A Longitudinal Analysis of Outcomes Associated with Ohio's Postsecondary Enrollment Options Program

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Abstract

Dual enrollment programs, once created for the most advanced students, are now seen as a way to provide an accessible and affordable bridge to postsecondary education for a broader range of students. Research on the outcomes of such programs has been limited in scope and exists for only a few states. This quantitative study used Astin's I-E-O Model as the conceptual framework to analyze 10 years of postsecondary data from Ohio. Outcomes of traditional-aged students enrolled in the state university system who participated in Ohio's Postsecondary Options Program (PSEOP) were compared with students of similar academic ability who did not participate in this program. Key findings centered on attributes which were significantly related to PSEOP participation and outcomes to which PSEOP participation was a significant contributor. Gender, ethnicity, academic performance, and family characteristics were all related to the decision of whether or not to participate in PSEOP. Students that did participate in PSEOP showed this experience as a significant factor in choosing certain majors and had a statistically significantly shorter time-to-degree completion than those students who did not participate in PSEOP. Results from this study provide areas where participation in PSEOP could be improved to widen the access of higher education to a larger pool of students.

Keywords: Postsecondary Enrollment Options Program, Ohio, dual enrollment, higher education access

Introduction

The wealth of a state or nation in the 21st century will be determined by its ability to generate knowledge assets where education will serve as the basic currency for individuals to advance society and to remain globally competitive (KnowledgeWorks & WICHE 2007; The Secretary of Education's Commission on the Future of Higher Education 2006). A postsecondary education is no longer a luxury meant for an elite few, but a necessity for entrance into the middle class (Bailey, Hughes, & Karp 2003; Fleischman & Heppen 2009; Pennington & Vargas 2004). Of the 20 fastest growing occupations projected for 2008-2018, as determined by the U.S. Bureau of Labor Statistics (2009), 12 will require an associate's degree or higher. Research has clearly demonstrated strong economic benefits accrued from education beyond high school graduation (Krueger 2006). According to the National Commission on the High School Senior Year (2001a) a high school diploma is no longer an adequate credential as we transition into a knowledge-based economy. All Americans should pursue at least two years of education beyond high school graduation in preparation for even entry-level positions in society (Krueger 2006).

Research from the National Center for Education Statistics [NCES] (2008, 2009b) reveals that the educational attainment of the United States population has improved. The number of 16- to 24- year-olds not earning a high school diploma or its equivalent decreased from 14 to 9% between the years of 1980 and 2007. Although the number of 25- to 29- year-olds completing a bachelor's degree or higher increased from 17 to 29% between the years of 1971 and 2000, there has only been a slight increase to 31% in 2008. The rate of college enrollment immediately following high school increased from 49 to 67% between 1972 and 1997, but has only fluctuated between 62 and 69% since 1997. According to Krueger (2006), only 20% of entering 9th graders will earn a college degree by the age of 24. Nationally, this loss in educated citizenry will handicap the United States in its ability to remain globally competitive.

State-wide statistics for Ohio indicate rates lower than national averages, with only 17% of its ninth graders graduating from high school on time, proceeding on to college, returning for the second year, and graduating with a baccalaureate degree within six years. In 2000, 24% of adult Ohioans aged 25 to 44 had earned a bachelor's degree or higher which was lower than the national average of 27% (Pennington & Vargas 2004). These statistics provide a major concern for Ohio's future economic growth (Krueger 2006; Pennington & Vargas 2004).

In recent years, the annual cost of attending a four-year undergraduate institution has increased twice as fast as the rate of inflation, with the average cost for attending a public institution rising from $2,550 in 1980-81 to $13,424 in 2007-08 and the cost for attending a private institution from $5,594 in 1980-81 to $30,393 in 2007-08 (NCES 2009c). Adding to the flattened level of college attainment and the escalating costs of higher education, the

time-to-completion for most baccalaureate recipients has extended beyond four years with only 58% of full-time students pursuing a bachelor's degree or its equivalent in 2000-01 finishing within six years (NCES 2009a).

