

University Admission Criteria and Learning Style:
Predictors of Agriculture Students' Academic Performance and Degree Completion?

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Abstract

This study was conducted to determine predictors of academic performance and degree completion of college agriculture students. Freshmen enrolled in a college of agriculture learning and development course in the fall of 1997 ($n = 245$) at the University of Missouri participated. ACT, high school core grade point average, and high school class rank were investigated as predictors of academic performance and degree completion. In addition, students' preferred learning styles were investigated as a possible predictor of academic performance and degree completion. Regression analysis was utilized to determine the variance in students' cumulative GPA at the completion of four and one-half academic years. Step-wise discriminant analysis was performed to build a predictive model that could determine whether a linear combination of learning style, ACT score, high school class rank, and high school core GPA could be used to predict student degree completion.

Field-independent learners exhibited a tendency for greater academic performance than did their field-dependent peers. The best predictor of students' academic performance, as determined by cumulative college GPA, was their high school core GPA. Learning style was not a predictor of students' cumulative GPA. High school core GPA was found to have limited value in predicting agriculture students' degree completion rates.

Introduction/Theoretical Framework

Universities across the nation have established criteria in the selection of students for admission. While the selection criteria vary among universities, most universities use some combination of high school grade point average, high school class rank, and ACT examination. However, are these admission criteria valid in predicting academic performance and degree completion of agriculture students? Can certain variables be added or excluded from such admission equations to provide more accurate and efficient selection criteria for college of agriculture students?

Students' academic performance and their continued enrollment through attainment of a bachelor's degree are a concern for universities and their respective colleges. Several studies have placed high monetary values on student retention (Dyer, Lacey, & Osborne, 1996; Glennen, Farren, & Vowell, 1996). Vernon (1996) noted that factors other than academic performance influence student retention. Dyer and Breja (1999) reported that retention could be predicted by examining the criteria by which students were admitted. They further indicated that traditional admission criteria were not the best predictors of academic performance and retention of agriculture students. Enrollment in secondary agriculture classes and agricultural experience were two factors that appeared to have a more accurate prediction value of student retention.

To date, the research regarding students in colleges of agriculture has provided important indicators of variables that may or may not be effective in predicting students' academic performance and retention. The previously identified studies however, do not track students' retention throughout the completion of a degree. National studies indicate that the number of students able to achieve a bachelor's degree within four years of enrolling in college is declining (Astin, 1996; National Center for Educational Statistics [NCES], 1993). Adelman (1999) reported that the rigor of a student's high school curriculum explained more of the variance in degree completion than either ACT, high school class rank, or high school GPA. In addition, Adelman indicated that college admissions formulas that emphasized ACT, high school class rank, or high school GPA were more likely to produce lower degree completion rates. "Degree completion is the true bottom line for college administrators, state legislators, parents, and most importantly, students—not retention to the second year, not persistence without a degree, but completion." (Adelman, 1999, p.1) Thus research is warranted that determines the best predictors of degree completion in colleges of agriculture.

In addition to research concerning admission variables, research has been conducted regarding the relationship between students' learning styles and academic performance (Witkin, 1973; Gregorc, 1979; Garger & Guild, 1984; Claxton & Murrell, 1987; Schroeder, 1993). These studies concluded that when learning styles were considered in the teaching-learning process, student achievement was enhanced. Regarding the relationship between learning styles and retention, Matthews (1996) concluded that the interaction of learning style, race, and gender could be utilized to predict students' retention in postsecondary institutions. Schroeder (1993) acknowledged that being cognizant of and accommodating variations in learning styles could improve curricula, the teaching-learning process, and ultimately the retention of students in higher education.

Gregorc (1979) described a person's learning style as consisting of distinct behaviors which serve as stable indicators of how a person learns and adapts to his/her learning environment. The most extensively researched and applied learning style construct has been the field-dependence/independence dimension (Guild & Garger, 1985). Chickering (1976) noted that the field-dependence/independence dimension had major implications for college admissions and for faculty who make decisions about learning environments and practices.

Individuals who prefer a field-dependent learning style tend to have a global perception, have a more difficult time solving problems, are more attuned to their social environment, learn better when concepts are humanized, and tend to favor a spectator approach to learning. Additionally, individuals preferring a field-dependent learning style have been found to be more extrinsically motivated and learn better when organization and structure is provided by the teacher (Witkin et al., 1977).

