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ABSTRACT

This study identified predictors of academic performance in college algebra for postdevelopmental students at a predominantly black college. Questionnaires were randomly distributed to 175 students who were enrolled in college Algebra I and II. The sample included 142 students (classified as developmental on college entry by their own reports) who responded to a 21-item questionnaire, which included both traditional and nontraditional variables. Results indicate that students' entry-level characteristics, aptitude, and family-support variables were interrelated and had indirect effects on students' academic performance through institutional experiences and integration. Course grades have direct effects on academic performance, and students' motivation, ability, and familial influence on students' personal goals, have direct and indirect effects on academic performance through course grades. The result favor the developmental students regardless of gender and female students without regard to college grade point average. The trend analyses indicate that as levels of family income, family education, and school and community activities increased, the student's academic performance decreased. (Contains 7 tables and 61 references.) (SLD)

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EFFECTS OF INSTITUTIONAL EXPERIENCE AND FAMILY SUPPORT ON POST-DEVELOPMENTAL STUDENTS' ACADEMIC PERFORMANCE

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ABSTRACT

This study identified predictors of academic performance in College Algebra for post-developmental students. Questionnaires were randomly distributed to 175 students who were enrolled in College Algebra I and II. The sample included 142 students who responded to a 21-item questionnaire, which included both traditional and non-traditional variables.

Results indicated that students' entry-level characteristics, aptitude, and family-support variables were interrelated; and have indirect effects on students' academic performance through institutional experiences and integration. Course grades have direct effect on academic performance; and students' motivation, ability, and familial influence on students' personal goals have direct and indirect effects on academic performance through course grades. The results favored the developmental students regardless of gender as well as the female students without regards to college cumulative GPA. The trend analyses indicated that as levels of family income, family education, and school and community activities increased, the student's academic performance decreased.

EFFECTS OF INSTITUTIONAL EXPERIENCE AND FAMILY SUPPORT ON POST-DEVELOPMENTAL STUDENTS' ACADEMIC PERFORMANCE

Introduction

As postsecondary institutions have become committed to enroll minority and underprepared students from low-income families, the demography of the undergraduate student population has changed with respect to age, gender, ethnicity, and attitudes (Barham, 1992; Hill, 1987; Nora & Cabrera, 1996; Terenzini, Springer, Yaeger, Pascarella, & Nora, 1996). College attendance by minority students declined in the mid 1980s following a period of sustained growth. This trend was particularly obvious for African-American and Hispanic students who exhibited the lowest retention rates. More students are graduating from high schools and entering postsecondary institutions at an alarming rate. Many of these students come from low-income families, have varying educational needs and aspirations, and are first-generation college students with varying academic and psychosocial needs and ethnic composition (Castle, 1993; Cross & Astin, 1981; Terenzini, et al., 1996).

A very large number of adults in higher education can be classified as illiterates (Carmichael, Burke, Labat, & Seveniar, 1986). A large percentage of students in higher education need to improve their reading and study skills. Literacy has been defined

as the ability to perform reading, writing and figuring tasks with the expectations and needs of the individual (Roueche and Comstock 1981). It has been estimated that more than 50% of all students entering institutions of higher learning read below the eight-grade level, and that about 20 to 35% read at or below the fourth-grade level (Friedlander & Grede, 1981; Purvis & Niles, 1984). The cognitive and affective developments of these students have been explored (e.g., Cross, 1976; Johnson, 1984; Jones, Burton, & Davenport, 1984; Mathews, Carpenter, Lindquist, & Silver, 1984; Maxwell, 1980; Nora & Cabrera, 1996; Terenzini, et al., 1996).

The fact that minority students are underprepared for freshman college curricula puts them at risk of failure and increased their propensity for attrition. Literature abound on the "new" and disadvantaged students (e.g., Borgen, 1972; Clark, 1983; Cross, 1876; Cross & Astin, 1981; Johnson, 1984; Jones, et al., 1984; Mathews, et al., 1984; Hill, 1987; Hills, 1964; Pascarella, Edison, Nora, Hagedorn, & Terenzini, 1996; Terenzini, et al., 1996); the relationship among parents' level of education and familial support and students' degree aspiration and college choices, persistence and retention (Keith, Reimers, Fehrmann, Pottembaum, & Aubey, 1986; Cervero & Kirkpatrick, 1990; Clark, 1983); the effects of entry-level characteristics on students' academic performance beyond developmental programs

(Astin, 1975, 1985; Boylan, 1989; Hill, 1987; Kulik, Kulik, & Schwalb, 1983); and the institutional influence on the students' ability to co-integrate (Astin, 1990; Nettles, 1989; Nettles, Thoeny, & Gosman, 1986; Pascarella, et al., 1996; Spady, 1970; Terenzini et al., 1996; Tinto, 1975, 1987). Surprisingly, very little is known about the post-developmental African-American students' academic performances at predominantly Black institutions (PBIs). The demographic profiles of African American students at PBIs parallel those of African-American students at predominantly White institutions (PWIs) (American Council on Education, 1983; Hill, 1987; Howell & Frese, 1979; Nora & Cabrera, 1996; Terenzini, et al., 1996). However, their cognitive and metacognitive developments, as well as their affiliation needs are different in these institutions (Stanley & Porter, 1967; Spady, 1970; Tinto, 1982, 1988; Pascarella, 1985; Hill, 1987; Nora & Cabrera, 1996; Terenzini, et al., 1996).

The comprehensive literature reviews on the impacts of institutional environments on college performance, Pascarella (1985), Pascarella, Duby, and Iverson (1983), Pascarella and Terenzini (1979), Terenzini, et al., (1996), Spady (1970), and Tinto (1975, 1988) argued that the lack of understanding of the impacts of institutions on college students could be attributed to research efforts being focused on descriptive rather than theoretical underpinnings. This misunderstanding could only be

alleviated through research that is rooted in theory rather than application.

