Analysis of Contestants' Scores in the National FFA Agricultural Mechanics Contest 1979-1984

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Accepted for Publication October 1985

Competition has been an important component of all FFA activities since the beginning of the National FFA Organization and will likely maintain its level of importance. This competition has been nurtured through the local, state and national contest structure. When effectively designed, conducted, evaluated and analyzed, contests can enhance the total vocational agriculture program (Phipps, 1972).

Researchers have studied many aspects of FFA contests. Quantitative investigations have been conducted with varied purposes, i.e., participation and non participation (Layton, 1982), characteristics of advisors and student participants (Herren, 1982) and factors influencing participation and success. Qualitative analyses have also been conducted in most contest areas by state and national contest committees. These analyses were designed to evaluate contests with respect to the agricultural industry and changing technology in hopes of providing a more relevant experience for the contest participants.

The majority of the research efforts directed to FFA contests has dealt with participants. Efforts have not been directed to the development and implementation of an ongoing internal evaluation of the contests. Barrick (1984) completed a systematic analysis of scores for the state FFA degree in Ohio. The author of this investigation determined that a similar analysis of contestants' scores would be appropriate for an internal analysis of National FFA Contests.

The National FFA Agricultural Mechanics Contest is one of the many contests held yearly during the National FFA Convention in Kansas City. With the introduction of computer scoring of the National Agricultural Mechanics Contest, it has become possible to easily access and use contest data. These data include individual and team total scores, scores per contestant per contest area and demographic data. Contest areas are: written examination, problem solving, construction and maintenance skills, power and machinery skills, and electric power and processing skills. Demographic data include state and regional information per contestant.

Contest data from 1979-1984 provided the data base for the analysis of the National FFA Agricultural Mechanics Contest.

Journal of the American Association of Teacher Educators in Agriculture
Volume 27, Number 2, pp.27-33
DOI: 10.5032/jaatea.1986.02027

Purpose and Objectives

The purposes of this study were to analyze contestants' scores per individual contest area and contestants' total scores from the 1979-1984 National Agricultural Mechanics Contest, and to develop the methods of analysis used to evaluate internally the National FFA Agricultural Mechanics Contests. The research questions for the study were:

1. Does a regional bias exist in any contest area or areas based on contestants' scores?

2. Do any contest areas contribute a disproportionate share of the variance in contestants' total scores?

Procedures

An observational, data-analytic method was appropriate for the conduct of this investigation. The population consisted of all students who registered and participated in all National FFA Agricultural Mechanics Contests since their inception. The sample consisted of those students registered and participating in the 1979-1984 contests. Data per contestant included: year of contest participation, state represented, region represented, written examination score, problem solving score, construction and maintenance skills score, power and machinery skills score, electrical power and processing skills score and total contest score.

Data were directly entered into the computer for analysis. Means and standard deviations of contestants' scores per contest area and contestants' total scores were calculated. The data were analyzed using a General Linear Model Procedure for a simple analysis of variance (ANOVA) to determine if significant differences existed in contestants' scores when compared by region. Alpha was set a priori at $p<.01$. Duncan's Multiple Range Tests were used as the post hoc analysis to determine which regions were significantly different (Kennedy, 1978).

Pearson Product-Moment Correlation Coefficients were calculated in an effort to establish the strengths and directions of the relationships between each contest area and individual contestants' total scores. This procedure was done for all contestants on a national basis. Simultaneous multiple regression techniques were employed to calculate: (a) semi-partial correlations and the proportions of variance explained by the contestants' scores per contest area; (b) the independent variable, upon the contestants' total score; and (c) the dependent variable. The semi-partial proportions of variance represented the amounts of unique variance in the dependent variable explained by each independent variable when the effects of all other independent variables have been partialled out, or removed from the dependent variable. This analysis was conducted with the total sample data (Cohen & Cohen, 1975).

Results

The means and standard deviations of contestants' scores by contest area by regions are shown in Table 1. These data show that the means associated with the Central Region and the Western Region are numerically higher than the Eastern Region and the Southern Region. Standard deviation measures do not follow a similar pattern. Data are analyzed using a General Linear Model Procedure (GLM) for a simple analysis of variance (ANOVA) to determine if these numerical differences are significant. F-values generated by the ANOVA of these scores are summarized in Table 2.

