# The Implications of Frequency and Correlation in FFA Career Development Events in Texas[1]

***TraeAnn Schlemmer, Mark Yu, Frank Ewell and Ted Ford***
***Tarleton State University[2]***
***Stephenville, TX***

## Abstract

As the National FFA Organization continues to grow in membership, the quality of Career Development Events becomes critical. This study uses Pearson product-moment correlation coefficient and frequency measures to evaluate the event quality in the Farm Business Management competition. Poor quality questions use in the competition are identified based on frequency distribution and r values. These questions possess flaws and need to be reviewed or eliminated to improve test quality. This will increase the level of fairness and difficulty of FFA events in the future. However, the ultimate beneficiaries are the students, who will gain the most from improvements.

**Key Words:** Pearson product-moment correlation coefficient, r value, frequency, FFA, Career Development Event, Farm Business Management

## Introduction

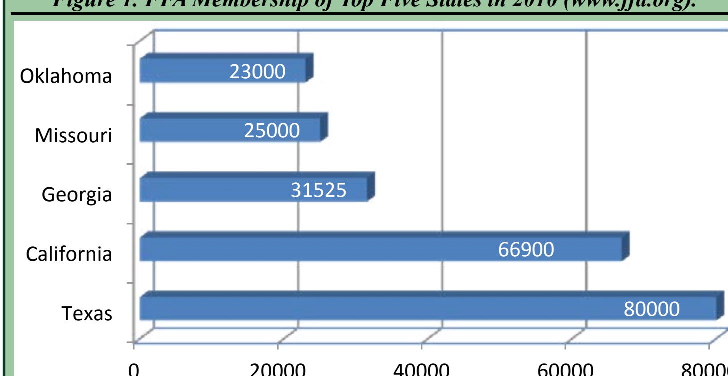
### FFA and FFA Events

Founded in 1928 to promote and support agricultural education, the Future Farmers of America (FFA) has benefitted millions of students over the years. Now known as the National FFA Organization, it has grown to become the largest student-led organization in the world, paving the road to "premier leadership, personal growth, and career success" (National FFA Organization, 2010). In 2010, FFA membership across the country totaled 523,309 (National FFA Organization, 2011), which continues the trend of increasing annual membership. The Texas FFA Association, founded in 1930, now has membership totaling over 80,000 students, which sets the record for the highest membership total ever in the State (Texas FFA Association, 2011). As shown in Figure 1, with 15.3% of the National membership Texas contributes the most students of any state, with California ranking second.

FFA consists of several pillar components. One of the components is Career Development Events, or CDE's, also known as judging contests. CDE's combine classroom activities with hands-on experience, serving as a valuable educational tool. Tens of thousands of students in Texas participate in these various events annually.

In order to fully comprehend this study, it is necessary to understand how Career Development Events work. All CDE's follow the same general format. Every contest uses a standard Scantron designated for the event, which makes grading much easier and provides a tool to gather data. Consistent with National CDE rules, events usually consist of placing classes, some form of grading, identification, and a written exam (National FFA Organization, 2011). Placing classes feature four animals, plants, or other

*Figure 1. FFA Membership of Top Five States in 2010 (www.ffa.org).*




[1]Acknowledgements: This work was supported by the Tarleton State University Office of Student Research and Creative Activities. We also thank Clay Ewell for his contributions.

[2]College of Agriculture and Environmental Science

subjects which students evaluate and compare based on judging rules presented by their coaches, usually their school's agri-science teachers. The contestants then rank the subjects by their assigned number in order from best to worst. For example, a steer class in Livestock Judging in which the 3 steer is the best, followed by 1, then 4, with 2 being the worst would be placed 3-1-4-2. The student would bubble the class as such on the proper area on the Scantron. Any mistake results in a loss of some points, based on the margin of error and the judges' cuts for the class, which are adjusted according to difficulty.

