relationship in student leadership strengths compared to the type of selection tools utilized to choose state officers was the focus of this study. The National FFA Organization provides state leaders with the opportunity, free of charge, to complete the Clifton StrenghtFinder® assessment. State FFA officers also have the opportunity to complete rigorous training through a leadership curriculum. Some states actively utilize strengths development and resources throughout the year of office, while others do not utilize the Clifton StrengthsFinder® assessment or the program. The data from the state officers that have completed the assessment provided by the National FFA Organization has been collected since 2006, except for 2011. The data have not been analyzed and used to propel student leadership development forward.

The purpose of this study was to identify and explore self-identified talents among state FFA officers using data collected by the National FFA Organization. The first objective was to analyze state FFA officers' talents according to the strengths-based domains of leadership utilizing the Clifton StrengthsFinder® The second objective was to compare the top five talent themes of state FFA officers utilizing the Clifton StrengthsFinder® assessment data to the state

selection process utilized to elect said officers. This objective allows researchers to investigate the spectrum of diversity in the talents of student leaders in the organization on the state level in relationship to the process utilized to elect student leader assessment data. The third objective of this study was to identify the election process used in the selection of state FFA officers.

Methodology

All states FFA associations are provided, free of charge, the opportunity for state FFA officers to utilize the Clifton StrengthsFinder® assessment. Once a student completes the assessment, the signature top five themes of talent are recorded and made available to the state associations and are compiled by the National FFA Organization, and if provided by participating officers or state association, the state demographic were also recorded. If sought by the student or staff, some additional resources are available to assist the officer and association with further development and information regarding each officers' talents. According to Clifton et al. (2006) in *StrengthsQuest* the Clifton StrengthsFinder® is a web-based talent assessment consisting of 180 item-pairs (with five response options). Clifton et al. further states that the participant is then asked to choose from a pair of statements that best describes him or her, and to the extent to which that chosen option is descriptive of him or her. The participant is given 20 seconds to respond to each pair of items before the system moves on to the next item-pair. Upon completion, the respondent receives feedback including his or her top five themes and related action items. Coming to know, understand, and value talents, have the ability to develop into strengths and can lead to achieving team success (Clifton, et al., 2006). The Clifton StrengthsFinder® assessment is based on positive psychology and has been used in understanding individuals in a variety of situations including student, team and personal development (Asplund, et al., 2009). Interviews administered by Gallup analysts to more than two-million individuals were reviewed and generated into data that was used to capitalize on the accumulated knowledge and experience of strengths-based practice (Asplund, et al., 2009). Currently, the assessment is available in over 20 different languages, and after a revision in 2006, these 180 items were reduced to 177 and were grouped into 34 themes, listed in Table 1 (Clifton, et al., 2006). After compiling the themes, additional data was collected on the process by which state FFA officers were selected.

The research design utilizes a convenience sample of participating state FFA officers who were administered the Clifton StrengthsFinder® assessment tool. The data was organized in Microsoft® Excel and then analyzed using JMP for descriptive statistics. In some state associations, regional officers or presidents are considered state FFA officers, and thus train together. Unfortunately, the number of total State FFA officers is not reported each year. The numbers are not static; therefore, the exact percent of the total population is not available to report.

The Clifton StrengthsFinder® assessment has been vetted through aspects of validity, reliability and consistency. Content validity has shown evidence of strength in its results, as well as deeper exploration into construct validity has shown no problem with multicollinearity (Asplund, et. al., 2009). Schreiner (2006) measured construct validity in two ways, comparing Clifton StrengthsFinder® student results to the same students taking two similar inventories, the California Psychological Inventory (Gough & Bradley, 1996) and the 16PF (Cattell, 1993). These predictions were confirmed by significant correlation coefficients (93.4%). Additionally

the average item clustering percentage across all possible theme pairs was 90% (Schreiner, 2006). Several studies exist that have examined the overall usefulness of the instrument, and such evidence to strongly support positive utility is easily found across a number of outlets (Clifton & Harter, 2003; Schreiner, 2006; Bayer, 2012; Lane & Chapman, 2011; Stebleton,et al., 2012; Wisner, 2011; Gillum, 2005; Lehnert, 2009).