The theoretical formulation of Spady's (1970) college student drop-out syndrome was reformulated by Tinto (1975); which was then validated by Pascarella, Duby, and Iverson (1983) in their model of college dropout. In the hypothesized causal model of the role of perceptions of prejudice and discrimination on the adjustment of minority students to college, Nora and Cabrera (1996) theorized that pre-college academic ability, parental encouragement, and students' perception of discrimination all have significant effects on students' academic and intellectual development and persistence predicated upon their ability to co-integrate within the institutional environment. In addition, the authors argued that students' academic and intellectual developments have direct and indirect effects on persistence through academic performance, personal goal, and institutional commitments. In the conceptual formulation of the model of high school achievement, Keith, et al. (1986) posited that entry-level characteristics, gender, ethnicity, students' aptitude, and family background all have significant direct and indirect effects on students' academic achievement predicated upon the amount of time spent on homework and leisure T.V. viewing. They concluded that parental involvement had no meaningful effects on academic performance, that the male had higher academic

achievements than the female students, and that high ability students spent less time in leisure T.V. viewing and more time studying than low ability students.

As indicated by Tinto (1975), Pascarella, et al (!983), Keith, et al., (1986), Nora and Cabrera (1996), Pascarella, et al. (1996), and Terenzini, et al., (1996), at least five sources of influence should be considered in order to understand the parental and institutional impacts on students' academic performance, retention, and persistence in college: (1) entry-level characteristics, (2) environmental atmosphere and emphases of the parent institution, (3) students' academic aptitude and experiences, (4) parental involvement on students' decisions and college outcomes, and (5) students' social and non-academic experience in college.

One common factor peculiar to these retention-persistence models is that: (1) all of them focused on predominantly White institutions in the northern and northeastern states, (2) none of these models considered post-developmental students nor African-American students at predominantly Black institutions, and (3) none of these models included in their samples institutions in the southern states or the students domiciled in these states.

Beyond factors shaping post-developmental African-American students' academic performance in College Algebra, there are no studies that examined the interrelationships of cognitive and

non-cognitive factors with gender, students' familial support, pre-college experiences, college expectations and institutional effects, adjustments while attending college, and academic performance. Hence, the present investigation sought answers to two questions: (1) What are some of the variables that predict the grades in College Algebra for post-developmental students at a predominated Black institution, and to what extent did post-developmental African-American students' academic performance differed by gender? (2) How did these factors relate in predicting the students' overall academic performance at a predominantly Black institution? These questions led to the formulation of the hypotheses and the conceptual model. It was hypothesized that: (1) Students' academic performance was a function of their course grades predicated upon the level of their motivation, family support, aptitude, and institutional co-integration. (2) The inherent gender difference (if any) observed was a consequence of the students' academic histories and personal preferences as they evolved in their academic pursuits.

Methodology

The basic conceptual model for this study is as depicted in Figure 1. This is a longitudinal model that draws upon many of the postulates of parental and institutional effects on college students (Spady, 1970; Astin, 1975; Tinto, 1975, 1987/88;

Pentages & Credon, 1978; Howell & Frese, 1979; Pascarella, 1985; Keith, et al., 1986; Weiderman, 1989; Pascarella, et al., 1996; Terenzini, et al., 1996). The model hypothesized seven sets of constructs (endogenous latent variables) defining a causal sequence that begins upon students' entry into the institutional environment with varying educationally plausible characteristics (e.g., family income, level of education, background, size [FAMIN], as well as, high school GPA and number of mathematics courses taken in high school). The construct, MOTIVE, was assumed to have direct effects on students' aptitude (ABILITY), institutional experiences (INSTEXP), and influence of familial support on students' personal goals, aspirations, and decision-making FAMIGOAL. The familial support, aptitude, and motivation variables were presumed to influence not only the outcomes of college directly, but also students' course enrollment, informal and formal classroom experiences, academic and non-academic advisement and counseling, institutional experiences as well as institutional integration (INSTINT). Co-integration was operationalized as the students' ability to be both socially and academically integrated within an institutional environment (Pascarella, 1985; Pascarella, et al., 1996; Terenzini, et al., 1996; Tinto, 1975, 1988). Co-integration and the interplay of these sets of influential constructs on learning take place within the institutional environment as dictated by the

institution's organizational structure, its overall climates (including faculty/staff attitudes, infrastructures, and location), policies and philosophies, and developmental programs (Tinto, 1975, 1988; Keith, et al., 1986; Pascarella, et al, 1983; Terenzini, et al,. 1996).

Sampling and Instrumentation

The sample consisted of students entering a predominantly Black institution in northern Louisiana as first or second semester freshmen (including transfer students) in the fall semester of 1995. Of the 7609 full and part-time students enrolled at this PBI during the fall semester 1995, 2628 (35%) were freshmen. New freshmen admission for the same fall semester, 1995 in developmental programs accounted for 1390 (53%) of the total fall enrollment. Of these 1390 new freshmen, 651 (573 on-campus and 78 off-campus) were males and 739 (670 on-campus and 69 off-campus) were females; 1182 enrolled in College Algebra; 1379 were African-Americans and the rest (11) were classified as either Oriental/Asian (1); American Indians (1); Hispanics (3); Whites (5); or refused (4). These frequency counts were consistent with the campus-wide frequencies. These summary statistics reflect the norm at all predominantly Black institutions with focus on the liberal Arts and non-technical education (Hills, 1964; Purvis & Niles, 1984).

Questionnaires were distributed (during regular class

periods) to a random sample of 210 College Algebra students prior to the mid-term examination. Of the 210 students, 175 (classified as developmental students by their admission records) were considered for inclusion in the study. 142 (a return rate of 81%) of these 175 students were selected based on correct information provided in the questionnaires and the students' records. Students responses were in agreement with the campus-wide records maintained by the institution's Registrar.

