An Examination of the Effect of Early Intervention on Learning Outcomes of At-risk Students

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Abstract

This research examines the effectiveness of early intervention for at-risk students on academic outcomes. An intervention program is implemented in a HBCU public university by providing counseling and advising to academically at-risk students. Student performances are monitored and evaluated to explore whether the early intervention impacts the likelihood of passing the class for at-risk students. Adopting matching sample method, our preliminary results show that at-risk students who receive additional advising have higher probabilities to pass the course than those who don't. We also find that student GPA, major and gender have statistically significant impact on students' academic performance. These results provide evidence that early intervention is effective in improving students learning outcomes.

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*This study is preliminary, please do not quote.

Introduction

According to National Center for Education Statistics, the six year graduation rate for full-time undergraduate students was 58.8 percent in 2011. The picture becomes even bleaker when we look at minority students. For example, the graduation rate for African American students was only 39.9 percent. This is especially a problem for Historically Black Colleges and Universities (HBCUs). Now with President Obama's neoliberal education reform that is designed to link federal funding of higher education directly with outcome metrics such as graduation rates, HBCUs may be penalized for lower than average graduation rates. This is unfair because the policy fails to account for the students' background before enrollment. Many students enrolled at HBCUs come from low-income households, are first-generation students, who are more likely to be academically unprepared. The HBCU's have historically been highly successful producing the minority graduates and providing access to those who traditionally have lacked access to higher education. Today there is increased focus at HBCUs as well as other institutions that outcome based funding is a reality and there is renewed attention 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 addressing 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 upcoming education reform and its profound implications for HBCUs, this paper is intended to evaluate an early intervention program at a HBCU public university and discuss its effectiveness. In addition, the study enhances our understanding of student persistence in general and black students at HBCUs in particular. An early intervention program is implemented in college of business at Prairie View A&M University (PVAMU, henceforth), a HBCU university, to help at-risk students. Students with failing midterm grades (below C) are identified as academically at-risk students. At-risk students are requested to come to professors and associate dean for advising. A structured student information form is used as a guide to determine students' problem areas so that suggestions can be made on how students can improve their course performance in the rest of the semester. The advising is not to provide a prescription, rather it is 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 will be followed and evaluated.

This research empirically examines whether the early intervention increases the likelihood of passing the class for at-risk students. Our data are collected from classes and students who participated in the early intervention program of College of Business at PVAMU in the spring 2013 semester. We adopt the match sample approach to conduct 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' 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 student retention in a number of ways. First, by designing a form of intervention based on relevant theories, this paper provides a new structured method of improving student performance and assist school's retention effort. Second, this is one of the few papers studying intervention in a HBCU institution. The very different institutional context requires a very 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

Theories for Student Persistence

The research on student retention has been dominated by Tinto's integration theory (1975, 1987 & 1993). His theory suggests that students' failure to separate from their former context is the main barrier for retention. Academic integration, social integration, goal

commitment, and institutional commitment are proposed to be keys for student retention. Despite its popularity, the empirical tests for the theory have mixed results (Braxton & Lee, 2005). Cabera, Nora and Cataneda (1993) attributed the contradictory findings to the theory's failure to recognize variables external to the institution. Culture is one such external variable. This gap accounts for many different and sometimes opposing results when Tinto's theory is applied to minority students.

Guiffrida (2005) interviewed 99 African American students from a midsize private research institution in the Northeast, and found that for "high achievers," the emotional, academic, and financial support from their families was one of the most cited reasons for their academic achievements, while "low achievers" and "leavers" rarely mentioned their families. Guiffrida (2006) further suggested that Tinto's theory be revised to reflect cultural dimensions. He argued for the importance of the former home social system in students' later connection to the college community.

Braxton, Milem, and Sullivan (2000) also criticized Tinto for failing to elaborate on factors influencing social integration. They used a sample of 718 students from a private research-oriented university, and found active learning to be an effective factor facilitating social integration, which in turn influences institutional commitment and student retention.