In the grading section of an event, participants must evaluate the subject against a standard, such as Low Prime beef in Meats Judging or a Grade A egg in Poultry Judging. Any deviations from the official key will result in a loss of points, depending on the size of the error in most events. The written exam portion consists of a test containing questions pulled from a question bank prepared and approved by the Texas FFA. However, these exams require more skills than simply memorizing an answer. It is given to students by coaches to study prior to the contest. Some events include other sections which are specific to their content, but nearly all contests have these three sections in common.

In most contests, the agri-science teacher of a high school team selects four members to represent the chapter. All four members in the team compete. However, in most events only the top three individual scores of the team members combine to constitute the total team score. Teams compete at two different types of events: invitationals and advancing meets. Invitationals are essentially warm-ups for advancing meets, but do award banners and other prizes to the top individuals and teams. Hosted by colleges or high schools, invitationals follow the same general rules but do not have as much at stake. Dozens of invitational events are held during the spring semester throughout Texas, making it virtually impossible for any high school or team to compete at all of them. The number of invitationals at which a school competes depends on the competitiveness of the Chapter and their proximity to the contest site.

Advancing meets are organized on the Area, State, and National levels. Area events are held separately at designated universities based on the location of each of the ten geographic Areas. According to Texas FFA rules, anywhere from three to ten of the top placing teams from each Area, depending on the participation level and rules of the event, move on to compete at the State event (Texas FFA Association, 2011). State events are held at specified universities, and they determine the best team in the entire state. In most events, only the first place team at the State contest advances to represent the state at the National competition, which over the past few years has been held in Indianapolis, Indiana, in October.

At each successive level of competition, participants intensely prepare and practice, vying for first place. Often, the difference between advancing to the next event and going home is only a handful out of the hundreds of possible team points. With such a long and difficult road to earn the honor of representing the state of Texas in the National event, it is imperative that all contests held in Texas, both invitationals and advancing events, are fair and ensure a degree of difficulty which will challenge students and allow the best individuals and teams to rise to the top. However, determining the degree of fairness and challenge in an event has historically been mostly a matter of opinion of participants and coaches with no supporting data. More in-depth analysis is required than simply looking at the schools and scores at face value. It is the collecting of data by section or question and then analyzing it that can truly reveal the quality of an event.

## PPMCC Background and Literature

This study utilized the Pearson Product-Moment Correlation Coefficient, (PPMCC or r), a statistics measure which determines the strength of the correlation, or linear dependence, between two variables to evaluate the quality of contest questions. This concept was first introduced in the 1880s by Francis Galton, but was later developed and studied by Karl Pearson (Rodgers and Nicewander, 1988). Though the PPMCC can also be used to test a null hypothesis, for the purposes of this study it will generally be used to construct a confidence interval. Data from Judging Card, a website which stores event data from hundreds of FFA contests across the United States, will be analyzed using this method (JudgingCard, 2011).

Rodgers and Nicewander (1988) examined several applications of the PPMCC and r value. They showed that "Pearson's r (or simple functions of r) may variously be thought of as a special type of mean" among other things, and "may be looked at from several other interesting perspectives" (Rodgers and Nicewander, 1988, p. 61). Their work analyzed r values as a mean, slope, or function of angles with numerous applications. This work showed that a "wealth of additional fascinating and useful portrayals" of the r value is available because of the "diversity of interpretations" which was accessible (p. 62). Not only was the measure accurate and advantageous, it also has remained true through the years of its century-old existence. The paper concluded that: "*the correlation has developed into a broad and conceptually diverse index… [yet] it is remarkably unaffected by the passage of time* (p. 64)."

Many books and articles (Ary et al., 2010; Cohen, 1988, 1992; Cohen et al., 2007; Gravetter and Wallnau, 2008; Pagano, 2007; Welkowitz et al., 2006) described uses of the PPMCC specifically in behavioral sciences and education. Some studies used this method to correlate grade point average with attendance, while others related factors such as gender and income bracket to academic competence. Most books referenced in this study observed that r values for social sciences are usually lower than those of disciplines such as physics. Cohen et al. (2007) stated that "*perfect correlations of +1.00 or -1.00 are rarely found and…most coefficients of correlation in social research are around +0.50 or less* (p. 531)."