A total of 32 potential variables were selected for this study. Seven readily available, traditional variables (high school GPA, number of years of high school mathematic taken, and composite and component ACT scores) found to have predictive power in the studies cited above were chosen for study as likely predictors of grade in college-level mathematics. The remaining 28 variables deemed necessary for this study were the family support and institutional variables. These predictors were believed to be significant in this study because of their potential impacts on students' performance at the college level. Some of the collected information were further screened and substantiated through the students' records. These variables were operationalized as follows:

1. Student's age (AGE) categorized as:-

   1 = 20 or under, 2 = 21 to 25, 3 = 26 to 29

   4 = 30 to 35, and 5 = 36 or above.

2. Gender (STUSEX) - dichotomized as 1 (male) or 2 (female).
3. Ethnicity (RACE) categorized as:-

   1 = Black, 2 = White, 3 = Hispanic, and 4 = Others.

Family support was subdivided into four variables as:-

4. Income (FAMINC) - categorized on a 1 to 5 scale.
5. Education (FAMEDUC) - categorized on a 1 to 5 scale and
6. Background (FAMBAGD) - categorized on a 1 to 3 scale.
7. Size (FAMSIZE) - categorized on a 1 to 5 scale.

Student Socialization (STUSOC) was subdivided into two variables as:

8. Community (COMACT) - categorized on a 1 to 5 scale and
9. School (SCHACT) - categorized on a 1 to 5 scale.
10. College expectation (EXPT) - categorized on a 1 to 5 scale.
11. Decision-making difficulty (DEC1) - categorized on a 1 to 5 scale.
12. Effect of decision-making on performance (DEC2) - categorized on a 1 to 5 scale.
13. Personal goal (PERGOAL) - categorized on a 1 to 5 scale.
14. Degree aspiration (DEGASP) - categorized on a 1 to 5 scale.
15. Number of hours of high school mathematics taken (HSCMATH).
16. Difficulty in attaining goals (DIFFGOAL) - categorized on a 1 to 5 scale.

17. Family's moral support (FAMSUPP1) and
18. Effect of family's moral support (FAMSUPP2) on performance were categorized on - a 1 to 5 scale each.
19. Institutional problem (INSTPROB) - categorized on a 1 to 5 scale.
20. Institutional problem resolution (INSTSOLN) - categorized on a 1 to 5 scale.
21. Significant knowledge (INSTKNOW) - categorized on a 1 to 5 scale.

The following variables were obtained from the students' records maintained by the institution's Registrar:

22. High school grade point average (HSCGPA) on a 4.0 scale.
23. College cumulative grade point average (CUMGPA) on a 4.0 scale.

24 to 28. Composite scores on the American College Testing (ACT) Program and scores on the four subsections (English, mathematics, natural science, and social science) on the established 1 to 36 scale: ACTCOMP, ACTENGL, ACTMATH, ACTSCIN, and ACTSOCL; and

29 to 32. Grades from developmental and College Algebra course (DEVMATH1, DEVMATH2, ALG1, and ALG2).

Analytical Procedures

Analyses were performed using the Statistical Package for

Social Science (SPSS [SPSS, 1988]). First, descriptive statistics were obtained for all variables associated with both ALG1 (n=77) and ALG2 (n=65). Numerical values were substituted for the earned grades in DEVMATH1, DEVMATH2, ALG1, and ALG2 course grades (A = 4, B = 3, C = 2, D = 1, F or W = 0). The grades for ALG1 were added to the list of ALG2 predictors for those students who had taken ALG1.

The dependent variable in this investigation was the students' college cumulative GPA (CUMGPA). Following the conceptual framework of the predictive model, seven sets of educationally plausible constructs were formulated from the maximum likelihood method of factor analysis. Each construct operationalized a portion of the model as depicted in Figure 1. The endogenous construct related to students' motivation and personal goals (MOTIVE) consisted of three indicators (HSCMATH, DEGASP, and PERGOAL). The family support construct (FAMIN) contained six indicators (INCOME, FAMEDUC, FAMSIZE, and FAMBAGD). The familial influence on students' personal goals, aspiration, and decision-making (FAMIGOAL) reflected a cluster of four indicators (Gender, HSCGPA, FAMSUPP1, and FAMSUPP2). The construct (ABILITY) measured the composite and components of the ACT (ACTCOMP, ACTENGL, ACTMATH, ACTSCIN, and ACTSOCL); the institutional related constructs, institutional experiences (INSTEXP) contained four variables (EXPT, DEC1, DEC2, and

DIFFGOAL) and institutional integration (INSTINT) had a cluster of five variables (SCHACT, COMACT, INSTPROB, INSTSOLN, and INSTKNOW). The earned grades (DEVMATH1, DEVMATH2, ALG1, and ALG2) loaded on the course grades construct (CGRADE). The sequential flow of information was a measure of the goodness-of-fit of this model as measured by the path coefficients. The specific variables in each set are listed in Table 7.

In answering question one (predictive variables for ALG1 and ALG2), the 32 variables were subjected to stepwise multiple regression analyses with earned scores in ALG1 and ALG2 (each) as dependent variables. This procedure was employed because it enters each independent variable one at a time on the basis of each measure's ability to explain the largest amount of the total variance not attributable to pre-existing variables in the regression equation. The result is an optimal prediction equation with as few variables as necessary to maximize the differences between group and minimize the error variance (Braxton, Duster, & Pascarella, 1988; Fassinger, 1987; Pedhazur & Schmelkin, 1991; Terenzini, et al., 1996, Tinsley & Tinsley, 1987).

