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RESEARCH ARTICLE

The Second-Year Retention Effect of Early Enrollment in a First-Year Seminar:

Executive Summary of Dissertation Research

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ABSTRACT

Is early enrollment in a qualified first-year seminar (FYS) positively associated with second-year retention rates of new community college students? A large mid-Atlantic community college (MAC) believes that it is, and this belief is the basis for the hypothesis being tested in this research. Beginning in 2010, new first-time college and degree-seeking students were required to enroll in the newly developed FYS course in the first semester of attendance. Students who complied with this policy over the years 2010-2013 were matched on an array of observable and unobservable variables with similar students from the prior years 2006-2009 using the propensity-score matching (PSM) method. Using a logistic regression model, it was estimated that average treatment effect was a statistically significant positive impact of a 6.07 percentage-point increase in the likelihood of being retained into the second year. This result is in line with a common, but not universal, belief in the theory and other research that suggests that enrollment in a FYS would have such an effect. Although there are clear limitations to this result, the implications are positive for the community college that adopted this new policy and for the students it serves.

INTRODUCTION

Recently competed research sought to answer the question as to whether enrollment in a FYS at a large MAC in the first semester of attendance had a statistically significant positive impact on the second-year retention rate of students when compared to similar students who had not enrolled. The implementation of a new FYS enrollment policy in the spring 2010 semester required all new students meeting certain criteria to enroll in the FYS course in the first semester of attendance. It was expected that there would be a statistically significant positive impact on the second-year retention rate of early enrolling students. It was expected and found that early enrollment had a statistically significant positive association with retention.

These expectations were based partially on the fact that many colleges, including MAC, had adopted extended orientation, student success, or FYS courses with the goal of increasing student retention (Padgett & Keup, 2011; Young & Hopp, 2014). It has been generally reported that participation in such courses is positively associated with increased retention (Friedman, 2012; Pascarella & Terenzini, 1991, Pascarella & Terenzini, 2005; Upcraft et al., 2005, Tinto, 2012; Permzadian & Credé, 2016), and recent examples of research focused on students in 2-year colleges (Feldman, 1993; Zeidenberg et al., 2007; Cho & Karp, 2013; Windham, et al., 2014) have added to the belief that this association can be rigorously identified through the use of sophisticated analysis techniques. The expected positive impact was also based more directly on the fact that enrollment in the new FYS course was intended to be compulsory, was designed for a clear target population, and was designed by MAC to put emphasis on academic advising and career planning, all features believed to be high-impact practices associated with positive student outcomes. Although not all of these features were considered in this research, they provided reason to believe that early enrollment would be an effective tool for positively impacting retention.

METHODS

Data

This research utilized historical academic records from the population of students who had enrolled as new members of the fall cohorts at MAC in the years 2006-2013. All of these students were first-time college attendees and had declared their intention to complete a certificate or degree. Student information recorded at the time of initial enrollment included demographic, financial, and academic measures. Each of these pieces of data were pre-treatment observable characteristics and were used as the covariates in the analysis. See Table 1 for a list and brief description of these variables along with the key predictor and response variables. It is also noted that one variable, the high school code, signifying the school from which the student graduated, was utilized as a fixed-effect measure. This variable was needed to capture any unobservable average characteristics considered common among all students that attended and graduated from the same high school. These characteristics include, but are not limited to, the quality of the principal and teachers, the average class size, and the number of AP courses available.

Table 1. **Description of Key Variables**
female: indicator of student-identified binary gender
age: student age at time of first enrollment
race: factor variable of student-identified race
full: indicator of full-time enrollment
*highschool_dummy**: fixed effect for unobserved characteristics
pell: indicator of acceptance of Pell grant funds
englvl: factor variable of English remediation need
rdglvl: factor variable of reading remediation need
mathlvl: factor variable of math remediation need
compliance: indicator of FYS policy compliance (key predictor variable)
retained: indicator of second-year retention (key response variable)

There are multiple variables that were not included in this analysis as they were not present in the data utilized or would have altered the direct application of the methods employed to complete the initial analysis of treatment impact. These variables include, but are not limited to, pre-treatment measures related to the professors teaching the FYS courses, the delivery method and time slot of the courses, the student majors, and even the level of academic advising included in the course. Post-treatment variables not utilized include student grades in the course, overall grade point average, and changes to enrollment levels. The decision was made to focus attention specifically on compliance with the new FYS enrollment policy and certain variables available that were typically used in similar research (Zeidenberg et al., 2007; Cho & Karp, 2013; Windham et al., 2014).