### PPMCC Related to FFA Events

When assessing test quality, requirements for what constitutes a less effective question must be set. In order for a test to best combine fairness and difficulty, questions must be hard enough so that not every participant is able to answer it correctly. At the same time, they must not be overly challenging, with only a handful of students arriving at the right answer. This reduces the exam to a guessing game, rewarding the lucky instead of the talented. A combination of these guidelines must be used when analyzing the tests.

Another ideal statistic which judges and test writers seek is higher positive r values for correct answers. This implies that a given student's correctly answering a question strongly correlated to that student having a higher overall score than those who missed it. Such a property is attributed to questions that are sufficient in difficulty and fairness. Conversely, negative correlation coefficients for right responses expose a flaw, either on the part of officials or contestants. These questions must be evaluated, improved, or even eliminated in order to ensure contests of utmost quality, which combine fairness and complexity to the highest degree.

## Objectives

The primary objective of this study is to apply frequency and correlation methods to FFA data in order to identify portions of contests which could be improved. Findings will aid judges and officials of events in understanding how to enhance contests by constructing a more fair and competitive event. Furthermore, the methods used in this study will allow the evaluation of the quality of an FFA contest using mathematical and statistical principles rather than opinion.

## Methods And Procedures

### PPMCC

By rule, the PPMCC requires two variables to perform the analysis, X and Y. With respect to the Farm Business Management contest in this study, the X variable is the number students selecting a given answer choice, and the Y variable is the contestant's total score for the event. With two variables, the PPMCC can be defined as the covariance of these variables divided by the product of their respective standard deviations. This is shown mathematically by the following formula:

$$\rho_{X,Y} = \frac{\operatorname{cov}(X,Y)}{\sigma_X \sigma_Y} = \frac{E[(X-\mu_X)(Y-\mu_Y)]}{\sigma_X \sigma_Y} \qquad (1)$$

The Greek letter rho (ρ) above represents the correlation coefficient for a population. When using sample statistics, the following formula gives the *r* value, which denotes a sample correlation coefficient:

$$r = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^{n}(X_i - \bar{X})^2}\sqrt{\sum_{i=1}^{n}(Y_i - \bar{Y})^2}} \qquad (2)$$

A similar equation finds the correlation coefficient as the mean of the products of the standard scores. Centered on $(X_i, Y_i)$, a sample of paired data, the PPMCC of a sample can be found:

$$r = \frac{1}{n-1}\sum_{i=1}^{n}\left(\frac{X_i - \bar{X}}{s_X}\right)\left(\frac{Y_i - \bar{Y}}{s_Y}\right) \qquad (3)$$

where, $\frac{X_i - \bar{X}}{s_X}$ is the standard score, $\bar{X}$ is the sample mean, and $s_X$ is the sample standard deviation.

By definition, the PPMCC yields an r between -1 and +1 inclusive, with a value of zero implying that no linear correlation exists between the two variables, X and Y. An r of +1 indicates that two variables are described perfectly by a linear equation, meaning that Y increases as X increases for all data points. Conversely, an r of -1 implies that Y decreases as X increases for all data points. Though guidelines do exist for interpreting a correlation coefficient, these are not set rules which must be followed in all situations. The relative strength of a correlation coefficient, such as whether a given number is high or low, rests on the purposes of the analysis and the context in which the PPMCC is being applied. For instance, an r of .82 may be very low when analyzing scientific law, but may be very high when considering subjects such as social sciences which are much more vulnerable to outside complicating factors. Thus, the range and strength of correlation coefficients are highly specific to the material and nature of the data at hand.