To answer the second part of question one (gender difference in academic performance of post-developmental), the dependent variable (CUMGPA) was stratified into two dichotomous variables (Low and High academic performance): 1, if CUMGPA was less than 2.00 and 2, if CUMGPA was at least 2.00. The rationale for this

stratification stemmed from the federal Financial Aid Program. Financial aid stipends are often denied to students with cumulative GPA less than 2.00. The resulting group of stratified data were analyzed using a simple t-test. Subsequent statistical analyses included the trend tests. The use of Odds Ratios (OR) and Relative Risk (RR) estimates were obtained and compared between Low and High academic performance status and across all levels of family income, and school and community activities while controlling for gender.

Analyses for question two focused on the reliability estimates as well as factor and multiple regression analyses procedures. The factorially derived constructs were recoded and weighted with their corresponding mean standardized (z-scores) for the continuous variables). Weighted estimates -- similar to the concept of probability proportional to size (PPS) -- were derived from the proportion of respondents who responded to a particular item (for the categorical variables). The means of these PPS weights were then calculated (Keith, et al., 1986; Pascarella, et al., 1983; Tinsley & Tinsley, 1987). The composites from these weighted and recoded variables were then used as inputs in the stepwise multiple regression analysis with CUMGPA as the dependent variable. The regression weights (Betas) served as the path coefficients (Braxton, Duster, & Pascarella, 1988; Pedhazur & Schmelkin, 1991). In addition, the internal

consistency coefficients were estimated for each of these constructs. The results of these analytical procedures are summarized below.

Results and Discussion

The mean high school grade point averages and the standard deviations are not statistically significant. The mean ACTCOMP for the ALG2 group is slightly below the 17+ mean of freshmen in the Southwest and South/Southeast (American College Testing Service, 1983). These means are in accordance with the Center for Developmental Education Programs' standards at this institution for post-enrollment in ALG1 and ALG2. The mean ACT composite and its components are not significantly different for these groups (ALG1 and ALG2 students) in comparison with the overall means. However, there is a slight variation in these mean scores as indicated in Table 1.

There were only 29 (20.4%) and 113 (79.6%) of the sample whose cumulative college GPA were less than 2.00 and at least 2.00 respectively. A comparison of both groups indicated that high school GPA, and the component parts of English and social science were significant at the 5% level as shown in the fourth column of Table 2. The rest of the variables were statistically insignificant. The reported $F_{(1, 140)}$ are the squares of the two-tailed t-test at the 5% level of significance.

Table 1

Means and Standard Deviations for Students in ALG1 and ALG2 (HSCGPA, HSCMATH, & ACTs Only)

	OVERALL (N = 142)		ALG1 (N = 77)		ALG2 (N = 65)	
Variables	Mean	SD	Mean	SD	Mean	SD
HSCGPA	2.57	0.50	2.62	0.51	2.51	0.55
HSCMATH	9.64	3.78	10.21	4.44	10.52	3.54
ACTCOMP	17.01	2.85	17.13	2.82	16.76	2.59
ACTMATH	16.33	4.32	16.14	3.80	16.52	3.64
ACTENGL	16.23	4.01	16.78	4.58	15.78	3.78
ACTSCIN	16.48	4.44	16.62	3.78	16.24	4.81
ACTSOCL	14.96	4.28	14.95	4.51	14.65	3.57

Table 2

Comparison between Students with Low and High Academic Performance (CUMGPA)

	LOW[a] (N = 29)		HIGH[b] (N = 113)		$F^*_{(1, 140)}$[c]	
Variables	Mean	SD	Mean	SD	F^*	p-value
HSCGPA	2.31	0.48	2.64	0.51	9.97	0.002
HSCMATH	9.21	2.77	9.75	3.98	0.48	0.489
ACTCOMP	15.90	2.19	17.36	2.93	6.35	0.013
ACTMATH	16.28	3.38	16.35	4.55	0.01	0.913
ACTENGL	14.24	4.09	16.74	3.85	9.52	0.003
ACTSCIN	15.48	2.63	16.74	2.63	1.86	0.181
ACTSOCL	13.39	3.63	15.36	4.35	5.12	0.025

Note.

[a] Students with cumulative GPA less than 2.00

[b] Students with cumulative GPA greater than or equal to 2.00

[c] The critical value fir the F-distribution with df as specified for all comparisons.

Analysis for Question One

The assessment of question one started with correlation analysis. The Pearson Product Moment correlation coefficients (r) between HSCGPA, HSCMATH, and CUMGPA, as well as each of the potential predictors were calculated. These correlations are presented in Table 3.

The correlation coefficients for ACTSCIN and ACTSOCL were not significant with HSCGPA, HSCMATH, and CUMGPA. The correlation coefficients for ACTCOMP, ACTSCIN, and ACTENGL were significant with CUMGPA. This indicated that these variables were potential predictors of performance with CUMGPA. The correlation coefficients of the component ACT scores with the composite ACT score were very high. Approximately 83% of the variance was explained by ACTCOMP alone and 51% and 24% when ACTENGL and ACTMATH were included respectively. About 57% of total variance was explained by HSCGPA, ACTCOMP, COMACT, DEGASP, DEVMATH1 and DEVMATH2, HSCMATH, and FAMSUPP2 with 0.69 as the minimum variance. FAMSIZE, INCOME, COMACT, SCHACT, DEGASP, EXPT, and grade in ALG1 explained about 64% total variance in ALG2 with 0.68 as its minimum variance.