Two types of reliability estimates were used to examine the Clifton StrengthsFinder®, internal consistency using Cronbach's alpha and test-retest reliability (Asplund, et al, 2009). Test-retest correlations were generally consistent; however, the reliability of the score profile is also critical, and a Chi-Square test of independence was conducted on each theme (Asplund, et al., 2009). The results of this test indicated that 33 of the 34 themes had significant results, indicating evidence of stability for those themes. However, one theme, self-assurance, was less stable over time in this study (Asplund, et al., 2009). Test-retest was also examined by Schreiner (2006) and performed like other similar instruments.

Results

The first objective of this study was to analyze state FFA officers' talents according to the strengths-based domains of leadership utilizing the Clifton StrengthsFinder®. Throughout the entire data collection period when the 3,283 state FFA officers' top five themes of talent were grouped and counted into the four leadership domains identified in strengths-based leadership, the results (Table 3) show most talents fell in the executing domain (32.87%). The influencing domain was ranked as the lowest of the five talents at 17.88%.

Table 3

StrengthFinders Leadership Domain Themes of State FFA Officers

Domain	*f*	%
Executing	5395	32.87
Relationship Building	4498	27.40
Strategic Thinking	3587	21.85
Influencing	2935	17.88

The second objective was to compare the top five talent themes of state FFA officers utilizing the Clifton StrengthsFinder® assessment data with the state selection process utilized to elect said officers. In Table 4, all student data (*N*=1,642) that corresponds to the participating states that employed a state FFA officer application as a component of the selection process, is displayed. Notably, the top ten most frequently occurring talents were: Achiever, Responsibility, Restorative, Includer, Learner, Belief, Positivity, WOO, Input and Communication. While the ten least frequently reported talents were: Activator, Empathy, Analytical, Consistency, Connectedness, Deliberative, Self-Assurance, Maximizer, Intellection, and Command.

Table 4

StrengthFinders Themes of State Officers Who were Elected Through Applications.

Strength	*f*	%	Strength	*f*	%
Achiever	611	37.21	Arranger	213	12.97
Responsibility	529	32.22	Relator	192	11.69
Restorative	527	32.10	Context	161	9.81
Includer	492	29.96	Significance	147	8.95
Learner	437	26.61	Ideation	144	8.77
Belief	407	24.79	Focus	134	8.16
Positivity	392	23.87	Discipline	128	7.80
WOO	365	22.23	Activator	114	6.94
Input	324	19.73	Empathy	113	6.88
Communication	302	18.39	Analytical	101	6.15
Strategic	294	17.90	Consistency	94	5.72
Developer	287	17.48	Connectedness	88	5.36
Futuristic	284	17.30	Deliberative	86	5.24
Harmony	247	15.04	Self-Assurance	77	4.69
Adaptability	244	14.86	Maximizer	71	4.32
Competition	243	14.80	Intellection	69	4.20
Individualization	226	13.76	Command	67	4.08

In Table 5, all student data (N=1,643) that corresponds to the participating states that employed a state FFA officer interview as a component of the selection process is displayed. Notably, the top ten most frequently occurring talents were: Achiever, Responsibility, Restorative, Includer, Learner, Belief, Positivity, WOO, Input and Communication. While the ten least frequently reported talents were: Activator, Empathy, Analytical, Consistency, Connectedness, Deliberative, Self-Assurance, Maximizer, Intellection, and Command.

Table 5

StrengthFinders Themes of State Officers Who Were Elected Through Interview Processes

Strength	*f*	%	Strength	*f*	%
Achiever	612	37.25	Arranger	213	12.96
Responsibility	529	32.20	Relator	192	11.69
Restorative	528	32.14	Context	161	9.80
Includer	492	29.95	Significance	147	8.95
Learner	437	26.60	Ideation	144	8.76
Belief	408	24.83	Focus	134	8.16
Positivity	392	23.86	Discipline	128	7.79
WOO	365	22.22	Activator	114	6.94
Input	324	19.72	Empathy	113	6.88
Communication	302	18.38	Analytical	101	6.15
Strategic	294	17.89	Consistency	94	5.72
Developer	287	17.47	Connectedness	88	5.36
Futuristic	285	17.35	Deliberative	86	5.23