Conversely, individuals who prefer a field-independent learning style tend to view concepts more analytically, therefore finding it easier to solve problems. Individuals preferring a field-independent learning style are more likely to favor learning activities that require individual effort and study. In addition, they prefer to develop their own structure and organization for learning, are intrinsically motivated, and are less receptive to social reinforcement. (Witkin et al., 1977).

Recent studies have focused on assessing the learning styles of students in colleges of agriculture. Learning styles have been found to have a positive relationship with academic performance, as measured by grade point average (Torres, 1993; Torres & Cano, 1994), performance in agriculture courses (Garton, Dauve, & Thompson, 1999), and overall success in higher education (Cano & Porter, 1997; Cano, 1999).

Previous research has identified students' learning styles and reported associations between learning style and academic performance and retention. However, data is lacking that describes the relationship between university admission criteria and learning styles to students' academic performance and degree completion rates in colleges of agriculture. Universities use selected criteria to determine if students are likely to be successful in their academic endeavors. By analyzing the admission criteria of groups of students who have been successful against groups who have not, the possibility exists to classify subsequent applicants for retention purposes based upon an analysis of admission criteria. Consequently, what are the best predictors of students' academic performance and retention? Possessing this knowledge could provide faculty and academic advisors with information to assist at-risk students.

Purpose and Objectives

The purpose of this study was to determine predictors of academic performance and degree completion of students in the College of Agriculture, Food and Natural Resources at the University of Missouri. The specific objectives of the study were to:

1. Describe the relationship between students' learning styles and academic performance, as measured by cumulative grade point average, at the completion of their academic degree program.
2. Determine the whether a linear combination of university admission criteria and/or learning style could predict academic performance, as measured by cumulative grade point average, at the conclusion of the academic degree program.
3. Determine whether a linear combination of university admission criteria and/or learning style could predict students' degree completion.

Methods/Procedures

The target population for this correlational study was freshmen entering the College of Agriculture, Food and Natural Resources at the University of Missouri in the fall of 1997 ($N = 326$). The accessible sample consisted of an intact group of freshmen enrolled in a college learning and development course ($n = 245$).

The Group Embedded Figures Test (GEFT) (Witkin, Oltman, Raskin, & Karp, 1971) was administered to assess the preferred learning style of students as field-dependent or field-independent. The possible range of scores on the GEFT is zero to 18. Individuals scoring 11 or less were considered to prefer a field-dependent learning style, while individuals scoring 12 or greater were considered to prefer a field-independent learning style.

The GEFT is a standardized instrument that has been used in educational research for more than 30 years (Guild & Garger, 1985). The validity and reliability of the GEFT was established by the developers of the instrument. The GEFT is a timed test; therefore internal consistency was measured by treating each section as split halves ($r = .82$) (Witkin et al., 1971).

Academic performance was measured by cumulative grade point average at the completion of the academic degree program. University admission variables included ACT score, high school class rank, and high school core grade point average. High school core grade point average was calculated based on courses required by the university for admission, and was determined from university admission data. Degree completion was determined based upon students' attainment of a baccalaureate degree at the conclusion of four and one-half academic years.

Descriptive statistics were generated on GEFT scores and academic admission variables (ACT, high school core GPA, and high school class rank). Pearson product-moment correlation coefficients were calculated between GEFT scores, academic admission variables, and cumulative grade point average and were interpreted using Davis=s (1971) descriptors. Regression analysis was used to explain variance in students= cumulative GPA. Step-wise discriminant analysis was performed to build a predictive model of independent variables that could determine whether a linear combination of GEFT score, ACT score, high school class rank, and high school core GPA could be used to predict completion of a baccalaureate degree. An alpha level of .05 was established a priori.

Results/Findings

The first objective sought to describe the relationship between students' learning styles and academic performance at the completion of four and one-half academic years. A majority (73%) of the students possessed a preference for a field-independent learning style (Table 1). The remaining students (27%) preferred a field-dependent learning style. Students were grouped according to cumulative grade point average at the completion of four and one-half academic years and categorized by their learning style preference.

An analysis revealed that 65% of the students with a field-dependent learning style achieved a cumulative GPA of 2.5 or greater, while 35% earned less than a 2.5 cumulative GPA. Conversely, 79% of the students possessing a preference for a field-independent learning style achieved a GPA of 2.5 or greater, while the remaining 21% earned less than a 2.5 cumulative GPA. A low positive relationship ($r = .17$) existed between students' GEFT scores and their cumulative GPA.