Multiple linear regressions were completed for ALG1 and ALG2. Variables were added sequentially so as to obtain the maximum in the multiple correlation coefficient at each step, until adding more terms failed to yield a statistically significant

Table 3

Correlation Coefficients (r) among HSCGPA, HSCMATH, and CUMGPA for Students in ALG1 and ALG2

Variables	HSCGPA	HSCMATH	CUMGPA	ACTCOMP
HSCGPA	1.000	0.082	0.471**	0.261**
HSCMATH	0.082	1.000	0.121	0.174
CUMGPA	0.472**	0.28**	1.000	0.282**
ACTCOMP	0.261**	0.174	0.482**	1.000
ACTMATH	0.212*	0.133	0.144	0.675**
ACTENGL	0.283**	0.121	0.384**	0.793**
ACTSCIN	0.104	0.092	0.213*	0.624**
ACTSOCL	0.113	0.132	0.112	0.643**

Note.
** $p < 0.01$ and * $p < 0.05$

improvement at the five percent level of significance. Before performing this analysis, the composites ACT and its components, family support, institutional, and social variables were dropped from the analysis. The rationale for this was the apparent interrelationships among these variables and their respective components and the high correlation coefficients among them. ACT scores correlate about 0.50 with cumulative GPA at the end of freshman year at most institutions; and values of 0.60 and 0.35 are regarded as high and fairly low in this instance (Ebel & Frisbie, 1991, p. 73).

The high degree of variable interdependence is an indication that the multiple regression procedure would not be feasible if these variables and their components were included. Subsequent

multiple linear regression analyses using the components rather than the composite ACT scores proved that the use of components did not improve predictive power. The results of these multiple linear regression analyses are as follows:

$$ALG1 = -1.99 + 0.6\ (HSCGPA) + 0.13\ (ACTCOMP) + 0.14\ (FAMSUPP2) - 0.24\ (DEGASP) + 0.08\ (DEVMATH2) + 0.07\ (DEVMATH1) + 0.06\ (HSCMATH) - 0.06\ (COMACT).$$

$R^2 = 57\%$ $R = 68\%$ Variance (MSE) = 0.69

$F^*_{(8,\ 133)} = 16.75$, p-value <<< 0.05

$$ALG2 = 1.38 + 0.27\ (FAMSIZE) + 0.25\ (COMACT) + 0.22\ (SCHACT) + 0.21\ (DEGASP) + 0.20\ (EXPT) + 0.18\ (ALG1) + 0.10\ (FAM)\_INC)$$

$R^2 = 64\%$ $R = 78\%$ Variance (MSE) = 0.68

$F^*_{(7,\ 134)} = 13.23$, p-value ≈ 0.023

The effects of students' abilities and high school experiences observed in predicting grades for ALG1 seemed to diminish when predicting the grades for ALG2. Institutional influence and degree of co-integration dictated students' course grades in ALG2. The predictive abilities of both regression equations were the consequences observed in question two.

Gender and Group-Specific Comparisons

Gender differences in the sample was the focus of question two. Of the 142 students, 53 (37.3%) were males and 89 (62.7%) were females; 77 (54.2%) enrolled in ALG1 and 65 (45.8%) enrolled in ALG2. The ratio of male to female students were consistent with the proportion of student population in the institution. Results did not indicate that female students performed better than their male counterparts.

Table 4

Means and Standard Deviations of CUMGPA, HSCGPA, HSCMATH, and ACTs by Gender

	MALE (N = 53)		FEMALE (N = 89)		$F^*_{(1, 140)}$[a]	
Variables	Mean	SD	Mean	SD	F^*	p
CUMGPA	2.32	0.65	2.57	0.61	5.15	0.002
HSCGPA	2.39	0.48	2.69	0.52	11.95	0.001
HSCMATH	9.64	4.31	9.64	3.43	0.00	0.997
ACTCOMP	17.19	2.97	16.99	2.79	0.16	0.690
ACTMATH	16.93	4.85	15.99	3.96	1.56	0.213
ACTENGL	15.81	4.10	16.48	3.96	0.93	0.342
ACTSCIN	16.72	4.14	16.34	4.61	0.24	0.621
ACTSOCL	14.72	4.43	15.10	4.19	0.27	0.616

Note.
1. CUMGPA is the cumulative college GPA with overall mean of and standard deviation of 2.48 and 0.62 respectively.
2. $F^*_{(1, 140)}$ is the critical value for the F-distribution with df as specified for all comparisons.

Table 4 indicated that both male and female students have identical aptitudes (academic abilities). They only differed in their previous academic histories and college GPAs. None of the mean ABILITY construct variables were statistically significant as indicated by the F-statistics. The mean number of high school mathematics taken by the male and female students were the same. Their college cumulative GPAs, however, showed some indications of concern that may warrant further investigations. These post-hoc analyses were explored using the relative risks and odds ratios.

Trend Analysis

Relative Risks and Odds Ratios

Regression analysis is primarily used to great effect in solving difficult analysis of variance and covariance problems. Odds ratios (OR) allow us to define meaningful contrasts for second and higher order contingency tables. Unlike regression, OR can be used to avoid some of the problems of confounding in non-orthogonal designs by using the partial F-test. The major difficulty in making this transition from partial F-test to OR test lies in defining the nature of the dependent variable, in an unordered qualitative variable, in regression context (Bain & Engelhardt, 1991).

Frequencies in a typical 2 X 2 Contingency Table

	METHOD 1	METHOD 2	TOTAL
YES	19 (f_{11})	8 (f_{21})	27
NO	4 (f_{12})	7 (f_{22})	13

For example, consider the hypothetical 2 X 2 table above. This table could be used to compare the effectiveness of two teaching methods (METHOD 1 and METHOD 2). Students could be given a multiple choice test and the numbers who passed (YES) and failed (NO) would be recorded after the test was graded. If in METHOD 1, nineteen passed and four failed; and in METHOD 2, eight passed and nine failed. Then the within program estimated relative risks ($[\hat{\delta}_I]$, risk of passing to failing) in METHOD 1 is: $\hat{\delta}_1 = 19/4$ [= 4.75]). For METHOD 2: $\hat{\delta}_2 = 8/9 = 0.89$. The odds favor passing for students in METHOD 1, whereas the odds are fairly close to unity for METHOD 2.