Built upon Tinto's integration Theory, Bean and Eaton (2001) described the underlying psychological processes. Attitude-behavior theory, coping behavioral theory, self-efficacy theory, and attribution theory were proposed to explain the social integration and academic integration that are at core of Tinto's theory. With a better understanding of the individual psychological processes, institutions can formulate better student retention strategies. Bean and

Eaton examined the four popular intervention programs and identified the psychological processes through which these programs work. To some extent, Bean's framework improved Tinto's theory by stressing the variables that are external to the institution but important for subsequent attitudes and decisions.

Most empirical studies on student retention are done at predominately white institutions (PWIs). However, there are profound differences 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.

Predictors of Student Persistence and Intervention

A number of individual and institutional characteristics have been proposed to be associated with student retention rate. These factors include: moving, changing school, student engagement, gender, race and ethnicity, immigration status, language background, early school experience, family background, student composition, school resources, school structure (e.g. size, location, ownership), and school policies and practices (Rumberger, 2001). When attempting to use some traditional admission criteria to predict agriculture students' academic performance and retention, Garton (2002) found these variables to be quite limited in explaining the outcome.

Based on the understanding of the above variables, researchers proposed different approaches for intervention. 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 emphasized the initiatives and development from the students and it promotes the 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.

While most studies find factors close in time are good predictor of the student persistence. Some researchers also managed to associate intervention in students' early ages with their academic development in adolescence. For example, Temple and colleagues (1998) 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 addition, the study also indicates parental involvement and school transferring can have impact on the student's academic achievement.

Data and Methodology

An early intervention program is implemented in 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) are identified as academically at-risk students. At-risk students are requested to come to associate 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 in the rest of the semester. Development advising rather than prescriptive advising is conducted. At-risk students' subsequent learning behaviors and performances are followed and evaluated.

Our data are collected from classes and students who participated in the early intervention program. We adopt 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 96 at-risk students.

We employ logistic regression model to examine the impact of our variables of interest on the likelihood of passing the class or withdrawal 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:

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

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), student major (business major=1 or nonbusiness major=0) and gender of student (Male=0 and Female=1).

Empirical Results

Summary statistics are presented in Table 1. Among 96 at-risk students, 20 (20.8%) sought additional advising. More female students (15) than male students (5) sought advising. The average GPA is higher for students who sought advising (2.13) than students who did not seek advising (1.78). The passing rate is much higher (65%) for students who received additional advising compared to students without the benefit of advising (32.9%). Also the withdrawal rate of students with advising is lower (5%) than that of students without advising (11.8%). These summary statistics indicate that at-risk students who received advising during the early intervention program have a higher success rate compared to those who did not receive such advising.

[Insert Table 1 here]

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 rough same percentage of business major students. In addition, advising students have both higher average GPA and passing rate than non-advising students. But the percentage of student withdrawal is not significantly different between the two groups. It may be due to the very small samples of withdrawal in our dataset.

[Insert Table 2 here]

Table 3 presents the correlation matrix of variables studied in this research. It is interesting to find passing rate is significantly positively correlated to advising (0.267), GPA(0.502), business major (0.242) and gender (0.195). Another significant correlation (0.246) 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 regressions and should be taken into consideration.

[Insert Table 3 here]

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 3.78 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 6.29 if GPA increases by one. Business major students also a have high passing rate than nonbusiness students indicated in column (3). The odds ratio for business major is 4.44. Column (4) shows that female students have a higher chance to pass the class than male students. The odds of passing the class are 2.26 higher for female students.

[Insert Table 4 here]

We further combine all variables of interests in the regression. Column (5) shows that only coefficients of GPA and business major are significant. Considering the multicollinearity issue due to the correlation of gender and advising. We put advising and gender one at a time to avoid the multicollinearity issue. Results of regressions without gender are shown in Column (6), in which advising becomes significant after we removing gender; Results of regression without advising are shown in Column (7) and gender becomes significant 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 to pass the class. Students with high GPA tend to be more likely to pass the class at the end. Business major students and female students are more likely to pass business courses because they are required courses or they received advising in the early intervention program.