The semester in which the new FYS enrollment policy was implemented divided these students into pre-policy and post-policy cohorts from which the treated and untreated comparison groups were identified. Students in the post-policy cohorts that had not complied with the new FYS enrollment policy would have feasibly self-selected themselves out of the policy and as a result differed significantly from those who had complied. Therefore, this group of students did not provide a suitable comparison group even after the application of the PSM method. Although students in the pre-policy cohorts differed significantly from those treated as well, they provided a large enough target population from which a suitable comparison group was found using the PSM method. Table 2 provides an average comparison of the groups considered as support for the selection of the 2 groups of students used in this analysis.

Table 2.
Summary of Key Variables across Target Population of Treated and Untreated Groups

Variable	**Post-policy treated**	**Post-policy untreated**	**Pre-policy untreated**
N	12,785	13,808	11,624
Female, ρ* (SD**)	0.5372 (0.4986)	0.5735 (0.4946)	0.5373 (0.4986)
Age, μ† (SD)	20.5936 (6.3169)	25.7664 (9.7932)	23.3402 (9.7452)
White, ρ (SD)	0.3646 (0.4813)	0.4219 (0.4939)	0.5442 (0.4981)
African American, ρ (SD)	0.5022 (0.5000)	0.4155 (0.4928)	0.3165 (0.4651)
Asian, ρ (SD)	0.0378 (0.1907)	0.0605 (0.2384)	0.0542 (0.2264)
Hispanic, ρ (SD)	0.0447 (0.2066)	0.0461 (0.2096)	0.0293 (0.1688)
Full-time, ρ (SD)	0.5345 (0.4988)	0.4261 (0.4945)	0.5441 (0.4981)
Pell acceptance, ρ (SD)	0.6537 (0.4758)	0.4429 (0.4967)	0.3567 (0.4790)
English need, μ (SD)	0.5521 (0.6230)	0.2089 (0.4700)	0.2438 (0.4923)
Reading need, μ (SD)	0.6347 (0.7760)	0.2253 (0.5249)	0.2203 (0.5168)
Math need, μ (SD)	1.9254 (1.0950)	0.9607 (1.2039)	1.2731 (1.1939)
Retained, ρ (SD)	0.5315 (0.4990)	0.3623 (0.4807)	0.4933 (0.5000)

Abbreviations: *ρ = proportion, **SD = standard deviation, †μ = mean.

Although there was no random assignment employed in the creation of the treated and untreated comparison groups across the policy period, the separation was not pre-determined based on observable student characteristics, meaning that the potential for selection bias was reduced. This assignment and the use of historical records categorized this research as a comparative retrospective cohort analysis.

Compliance with the new FYS enrollment policy was the key predictor variable and considered the treatment. Only students in the post-policy cohorts could have been exposed to the treatment, and its application was noted for each student when the first term of enrollment matched the term of FYS enrollment. Compliance was credited to students that enrolled early in the FYS in either of the 2 summer terms that preceded the fall term of initial enrollment as well. In addition, being enrolled in the course was registered for students who were still enrolled after the completion of the third week of the semester. Thus, any student who withdrew before this moment in time were not included as having complied, while those who withdrew from the course after this moment were included. Students in the pre-policy cohorts could not comply with the policy requirement and, therefore, were considered untreated. Second-year retention was the key outcome measure representing the dichotomous, or binary, response variable. This measure was recorded at the end of the second fall semester only if the student had persisted to and through the term. Thus, students must have demonstrated continual persistence over the fall, spring, and subsequent fall semesters at a minimum, in order to be counted as part of the second-year retention measure utilized in this research.

The treatment group consisted of approximately 48% of the target population in the post-policy cohorts and amounted to 12,785 students, while the comparison group was selected from the 11,624 students in the target population in the pre-policy cohorts. These treatment and comparison groups provided the opportunity to measure the effect of compliance on second-year retention, controlling for all other student characteristics available in the data. Table 3 provides a summary of the measured differences between these 2 groups based on the observable variables along with their statistical significance at a 0.001 level.