Between Gender and CUMGPA Comparisons

Define $\hat{\pi}^{CUMGPA}_{(k)}$ as the category-specific OR between male and female students with cumulative grade point average (CUMGPA) less than 2.00 and greater than or equal to 2.00. Let f_{ijk} be the cell frequency for a student in the ith CUMGPA group of the jth gender-type in the kth category. These odds ratios are

comparisons of risks for males to females between CUMGPA across categories of a particular variable of interest. In table 5(A), π_k (for SCHACT) are 1.84, 1.12, and 0.67 respectively, for k = 2, 3, 4. The first category is used as the baseline category in the computations. The rest of the odds ratios for COMACT, INCOME, and FAMEDUC, are computed similarly. Detailed results of these trend tests and the selected variables as predictors of performance are summarized in Tables 5 and 6.

As the level of categories for the INCOME, FAMEDUC, SCHACT, and COMACT increased, the overall students' academic performances decreased. These decreases were not similar when gender was considered. Table 5(A) indicated that there were significant trends in the odds of males to females across categories for those with college cumulative GPA less than 2.00 and at least 2.00.

In Table 5(B), a slightly different case was observed for the within gender and between CUMGPA comparisons. In this case, the trends were in somewhat reversed order. Female students performed better on average than the male students as indicated. These results contrasted those reported by the t-test. The gender difference were masked by the presence of confounding variable - Low and High academic performance status of the students. Table 5 summarized these results.

Table 5

Variations in Odds Ratios as Level Category Increase

Category	Level of Category 2	3	4	Remarks
(A) Between Gender and Cumulative GPA Comparisons				
INCOME	1.31	0.61	0.46	VERY SIGN.
FAMEDUC	1.71	0.79	0.94	FAIRLY SIGN.
SCHACT	1.84	1.12	0.67	VERY SIGN.
COMACT	1.97	0.82	0.32	VERY SIGN.
(B) Within Gender and Between CUMGPA Comparisons				
INCOME	0.47	0.61	0.59	NOT SIGNIFIC
FAMEDUC	0.57	0.21	0.41	FAIRLY SIGN.
SCHACT	1.72	3.64	3.66	NOT SIGNIFIC
COMACT	1.01	2.48	2.50	NOT SIGNIFIC

Note.
1. COMACT has only three levels with students responses.
2. INCOME and FAMEDUC has five levels, the last two were collapsed.
3. All are not significant at the 0.05 level using the chi-square with 1 degree of freedom (3.84).
4. FAMEDUC is significant at 0.01 level.
5. NOT SIGNIFIC means no significant trend across level.

Observing the apparent differences in tables 5(A & B), it is not surprising to conclude that community and school activities should be included as predictors of academic performance. Furthermore, the reason for the difference in Tables 1 to 5 could be the presence of cells with at most five entries (frequencies).

Also, the reason for these differences could be attributed to gender differences. As students mature and develop in search for the basis for their personal goals, they tend to make decisions that are typical to their gender norms.

Table 6 indicated that the risk of failing was greater for males, and that the odds of attaining a CUMGPA less than 2.00 was somewhat obscured when the odds ratios were compared across all levels of categories and with the t-test results in Table 4.

Table 6

Variations in Relative Risks as Levels of Category Increases: Within Gender and Between CUMGPA Relative Risk Comparisons

Category	Level of Category			Remarks
	2	3	4	
Males:				
INCOME	1.33	0.81	0.30	VERY SIGN.
FAMEDUC	1.44	1.32	1.05	FAIRLY SIGN.
SCHACT	4.29	3.26	2.76	VERY SIGNI.
COMACT	2.56	2.01	1.61	VERY SIGN.
Females:				
INCOME	1.25	1.28	0.66	FAIRLY SIGN.
FAMEDUC	1.23	1.18	0.98	FAIRLY SIGN.
SCHACT	2.95	2.77	1.88	SIGNIFICANT
COMACT	1.94	1.32	0.97	VERY SIGN.

Note.
1. VERY SIGN. means consistent trend across levels
2. SIGNIFICANT means has meaningful contrast across levels
3. FAIRLY SIGN means inconsistent trend across levels

Analysis for Question Two

Question two focused on the overall prediction of performance of African-American students at a predominated Black institution. The interrelationships among the predictive variables are as depicted in Table 7 and Figure 1. Results from question one indicated that HSCGPA and the composite and component ACT score were very important predictive factors in this study. These variables could also be used in predicting CUMGPA. However, due to the multicollinearity between the ABILITY variable, the ACTCOMP was selected. Regression diagnostics indicated that ACTCOMP was the best of all five ABILITY variables. The next important factors were the family support and institutional variables. Among these variables, EXPT, DEGASP, FAMSUPP2, INCOME, FAMEDUC, FAMSIZE, COMACT, and SCHACT indicated that they were worthy of consideration as predictors. Grades in ALG1, DEVMATH2, and DEVMATH1 could also be used to predict ALG2 grades.

Thus, it suffices to say that knowledge of high school performance was directly related to college grades in DEVMATH1 and DEVMATH2, which were also directly related to grades in ALG1 and ALG2 through the aptitude tests and students' ability to co-integrate within the institutional environment. In addition, College Algebra grades as well as those extra curricula activities and family support variables were directly related to