Strength	*f*	%	Strength	*f*	%
Harmony	247	15.03	Self-Assurance	77	4.69
Adaptability	245	14.91	Maximizer	71	4.32
Competition	243	14.79	Intellection	69	4.20
Individualization	226	13.76	Command	67	4.08

In Table 6 student (*N*=1,058) data that corresponds to the known participating states that utilize a state FFA officer slate as a component of the selection process is displayed. The top ten most frequently occurring talents were: Achiever, Responsibility, Restorative, Includer, Learner, Positivity, WOO, Belief, Input and Communication. While the ten least frequently reported talents were: Empathy, Activator, Analytical, Consistency, Deliberative, Connectedness, Self-Assurance, Intellection, Maximizer, and Command.

Table 6

StrengthFinders Themes of State Officers Who Were Elected Through a Slate Election Process.

Strength	*f*	%	Strength	*f*	%
Achiever	369	34.88	Arranger	139	13.14
Responsibility	334	31.57	Relator	121	11.44
Restorative	334	31.57	Context	109	10.30
Includer	314	29.68	Ideation	102	9.64
Learner	280	26.47	Significance	95	8.99
Positivity	261	24.67	Discipline	92	8.70
WOO	244	23.06	Focus	84	7.94
Belief	241	22.78	Empathy	79	7.47
Input	220	20.79	Activator	70	6.62
Communication	203	19.19	Analytical	67	6.33
Strategic	189	17.86	Consistency	60	5.67
Developer	187	17.67	Deliberative	53	5.01
Futuristic	186	17.58	Connectedness	51	4.82
Harmony	162	15.31	Self-Assurance	49	4.63
Competition	161	15.22	Intellection	48	4.54
Adaptability	156	14.74	Maximizer	45	4.25
Individualization	144	13.61	Command	41	3.88

In Table 7, all student (*N*=826) data that corresponds to the known participating states that utilize a state FFA officer slate with an immediate vote to accept slate as a component of the selection process is displayed. The top ten most frequently occurring talents were: Achiever, Restorative, Responsibility, Includer, Belief, Learner, Positivity, WOO, Communication, and Input. While the ten least frequently reported talents were: Activator, Focus, Consistency, Analytical, Deliberative, Maximizer, Connectedness, Intellection, Self-Assurance, and Command.

Table 7

StrengthFinders Themes of State Officers Who Were Elected Through Immediate Vote of

Accepted Slate.

Strength	*f*	%	Strength	*f*	%
Achiever	289	34.99	Arranger	103	12.47
Restorative	282	34.14	Relator	100	12.11
Responsibility	268	32.45	Ideation	85	10.29
Includer	241	29.18	Context	82	9.93
Belief	208	25.18	Discipline	76	9.20
Learner	205	24.82	Empathy	63	7.63
Positivity	194	23.49	Significance	61	7.38
WOO	185	22.40	Activator	57	6.90
Communication	162	19.61	Focus	57	6.90
Input	159	19.25	Consistency	54	6.54
Developer	154	18.64	Analytical	49	5.93
Strategic	150	18.16	Deliberative	47	5.69
Futuristic	149	18.04	Maximizer	40	4.84
Adaptability	133	16.10	Connectedness	39	4.72
Harmony	131	15.86	Intellection	33	4.00
Competition	110	13.32	Self-Assurance	31	3.75
Individualization	105	12.71	Command	28	3.39

In Table 8, all student data (*N*=578) that corresponds to the known participating states that utilize a popular vote per individual office for selection of state FFA officers as a component of the selection process is displayed below. The top ten most frequently occurring talents were: Achiever, Responsibility, Includer, Restorative, Learner, WOO, Belief, Positivity, Input, and Communication. While the ten least frequently reported talents were: Empathy, Discipline, Analytical, Connectedness, Self-Assurance, Consistency, Deliberative, Intellection, Maximizer, and Command.

Table 8

StrengthFinders Themes of State Officers Who Were Elected Through Popular Vote Per Individual Office.