## Data

This study will focus on the Farm Business Management CDE, which consists solely of a written exam. Points are awarded for correct responses, but none are given for incorrect answers. The contests in review are the 2011 Tarleton State University (Tarleton) Invitational event with 137 contestants and the 2011 Area IV and VIII competition with 92 contestants, also hosted by Tarleton. Each of these tests contains an economics concepts (Economics) section with 50 questions worth two points each as well as an economics problem-solving (Math) section with 30 questions worth five points apiece. The PPMCC is applied to each answer choice for every question. The frequency of each answer choice, or how many contestants selected it, is recorded. As with most statistical principles, a higher frequency results in a more accurate measurement, in this case correlation. Thus, a higher frequency will yield a correlation coefficient which more accurately represents sample data and possesses a greater degree of reliability. By utilizing frequency and correlation principles, data from these events can be analyzed to appropriately evaluate quality.

## Methods and Procedures

Each PPMCC value must be either positive or negative. Positive r values indicate that Y increases as X increases, or Y decreases as X decreases. On the contrary, negative PPMCC numbers denote that the Y variable increases as X decreases. Applied to this study, a positive correlation coefficient conveys that students who selected a given answer choice tended to score higher on the overall contest than those who selected an answer with a negative r value. Conversely, negative coefficients imply that a given response tended to correlate with a lower total score.

As previously stated, the relative strength of r depends on the type of data collected, particularly the degree of vulnerability to outside factors. As in previous research in education, this study used conservative coefficient ranges. More specifically, this paper utilizes the range formulated by J. Cohen (1992), which sets r values of small, medium, and large as .10, .30, and .50 respectively. With the Farm Business Management CDE as the contest of focus, the range categories for the PPMCC are shown in Table 1. As a result of these divisions, seven correlation coefficient categories exist: No Correlation (NC), Small Positive (SP), Medium Positive (MP), Large Positive (LP), Small Negative (SN), Medium Negative (MN), and Large Negative (LN). Table 1 summarizes these categories. These categories will be referenced throughout the study. The greater the absolute value, or distance from zero, the stronger the correlation is between X and Y. For example, an answer choice with a coefficient of 0.72 statistically tended to lead to a higher overall score more often than an answer choice with a 0.13 coefficient.

*Table 1. r value Categories and Ranges as used for Farm Business Management*

| Correlation | Positive | Negative |
|---|---|---|
| No Correlation | 0.00 – 0.09 | -0.09 – 0.00 |
| Small | 0.10 – 0.30 | -0.30 – -0.10 |
| Medium | 0.31 – 0.50 | -0.50 – -0.31 |
| Large | 0.51 – 1.00 | -1.00 – -0.50 |

For the purpose of this study, these limits have been established mathematically based on the frequency of each answer choice. A given question was deemed less effective if more than 85% of the total number of participants answers correctly or less than 10% select the right answer choice. These limits were decided after consulting various writers of Texas FBM exams. The number of students at the Tarleton Invitational contest totaled 137, making the boundaries for a less effective question 116 and above on the high end and 14 and below on the low end. For the Area event, which had 92 total contestants, the limits will be a ceiling of 77 and above with a floor of nine and below. These frequency limits were used for both the Economics and Math sections of each test.

In addition to frequency, the sign and strength of the correlation coefficient were also used in the identification of less effective questions. For both sections of the Farm Business Management event, questions which have at least one wrong answer choice with a coefficient in the Small Positive r category or greater (SP, MP, LP) were considered less effective. The goal of test writing should be for a correct answer to a given question to correlate with a higher overall score. Therefore, incorrect choices should correlate with lower overall scores.

When focusing on the Economics section, correct answer choices with an r value in the No Correlation (NC) category or any of the negative categories (SN, MN, LN) were also marked as poor quality. Correct responses should correlate with an improved total score, which is indicated by the positive coefficient categories (SP, MP, LP). On the Math section, less effective questions were those which possessed correct answer choices with coefficients in the Small Positive (SP), No Correlation (NC), or any of the negative correlation categories (SN, MN, LN). Small Positive (SP) is included in this section because the correlation between a correct response and a higher overall score should be stronger than in the Economics section. This is because questions in the Math section are worth as many points as 2.5 questions in the Economics section. Therefore, a single Math question has more impact on the total score than a single Economics question, which should be shown by a stronger correlation and higher r value.

