An examination of the impact of early intervention on learning outcomes of at-risk students

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ABSTRACT

This research examines the effectiveness of early intervention on academic success for at-risk students. An intervention program is implemented in a minority serving public university by providing counseling and advising to academically at-risk students. Student performance is monitored and evaluated to explore whether early intervention impacts the likelihood of success for at-risk students. Adopting the matching sample method, our preliminary results show that at-risk students who receive additional advising are more likely to pass the course than those who don't receive such advising. We also find that student's prior GPA and gender have a statistically significant impact on students' eventual academic performance. These results provide further evidence that early intervention strategies can be effective in improving student success.

INTRODUCTION

According to National Center for Education Statistics, the six year graduation rate for full-time undergraduate students nationwide was 58.8 percent in 2011. The picture is bleaker when we look at minority students. For example, the graduation rate for African American students was only 39.9 percent. This is a problem many Historically Black Colleges and Universities (HBCUs) are grappling with. Now with President Obama's neo-liberal education reform that is designed to link federal funding of higher education directly with outcome metrics such as retention and graduation rates, HBCUs risk being penalized for below average graduation rates. This is unfair because the policy fails to account for the institutional mission and students' background before enrollment. Many HBCU students are first-generation students coming from low-income households, and they are more likely to be academically unprepared. The HBCUs have historically been highly successful in providing access to college education for minority students who otherwise would not have such access. Today there is an increasing concern at HBCUs as well as other institutions that outcome based funding will negatively impact their resource base and renewed attention is being paid to metrics such as the retention and graduation rates.

Early intervention for at-risk students is based on the philosophy that an institution that takes a pro-active approach to address students' problems will produce better outcomes. Research literature (e.g. Campell and Ramey, 1995) has shown that early intervention has a positive effect on improving the student academic outcome. Of particular importance to the success of institutions of higher education is student retention. Academically at-risk students and their retention have a substantial impact on institutional funding and academic curricula offered (Jones and Watson, 1990). Literature has suggested that advising is a critical factor in a student's decision to remain in college (e.g. Glennen et al., 1996). An early intervention program which not only identifies at-risk students but also provides advising to at-risk students should help student retention. In addition, early intervention provides a precious opportunity to help faculty better understand why students lag behind so that appropriate measures such as change of instruction manners or classroom policy can be implemented to improve students' learning overall.

Because of the anticipated education reforms and its profound implications for HBCUs, this paper is intended to evaluate an early intervention program at an HBCU public university and discuss its effectiveness. In addition, the study enhances our understanding of student persistence in general and that of minority students at HBCUs in particular. An early intervention program is implemented in the College of Business at Prairie View A&M University (PVAMU, henceforth), an HBCU university, to help at-risk students. Students with failing midterm grades (below C) were identified as academically at-risk students. At-risk students were contacted by email to set up an appointment with an advisor to discuss reasons for poor academic performances. Those who responded were given a face-to-face advising session to determine causes for failing grades. Students were asked a series of questions and responses were recorded. A structured student information form (see appendix A) was used as a guide to determine students' problem areas. An individual academic plan was drafted for each student, including tutorials, student follow-up with professors, increased study habits, decreased number of working hours, etc. The advising was not to provide a prescription, rather it was to form an informal relationship with the students and proactively explore, together with students, solutions to identified problems. At-risk students' subsequent learning behaviors and performances were followed and evaluated.

This paper empirically examines whether early intervention increases the likelihood of passing the class for at-risk students. Our data was collected from classes and students who participated in the early intervention program at the College of Business at PVAMU in the spring semester of 2013. We adopt the matched sample approach for our data analysis. We select classes with multi sections for our study in order to control variations in courses which may result in variations in class failure rates. At-risk students who sought for advising are compared with at-risk students who didn't seek for advising to examine whether the probability of passing the course increases with the adoption of early intervention program. The Logistic model in which the binary variable (Pass or Fail) is the dependent variable is employed in this study to examine the differential effect of early intervention on student performance.

