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THE USE OF LEARNING STYLES AND ADMISSION CRITERIA IN PREDICTING ACADEMIC PERFORMANCE AND RETENTION OF COLLEGE FRESHMEN

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Abstract

Research was conducted with college freshmen to assess the effectiveness of university admission variables and student learning style in predicting students ' academic performance and retention. ACT composite score, high school class rank, high school core GPA, and learning style were analyzed. An intact group of freshmen enrolled in a college learning and development course was studied. Learners preferring a field-independent and field-neutral learning style exhibited greater academic performance than their field-dependent peers during the first year of college as evidenced by GPA. The best predictors of academic performance during the first year of college were high school core GPA and ACT score. Learning style and ACT score appeared to be the most accurate predictors of student retention.

Introduction

Universities across the nation have established criteria for student admission. Most universities use a combination of high school grade point average, high school class rank, and ACT scores. However, are these admission criteria valid in predicting academic performance and retention of agriculture students?

Students' academic performance and their continued enrollment 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) predicted retention by examining admission criteria. They found 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 more accurately predicted student retention.

In addition to research concerning admission variables, considerable research has been conducted regarding the relationship between students' learning styles and academic performance (Witkin, 1973; Gregorc, 1979; Guild & Garger, 1984; Claxton & Murrell, 1987; Schroeder, 1993). These studies concluded that when learning styles were considered in the teaching-learning process, student achievement was enhanced. Schroeder acknowledged that accommodating the 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 indicators of how a person acquires information 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 admission and for faculty who make decisions about learning

environments and practices. Dyer (1995) noted that in the field-dependence/independence learning style dimension, a person can also be categorized with a field-neutral (possessing characteristics of both field-dependent and field-independent) learning style.

Individuals who prefer a field-dependent learning style tend to perceive globally, 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 prefer that organization and structure for the subject matter be provided by the teacher (Witkin, Moore, Goodenough, & Cox, 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 reported associations between learning style and academic performance. However, data are lacking that describe the relationship between university admission criteria and learning styles to students' academic performance and retention in colleges of agriculture. Consequently, what are the best predictors of students' academic performance and retention? Possessing this knowledge could provide faculty and academic advisors with the necessary information to assist at-risk students.

Purpose and Research Questions

The purpose of this study was to determine predictors of academic performance and retention of freshmen 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 freshmen academic year.
2. Determine the best predictors of academic performance as measured by cumulative grade point average at the conclusion of the freshmen academic year
3. Determine whether a linear combination of university admission variables and/or learning style could predict the retention of students for enrollment in the sophomore year.

Methods and Procedures

Population and Sample

The target population for this *ex post facto* correlational study was freshmen entering the College of Agriculture, Food and Natural Resources during the 1997 Fall Semester (N = 326). The sample consisted of an intact group of freshmen enrolled in a learning and development

course (n = 245).

Instrumentation

The Group Embedded Figures Test (GEFT) (Witkin, Oltman, Raskin, & Karp, 1971) was administered to assess the preferred learning style of each student as field-dependent, field-neutral, or field-independent. The total possible range of scores on the GEFT is 0 to 18. Individuals scoring 14 or greater were considered to prefer a field-independent learning style, individuals scoring 10 or less were considered to prefer a field-dependent learning style, and those individuals scoring from 11 through 13 were considered to prefer a field-neutral learning style.

The GEFT is a standardized instrument that has been used in educational research for more than 25 years (Guild & Garger, 1985). The validity and reliability of the GEFT was established by the developers of the instrument (Witkin et al., 1971). The validity of the instrument was established by determining its relationship with the parent test, the Embedded Figures Test (EFT), as well as the Rod and Frame Test (RFT), and the Body Adjustment Test (BAT). The GEFT is a timed test, therefore internal consistency as a measure of reliability was measured by treating each section as split halves (r = .82).

Data Collection and Analysis

The GEFT was administered to freshmen in a college wide learning and development course during the second week of the fall semester. Academic performance was measured by cumulative grade point average at the completion of the freshmen academic year. 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. No courses were weighted for high school core GPA calculations. Retention was determined based on enrollment status at the beginning of the first semester of the sophomore year.

Descriptive statistics were generated on GEFT scores and academic admission variables (ACT, high school core GPA, and high school rank). Pearson product-moment correlation coefficients were calculated between GEFT scores and academic admission variables and were interpreted using Davis' (1971) descriptors. Regression analysis was used to explain variance in students' cumulative GPA at the completion of the freshmen academic year. 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 student enrollment status for the fall semester of the sophomore year. An alpha level of .05 was established *apriori*.

Results

The first objective sought to describe the relationship between students' learning styles and academic performance at the completion of their freshmen academic year. Fifty-six percent of the students preferred a field-independent learning style. The remaining students were split between the field-neutral (24%) and field-dependent (20%) learning style preferences. Students were grouped according to cumulative grade point average at the completion of the freshmen academic year and categorized by their learning style preference.

Seventy-seven percent of the students with a preference toward a field-independent learning style received a GPA of 2.5 or greater during their freshman academic year (Table 1). Seventy-three percent of the students with a field-neutral and 60% with a field-dependent learning style achieved a GPA of 2.5 or greater during their first semester. Overall there was a low positive relationship (r =

.21) between students' GEFT scores and their cumulative GPA at the completion of the freshmen academic year.

The second research objective sought to determine the best predictors of students' academic performance at the completion of the freshmen academic year. Substantial positive intercorrelations were found between the predictor variables of ACT and high school core GPA (r = .56) 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 GPA (r = .22) and high school class rank (r = .24). A moderate positive association was found between GEFT and ACT scores (r = .36).