Strength	*f*	%	Strength	*f*	%
Achiever	214	37.02	Arranger	66	11.42
Responsibility	173	29.93	Context	62	10.73
Includer	172	29.78	Significance	59	10.21
Restorative	170	29.41	Relator	56	9.69
Learner	158	27.34	Focus	47	8.13
WOO	146	25.26	Ideation	46	7.96
Belief	143	24.74	Activator	45	7.79
Positivity	137	23.70	Empathy	42	7.27
Input	115	19.90	Discipline	38	6.57
Communication	110	19.03	Analytical	36	6.23
Strategic	108	18.69	Connectedness	36	6.23
Competition	102	17.65	Self-Assurance	31	5.36
Futuristic	102	17.65	Consistency	29	5.02

Strength	*f*	%	Strength	*f*	%
Developer	96	16.61	Deliberative	28	4.84
Adaptability	87	15.05	Intellection	28	4.84
Individualization	87	15.05	Maximizer	22	3.81
Harmony	80	13.84	Command	19	3.29

In Table 9, all student data (*N*=690) that corresponds to the known participating states that utilize on convention stage speeches and/or rounds for selection of state FFA officers as a component of the selection process is displayed below. The top ten most frequently occurring talents were: Achiever, Responsibility, Restorative, Includer, Learner, Belief, WOO, Positivity, Input, and Communication. While the ten least frequently reported talents were: Empathy, Connectedness, Analytical, Discipline, Deliberative, Consistency, Self-Assurance, Intellection, Command, and Maximizer.

Table 9

StrengthFinders Themes of State Officers Who Were Elected Through Convention Onstage Speeches and/or rounds.

Strength	*f*	%	Strength	*f*	%
Achiever	253	36.67	Arranger	85	12.32
Responsibility	224	32.46	Relator	77	11.16
Restorative	224	32.46	Context	68	9.86
Includer	211	30.58	Significance	65	9.42
Learner	183	26.52	Ideation	56	8.12
Belief	177	25.65	Focus	52	7.54
WOO	173	25.07	Activator	51	7.39
Positivity	169	24.49	Empathy	50	7.25
Input	137	19.86	Connectedness	44	6.38
Communication	134	19.42	Analytical	41	5.94
Strategic	128	18.55	Discipline	40	5.80
Developer	127	18.41	Deliberative	35	4.07
Futuristic	108	15.65	Consistency	34	4.93
Competition	106	15.36	Self-Assurance	31	4.49
Adaptability	100	14.49	Intellection	29	4.20
Individualization	97	14.06	Command	23	3.33
Harmony	96	13.91	Maximizer	22	3.19

The third objective of this study was to identify the election process used in the selection of state FFA officers. Table 10 outlines the election process used to select state FFA officers. A variety of selection process tools are utilized across the National FFA Organization's member associations. Of the 52 total state associations including Puerto Rico and the U.S. Virgin Islands in the National FFA organization, this information is known to 49 of those associations. When considering these results, 49 used an interview process, 48 used a state officer application, 30 utilized a slate of state officers, 24 held an immediate vote to accept slate, 20 held some type of on convention stage speeches and/or rounds and 16 held a popular vote per officer position. It is noteworthy to explain that each state association may use any or all of these methods. While

there may be additional components to each individual association's selection process, these are the most easily and commonly identified and grouped components.

Table 10

State FFA Officer Election Process

Process	*f*	%
Interview	49	100
Application	48	98
Officer Slate	30	61
Slate with Immediate Vote	24	49
On-Stage Speech with Voting	20	41
Popular Vote	16	33

Limitations

This study has several limitations. The authors first recognize that this study is limited to the states that utilized Strengthfinders. Furthermore, the study is limited to the accuracy of state leader's abilities to remember or correctly identify the election processes used during the data collection period. Finally, this study is limited to the accuracy of the responses provided by the respondents. Did they answer the items that best describe themselves or did they answer the items they would prefer to be identified as possessing. This selection could alter the actual strengths of the individual respondents. Although the instrument used in this study is valid and reliable, the method in which participants were selected to complete the Clifton StrengthsFinder®, was not consistent across all states and is based solely on data provided by the National FFA Organization. Care should be taken in generalizing recommendations from this study to all state FFA Officer training programs.