Of the students who do go to college after high school, not all earn a college credential. According to Mike Bowler (2009), "30 percent of college and university students drop out after their first year. Half never graduate, and college completion rates in the United States have been stalled for more than three decades" (para. 2). Research collected and analyzed by Pascarella and Terenzini (2005) established first-generation college students to be the student group most at risk for dropping out. Students from families which have not experienced college tend to have lower degree aspirations, more self doubt about their abilities to be successful in college, and find going to college a threatening experience. Students' financial resources also influence college persistence (Tinto 1993).

The misalignment between secondary education and postsecondary education is not a new problem, but one that has been observed over many years. While some students need longer than four years to prepare for college, others are prepared a year or more prior to high school graduation to take on more challenging coursework. The National Commission on the High School Senior Year (2001b) in its summary of its report *The Lost Opportunity of Senior Year: Finding a Better Way*, recommended that American high schools re-think the policy of requiring all students to complete four years of high school suggesting that "time" didn't equate with readiness for postsecondary education. Even though students are ready to move on to a new challenge, society indicates that they need to finish out the senior year and wait for high school graduation. As a consequence, many bright and talented students spend their senior year in courses that are unchallenging and taught at a pace too slow to keep them engaged in learning during their senior year (Andrews & Davis 2003; Peterson 2003; Pierce 2001). Students, who dismiss their senior year, have in fact lowered their readiness for college. According to Peterson (2003), many of the students who need remediation courses in college took rigorous courses during their early years of high school. They simply forgot what they learned by lowering the caliber of their high school curriculum for their senior year. Adelman (1999) demonstrated through his research that the intensity and quality of one's high school curriculum is the strongest predictor of bachelor degree attainment. Through a lack of consistent rigor in their high school curriculum students have increased the probability of needing remedial courses in mathematics and English once they enter college (Jayson 2005; Rosenbaum 2004). As a consequence, time and money are wasted by having to repeat subject material in college that should have been mastered in high school and students increase their chances of not completing a baccalaureate program (Peterson 2003).

Hoffman, Vargas, and Santos (2009) reported in their article *New Directions for Dual Enrollment: Creating Stronger Pathways from High School Through College*:

> An emerging body of research and practice suggests that providing college-level work in high school is one promising way to better prepare a wide range of young people for college success, including those who do not envision themselves as college material (p. 43-44).

Well-known programs such as the College Board Advanced Placement (AP) Program, established in 1955, and the International Baccalaureate (IB) Program, established in 1968, have provided an elite group of students enrichment opportunities to engage in college-level work and the opportunity to demonstrate their mastery of this coursework through external examinations (College Entrance Examination Board [CEEB] 2003; International Baccalaureate Organization [IBO] 2005). The first state legislated dual enrollment program was established in 1985 by the state of Minnesota allowing high school students to earn high school and college credit simultaneously without achievement testing. Students participated by completing courses offered on a college or university campus and where available, offered at the high school. In 1990, legislation in the State of Washington created the Running Start Program, where students could take their full high school load during their 11th and 12th grade years by enrolling at a participating postsecondary institution for dual credit (U.S. Department of Education 2007; Minnesota State Colleges and Universities 2009; State of Washington, Superintendent of Public Instruction n.d.). These two programs served as models for the remaining states with 46 states now having state-wide dual enrollment policies. The remaining four states and the District of Columbia have local or institutional dual enrollment policies established for students to earn college credit while in high school (Education Commission of the States [ECS] 2008). While all of these programs are currently used in the United States to provide more rigorous college and university-level curricula to high school students, dual enrollment is seen as a way to broaden the access to more students, lower the costs of higher education, and accelerate the time to baccalaureate degree completion. Participation in dual enrollment within the high school can be used to help bridge the academic transition to college. Students participating in dual enrollment classes on college campuses will additionally experience the interpersonal interactions between college students and faculty bridging the social transition to college. Students provided with the higher expectations of college-level coursework and social expectations while they are still in high school will better understand the rigor of postsecondary education and the skills they need to be successful in college and increase the probability of their college persistence (Hoffman et al. 2009; Tinto 1993).