Table 1. *Relationship Between Learning Style and Academic Performance (n = 245)*

Cumulative GPA	Field-Dependent		Field-Independent	
	<i>n</i>	%	<i>n</i>	%
3.50 - 4.00	8	12.1	43	24.0
3.00 - 3.49	15	22.7	54	30.2
2.50 - 2.99	20	30.3	45	25.1
Total (≥2.50)	43	65.2	142	79.3
2.00 - 2.49	14	21.2	19	10.6
1.50 - 1.99	6	9.1	12	6.7
below 1.49	3	4.5	6	3.4
Total (<2.50)	23	34.8	37	20.7
Total	66 (27%)	100.0	179 (73%)	100.0

Note. $r = .17$; Cumulative GPA $M = 2.88$, $SD = .72$; GEFT $M = 13.3$, $SD = 3.88$

The second research objective sought to determine whether a linear combination of university admission criteria and/or learning style could predict academic performance. Substantial positive intercorrelations were found between the predictor variables of ACT and high school core GPA ($r = .57$) and high school class rank ($r = .54$) (Table 2). In addition, a very strong positive association was found between high school core GPA and high school class rank ($r = .86$). Meanwhile, low positive associations were identified between GEFT scores and the predictor variables of high school core GPA ($r = .17$) and high school class rank ($r = .23$). A moderate positive association was found between GEFT and ACT scores ($r = .36$). Substantial positive correlations were identified between the criterion variable (cumulative GPA) and high school core GPA ($r = .56$) and high school class rank ($r = .49$).

Table 2. *Intercorrelations of Variables Regressed on Cumulative Grade Point Average*

Variable	1	2	3	4	5
1. GEFT	--	.36	.17	.23	.17
2. ACT		--	.57	.54	.45
3. High school core GPA			--	.86	.56
4. High school class rank				--	.49
5. Cumulative GPA					--

Note. ACT $M = 24.7$, $SD = 4.1$; High school core GPA $M = 3.41$, $SD = .48$;
High school class rank (percentile) $M = 78.2$, $SD = 17.9$

The intercorrelation matrix of predictor variables revealed the presence of multicollinearity, a potential violation of the assumptions in using multiple linear regression. Using guidelines offered by Lewis-Beck (1980), each independent variable was regressed on the remaining independent variables. Regressing the independent variables on high school core GPA resulted in an R^2 value of .73, indicating a high degree of multicollinearity. Furthermore, an R^2 value of .74 was found when the independent variables were regressed on high school class rank, again indicating a high degree of multicollinearity. Due to a lower correlation coefficient with the criterion variable, high school class rank was excluded from consideration in the regression equation.

Step-wise multiple regression was used to explain the variance in student cumulative GPA. An analysis indicated that 32% of the variance in cumulative GPA could be accounted for by high school core GPA (Table 3). ACT score accounted for an additional two percent of the variance when entered into the regression analysis. Subsequently, a combination of high school core GPA and ACT score accounted for 34% of the variance in cumulative GPA. Students' learning styles (GEFT scores) did not enter the regression equation.

Table 3. *Step-wise Regression of High School Core GPA and GEFT Score on Cumulative GPA*

Variable	R^2	b	t
High school core GPA	.32	.67	7.26*
ACT	.34	.02	2.73*
(Constant)		-.16	

* $p < .05$

The third objective sought to determine the best predictors of degree completion as evidenced by students' attainment of a baccalaureate degree at the conclusion of four and one-half academic years. To accomplish this purpose, a discriminant analysis procedure was used to generate a predictive model of linear relationships between learning style (GEFT score) and university admission criteria (ACT score, high school core GPA) and degree completion. Descriptive data for the discriminating variables used for the model are presented in Table 4.

Again, due to the presence of multicollinearity between the variables high school core GPA and high school class rank, the latter variable was omitted from consideration. In addition, due to missing data on discriminating variables, eight cases were not included in the analysis.

Table 4. *Means and Standard Deviations of Discriminating Variables*

Discriminating Variables	Non-Graduates (<i>n</i> = 81)		Graduates (<i>n</i> = 156)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
GEFT	12.7	4.2	13.6	3.7
ACT	23.1	3.6	25.6	4.0
H.S. Core GPA	3.15	.49	3.53	.44

When employing discriminant analysis, high school core GPA was the only variable to enter the prediction equation (Wilks' Lambda = .87, $p < .05$). GEFT score and ACT score were eliminated as discriminating variables. The Eigenvalue (.15) indicated the discriminating power of the discriminant function (Garson, 2001). The canonical correlation ($R_c = .37$) expressed the degree of association between the groups and the discriminant scores. The canonical discriminant function coefficients (High School Core GPA = 2.18, Constant = -7.41) were the unstandardized discriminant function coefficients used to construct a prediction equation for classifying new cases. Overall the discriminant function was accurate in predicting 71% of the cases (Table 5).