Conclusions and Discussion

The first objective of this study was to analyze state FFA officers' talents according to the strengths-based domains of leadership utilizing the Clifton StrengthsFinder®. We conclude that the Executing Domain was the most common theme identified among all state officers that completed Strengthfinders while the Influencing Domain was the least common. It is easy to assume the Executing Domain would be one of the most common domains among state officers when you consider Achiever, Belief, Discipline, Focus, and Responsibility are among the nine Executing sub-themes. However, it is quite interesting that the influencing domain was the least common when you consider command, communication, self-assurance, significance, and WOO fall under this theme.

As grouped talents, the domains provide another perspective on these results. Individual state FFA officer strengths collected together and grouped in these domains stir some additional thoughts and questions. The Executing domain provides further information as to how these particular top talent themes work together to potentially benefit the organization. The culture of state officers often reflects this domain, working relentlessly to make things happen (Rath & Conchie, 2008). The Influencing domain weighs in as the least prevalent grouping. Focusing upon the successful spreading the key messages and principles of the organization both inside and out (Rath & Conchie, 2008). What does this mean to the organization? The heart of the state

FFA officer concept is rooted in the peer leadership model of state FFA officers providing a conduit to the greater membership at large. While the Influencing talents of state FFA officers in this sample are less frequently measured in the top five themes, it does not definitively mean this is an area of non-talent. Areas of non-talent could only be identified by knowing the entire ranked 34 themes of each officer. Theoretically, for example, what if many of these themes were ranked sixth or seventh? With investment into knowledge and skill, a talent theme can become a true strength. Through the strengths-based leadership framework, considerations should be given to the content of leadership development programming and opportunities.

The second objective was to compare the top five talent themes of state FFA officers utilizing the Clifton StrengthsFinder® assessment data (Clifton, et al., 2006) to the state selection process utilized to elect said officers. While there is a variance in the number of associations that utilize different election processes, each process yielded the same top ten talents: Achiever, Restorative, Responsibility, Includer, Learner, Belief, Positivity, WOO, Input, and Communication. The different election process also yielded the same bottom ten talents: Activator, Empathy, Analytical, Consistency, Connectedness, Deliberative, Self-Assurance, Maximizer, Intellection, and Command (Clifton, et al., 2006). Maximizer, Intellection, and Command strengths typically rated below five percent by the participants in this study. We believe that most state selection processes reviewed do not provide officer candidates with the opportunity to showcase these particular skills, and therefore they may not be at the forefront of the officers thoughts as they completed strengths assessment. Additional research in this area is warranted. Additionally, as we look from state association to state association, slight variations can be seen across the most commonly occurring talents ranked within the top 10. However, these results would indicate no relationship between the type of selection process utilized and differentiation of those strengths.

The third objective of this study was to identify the election process used in the selection of state FFA officers. An interview and application process appear to be universally adopted for use during the state officer selection process. It also appears that most states have adopted an officer slate selection process as well. It is quite possible that states have moved towards a nomination committee that interviews all applicants and forward a recommended slate of candidates in an effort to align applicant strengths with officer positions. It is possible that state FFA associations have moved away from on stage speeches/election processes in an attempt to find a more streamlined approach to officer elections and avoid popularity contests.

Implications and Recommendations

Potential state officer candidates and those involved with student leader selection alike can benefit from this research. School-Based Agricultural Education teachers and FFA staff at all levels should consider the type of selection process component utilized and the pattern of talents shared across state FFA officers. Do the selection processes utilized for selection of state FFA officers provide for all talents to move through the ranks of FFA leadership? Do the selection processes utilized provide the opportunity to showcase strengths other than these top ten talents? Providing opportunities throughout the selection process for students to authentically express their talents could be the beginning of building a strengths-based organization. With no differentiation of talents across these selection components, is that truly being accomplished?

As reflected in the data, over 30% of state FFA officers talents are heavy in the Executing Domain—that is, they are hard workers who can make things happen (Rath & Conchie, 2008). By simply providing officers with the tools and resources for self-exploration to learn about their own strengths, interesting results may develop. Evaluating and realizing the talents of student officers and how the respective domains of each are categorized may also be valuable information for coordinators when creating curriculum and programmatic content revisions. For example, more content focused on finding solutions (talent of Restorative), exploring new information (talent of Learner), and taking ownership of projects (talent of Responsibility) may actively engage more officers and students in their own development.

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