Ohio's Postsecondary Enrollment Options Program

Modeled after Minnesota's PSEO legislation, The Ohio Postsecondary Enrollment Options Program (PSEOP) was established by Ohio lawmakers in 1989 as a way for high school juniors and seniors to earn dual high school and college credit through the successful completion of college courses (Cubberley 2009; Fowler 1994). In 1997, the program expanded to include freshman and sophomores, and in 1999, the program restricted participation

to those students having a 3.0 grade point average in the field of study (Ohio Department of Education [ODE] 2006). In 2008, then Ohio Governor Ted Strickland unveiled the *Seniors to Sophomores* initiative to give high school seniors the opportunity to earn college credit for their last year of high school by taking their full class load at a University System of Ohio campus. This dual credit would result in college sophomore status at the time of high school graduation (University System of Ohio [USO] n.d.). The original purpose of PSEOP was to provide Ohio high school students with opportunities to pursue coursework with a higher-level of academic rigor in areas that were not offered as a part of the typical high school curriculum (ODE 2006). Benefits to the students include earning dual high school and college credit at no cost to them or their families and the opportunity to experience college-level coursework while still in high school. For some students who did not initially consider a college education, this policy could prove they would be successful in college (KnowledgeWorks Foundation & WICHE 2007).

Student participation in Ohio's dual enrollment programs has steadily increased over the last 10 years with 6,859 students participating in 1998 and 12,195 students participating in 2007 (ODE 2007). With the recent extension of the *Seniors to Sophomores* program, the intent of dual enrollment in Ohio has progressed from one of education enrichment to that of higher education accessibility with the goal to increase the state's college enrollment level by 230,000 students over the next 10 years (National Governors Association Center for Best Practices 2008; USO n.d.).

Despite the tremendous growth of PSEOP, Ohio has done little to assess the effectiveness of PSEOP resulting in policy created solely on anecdotal evidence and research that shows glimmers of program success (Ohio Association for Gifted Children 2005; KnowledgeWorks Foundation & WICHE 2007). One of the more significant attempts, funded by the Bill & Melinda Gates Foundation, resulted in a 2007 study by KnowledgeWorks Foundation and the Western Interstate Commission for Higher Education (WICHE). The primary focus of this study was to analyze outcomes related to program participation trends, ascertain what type of students have had access to participate in PSEOP, measure subsequent success of students through college attendance and degree completion, and determine program cost to multiple constituents. The findings presented from this research were primarily descriptive comparisons of PSEOP participants to all students and was limited to a year's worth of data for most comparisons (KnowledgeWorks Foundation & WICHE 2007). More research needs to be done at the state-level to determine what type of students take advantage of dual enrollment through PSEOP and how they differ from their non-PSEOP counterparts. An analysis of differences in graduation rates, time-to-completion, majors chosen, and eventual pursuit of graduate education will provide policymakers with valuable insight on the overall effectiveness of Ohio's PSEOP.

Purpose of the Study

The purpose of this study was to provide a more comprehensive assessment of the higher educational outcomes of students attending public universities in Ohio from 2000 to 2010 who previously participated in PSEOP and how their participation in this program impacted their matriculation to college and collegiate success. The following research questions will guide this study:

1. What is the demographic profile of PSEOP students? How do factors of gender, race, age at the time of matriculation, high school academic performance, family income, and parental education impact those who enroll as PSEOP students? How is the profile of former Ohio PSEOP students like or unlike that of non-PSEOP Ohio college students?
2. Were there significant differences in the selection of major fields of study between former Ohio PSEOP students and non-PSEOP Ohio college students, controlling for significant input variables?
3. Were there significant differences between one-year retention rates of former Ohio PSEOP students and non-PSEOP Ohio college students, controlling for significant input variables and environmental variables?
4. Were there significant differences in cumulative grade point averages after the first year of college between former Ohio PSEOP students and non-PSEOP Ohio college students, controlling for significant input variables and environmental variables?
5. Were there significant differences in cumulative grade point averages at the time of graduation of former Ohio PSEOP students and non-PSEOP Ohio college students, controlling for significant input variables and environmental variables?
6. Were there significant differences in graduation rates of former Ohio PSEOP students and non-PSEOP Ohio college students, controlling for significant input variables and environmental variables?
7. Were there significant differences in time-to-degree attainment of former Ohio PSEOP students and non-PSEOP Ohio college students, controlling for significant input variables and environmental variables?
8. Were there significant differences in the proportion of students who pursued graduate or professional studies within one year of baccalaureate degree completion between former Ohio PSEOP students and non-PSEOP Ohio college students, controlling for significant input variables and environmental variables?