Table 3.
Differences in Variables for Treatment and Comparison Groups in Pre-Policy and Post-Policy Periods

	Post-policy treated	***Pre-policy untreated***	**Difference**
N	12,785	11,624	
Female, ρ* (SD**)	0.5372 (0.4986)	0.5373 (0.4986)	0.0001 (0.0064)
Age, $\mu^{\dagger}$ (SD)	20.5936 (6.3169)	23.3402 (9.7452)	$2.7467^{\ddagger}$ (0.1042)
White, ρ (SD)	0.3646 (0.4813)	0.5442 (0.4981)	$0.1796^{\ddagger}$ (0.0064)
African American, ρ (SD)	0.5022 (0.5000)	0.3165 (0.4651)	$-0.1857^{\ddagger}$ (0.0063)
Asian, ρ (SD)	0.0378 (0.1907)	0.0542 (0.2264)	$0.01642^{\ddagger}$ (0.0027)
Hispanic, ρ (SD)	0.0447 (0.2066)	0.0293 (0.1688)	$-0.0153^{\ddagger}$ (0.0024)
Full-time, ρ (SD)	0.5345 (0.4988)	0.5441 (0.4981)	0.0097 (0.0064)
Pell acceptance, ρ (SD)	0.6537 (0.4758)	0.3567 (0.4790)	$-0.2971^{\ddagger}$ (0.0064)
English need, μ (SD)	0.5521 (0.6230)	0.2438 (0.4923)	$-0.3082^{\ddagger}$ (0.0072)
Reading need, μ (SD)	0.6347 (0.7760)	0.2203 (0.5168)	$-0.4144^{\ddagger}$ (0.0085)
Math need, μ (SD)	1.9254 (1.0950)	1.2731 (1.1939)	$-0.6523^{\ddagger}$ (0.0146)
Retained, ρ (SD)	0.5315 (0.4990)	0.4933 (0.5000)	$-0.0382^{\ddagger}$ (0.0064)

Abbreviations: *ρ = proportion, **SD = standard deviation, $^{\dagger}\mu$ = mean.
Note: $^{\ddagger}\alpha = 0.01$.

Analysis

In an attempt to minimize the effect of the possible bias that is often present in comparisons made between non-randomized groups, the comparison group was constructed using the PSM method. The PSM method was pioneered by Rosenbaum and Rubin (1983) for the purpose of creating balanced groups for which meaningful comparisons could be made by addressing the systematic differences in the observed variables of the subjects. It was determined that this approach would be appropriate in this research and was expected to provide suitable balances on the key variables and, thus, provide the foundation for the estimation of the impact of the treatment as conducted in this analysis.

The purpose of seeking this better match using the PSM method was to provide an acceptable counterfactual in the comparisons made. The counterfactual in this research was an estimate of the average second-year retention outcome of students who were exposed to the treatment (i.e., those that had complied with the FYS enrollment policy) had they not been exposed to the treatment (i.e., they did not comply with the policy). Since the exposure to the treatment cannot be undone, the best estimate of the outcome for this group can be found by using the second-year retention outcomes of untreated students that possessed similar observable characteristics as those treated.

The foundation of the PSM method relies on a calculated, “probability of treatment assignment [that is] conditional on observed baseline covariates” (Austin, 2011, p. 402) to match subjects who were treated with those who were not. This probability is referred to as the propensity score and is used as a balancing mechanism that would, ideally, mimic the assignment that occurs in randomized control trials.