*Table 2. Frequency and r value Characteristics of Less Effective Questions*

| Section | Frequency | | r value | |
|---|---|---|---|---|
| | Too High | Too Low | Correct Answer | Incorrect Answer |
| Economics | X > 85% | X < 10% | NC, SM, MN, LN | SP, MP, LP |
| Math | X > 85% | X < 10% | SP, NC, SM, MN, LN | SP, MP, LP |

*Table 3. Evaluation of Less Effective Questions on the 2011 Tarleton Invitational*

| Section | Requirement not Met | | | |
|---|---|---|---|---|
| | Frequency | | r value | |
| | Too High | Too Low | Correct Answer | Incorrect Answer |
| Economics | 1, 20, 22, 25, 33, 44, 46 | 11 | 5, 9, 25, 28, 31, 39 | 23, 38 |
| Math | 2 | None | 1, 19, 29 | 29 |

During the analysis of each test, researchers looked for two general types of questions that are significant to the study. Questions of poor quality were marked according to the guidelines for frequency and r values outlined above. Those with a frequency which is too high or too low were noted, as well as answer choices that do not have appropriate r values. Additionally, questions of high quality were pointed out. Such questions were identified first by assessing the frequency of each answer choice. Frequency should be within designated limits, which is an indication of a well-written question. Furthermore, the correlation coefficients of each answer choice should be higher than average, which shows that the question had a higher than usual impact on a given contestant's total score. The inclusion of several questions of this caliber will boost the overall quality of the exam, as these tend to be more challenging, and will improve the degree of difficulty for the contest.

Generally speaking, when evaluating scores after a Farm Business Management event, or any contest, officials desire to find more questions which convey fair competition and an adequate degree of complexity. Test writers are striving for more high quality, meaningful questions than ones that did not contribute any positives to the exam. To improve questions, writers can restructure questions to increase clarity, include more detail and select answer choices more carefully. These actions can raise test takers' comprehension of questions without sacrificing any degree of difficulty.

## Results

After evaluating each test and analyzing the frequency and correlation strength for each answer choice, several interesting observations were made, as seen in Table 3. In the Economics section of the Invitational exam, eight questions did not meet frequency requirements, with seven having too high a frequency and only one possessing a frequency under the specified level. An example of a frequency which was too high is Question 1, as 122 of the 137 contestants picked choice D, exceeding the limit of acceptability of 116. The question with not enough students answering correctly was number 11, with only eight of 137 participants being right, not meeting the minimum of 14.

Additionally, eight other questions fell short of the requirements for correlation coefficient strength. Of these, six were correct answer choices which did not have a high enough r value, while two were wrong selections with positive r values. Both of these indicate questions of poor quality. One correct selection whose correlation was too weak was number 9 answer choice C which had a frequency of 94 but an r value of just 0.0830, falling into the No Correlation category. An instance of a wrong choice with a positive correlation coefficient was 38 B, whose frequency is 67 and r value was 0.1108. Such characteristics reveal low quality.

Six questions from this same section stood out because of high quality, combining an appropriate frequency distribution with stronger correlation coefficients. One of these good questions was number 8, with frequencies of 46, 60, 17, and 14 and respective r values of -0.1794 (SN), 0.4686 (MP), -0.2936 (SN), and -0.1682 (SN). Another high quality question was 48, whose frequencies and correlation coefficients were similar to 8. Each of these types of questions challenged participants and contributed more to the event, as reflected by stronger correlation coefficients.