Our results show that at-risk students who received advising have a higher probability to pass the course than those who didn't. Also students' pre-advising GPA and gender have an impact on the outcome of early intervention. Our results produce supporting evidence that early intervention is effective in improving students' learning outcomes. The findings also demonstrate the importance of connecting to the students through both instructors and staff advisors.

This paper is contributing to the stream of research on early intervention in a number of ways. First, by adopting a form of intervention based on relevant theories, this paper provides a new structured method of improving student performance and assist a school's retention effort. Second, this is one of the few papers studying intervention in a minority serving (in this case HBCU) institution. The different institutional context requires a different intervention approach, the effectiveness of which is empirically tested in the paper.

In the remainder of the paper, we first give a literature review. Then we describe the data and methodology, followed by a presentation and discussion of the results. The last section concludes the paper by summarizing the findings and their implications, and exploring future work.

LITERATURE REVIEW

In the literature, early intervention is referring to a broad range of efforts aimed at helping students improve their performance. The early intervention actions range from simple educational programs to systematic social integration strategies, and the performance measurements are also numerous, the most frequently used ones being school dropouts and test results. Generally, researchers have found these efforts to be effective for students of different age groups. For example, Campbell and Ramey (1995), through a sample of children from low-income families, showed that preschool and school educational intervention increased students' long term academic achievement after seven to ten years of treatment. Similarly, Temple and colleagues (1998) linked early intervention with long term achievement. They investigated whether participating in the Chicago Child-Parent Center and Expansion program at ages of 3 to 9 can influence students' dropout at age 17. The results show the effectiveness of the early age intervention. In the context of higher education, early intervention has been shown to be effective for student retention and improved academic outcomes. Nagda et al (1998) provides evidence that the student-faculty research partnerships are a highly effective program in reducing dropouts. Mahoney and Cairns (1997) found school-based extracurricular activities significantly reduced early school dropout rate. Colalillo (2007) reported positive results from a mentoring program for nursing students.

For college students, a number of individual and institutional characteristics have been proposed to be associated with their success. These factors include: student mobility, engagement, demographic characteristics, social and academic experiences, family background, and school factors (e.g. student composition, resources, structural characteristics, and processes and practices (Rumberger, 2001). The educational models represented by Tinto's student integration theory (1975, 1987 & 1993) and Bean's student attrition model (1980, 1983) suggest that institutions can intervene to influence some of these factors and improve students' performance. Tinto showed that students' failure to separate from their former context is the main barrier for higher retention. Academic integration, social integration, goal commitment, and institutional commitment are proposed to be keys for student retention. Built upon Tinto's integration Theory, Bean and Eaton (2001) emphasized the underlying psychological processes and proposed attitude-behavior theory, coping behavioral theory, self-efficacy theory, and attribution theory to explain the social integration and academic integration that are at core of Tinto's theory. Another early intervention model is based on the motivational theories from the literature in psychology (Covington, 2000; Eccles and Wigfield, 2002).

Based on the above studies, researchers have successfully designed different intervention methods. Frequently the intervention takes the form of advising, and Heisserer and Parette (2002) summarized advising models into three types: prescriptive, developmental, and integrated approaches. Prescriptive advising is a one-way communication from advisor to students, and there is a lack of interaction. However, many students expect prescriptive advising (Pardee, 1994), and they may actually view the advisor with the prescriptive approach as more competent and more responsible (Chando, 1997). The development advising emphasizes the initiatives and development from the students and it promotes interaction and shared responsibility. However, with poor training and inexperience, the development advising can be ineffective (Gordon, 1994). The integrated advising approach combines both the prescriptive and development approaches.