Conclusion

Our research contributes to the literature on student learning and proactive approach of education. While most existing studies on early intervention focus on K-12 students, our study target for college students, particularly in a HBCU institution, which has not been explored so far. We find early intervention program with development advising has a positive impact on passing the class of participating students. Surprisingly we find more females sought out advising and as a result have higher passing rate than male students. This research also reveals the importance of advising to academic success and provides insight for college administrations on the increasing importance of student retention.

Due to limited data, these results should be considered preliminary. The early intervention program will continue to be implemented in the College of Business at PVAMU. We will continue to collect data to create a larger sample and more advanced matching method can be employed to produce better testing. Clearly there are other factors which affect the students learning outcomes, and these can be explored in future work. In addition to examining the effect of early intervention at the individual student level, one can also examine the issue at the class level to explore whether classes which adopt the early intervention program have higher passing rates than classes which don't adopt such a program.

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Appendix A

Early Intervention Program
College of Business
Student Information Form

Date:_____
Instructor: _____

Student Data:

Student:_____ e-mail:_____
Course:_____ Phone:_____
Semester:_____ Overall GPA: _____
Current Semester Credit Hours:_____ Major: _____

Grades (Quizzes, Homework, Exams):_____

Absences: _____

Reason For Faculty
Intervention:_____

Student Responses:

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.
_____
_____
Instructor suggestions for improvement:
_____
_____
Follow up discussions (progress assessment and additional suggestions):
_____
_____

Table 1. Summary Statistics

	Number	Percentage	Female	Male	Business Major	Average GPA	Number of Passing	Percentage of Passing	Withdrawal	Percentage of Withdrawal
Total Students	96		49	47	77	1.85	38	39.6%	10	10.4%
Students with advising	20	20.8%	15	5	17	2.13	13	65.0%	1	5.0%
Students without advising	76	79.2%	34	42	60	1.78	25	32.9%	9	11.8%

Table 2. T-test for Differentials

Variables	Student with Advising	Student Without Advising	Difference	t-value	p-value
Percentage of Female	75.0%	44.7%	30.3%	2.46	0.0158
Percentage of Business Major	85.0%	78.9%	6.1%	0.6	0.5504
Average GPA	2.13	1.78	0.35	1.82	0.0772
Percentage of Passing	65.0%	32.9%	32.1%	2.68	0.086
Percentage of Withdrawal	5.0%	11.8%	-6.8%	1.1	0.2789

Table 3. Correlation Matrix

Correlation	Advising	GPA	Business	Gender
Passing	0.267	0.502	0.242	0.196
(p-value)	0.009	<.0001	0.018	0.055
Advising		0.166	0.062	0.246
(p-value)		0.106	0.550	0.016
GPA			0.071	0.039
(p-value)			0.491	0.707
Business				0.141
(p-value)				0.170

Table 4. Logistic Regression Results

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	-0.72	-4.09	-1.67	-0.86	-4.54	-4.13	-4.54
(p-value)	(0.0035)	(<0.0001)	(0.0078)	-0.0072	(<0.0001)	(<0.0001)	(<0.0001)
Advising	1.33				0.89	1.097	
(p-value)	(0.0117)				(0.1644)	(0.0776)	
GPA		1.83			1.88	1.86	1.94
(p-value)		(<0.0001)			(<0.0001)	(<0.0001)	(<0.0001)
Business			1.49		1.51	1.5645	1.53
(p-value)			(0.0256)		(0.0446)	(0.0339)	(0.0389)
Gender				0.82	0.72		0.90
(p-value)				(0.0566)	(0.1927)		(0.0902)
Likelihood Ratio	6.71	29.96	6.21	3.73	40.88	39.16	38.88
(p-value)	(<0.0001)	(<0.0001)	(0.0127)	(0.0535)	(<0.0001)	(<0.0001)	(<0.0001)