The Math portion of the 2011 Tarleton Invitational test was also examined by using much of the same criteria. Only one question failed to meet the established requirements for frequency. Number 2 had 121 participants answer correctly, exceeding the acceptable maximum of 116. This section also possessed less questions marked as low quality due to r value flaws than the Economics section. Three questions on this portion of the exam had correct answer choices with negative or No Correlation, which is not desired. As seen above, this section also included seven questions which were of great importance to the outcome of the exam, indicating a well-designed section. One instance was question 4, which had answer choice frequencies of 1, 72, 16, 27, and 21 coupled with respective r values of -0.2309 (SN), 0.6268 (LP), -0.3262 (MN), -0.3008 (MN) and -0.1913 (SN). Simply stated, the correlation coefficients were stronger than average with a relatively good frequency distribution. Another such question was 28, which had similar superior properties.

When looking at the data from the 2011 Tarleton Area competition, several qualities common to both tests were discovered. The Economics section of this test contained three questions that exceeded the upper frequency limit. One such question was number 2, with its correct answer choice having a frequency of 78 out of 92 total contestants, narrowly exceeding the maximum of 77. An additional instance was number 45, with the right selection being chosen 82 times. As shown below, this test had no questions with a frequency below the acceptable minimum.

When considering correlation, this portion of the test contained four correct answer choices with an r value in the No Correlation or negative categories. Question 3 had a frequency of 72 and an r value or -0.0760 (NC) for its right response, while the correct selection for number 38 possessed a frequency of 38 and a correlation coefficient of -0.0291 (NC). This indicates that these questions have some sort of flaw and can be improved. In addition to these, three other questions possessed wrong answer choices with positive r values. Question 5 had frequencies of 44, 10, 15, and 23 while having respective r values of 0.1130 (SP), -0.4073 (MN), 0.3276 (MP), and -0.1171 (SN). This question is of particular interest because, judging by the given data, the 15 participants who answered incorrectly by selecting C tended to score higher on the overall contest than the 44 students who correctly chose A. These data strongly suggests that this question must be reviewed or eliminated.

Following a thorough examination of the Economics section of the 2011 Tarleton Area test, eight questions stood out because of high quality. Question 4 combined frequencies of 59, 3, 12, 17, and 1 with respective r values or 0.5610 (LP), -0.1826 (SN), -0.1507 (SN), -0.4633 (MN), and -0.0587 (NC). The 59 participants who selected the right answer had a strong tendency to do well on the overall contest, while the 17 students who answered D had an almost as strong tendency to not perform well. Several other questions, including numbers 6, 11, and 15 had the same characteristics.

The Math section of the test was written extremely well, as no questions out of the entire portion of the event were found to be flawed due to frequency or correlation coefficient discrepancies. Only questions which had a high positive impact on the exam were easily spotted when reviewing the data. Questions such as number 19, which had frequencies of 12, 56, 16, 4, and 4 with corresponding r values of -0.3570 (MN), 0.6758 (LP), -0.3113 (MN), -0.2101 (SN), and -0.2390 (SN), combine fairness and complexity to a high degree. One possible reason for this section having no frequency or correlation flaws is the inclusion of a fifth possible answer choice, E. This additional answer choice decreases the chance of a participant being able to guess correctly. An added answer choice also makes eliminating choices more difficult, which helps the talented rise to the top.

Several trends were found after analyzing the exams. A common theme, found solely on the Invitational test, was the repetitiveness of no answer choice being bubbled, resulting in a blank answer. On both the Economics and Math sections, every instance of a blank answer with the exception of number 50 on the Economics portion had an r value of -0.2309 (SN). It is possible that that the same participant left the questions blank, which would yield the same correlation coefficient in every instance. Another potential explanation is that two or more participants had the same overall score but left different answers blank.

On both contests, the Math section received higher r values than the Economics section, regardless of frequency. A consistent, greater correlation coefficient conveys that a given question on the Math portion has more weight and is of more consequence to the overall score than a given question on the Economics section. This occurs because each question on the Math is worth 5 points, as opposed to a question on the Economics having a value of 2 points. Therefore, it can be inferred that a question worth more points will be of greater significance and impact to the total score, with higher corresponding r values. Another observation is that the number of poor quality questions was less for the Area test than for the Invitational. This finding suggests that student aptitude may affect test quality, as the Area exam is held later in the season than the Invitational and gives the contestants more time to practice and prepare for the contest. An increase in the capability and knowledge level of the students decreases the chances of finding errors on the part of students when assessing scores.