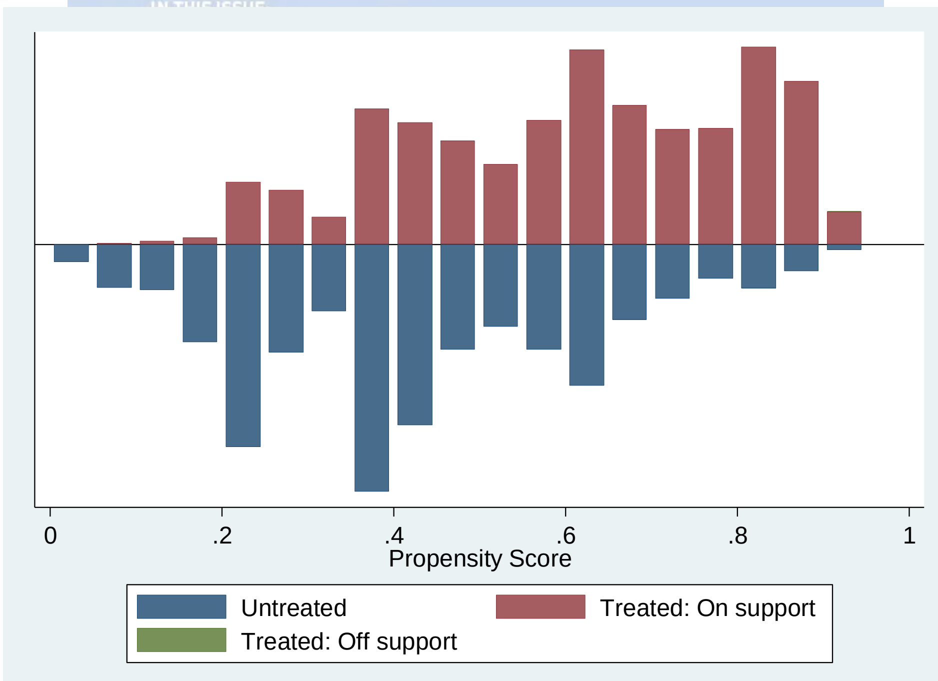

Figure 1: Visual mapping of quality of propensity score matching (PSM) of treatment and pre-policy untreated comparison groups using common support to satisfy the overlap condition of the PSM assumptions.

For the matching to be sufficient for use in estimating treatment effects, 2 assumptions must be satisfied. The first assumption, that of conditional independence or unconfoundedness, requires that the potential outcomes be conditional on the pre-treatment observable covariates but independent of treatment assignment itself (Caliendo & Kopeinig, 2005). This assumption was satisfied in that no student was assigned to treatment based on the observable covariates meaning that the retention outcome was independent of such assignment. The second assumption, that of overlap, states that subjects with the same values of the observable covariates must be equally likely to be exposed to the treatment as they are to not be. In other words, the probability of treatment exposure for matched subjects in the treatment and comparison group must be, on average, the same. This assumption was sufficiently satisfied and was supported by the evidence seen in Figure 1, demonstrating the overlap of propensity scores of the treated and untreated students. These 2 assumptions are the foundations for the strongly ignorable condition of treatment assignment (Rosenbaum & Rubin, 1983) that is the gold standard of randomized control trials. The PSM method works to potentially create this condition and allows for the estimation of the treatment effect to be determined as the difference of the average outcomes of treated and untreated groups, given they had equal propensity scores. To further support the suitability of the treatment and comparison groups after the PSM method was applied, Table 4 gives a new summary of the observable variables along with the associated p value of the differences.

Table 4.
Differences between Treatment and Pre-Policy Untreated Comparison Groups after Propensity Score Matching

	Post-Policy Treated	***Pre-Policy Untreated***	***p value***
Female (ρ*)	0.5373	0.5457	0.179
Age (μ**)	20.594	20.029	0.000
African American (ρ)	0.5023	0.5078	0.381
Asian (ρ)	0.0377	0.0488	0.000
Hispanic (ρ)	0.0446	0.0246	0.000
Full-time (ρ)	0.5345	0.5570	0.000
Pell acceptance (ρ)	0.6537	0.6545	0.895
English need (μ)	0.5520	0.5367	0.048
Reading need (μ)	0.6345	0.6084	0.007
Math need (μ)	1.9253	1.889	0.008
Abbreviations: *ρ = proportion, **μ = mean.			

Applying the PSM method to estimate the average treatment effect of the FYS enrollment policy on student retention required an accurate specification of the regression model. In this research, this model included the outcome variable of second-year retention, the primary predictor variable of compliance, an array of student characteristics, and the fixed effects variable of student high school code.