Table 1. Relationship Between Learning Style and Academic Performance

	Learning Style					
	Field-Dependent		Field-Neutral		Field-Independent	
Cumulative GPA	n	%	n	%	n	%
3.50 - 4.00	4	1.6	10	4.1	34	13.9
3.00 - 3.49	10	4.1	16	6.5	39	15.9
2.50 - 2.99	15	6.1	18	7.3	33	13.5
Total (22.50)	29 (60.0%)		44 (73.3%)		106 (77.4%)	
2.00 - 2.49	11	4.5	15	6.1	16	6.5
1.50 - 1.99	5	2.0	0	.0	7	2.9
below 1.49	3	1.2	1	.4	8	3.2
Total (<2.50)	19 (40.0%)		16 (26.7%)		31 (22.6%)	
Grand Total	48	19.6	60	24.5	137	55.9

Note r=.21; Cumulative GPA M = 2.88, SD = .70; GEFT M = 13.3, SD = 3.88

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

	Intercorrelations				
Variable	X_1	X_2	X_3	X_4	Y
GEFT (X_1)	1.00	.36	.22	.24	.21
ACT (X_2)		1.00	.56	.54	.47
High school core GPA (X_3)			1.00	.86	.61
High school class rank (X_4)				1.00	.52
Cumulative GPA (Y)					1.00

Note. ACTM=24.8, SD = 4.0; High school core GPA = M = 3.38, SD = .52; High school class rank (percentile) M = 77.6, SD = 18.4

Substantial positive correlations were identified between the criterion variable (cumulative GPA) and high school GPA (r = .61) and high school class rank (r = .52).

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. R^2 values of .75 and .74 were found when independent variables were regressed on high school GPA and high school class rank (respectively), indicating a high degree of multicollinearity. Therefore, 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 at the completion of the freshmen academic year. Thirty-nine percent of the variance in cumulative GPA at the conclusion of the freshmen academic year could be explained by a linear combination of high school core GPA and ACT score (Table 3).

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	.37	.69	8.11*
ACT	.39	.03	3.12*
(Constant)		-.24	

*p < .05.

Students' GEFT scores did not enter the regression equation.

The third objective sought to determine the best predictors of retention as evidenced by students' continuing enrollment at the beginning of sophomore year. Universities use certain criteria to determine if students have been, or are likely to be, successful in their academic endeavors. By analyzing the admission criteria of the group of students who have been successful against the group of those who have not, the possibility exists to classify subsequent applicants for retention purposes based upon an analysis of admission criteria. To accomplish this, a discriminant analysis procedure was used to generate a predictive model of linear relationships between admission criteria (GEFT score, ACT score, high school core GPA) and continued enrollment. 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.

Because of missing data on discriminating variables, the step-wise discriminant analysis procedure used mean scores for eight of the cases. The analysis produced a model with two discriminating variables; GEFT score and high school core GPA (Table 5). ACT score was eliminated as a discriminating variable. The centroid for students continuing their enrollment was significantly different from those students who did not return for their sophomore year (Wilks' Lambda = .95, p = .002). The discriminating power of the discriminant function, expressed as an eigenvalue, was .26. The degree of association between the groups and the discriminant scores was expressed as a canonical correlation of .45.

Table 4. Descriptive Statistics of Discriminating Variables

	Group			
	Not-continuing (n = 24)		Continuing (n = 221)	
Discriminating Variable	M	SD	M	SD
GEFT	14.27	3.53	13.14	3.88
ACT	23.91	2.89	24.83	4.14
High School Core GPA	3.14	.38	3.41	.50

Table 5. Summary Data for Discriminant Analysis

Discriminating Variable	b	s	Group	Centroids
GEFT	-.71	-.51	Not-continuing	-.73
High School Core GPA	.88	.72	Continuing	.07
Eigenvalue	R_c		Wilks' Lambda	p
.26	.45		.95	<.002

The discriminant analysis model successfully predicted group membership in 66.7% of the cases for non-continuing students and 67% of the cases for continuing students (Table 6). Overall, the discriminant function correctly predicted 66.9% of the cases.

Conclusions/Implications/Recommendations

Learners preferring a field-independent and field-neutral learning style exhibited greater academic performance, measured by GPA, than their field-dependent peers during their first year of college. However, a higher percentage of field-independent learners did not continue in college past their first year of enrollment. Further research is needed to explain this phenomenon. The question remains: Why did field-independent learners have greater academic success yet have a tendency to discontinue their enrollment in college?

The best predictor of academic performance during the first year of college was high school core GPA and ACT score. Although Witkin et al. (1977) noted that field-independent learners tend to favor careers in areas such as agriculture, GEFT score was not one of the best predictors of students' academic performance during their first year of enrollment in a college of agriculture.

Students with lower GEFT scores often out-perform strongly field-independent learners in courses commonly referred to as "general education," which largely comprise the course-load in which freshmen and sophomore students frequently enroll. During the first two years of college, students in colleges of agriculture are typically exposed to more non-agricultural curricula than agricultural course work. As a result, courses required for a specific major study are often limited to the last two years of a student's academic career. Perhaps a more

Table 6. Classification of Cases

Group	No. of Cases	Predicted Group: Not-continuing	Predicted Group: Continuing
Not-continuing	24	16 (66.7%)	(3393%)
Continuing	221	73 (33.0%)	148 (67.0%)
Percent of cases correctly classified: 66.9%			

uniform mix of course offerings – or the postponement of selected general education courses to later years – would facilitate increased retention of field-independent learners.

Criteria used for college admission of students is a good predictor of academic performance, but has limited power and value as a predictor of student retention. Other variables appear to influence a student's choice to continue his/her education. Further quantitative and qualitative research is needed to identify those other variables that influence a student's decision to continue or discontinue his/her education.

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