References

1. John C. Barber, "Opportunities in the Federal Government." **Proceedings of a Workshop on Entry of Minorities Into Natural Resource Careers** (New Orleans: USDA Forest Service Southern Forest Experiment Station, 1975). pp. 40-42.
2. Gordon L. Berry, "Career Development and Afro-Americans: Defoliation of the Barriers." **Proceedings of a Workshop on Entry of Minorities Into Natural Resource Careers** (New Orleans: USDA Forest Service Southern Forest Experiment Station, 1975). pp. 9-17.
3. John Bethea, "Opportunities for Employment in State Government," **Proceedings of a Workshop on Entry of Minorities Into Natural Resource Careers** (New Orelans: USDA Forest Service Southern Forest Experiment Station, 1975). pp. 43-46.
4. Delano C. Claymore, "Natural Resources and the American Indian," **Proceedings of a Workshop on Entry of Minorities Into Natural Resource Careers** (New Orelans: USDA Forest Service Southern Forest Experiment Station, 1975). pp. 6-8.
5. Ernest L. Finger, "Forward." **Proceedings of a Workshop on Entry of Minorities Into Natural Resource Careers** (New Orleans: USDA Forest Service Southern Experiment Station, 1975). pp. ii.
6. B. D. Mayberry, "Introductory Remarks," **Proceedings of a Workshop on Entry of Minorities Into Natural Resource Careers** (New Orleans: USDA Forest Service Southern Forest Experiment Station, 1975). pp. 3-4.

A Predictive Model of Academic Performance In the MSU Agricultural Production Program

Wayne A. Knoblauch

Abstract

Which applicants should be admitted to a technical training program? If admitted, in which academic areas might the student experience difficulty? These are questions which concern admissions officers and advisors of students almost daily. On what predictors should the decision to admit or not admit be based? Is it possible to foresee academic weaknesses? The objective of this research was to identify those quantifiable predictors which may be used to estimate a student's academic performance and certain academic deficiencies in the Agricultural Production Program at Michigan State University.

The numerical criterion of a student's academic performance used in this study is the grade point average (GPA). Possible predictors of GPA analyzed are (1) vocabulary test scores (Voc). (2) comprehension test scores (Comp). (3) combined vocabulary, comprehension, and reading rate scores (Comb), (4) arithmetic test scores (Arith), (5) algebra test scores (Alg). (6) high school math GPA (HSMGPA), (7) number of high school math courses (M), (8) Differential Aptitude Test for Mechanical Ability (DAT), (9) number of vocational agriculture courses (VA), (10) GPA in vocational agriculture (GPAVA), (11) number of high school English courses (HSE), (12) GPA in high school English (GPAHSE), (13) chemistry test scores (Chem). and (14) high school GPA in academic courses (HSGPA).

Knoblauch is graduate research assistant, Department of Agricultural Economics, Michigan State University and former student advisor, Institute of Agricultural Technology, Michigan State University.

Predictor of Grade Point Average

The first step in the analysis of the possible predictors was to calculate simple correlations. A positive correlation between two variables indicates that high values of one variable tend to be associated with high values of the other variable and similarly with low values. When high values of one variable occur with low values of the other, they are inversely or negatively correlated. Table 2 presents the possible predictors of cumulative GPAs and their correlation coefficients (concurrent validity coefficients).

However several precautions must be observed when interpreting a validity coefficient. First, most correlation statistics are appropriate for linear relationships between the predictor and the criterion. If a nonlinear relationship exists, the traditional Pearson correlation coefficient will provide an underestimation of validity. In this study, plotting of residuals revealed no curvilinear relationships.

Second, if we lack the full range of possible scores on either the predictor or criterion, again we get an underestimation of validity. Given the current selection procedure in the Agricultural Production Program, the students exhibit a very wide range of scores and HSGPAs.

Third, reliability of both the predictor and criterion limits validity. If the predictor and/or criterion is unreliable and therefore inconsistent in assessing its own characteristic, we cannot expect one to measure the other. Thus, if we have poor reliabilities in the predictor and/or criterion we get underestimates of validity. The orientation tests used as predictors have proven reliable. GPAs in courses at the high school and college levels,

when computed on the basis of enough courses, are assumed reliable.

Upon completion of the first term of campus instruction, the predictors of a student's GPA with the highest correlations are Voc (.69), Comb (.66), and HSGPA (.61).