Table 7
Reliability Estimates and Predictive Power of the Model

Constructs	Reliability	FL[a]	b	Beta
MOTIVE	0.21			
College/personal goal		0.49	0.012	0.020
Degree aspiration		0.67	-0.008	-0.009
Number of high school math		0.63	0.004	0.026
FAMIGOAL	0.47			
High school GPA		0.45	0.343	0.355***
Gender		0.52	0.180	0.197*
Familial support		0.53	0.106	0.128*
Effect of familial support on performance		0.80	0.059	0.091
FAMIN	0.51			
Family income		0.83	0.215	0.236***
Family background		0.73	0.080	0.108
Family level of education		0.54	-0.013	-0.065
Family size		0.74	0.252	0.278***
ABILITY/APTITUDE	0.84			
Composite ACT		0.91	0.340	0.354***
Mathematics ACT		0.77	0.315	0.337***
English ACT		0.76	0.105	0.291***
Social Science ACT		0.61	0.093	0.125*
Science ACT		0.82	0.108	0.186**
INSTINT	0.53			
School activity		0.80	0.207	0.213**
Community activity		0.51	0.198	0.215**
Institutional problem(s)		0.47	-0.037	-0.085
Solution to institutional problem		0.82	-0.027	-0.042
Knowledge gained in institution		0.63	0.035	0.053
INSTEXP	0.71			
College expectation		0.47	-0.022	-0.057
Difficulty in making decisions		0.83	-0.012	-0.034
Effects of difficult decisions		0.79	0.057	0.076
Difficulty in goal attainment		0.57	0.014	0.028
CGRADE	0.62			
Developmental math 1		0.88	0.193	0.206*
Developmental math 2		0.88	0.107	0.145**
College Algebra 1		0.45	0.172	0.202**
College Algebra 2		0.47	0.169	0.198**
OVERALL	0.647	$R^2 = 0.64$	$R = 0.72$	

Note.
[a] Factor Loadings (FL).
*** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$

College cumulative grade point average. These results are in agreement with the literature with regard to the traditional variables. However, the inclusion of the family support and student social variables indicated that students' assessment and placement in developmental programs should not be based only on these traditional variables. The deletion of the DEVMATH1, DEVMATH2, DEGASP, and FAMSUPP2 variables from the selected variables for the ALG2 group was an added indication that as students progressed through their quest for academic excellence and the realization of their educational goals, certain decisive factors in their individual lives tend to outweigh others in terms of preference and choice. This inference was justified by the results of the trend analyses.

Table 7 summarized the results of post-developmental African-American students at a predominantly Black institution on the seven sets of educationally plausible constructs. The reliability estimates are the alpha coefficients. The factor loadings are the results of the maximum likelihood method of factor analysis. The Betas are the standardized partial regression (path) coefficients, and the "b" is the unstandardized (metric) partial regression weights. The MOTIVE variables explained about 15.19% of the variance in college CUMGPA. None of them is statistically significant. This result is not surprising when their factor loadings are considered in conjunction with

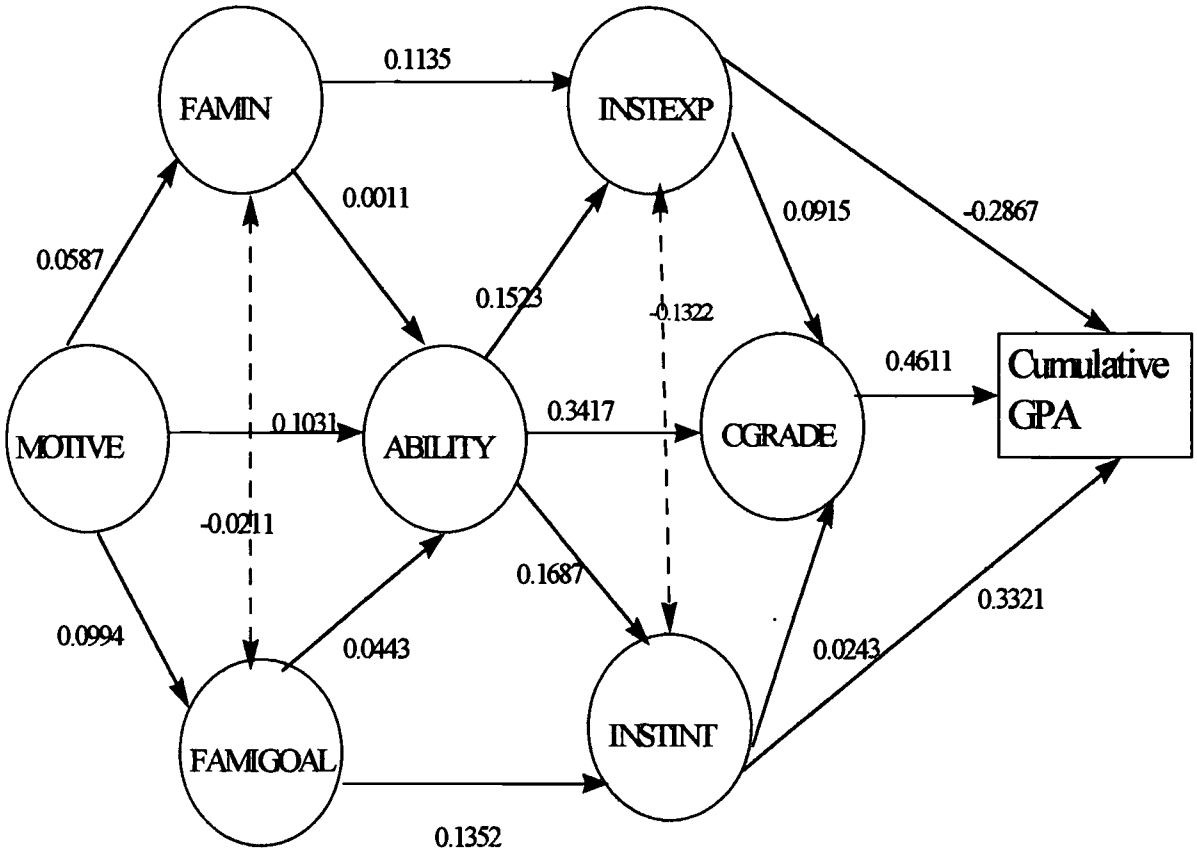

Figure 1

Predictive Model of Post-Developmental Students' Academic Performance:

f(GPA) = {CGRADE + ABILITY + INSTEXP + INSTINT + FAMIN + FAMIGOAL + MOTIVE}

the reliability estimate of 0.21.