On the individual student level, the binary variable y_{ic} was modeled to represent the second-year retention outcome for student *i* of cohort *c*. This outcome was equal to 1 if the student returned for and completed the first semester of the second year at MAC, and 0 otherwise. The c represented the cohort year of entry for the student and dually specified whether the student entered MAC in the pre-policy or post-policy period. The equations that modeled this outcome as a response of the independent variables are given below. These models start with equation 1 that represents the basic ordinary least-squares (OLS) model with *compliance* as the only control variable. However, this standard linear equation has a binary outcome measure, thus allowing the model to be characterized as a logistic regression model. This means that the interpretation of the coefficients on the covariates is the impact on the likelihood of a particular category, which in this case is second-year retention. Each of these equations contain the constant intercept of β_0, as well as ε_{ic}, which represents the standard zero-mean error term.

$$y_{ic} = \beta_0 + \beta_1(compliance) + \varepsilon_{ic} \qquad \text{(equation 1)}$$

Equation 2 follows with the inclusion of X_{ic}, which is an array of the pre-treatment observable characteristics for individual students that have been summarized for the treatment and comparison groups to this point.

$$y_{ic} = \beta_0 + \beta_1(compliance) + \beta_2(X_{ic}) + \varepsilon_{ic} \qquad \text{(equation 2)}$$

Finally, equation 3 includes the fixed-effects variable hs_dummy_{ic} that represents the high school from which a student graduated and was used to control for the unobservable characteristics associated with each student.

$$y_{ic} = \beta_0 + \beta_1(compliance) + \beta_2(X_{ic}) + \beta_3(hs\_dummy_{ic}) + \varepsilon_{ic} \qquad \text{(equation 3)}$$

Equation 3 also provided the foundation for the application of the PSM method utilized to estimate the average treatment effect.

RESULTS

Following the specific regression procedure of walking through the 3 regression models in equations 1, 2, and 3 given above, the estimates of the coefficients of interest (representing the marginal effect of each variable on the outcome of interest) were calculated. These results can be seen in Table 5. All calculations and the requisite analysis were completed using the statistical package STATA. In summary, the initial estimation of the effect of compliance was seen to be a 3.8 percentage-point increase in the likelihood of retention when considering treatment exposure alone. When the student characteristics were controlled for, the effect of compliance rose to a 7.1 percentage-point advantage. But when the high school unobservable fixed effect was included, the increased likelihood of retention dropped to 5.7 percentage points. Each of these results were statistically significant at the 0.01 level.

Table 5.
Coefficients on Compliance and Other Variables as Initial Estimations of the Effect of the Policy on Second-Year Retention

	Ordinary least-squares…	**…with observable covariates**	**…with high-school fixed effects**
Compliance	0.03819* (0.0064)	0.07154* (0.0069)	0.05728* (0.0070)
Female		0.05734* (0.0064)	0.05457* (0.00657)
Age		-0.00098** (0.0042)	0.00090** (0.00044)
African American		-0.08544* (0.00724)	-0.05203* (0.00816)
Full-time		0.12148* (0.00683)	0.10549* (0.00688)
Pell		-0.04264* (0.00716)	-0.02212* (0.00731)
Developmental English			
1 Course		-0.02244** (0.00889)	-0.01857** (0.00886)
2 Courses		-0.05702* (0.01772)	-0.05578* (0.01768)
Developmental reading			
1 Course		-0.00704 (0.00935)	-0.00303 (0.00933)

2 Courses		-0.03729* (0.01327)	-0.02800** (0.01328)
Developmental mathematics			
1 Course		0.09986* (0.00950)	0.09040* (0.00955)
2 Courses		0.06665* (0.01017)	0.06739* (0.01033)
3 Courses		0.03008* (0.00968)	0.04567* (0.01000)
Notes: *significant at the α = 0.01 level, **significant at the α = 0.05 level.			

Table 6 shows only the calculated average treatment effect, i.e., the estimated effect of compliance with the enrollment policy, as a 6.07 percentage-point increase in the likelihood of second-year retention. This positive effect supports the expectation that enrollment in the FYS in compliance with the policy would have a positive impact on the retention of its students, as MAC intended. It also confirms the stated expectations of this research and lends further evidence to the purported positive association between FYS enrollment and student persistence outcomes overall.

Table 6.
Estimation of the Average Treatment on the Treated Effect of Compliance within the Treatment Group Using the Propensity Score Matching Method

	Treated	Comparison	Difference	SE	T-Stat
ATT	0.53434	0.47364	0.0607	0.01189	5.11
Abbreviations: ATT = average treatment on the treated effect, SE = standard error.					