TABLE 1 Possible Cumulative Grade Point Average Predictors and Corresponding Correlation Coefficients[1].

Possible Predictors		Cumulative Grade Point Average End of 1st Term	End of 2nd Term	End of 3rd Term	End of 4th Term
		Correlation Coefficient			
*X_1	Vocabulary Test Scores	.69	.62	.58	.55
*X_2	Comprehension Test Scores	.61	.61	.58	.52
*X_3	Vocabulary, Comprehension and Reading Rate Scores	.66	.63	.59	.53
*X_4	Arithmetic Test Scores	.48	.48	.49	.50
*X_5	Algebra Test Scores	.30	.34	.36	.38
X_6	High School Math GPA	.49	.55	.56	.58
X_7	Number of High School Math Courses	.26	.36	.38	.44
*X_8	Differential Appitude Test for Mechanical Ability	.42	.35	.35	.22
X_9	Number of Vocational Agriculture Courses in High School	-.19	-.11	-.11	-.10
X_{10}	Vocational Agriculture GPA	.01	.09	.11	.11
X_{11}	Number of High School English Courses	.07	.17	.20	.24
X_{12}	High School English GPA	.43	.56	.56	.56
*X_{13}	Chemistry Test Score	.55	.53	.54	.51
X_{14}	High School GPA in Academic Courses	.61	.65	.62	.61

* Administered at a summer orientation program

1 Correlation coefficients greater than .32 are significant at the .05 level

These results are quite consistent with expectations based on the fact that most first term students enroll in an English or communications skills class and general academic courses.

At the end of the second term, HSGPA (.65), Comb (.63), and Voc and Comp test scores with correlation coefficients of .62 and .61 are leading predictors. These results are again as would be expected. HSGPA as well as other predictors may be capturing other factors such as learning ability. This suggests that we are measuring components of intelligence with the above mentioned predictors. This statement is reinforced when we see that the correlation between HSGPA and Total is .55, with Voc at .54 and Comp at .53. Thus, all three of these factors may, in fact, be measures of learning ability.

At the end of the third term HSGPA (.62), Comb (.59), and both Voc and Comp (.58) exhibited the highest correlation. This again is consistent and the remarks above are appropriate.

For predicting GPA upon completion of the Agricultural Production Program at the end of the fourth term, HSGPA (.61), HSMGPA (.58), HSE (.56), and Voc and Comp in combination with Total scores with correlations of .55, .52, and .53 were the most highly correlated predictors. Here two measures which were significant for other terms become top predictors.

TABLE 2 Possible Academic Area Grade Point Average Predictors and Corresponding Correlation Coefficients

Possible Predictors		Grade Point Average Agricultural Engineering	Agricultural Economics	Animal Husbandry	Dairy	Crop Science	Soil Science	Communications	Resource Development
		Correlation Coefficients							
X_1	Vocabulary Test Scores	.45	.53	56	.45	28	.44	.23	.29
X_2	Comprehension Test Scores	.49	.52	.46	.34	.28	.43	.35	.38
X_3	Vocabulary, Comprehension, and Reading Rate Scores	.47	.51	.55	.41	.29	.44	.31	.32
X_4	Arithmetic Test Scores	.41	.60	.28	.39	.32	.23	.34	.31
X_5	Algebra Test Scores	.31	.49	.29	.35	.12	.18	.26	.35
X_6	High School Math GPA	.51	.59	.44	.29	.46	.39	.49	.43
X_7	Number of High School Math Courses	.40	.45	.36	.26	.43	.31	.32	.26
X_8	Differential Appitude Test For Mechanical Ability	.33	.28	.17	.16	.36	.38	.16	.12
X_9	Number of Vocational Agriculture Courses in High School	-.32	-.02	.20	.07	-.06	-.28	-.12	-.21
X_{10}	Vocational Agriculture GPA	-.10	.15	.35	.24	.16	-.03	.08	.03
X_{11}	Number of High School English Courses	.19	.12	.24	-.02	.28	.33	.38	.07
X_{12}	High School English GPA	.48	.54	.52	.40	.42	.42	.53	.42
X_{13}	Chemistry Test	.50	.53	.37	.23	.41	.38	.33	.53
X_{14}	High School GPA in Academic Courses	.60	.68	.62	.54	.43	.37	.37	.51

1 Correlation Coefficients greater than 0.32 are significant at the .05 level.

An interesting note is the non-significant correlation of GPAVA and a negative correlation for the number of vocational agriculture courses with GPA in the Agricultural Production Program. This may result from the fact that GPAs in vocational agriculture are not estimates of learning ability, which is a good predictor of performance in academic endeavors. Later in the paper, these predictors will be combined possibly to achieve better validity.