Table 1

Means and Standard Deviations of Contestants' Scores by Contest Area by Region

	Eastern Region n=207		Central Region n=198		Southern Region n=126		Western Region n=231		Total n=762	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Written Examination	38.90	8.70	46.26	8.06	40.37	8.27	42.44	8.37	42.13	8.81
Problem Solving	38.51	11.08	45.06	10.02	37.79	9.59	41.75	10.81	41.07	10.84
Construction and Maintenance Skills	24.72	7.78	28.70	8.33	26.75	8.15	28.31	8.91	27.18	8.48
Power and Machinery Skills	30.53	8.32	35.20	7.83	29.97	7.58	32.01	8.44	32.10	8.34
Electric Power and Processing Skills	20.68	9.14	27.31	11.05	21.57	9.03	23.28	10.15	23.34	10.38
Total	153.33	30.64	182.53	29.09	156.44	26.99	167.79	31.13	165.82	31.88

Table 2

F-Values Generated by the Analysis of Variance of Contestants' Scores by Region

Contest Area	F-Value (3,758)*
Written Examination	28.29
Problem Solving	18.11
Construction and Maintenance Skills	9.71
Power and Machinery Skills	15.14
Electric Power and Processing Skills	16.37
Total	37.32

*$p<.01$.

Observed effects of the independent variable, Region, yields significant results (F (3,758)=37.32, $p<.01$. The post hoc analysis indicates that the Central Region scores significantly higher than the other regions when contestants' total score is the dependent variable. Further analysis shows that this significant difference is also true for scores by region in each individual contest area except Construction and Maintenance Skills, where the Central, Southern and Western regions are significantly different than the Eastern Region.

Table 3 presents the means, standard deviations, variances, multiple correlation coefficients and semi-partial correlation coefficients for the scores of all contest participants. Squaring the multiple correlation coefficients and the semi-partial correlation coefficients yields the proportions of the total variance and the unique variance explained in contestants' total score by each specific contest area.

From these data, these major findings are formulated:

1. Contest participants from the Central Region achieve generally higher scores per contest area and in total contest score.

2. Problem Solving and Electrical Power and Processing Skills have the greatest variability in scores, and the greatest unique contribution (sr^2) to the variance in contestants' total score.

3. Written Examination shows the largest multiple correlation (R) and the largest proportion of total variance (R^2) explained in the dependent variable, contestants' total score, yet its unique contribution (sr^2) to the variance in contestants' total score is lower than that of all other contest areas.

4. Power and Machinery Skills has the least variability of scores.

Table 3

Means, Standard Deviations, Variances, Multiple Corelation Coefficients and Semi-partial Correlation Coefficients for all Contestants' Scores

	Mean	S.D.	Var	R	R^2	sr	sr^2
Written Examination	42.13	8.81	77.62	0.802	0.644	0.204	0.042
Problem Solving	41.07	10.84	117.51	0.714	0.509	0.274	0.075
Construction and Maintenance Skills	27.18	8.48	71.91	0.481	0.232	0.241	0.057
Power and Machinery Skills	32.10	8.34	69.56	0.589	0.346	0.237	0.056
Electric Power and Processing Skills	23.34	10.38	107.74	0.780	0.608	0.262	0.069
Total	165.82	31.68	1016.33				

5. Construction and Maintenance Skills explains the least proportion of total variance (R^2) in the dependent variable, contestants' total score.

Conclusions and Recommendations

The significant conclusions drawn and the recommendations forwarded from the results of this investigation are:

1. There are significant differences in contestants' scores based on region. Central Region participants score significantly higher than contestants from all other regions. Further study should be directed to finding possible explanations for the regional bias in contestants' scores as indicated by the data.

2. The areas of Power and Machinery Skills and Construction and Maintenance Skills should be modified to increase the variability of scores, thus tending to balance the impact of all individual contest areas on contestants' total score.

3. Written Examination accounts for the largest proportion of the total variance explained in the contestants' total score, yet its unique contribution is lower than all other contest areas. This may be explained by the fact that the Written Examination is composed of questions applied to each respective skill area. However, this format is also true of the Problem Solving area, and Problem Solving shows the greatest unique contribution to variance in contestants' total score.

4. For the total population, contest areas alone are contributing less to the variance in contestants' total scores than other undetermined variables. These undetermined variables may be: following directions, maturation, preparedness and others.

5. This analysis was conducted with all participants of the National FFA Agricultural Mechanics Contest for the years 1979-1984. Would the results be the same if only the Gold Emblem winners' scores were used in the analysis? Further study in this direction may yield interesting results.

6. This investigation demonstrates the utility of contest score evaluation and the need for further evaluation. Other National FFA Contests should be internally evaluated, not only in the area of significant differences in contestants' scores, but also in the area of score prediction and trend analysis. Investigations of the prediction value of selected variables could prove useful in the development and enhancement of the contests. The use of trend analysis could explore the progress of contestants' scores in the various areas of a contest and may indicate areas needing particular attention.

In conclusion, the National FFA Agricultural Mechanics Contest is an exceptional learning experience and motivating force in vocational agriculture. The contest is effectively determining the best participants. However, continued analysis, not only qualitative but also quantitative, is important for the further development and refinement of the National FFA Agricultural Mechanics Contest.

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