Research Methods

Data

The Ohio Board of Regents provided demographic, enrollment, and graduation data on all students who started their undergraduate education at one of the 13 state universities of Ohio between the years of 2001 and 2003 for use in this study. A control group of 3,978 students was constructed from these data to include all students who had graduated from an Ohio high school, were between the ages of 17 and 19 years of age at the time of matriculation, had a recorded ACT score, and who had participated in the PSEOP as a high school student. A comparison group of equal size was constructed as a stratified random sample based on ACT scores from the remaining 101,019 students who had graduated from an Ohio high school, were between the ages of 17 and 19 years of age at the time of matriculation, had a recorded ACT score, but did not participate in the PSEOP as a high school student. The use of stratification ensured that the two groups were balanced based on academic talent.

Variables

Astin's I-E-O Model, developed by Alexander Astin (2002), served as the conceptual model for assessing outcomes associated with PSEOP participation. Independent variables used in this study corresponded to the inputs and environments of Astin's I-E-O Model. Gender, race, income, first-generation status (as determined by parental education), and participation in the PSEOP all represented input variables of the model. First-generation status and participation in the PSEOP were represented as dichotomous variables. First-generation status posed some limitations to the study as this information was only available for those students who completed the Free Application for Federal Student Aid (FASFA) form.

Environmental variables were represented by the public university in Ohio where the student matriculated to and whether or not the student lived in institutional housing during their first term. The institutions were dummy-coded into a variable for each of the 13 state universities in Ohio so that each student attended only one of the institutions. In cases where the student attended multiple institutions, the institution where the most hours were earned was used. The Ohio State University had the largest enrollment numbers and as such served as the contrast group for the study.

Outcome variables, which were the dependent variables of the study, included the undergraduate institution, undergraduate major, first-year retention at the institution started at, first-year retention at any Ohio institution, first-year cumulative grade point average, graduation cumulative grade point average, graduation rates for the institution started at, graduation rates from any Ohio institution, time-to-degree, and whether or not the student continued to professional or graduate school within one year of his/her baccalaureate program. Undergraduate majors were categorized into one of business; education; health science; liberal arts; math, science,

and engineering; visual and performing arts; and undecided. First-year retention from the institution started at, first-year retention at any Ohio institution, and graduate/professional school continuance were all represented as dichotomous variables. Time-to-degree was calculated as the number of semesters (fall and spring) until degree attainment. The effects of race, gender, parental education, high school cumulative grade point average, age of student at start of college, and years between high school and college were controlled for in situations where it might modify the effect of the relationship.

Analysis

The demographic profile was presented through a descriptive analysis of the PSEOP and non-PSEOP student. The impact of the demographic, family, and academic independent variables was determined through logistic regression since the outcome of whether or not a student participated in the PSEOP is a dichotomous variable. Differences between the groups based on each of the independent variables were ascertained through the use of chi-squared and t-tests. Logistic regressions were used to determine significant differences in major fields of study, retention, graduation rates, and the number of students who pursued graduate or professional school within one year of baccalaureate degree attainment between the PSEOP and non-PSEOP groups. ANCOVAs were used to ascertain differences in cumulative grade point averages at the end of the first-year, cumulative grade point averages at the time of graduation, and time-to-degree completion between the PSEOP and non-PSEOP groups. Input characteristics of age, race, gender, family income, parental education, how soon students started college after high school graduation, and high school cumulative grade point average with significant differences in the PSEOP and non-PSEOP groups were used as covariates. Environmental characteristics of the institution where students started their undergraduate education and whether or not they lived in institutional housing were used in questions where outcomes were associated with the completion of the first-year or graduation.