In the above discussion, results of a validation procedure were mentioned. These concurrent validations measured the strengths of a relationship between the criterion (GPA in the Institute of Agricultural Technology) and the predictor (our 14 explanatory variables).

Table 2 contains correlation coefficients (concurrent validity coefficients) between our original 14 possible predictors and GPAs in eight academic areas in which agricultural production students take courses.

For agricultural engineering courses we find that HSGPA (.60), HSMGPA (.51), and Chem (.50) are leading predictors. The HSGPA and HSMGPA were expected; however, the Chem test scores were not anticipated to be good predictors of Agricultural Engineering GPAs. The chemistry test may very likely be masking underlying causes, namely learning ability.

HSGPA (.68), Arith (.60), and HSMGPA (.59) are predictors with the highest correlations with the GPA in agricultural economics. These predictors reflect the great deal of mathematics skills involved in accounting, budgeting, etc. that are contained in the agricultural economics courses.

Animal husbandry GPAs are most highly correlated with HSGPA (.62), Voc (.56), and Comb (.55). These three predictors again carry a large measure of learning ability. The GPAVA (.35) is a significant variable in predicting the Animal Husbandry GPA but not for the other academic areas.[1]

The predictors with the highest correlation with dairy GPAs are HSGPA (.54) and Voc (.45). It was previously believed that vocational agriculture GPAs and chem test scores might be more significant than in fact they are.

The best predictors of GPAs in crop science are HSMGPA (.46), HSGPA (.43), M (.42), and Chem (.41). These results are as expected.

For soil science the best predictors are Voc (.44), Total (.44), and HSMGPA, DAT, and Chem all with approximately .38 correlation coefficients. Voc test scores are again capturing a component of general intelligence: the other variables may be also.

GPAs in communications are best predicted by HSEGPA (.53), HSMGPA (.49), and HSE (.38). This is as expected. Communications skills are related to intelligence and to the command of the English language.

Chem test scores (.53) and HSGPA (.51) are the best predictors of the GPA in resource development. Since chemistry is not taught in resource development, a spurious correlation may be the answer to why the Chem test scores enter as a good predictor. However, GPAs in academic courses are again good predictors and serve as a good measure of academic ability.

Regression Analysis

Using the 14 predictor variables, a regression equation with GPAs at the end of one (GPA1), two (GPA2), three (GPA3), and four (GPA4) terms of instruction as the dependent variables was calculated. The results are presented in Table 3.

In predicting GPA1, the equation utilizes Voc, HSMGPA, and DAT variables. When moving to GPA2 the Voc variable is replaced by Comb and the HSGPA is added. The predictive equation for GPA3 finds HSMGPA becoming most important in predicting, with Comp, Voc, and HSGPA following in importance.

For GPA4, in comparison to GPA3, the number of math courses enters the equation and no variables are eliminated.

Predicting Academic Area GPA A Regression Analysis

Table 4 contains the results of the regression analysis using academic area GPA as the dependent variables.

In predicting agricultural engineering GPA's (AEGPA), the HSGPA is most important with VA and M following in importance. If an advisor were to use this

[1] To test the hypothesis that GPAVA or that VA was a predictor or influencer of GPA in agricultural production, an equation with vocational agriculture as a dummy variable was constructed. It could not be concluded that the effect of vocational agriculture was significantly different from zero at the .05 level.

TABLE 3 Regression Equations for GPA_1 to GPA_4

Dependent Variable	Constant Term	Variables and Coefficients	R	R^2	Standard Deviation
GPA_1	-3.47	+ .034 Voc + .235 HSMGPA + .009 DAT[2]	.77	.60	.41
GPA_2	-2.13	+ .025 Comb + .215 HSMGPA + .006 DAT + .120 HSGPA	.76	.58	.39
GPA_3	-2.10	+ .213 HSMGPA + .014 Comp + .014 Voc + .073 HSGPA	.75	.56	.38
GPA_4	-1.51	+ .102 M + .023 Voc + .057 HSGPA + .167 HSMGPA	.72	.53	.38

1 Ordinary Least Squares Regression was used in a step-wise routine.
2 Variables are listed in all equations in order of importance or beta weight attached to them.