## Conclusion and Discussion

Strategies and methods for applying the Pearson product-moment correlation coefficient (PPMCC) to FFA data shown in this study can aid officials and judges in analyzing and assessing their events. It can additionally be utilized to evaluate whether or not the contest was keyed correctly. Once problem areas are identified, actions can be taken to improve these areas in order to consistently host a high quality contest. This study has made finding less effective questions in the Farm Business Management CDE easier and can also be applied to other events, which will lead to contests which have a higher degree of both fairness and difficulty, accomplishing the original objective.

Findings and methods taken from this study are not strictly confined to FFA use, but may also be applied in other areas as well, most notably in the classroom. Educators in all fields can utilize the PPMCC as a way to strive for excellence and fairness in their exams. Correlation analysis can also relate other pertinent factors to overall grades, such as attendance, class participation, and amount of notes taken. Findings will help both students and educators understand what contributes to success in the classroom and adjust their actions accordingly.

Evaluation of tests and general classroom practices will keep educators sharp and will allow for more well-written questions on exams. Improved tests will ultimately benefit students, as higher overall quality leads to improved clarity, less confusion, and a better opportunity for prepared students to succeed. Methods in this study can be beneficial not only in FFA exams, but in all types of examination as well.

## Literature Cited


Ary, D., L.C. Jacobs, C. Sorensen and A. Razavieh. 2010. Introduction to research in education. 8th ed. Belmont, CA: Cengage Learning, Inc.

Cohen, J. 1992. A power primer. Psychological Bulletin 112(1): 155-159.

Cohen, J. 1988. Statistical power analysis for the behavioral sciences. 2nd ed. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc. Publishers.

Cohen, L., L. Manion and K. Morrison. 2007. Research methods in education. 6th ed. New York, NY: Routledge.

Georgia FFA Organization. 2011. <http://www.georgiaffa.org/index.php?page=membership>. 19 August 2011.

Gravetter, F.J. and L.B. Wallnau. 2008. Essentials of statistics for the behavioral sciences. 6th ed. Belmont, CA: Thomson Learning, Inc..

JudgingCard. 2011. <www.judgingcard.com>. 8 May 2011.

Missouri FFA Organization. 2011. <http://dese.mo.gov/divcareered/ag_mo_ffa.htm>. 19 August 2011.

National FFA Organization. 2011. <http://www.ffa.org/Documents/cde_handbook.pdf>. 19 August 2011.

National FFA Organization. 2011. <http://www.ffa.org/About/WhoWeAre/Pages/History.aspx>. 19 August 2011

National FFA Organization. 2010. <http://www.ffa.org/about/whoweare/Pages/Statistics.aspx>. 19 August 2011.

Ohio FFA Association. 2010. <http://www.ohioffa.org/cms/index.php?option=com_content&view=category&layout=blog&id=72&Itemid=78>. 19 August 2011

Pagano, R.R. 2010. Understanding statistics in the behavioral sciences. 10th ed. Belmont, CA: Wasworth, Cengage Learning.

Rodgers, J.L. and W.A. Nicewander. 1988. Thirteen ways to look at the correlation coefficient. The American Statistician (42)1: 59-65.

Texas FFA Association. 2011. <www.texasffa.org/page.aspx?ID=62>. 19 August 2011.

Texas FFA Association. 2011. <http://news.texasffa.org/article.aspx?ID=91>. 19 August 2011.

Welkowitz, J., B.H. Cohen and R. Ewen. 2006. Introductory statistics for the behavioral sciences. 6th ed. Hoboken, NJ: John Wiley & Sons, Inc.