DISCUSSION AND CONCLUSION

The primary result of a 6.07 percentage-point increase in the likelihood of second-year retention for those students who complied with the FYS enrollment policy indicates a statistically significant benefit for MAC. It is concluded, therefore, that early enrollment may be an effective tool in efforts to increase the retention of community college students. As a result of compliance with the new enrollment policy adopted at MAC, first-time college degree-seeking students appeared to be positively influenced to remain enrolled in college and persist toward their expressed goal of earning a marketable credential. The clearest implication of this result is that the effort made by MAC in the creation and implementation of the FYS enrollment policy was well worth the investment. Having more students continue to enroll into and through the second year helps stabilize their enrollment and reduces the burden of continued recruitment of students with prior experience. Further, the students themselves will enjoy the benefits associated with completion if they reach their intended goals.

However, this result is limited to only providing evidence of the effect that compliance had on the likelihood of second-year retention. It does not provide any insight into why it had the estimated effect. There was no consideration given to the many variations related to the delivery of the FYS course, including the format, time slot, experience of the instructor, or the specific topics included in the instruction. Although compliance with the enrollment policy was considered the treatment under investigation, the FYS course itself was, in effect, a black box, but feasibly had some impact on the outcome that was not accounted for.

In addition, the narrow focus of this research on compliance in the first semester of attendance and its impact on second-year retention measured a year later, assumed that the average treatment on the treated effect remained present over that time period. Further, only the pre-treatment student characteristics were included as covariates in the analysis, which meant that other outcomes like grade point average, changes in Pell status, or changes in enrollment intensity were not considered. As each of these can reasonably assumed to have respective positive or negative associations with retention, any changes in the subsequent semesters would have flipped the direction of that association and contributed to an opposite effect on retention. These possible changes were not accounted for in this research either and naturally reduced the validity of the model specification.

Finally, and more broadly, the finding of this research is limited in its generalizability. Although community college students have many similar commonalities among them, these characteristics are taken as averages and cannot be expected to represent the specific student populations at different institutions. The unique environmental and structural features of each institution also make any expectation of the applicability of this result improbable, in spite of its promise.

Enrollment in an FYS has long since been believed to be positively associated with persistence, largely based on the seminal analysis by Pascarella and Terenzini (1991). This analysis found that the overwhelming majority of published studies from the past 20 years to that point, showed statistically significant improvement in student outcomes as they related to FYS enrollment. Utilizing more up-to-date research techniques, more recent reviews of these studies confirmed these associations (Pascarella & Terenzini, 2005; Upcraft et al., 2005). Additional reviews of more current research found that FYS enrollment was a strong predictor of student persistence (Tinto, 2012; Permzadian & Credé, 2016). It is no wonder, then, that belief in the effectiveness of the FYS remains high (Young & Hopp, 2014).

The research conducted here was motivated by the continued belief that enrollment in an FYS course is a good predictor of student retention and the resulting finding served to add to the increasing body of literature that investigates the validity of retention theories in the community college, 2-year college, or commuter college settings (Feldman, 1993; Zeidenberg et al., 2007; Cho & Karp, 2013; Windham et al., 2014; Braxton et al., 2014). However, in light of the stated limitations of this result there are some suggestions for future research that should be considered to address any validity concerns.

Some of the strengths of this research are the facts that it was conducted at a single institution and involved only one FYS course. Therefore, it is suggested that further research be conducted to extend the current results by addressing the omission of these important and likely significant variations that could reasonably contribute to varying effects on student outcomes. In relation to this, it is suggested that a more detailed investigation of the primary elements of the FYS be conducted, possibly through a qualitative analysis that may possibly identify any major lever arms that drive the observed association with student retention. It would be valuable to determine if these elements have any association with student outcomes as well.

In conclusion, this research served the purpose of making a contribution to the research literature on the impact of programs and initiatives in a community college setting. Specifically, this research helped fill the gap in the investigation of the effect that enrollment in an FYS course had on second-year retention for first-time college degree-seeking students at a large community college. In addition, the conditions of the new FYS enrollment policy, requiring students to complete the course in the first semester of attendance, extends the existing research beyond the common elective nature of many policies and adds the compelling question about the benefit of early enrollment. Through the application of the PSM method, this research also increased the rigor of the estimation of any treatment effect by providing support for the identification of a causal relationship between early enrollment in an FYS course and the short-term student outcome of the likelihood of second-year retention. Therefore, this research could provide additional justification for increased efforts to determine the effectiveness of new programs and initiatives at other community colleges that have yet to find value in such endeavors.

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