Table 5. *Classification of Cases for Degree Completion*

Group	No. of Cases	Predicted Group	
		Non-Graduates	Graduates
Non-graduates	85	33 (38.8%)	52 (61.2%)
Graduates	156	17 (10.9%)	139 (89.1%)
Percent of cases correctly classified: 71.4%			

Conclusions and/or Recommendations

Learners preferring a field-independent learning style exhibited a tendency for greater academic performance than their field-dependent peers. A greater percentage of students with a field-independent learning style preference attained a cumulative GPA of 2.5 or greater than students with a field-dependent learning style preference. Does this imply that students possessing a preference for a field-independent learning style were academically superior? Perhaps a more plausible conclusion would be that instructors' teaching styles, course assignments/projects, and course assessments were better suited to the strengths of field-

independent learners. While students with the field-independent learning style preference exhibited higher grade point averages in general, learning style had no predictive value when other variables were considered in predicting academic performance.

The best predictor of academic performance was a combination of high school core grade point average and ACT score. However, ACT score accounted for only two percent of the variance in academic performance beyond the variance that could be accounted for by high school core GPA (32%). Although Witkin, et. al. (1977) noted that field-independent learners tend to favor careers in areas such as agriculture, GEFT score was not a predictor of students' academic performance.

Prior research also identified high school grade point average as a predictor of students' academic performance (Murtaugh, et. al., 1999; Wold & Worth, 1991). The findings of the current study and those of prior research should raise concern with the use of university wide admission criteria as adequate predictors for the success of students enrolled in colleges of agriculture. What additional variables account for the remaining variance in the academic performance of students? Additional research is needed to establish valid and reliable predictors of student success in colleges of agriculture.

In the current study the criteria used for college admission was found to have limited value in predicting agriculture student degree completion. High school core GPA appeared to be the best predictor of students attainment of a baccalaureate degree, yet only accounted for 15% of the variance ($R_c^2 = .15$). Should other variables be considered in admitting students to colleges of agriculture? Further quantitative and qualitative research is needed to identify if other variables exist that can predict whether students will complete their education. Further research is needed to determine the strength of and establish trends between this as well as other variables regarding student performance and degree completion in colleges of agriculture.

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Garton, Ball, and Walker identified several variables currently used in most college admissions programs and wanted to know if the addition of learning styles to the equation could better predict degree completion. While the literature review adequately summarizes major research on learning styles it doesn't go far enough in building the rationale for conducting this study. What are the implications for non-completion of a college degree, both on a personal and a societal level? For example, a student who completes a college preparatory program, enrolls in a four-year postsecondary program, but doesn't complete it, is likely to enter the workforce with few skills. The monetary cost of non-completion is more than the university's bottom line and the implications for high school counseling are high.

Literature on learning styles measures other than GEFT suggests that 75% of high school students are "globally oriented" and 25% are "analytically oriented" (note that these percentages are close to what the authors found) while those who enter the teaching profession are overwhelmingly oriented towards the analytical. The authors allude to the relationship between teaching styles at the university and student success, but they do not explore this in enough detail to explain some of their results. This would be a worthwhile area for further exploration, both in the literature and through research. Also, what other measures of learning preference might be interesting to investigate, particularly those that are not dichotomous in nature?

The authors have done an outstanding job in presenting their methods used, the data analysis, and the findings. The paper is an easy read, but that does not diminish the scholarly presentation of the information. One question is looming, though, and that is one of "What difference does having learning styles information make?" In other words, assuming that you can't change the learning styles of applicants, of what proposed benefit will that information be? The answer to that question is also needed in the development of the rationale for the study.

One of the recommendations put forth by the authors is that further research is needed to identify additional predictors of degree completion. This may be wise, but we once again may get into the "why is this important" question because of not being able to change certain characteristics about an individual applicant. Perhaps a focus on how to improve factors influencing student achievement in high school is warranted – does the university have a responsibility to work in those areas? This would mean attention to teacher quality, resource equity across states and districts, improvement of socioeconomic status, etc. For purposes of our discussion, I would be interested in hearing how the authors would justify a study to identify predictors of success and what implications the results might have.

Garton, Ball, and Walker have tackled a unique problem and I hope they will explore it to greater depth.