Heisserer and Parette (2002) advocated using the intrusive advising approach, a proactive intervention focused on motivating students (Earl, 1988). One way of motivating students is through engaging them into a trusting relationship with advisors. Nagda et al (1998) found the student-faculty research partnerships are a highly effective program in reducing dropouts. There are many other ways to increase the student's motivation. For example, Mahoney and Cairns (1997) found school-based extracurricular activities significantly reduced early school dropout rate. Colalillo (2007) reported positive results from a mentoring program for nursing students. A meta-analysis of 109 studies on the determinants of college outcomes confirms the efficacy of psychological and study skill factors.

Most empirical studies on college student retention are done at predominately white institutions (PWIs). However, there are important differences in resources, student demographics and background between minority-serving institutions (e.g. HBCUs) and PWIs. Allen illustrated this in his 1992 paper. Allen reported overall better experience for black students in HBCUs than in PWIs. This is lending support to Tinto's theory because students' persistence and performance depend on their integration into the institution context. Black students felt alienated in PWIs, while they felt at home in HBCUs.

DATA AND METHODOLOGY

An early intervention program was implemented in the college of business at PVAMU in spring 2013 in an attempt to improve student learning outcomes and reduce failure rate. Students with failing midterm grades (below C) were identified as academically at-risk students. At-risk students were requested to come to assistant dean and professors for advising. Student came for advising voluntarily. A structured student information form (see appendix A) is used as a guide to determine students' problem areas so that students and advisors can discuss ways to improve their course performance for the rest of the semester. Developmental advising rather than prescriptive advising was conducted. At-risk students' subsequent learning behaviors and performances were followed and evaluated.

Our data was collected from classes and students who participated in the early intervention program. We adopt a matching sample method. To better estimate the causal effect using observable data, we would like to compare treated and control groups that are as similar as possible so that well-matched samples of the treated and control groups are often used to reduce bias due to the covariates and differentials. In our sample, we only select multi-sectional classes, in which the course materials are the same across sections and some sections are even taught by the same instructor. In this way, we can somewhat reduce biases due to variations in courses and instructors. Our sample includes 13 multi-sectional classes with 128 at-risk students.

We employ logistic regression model to examine the impact of our variables of interest on the likelihood of passing the class for at-risk students. Logistic regression is better than OLS regression for binary variables because the errors from the linear probability model violate the homoskedasticity and normality of errors assumptions of the OLS regression, resulting in invalid standard errors and hypothesis tests. Logistic regression can also capture non-linear relationship of variables rather than linear relationship in the OLS regression. Our logistic regression model is followed:

$$Passing_i = \alpha + \beta_1 Advising_i + \beta_2 GPA_i + \beta_3 Business_i + \beta_4 Gender_i + \beta_5 Ethnics_i + \varepsilon_i \quad (1)$$

We define our dependent variable Passing as 1 if the student passed the class with a grade equal or above C, and 0 for a grade of D, F and W. Our variables of interest include advising (1 for students who received advising and 0 for students who didn't receive advising), student GPA (on a 4.0 basis) prior to our study, student major (business major=1 or nonbusiness major=0), gender of student (Male=0 and Female=1) and ethnics (black student=1 and nonblack student =0). In our study, some of the variation in the academic performance measure could be due to the fact that self-motivated students tend to seek advising and are more likely to improve their performance. While our study does not have a pretest for self-motivation, we somewhat control for it by a variable indicating students' pre-advising GPA. It is not a perfect control for self-motivation, but self-motivated student tend to have higher prior GPA. Zimmerman, Bandura, and Martinez-Pons (1992) showed that students' prior grades are linked with their grade goals.

EMPIRICAL RESULTS

Summary statistics are presented in Table 1. Among 128 at-risk students, 26 (20.3%) sought additional advising. More female students (20) than male students (6) sought advising.

The average GPA is higher for students who sought advising (2.32) than students who did not seek advising (2.11). The passing rate is much higher (57.7%) for students who received additional advising compared to students without the benefit of advising (33.3%). Also the withdrawal rate of students with advising is lower (3.8%) than that of students without advising (10.8%). Most students are African American (121 out of 128). These results seem to indicate that at-risk students who received advising as part of an early intervention program have a higher success rate compared to those who did not receive such advising. All tables are in the Appendix.