The same was true for the institutional experience (INSTEXP) construct with reliability of about 0.71. The majority of the students have negative feelings with this institution with regards to its faculty/staff attitude, location of the institution, financial aid problems, and class scheduling and registration. These negative feelings reflected in their individual

responses to items relating students to the institution. The factor loadings of INSTEXP ranged from 0.47 to 0.83. The familial influence on students' personal goals (FAMIGOAL) has an alpha coefficient of 0.47, and the construct for course grades (CGRADE) has a reliability of 0.84. All the component parts of these constructs were significant except the effects of familial support on performance. High school GPA and ACTCOMP have the strongest effect. With Betas of 0.355 and 0.354 respectively, their net impacts were more than three times as strong as most other independent variables. Other influential indicators are the family income and size from the FAMIN group with alpha coefficient of 0.51. The ABILITY construct has the highest reliability (0.84). As shown in Table 7, the component and composite ACT were very significant with high factor loadings.

It is clear from the results of the multiple regression analyses that the net effects of most of these latent variables and their measures were modest in magnitude. This is reflected in the overall internal consistency estimate of 0.65. The unique factor loadings of these latent variables on the constructs, and the simultaneous contributions of these constructs in the overall predictive model, are reflections of the effects of institutional experience and family support on developmental students. About 36% of the total variation in predicting college cumulative GPA was not explained by these success indicators. The multiple R

value of 0.716 is an indication that the predictive regression equation was a good fit.

The findings of this study point to a variety of seemingly related sources of influence on students' academic performance at a predominated Black institution. These influences span the full range of students' college experience, including the courses they take, their prior academic histories, the influence of their families in their decision-making, their degree of co-integration (with regard to peer and faculty/staff interactions), and their overall personal preferences and choices as they evolve in their respective quests for academic excellence. Such findings are consistent with the literature (Keith, et al., 1986; Nora & Cabrera, 1996; Terenzini, et al., 1996).

Summary and Conclusion

The present investigation presented some interesting results about the predictive model. The model serves three useful purposes. First, it could be used by academic advisors and counselors as a guide in monitoring the number of activities students are engaged in before and after exiting the developmental programs. Second, it also serves as a screening tool of potential variables that have the strongest impact upon students' performance, as well as in determining students' success in their post-developmental academic pursuits. Third, it

suggests a causal sequence that forms the basis in addressing the third question. In answering that question, I estimated the regression weights by using coded variables as inputs to determine the percent of variance explained by the most parsimonious exogenous variables (Braxton, Duster, & Pascarella, 1988; Pascarella, et al., 1983; Pascarella & Terenzini, 1979; Pedhazur & Schmelkin, 1991; Terenzini, et al., 1996; Tinsley & Tinsley, 1987).

Since previous studies (e.g., Mckelpin, 1965; Mathews, et al., 1984) have indicated that traditional variables were less useful in predicting the academic performances of African-American males and females, separate regression analyses were run for these sub-groups. In ALG1, ACTCOMP and HSCGPA were best predictors for both sexes with coefficient of multiple determination (R) = 0.604 for females and R = 0.574 for males. The inclusion of family support, institutional, and social variables in the regression equations increased R^2 to 0.708 (and reduced the MSE) for females and 0.689 for males. The full regression analysis in the current study indicated that a combination of ACTCOMP score, HSCGPA, FAMSIZE, INCOME, grades from developmental math course, grades from ALG1, school and community activities, and some of the institutional variables would yield the best predictive equation for grades in ALG1 and ALG2 with R^2 values of 0.683 and 0.782 respectively. When all the 142 students (to predict CUMGPA)

were considered, the same results were obvious with $R^2 = 0.604$. Thus, there is not much difference in the sub-group samples to the total sample of students.

Case by case comparisons of actual grades with predicted grades (rounded off to the nearest letter grade) indicated that the regression equation for ALG1 predicted grades correctly about 48% of the time with error rate less than one letter grade. The regression equation for the ALG2 students and overall students portrayed the same results - 46% and 44% predictions respectively. For the students classified as Low and High academic performance students, the predictive equation differed significantly and could predict grades about 22 and 27% of the time with error rates in the range of one to two letter grades. The indicators considered in this study predicted the grades for African-American males and females similarly. The pairwise t-test comparisons showed no statistical significant differences between the male and the female students. These findings are in contrast with other similar studies (e.g., Sample & Seymour, 1971 and Farver, et al., 1973); but in agreement with other studies (e.g., Carmichael et al., 1986; Stanley & Porter, 1967; Temp, 1971).

In conclusion, previous studies indicated that procedures like those used in this study are successful in predicting the academic performance of the most students in most institutions, in mathematics as well as in other areas. The present study

showed the same results for African-American students in predominantly Black institutions. Thus, without loss of generality, this study is in agreement with the global contention that traditional variables do actually predict students' academic performances. It is noteworthy, however, to mention that these previous studies did not consider the family support, institutional, and social variables. Similar results could be obtained to predict students' performances in Biology, Chemistry, Physics, and English.

I propose, given the results of studies cited above, that high values of R^2 (at least 0.65) are to be expected when predicting grades with traditional indicators, and at least 0.45 (when institutional and family support variables are included in the predictive model). Predictive studies may then serve as a warning signal when R and R^2 values are lower than expected. This could indicate that a non-cognitive factor (presumably the family support system and institutional environment of the student, as well as, the students' social interactions with their environments) are interfering with the student's performance. Hence, the additional rationale for inclusion of these variables in this study at the author's expense. If this assumption is valid, then predictive studies could ultimately provide guidance and direction as individual schools and programs seek to improve minority students' retention and their subsequent matriculation

from their institutions. If, on the other hand, there is obvious reasons that the particular student is not performing up to expected, then remedial or developmental studies should be suggested to the student for his or her own betterment. Overcoming the non-cognitive factors is the main reason for establishing developmental programs. The institution should try to implement this in their policy guidelines for its future freshmen students.

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