TABLE 4 Regression Equations For Academic Area Grade Point Average

Dependent Variable	Constant Term	Variables and Coefficients	R	R^2	Standard Deviation
AEGPA	2.12	+ .350 HSGPA - .125 VA+ .145 M	.70	.49	.40
AECGPA	0.66	+ .459 HSGPA + .033 Arith.	.74	.55	.44
AHGPA	-6.92	+.049 Voc + .233 VA + .558 HSGPA	.75	.56	.69
DRYGPA	-6.66	+ .760 HSGPA + .045 Voc + .173 GPAVA	.60	.36	1.27
CSCGPA	-0.59	+ .034 DAT + .321 HSMGPA + .241 M	.61	.37	.80
SLSGPA	-3.81	+ .413 HSE + .026 Voc + .024 DAT - .111 VA	.67	.44	.68
COMGPA	1.94	+ .467 GPAHSE - .104 VA	.57	.33	1.94
RDGPA	0.30	+ .064 Chem + .817 HSGPA - .041 DAT - .204 VA	.64	.41	1.42

equation as an aid in advising a student of the possibility of doing well in AE, the HSGPA, VA, and M would be most important variables. To estimate the GPA he might expect in AE, he would utilize data from the student's transcript and perform the mathematical computations. This would yield the expected GPA. The advisor could also stress the importance of vocational agriculture and math skills as well as HSGPA in helping students do well in AE courses.

From the equation for agricultural economics (AEC), we can generate an estimated GPA and show that arithmetic ability is very important in AEC. Thus, if a student scores low on the Arith test or has a low HSGPA, he may encounter difficulty in AEC. The advisor would do well to recommend that the student improve his math skills prior to taking AEC courses.

In predicting animal husbandry (AH) GPA, Voc, number of vocational agriculture courses, and HSGPA are the most important variables. HSGPA, Voc, and GPAVA are most important in determining dairy (DRY) GPAs.

The differential aptitude test, HSMGPA, and the number of math courses were the most important when used in combination to predict crop science GPAs.

Soil science GPAs were best predicted when using the number of high school English courses, Voc and DAT scores, and the number of vocational agriculture courses.

For communications skills the GPAHSE is the most important variable with the number of vocational agriculture courses having an inverse relationship.

Chemistry test scores, high school GPAs, DAT test scores, and the number of vocational agriculture courses are the best predictors of resource development GPAs.

When using equations for DRYGPA, COMGPA, and RDGPA, we find that the magnitude of the standard deviation greatly reduces the usefulness of these equations. And the R^2 for all equations is rather low. This may be explained by the heterogeniety of the Agricultural Production Program students.

Conclusions

Our study found correlation coefficients for GPAs with single predictors and used regression analysis for a set of multiple predictors. The study suggests that a student's GPA in the Agricultural Production Program can be predicted using certain predictor variables. However, from 47 to 40 percent of the variation in $GPAs_{1-4}$ was not explained using our variables. Thus, motivation and other factors not measured were responsible for this remaining variation. While not denying that 47 percent unexplained variation is an important consideration when using these equations, the 53 percent that was explained could be used as an aid in student acceptance and in advisement once the student is in the program.

The subjective evaluation of a student's background, the high school counselor recommendation, references, and personal interviews with the student are invaluable tools in the admissions and advisement process. The regression models presented in this paper are another tool the admissions officer or advisor might find beneficial, but it should not be used in a vacuum.

To Meet The Need

Donald E. Ringstmeyer

Abstract

Case study of a unique post-secondary vocational technical institution connected with a major land-grant university. Evidence is cited showing benefits of such association.

In the early 1960's, a Nebraska Unicameral Legislature interim study revealed there was a serious shortage of adequately trained, technically educated, work force to meet the needs of farmers, ranchers, and the agri-business related industries in Nebraska. This need was serious enough to impede the normal economic growth of rural as well as urban Nebraska. To help relieve this situation, serious consideration was given by the Nebraska Unicameral Legislature to the development of an agricultural related technical school on the post-secondary level. The fruit of this consideration was the development of a pilot educational program in technical agriculture.

Unique UNSTA

Thus, the University of Nebraska School of Technical Agriculture at Curtis was established by a unanimous resolution of the members of the unicameral in 1965. In

Ringstmeyer is media specialist in residence at the School of Technical Agriculture, The University of Nebraska, Curtis, Nebraska.