We further test the statistical significance for several differential results for advising and non-advising students. T-test is employed and Table 2 shows the *t*-test for the mean differences between the two groups of students. The percentage of female student in the group of students with advising is significantly higher than that of the group of students without advising. Both groups have roughly the same percentage of business major students and the same percentage of African American students. In addition, advising students have both a higher average GPA and passing rate than non-advising students. But the student withdrawal is not significantly different between the two groups. This may be due to the very small sample size of withdrawal in our dataset.

Table 3 presents the correlation matrix of variables studied in this research. The significant correlations are bolded. Passing rate is significantly positively correlated to advising (0.202), GPA (0.231), and gender (0.231). GPA is also positively correlated with major (0.15) and gender (0.225), indicating business major students and female students have higher GPA. Another significant correlation (0.296) is between gender and advising, which is consistent with our previous findings that more female students came to advising. This correlation may cause the multicollinearity issue in the following multivariate regressions and should be taken into consideration.

The logistic regression results are presented in Table 4. The univariate regressions of Passing on each variable of interest confirm previous findings. Column (1) shows that students with advising in the intervention program have a high probability to pass the class. The odds of passing the class increase by 2.73 with advising in the intervention program. Column (2) shows that GPA has a great positive impact on the passing probability. The odds of passing the class increase by 2.14 if GPA increases by one. Column (3) shows that female students have a higher chance to pass the class than male students. The odds of passing the class are 2.44 higher for female students. The univariate regression coefficients for business major and ethics are insignificant so they are not reported and will be provided upon request.

We further combine all variables of interests in the regression. Column (4) shows that the coefficient of GPA is significant at 5% level and coefficient of advising is only significant at about 10% level while coefficient of gender becomes insignificant. Considering the multicollinearity issue due to the correlation of gender and advising, we put advising and gender one at a time to avoid the issue. Results of regressions without gender are shown in Column (5), in which advising becomes more significant (at 5%) after we omitting gender; Results of regression without advising are shown in Column (6) and gender becomes significant (at 5% level) when advising is excluded in the regression. These results further confirm previous findings and highlight the important correlation between advising and gender.

In summary, empirical results show students who participated in the early intervention program and received advising have a higher probability of passing the class. Students with a high GPA and female students are more likely to pass the class, and they are also more likely to seek advising in the early intervention program.

CONCLUSION

Our research contributes to the literature on student learning and success in college and lends support for a proactive approach to education. While most existing studies on early intervention focus on K-12 students, our study targets college students, particularly business students in an HBCU institution, something that has not been previously explored in-depth. We find that an early intervention program based on developmental advising can have a positive impact on the academic success of students in participating courses. Surprisingly, we find more females sought out advising than males, and perhaps because of this they have higher passing rate than male students. This research also reveals the importance of advising to academic success and provides insights for college administrators who are grappling with the increasingly important issue of student retention and graduation rates. Legislative bodies throughout the United States including Texas have become increasingly focused on accountability. The funding formulas for state supported institutions are being increasingly tied with being able to "move the needle" on student retention and graduation rates. In this context, innovative strategies to improve student success are receiving renewed attention. Although the results of this study are promising, much more research needs to be done before these results can be deemed conclusive. For example, researchers can test the impact of early intervention on other important outcome variables such as retention. Although grade performance is directly linked to students' dropout decision (Spady, 1970), there are many other factors. This is especially true in HBCUs because of the many social and economic issues minority students are struggling with. So, it is beneficial to find if advising is effective in helping students deal with non-academic as well as academic issues and thus leading to better results in retaining students in general.

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APPENDIX A

Early Intervention Program
College of Business
Student Information Form

Date:___________
Instructor: __________________

<u>Student Data:</u>

Student:_____________________________ e-mail:_________________________
Course:______________________________ Phone:_________________________
Semester:____________________________ Overall GPA: ___________________
Current Semester Credit Hours:__________ Major: _________________________

Grades (Quizzes, Homework, Exams):____

Absences: _________

Reason For Faculty
Intervention:____

<u>Student Responses</u>:

Do you have the book or required course material? _______
How many hours per week do you study for this class? _____________
How many hours per week are you working? _____________
Have you gone to tutoring? __________________ If yes, how often? ______ Results? _____
Why do you think you are performing poorly in this class? _______________________________
____

What do you think you can do or need to improve your performance in this class? ___________
____

Other student comments.
____
____

<u>Instructor suggestions for improvement:</u>
____
____

Follow up discussions (progress assessment and additional suggestions):
____
____

Table 1. Summary Statistics

	Number	Percentage	Female	Male	Business Major	Male	Average GPA	Number of Passing	Percentage of Passing	Number of Withdrawal	Percentage of Withdrawal
Total Students	128		62	66	111	121	1.85	49	38.3%	12	9.4%
Students with advising	26	20.3%	20	6	23	24	2.13	15	57.7%	1	3.8%
Students without advising	102	79.7%	42	60	88	97	1.78	34	33.3%	11	10.8%

Table 2. T-test for Differentials

Variables	Student with Advising	Student Without Advising	Difference	t-value	p-value
Percentage of Female	76.9%	41.2%	35.7%	3.48	0.0007
Percentage of Business Major	88.5%	86.3%	2.2%	0.75	0.4567
Percentage of Black	92.3%	95.1%	-2.8%	0.15	0.8837
Average GPA	2.32	2.11	0.21	1.82	0.0772
Percentage of Passing	57.7%	33.3%	24.4%	2.31	0.0225
Percentage of Withdrawal	3.8%	10.8%	-6.9%	-1.41	0.1645

Table 3. Correlation Matrix

Correlation	Advising	GPA	Business	Gender	Ethnics
Passing	**0.202**	**0.231**	0.132	**0.214**	-0.03487
(p-value)	**(0.023)**	**(0.009)**	(0.138)	**(0.015)**	(0.696)
Advising		0.114	0.066	**0.296**	-0.01305
(p-value)		(0.198)	(0.457)	**(0.001)**	(-0.013)
GPA			**0.150**	**0.225**	0.01682
(p-value)			**(0.090)**	**(0.011)**	(0.851)
Business				0.043	0.04319
(p-value)				(0.633)	(0.628)

Table 4. Logistic Regression Results

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	-0.69	-2.16	-0.93	-2.45	-2.38	-2.40
(p-value)	(0.0010)	(0.0019)	(0.0006)	(0.0017)	(0.0201)	(0.0202)
Advising	1.00			0.72	0.91	
(p-value)	(0.0255)			(0.1068)	(0.0510)	
(odds ratio)	(2.73)			(2.05)	(2.47)	
GPA		0.76		0.61	0.69	0.61
(p-value)		(0.0109)		(0.0532)	(0.0266)	(0.0471)
(odds ratio)		(2.14)		(1.84)	(1.99)	(1.85)
Business				0.64	0.62	0.67
(p-value)				(0.2662)	(0.2800)	(0.2428)
(odds ratio)				(1.90)	(1.85)	(1.95)
Gender			0.89	0.59		0.75
(p-value)			(0.0165)	(0.1442)		(0.0539)
(odds ratio)			(2.44)	(1.80)		(2.11)
Ethnics				-0.40	-0.37	-0.41
(p-value)				(0.5789)	(0.6014)	(0.5713)
(odds ratio)				(0.67)	(0.69)	(0.66)
Likelihood Ratio	5.07	7.02	5.90	14.67	12.54	12.44
(p-value)	(0.0243)	(0.0081)	(0.0152)	(0.0119)	(0.0138)	(0.0143)