Effect sizes were used to measure the strength and direction of the association of the dependent variable with levels of an independent variable. Phi (Φ), equivalent to Pearson's *r* for binary variables, was used to measure effect size for chi-squared tests and Pearson's $r = \sqrt{\frac{t^2}{t^2 + df}}$ for t-tests in conjunction with Cohen's (1988) definitions of a small effect ($r = .10$), medium effect ($r = .30$), and large effect ($r = .50$). Effect sizes for ANCOVA were measured by partial eta-squared (η_p^2) and were interpreted as R^2or the proportion of the variance in the dependent variable that is attributed to the effect. A small effect is defined as 1%, a medium effect as 9%, and a large effect as 25%. Logistic regression used the odds ratio as the measurement of effect size. For an odds ratio less than one, the ratio is described based on its reciprocal and the negation of the variable it relates to.

Results

PSEOP Student Profile

Table 1 presents demographic characteristics of the PSEOP and non-PSEOP groups. Sixty-four percent of the students who participated in PSEOP were female compared to the non-PSEOP group where 50.4% were female, a difference that was significant ($\chi^2(1, 7956) = 144.12$, $p < .001$) , but with a small effect size, $\Phi=0.14$. Race and ethnicity also differed significantly with the number of Asian Americans who had participated in the PSEOP significantly higher, ($\chi^2(1, 7956) = 9.81$, $p < .01$) with an effect size of $\Phi=0.035$, than those who did not. There were 134 Asian Americans in the PSEOP group compared to only 88 in the non-PSEOP group. The number of African Americans was significantly lower, ($\chi^2(1, 7956) = 16.01$, $p < .001$) with an effect size of $\Phi=-0.045$, having only 112 African Americans participating in PSEOP compared to 179 who did not.

Table 1 Demographic Characteristics of the PSEOP and non-PSEOP Populations

	PSEOP Students		Non-PSEOP Students			
Characteristic	*n*	%	*n*	%	χ^2	Φ
Gender					144.12***	0.135
Male	1442	36.2	1972	49.6		
Female	2536	63.8	2006	50.4		
Total	3978	100.0	3978	100.0		
Race/Ethnicity						
American Indian	14	0.4	18	0.5	0.50	-0.008
Asian American	134	3.4	88	2.2	9.81**	0.035
African American	112	2.8	179	4.5	16.01***	-0.045
Hispanic/Latino	78	2.0	57	1.4	3.32	0.020
Caucasian	3535	88.9	3529	88.7	0.05	0.002
Unknown[a]	105	2.6	107	2.7	0.02	-0.002
Total	3978	100.0	3978	100.0		
First Generation					0.40	-0.009
Yes	925	23.3	681	17.1		
No	1987	49.9	1407	35.4		
Missing	1066	26.8	1890	47.5		
Total	3978	100.0	3978	100.0		

Note. [a]Unknown also includes non-resident alien of which there were two cases.
*$p < .05$. **$p < .01$. ***$p < .001$.

First-generation status was determined for students where neither parent had any college education and was shown in Table 1 to be non-significant. When considering the father's and mother's educational achievements separately there were fewer missing data records as students with the educational achievements of only one parent could be considered. The mothers of students in the PSEOP group were educated at a higher level with 41% having

completed some college compared to only 28% with any college education in the non-PSEOP group. It should be noted however that over 45% of the non-PSEOP students had missing information for parental educational levels.

Significant differences of family income and parental education are described in Table 2. There were no significant differences between PSEOP and non-PSEOP students in terms of family income and father's education, but mothers of PSEOP students had significantly higher levels of education ($t(5184) = 2.04$, $p < 0.05$). It should be noted that the effect size of the mother's education level was small with $r = 0.03$.

Table 2 Family Characteristic Differences of PSEOP and Non-PSEOP Students

	PSEOP Students			Non-PSEOP Students				
Characteristic	*n*	*M*	*SD*	*n*	*M*	*SD*	*t*	*df*
Income	3169	78242.12	49941.10	3055	77010.05	52128.90	0.95	6222
Education[a]								
Father	2977	2.50	0.53	2131	2.51	0.54	-0.59	5106
Mother	3017	2.52	0.53	2169	2.49	0.53	2.04*	5184

Note. [a]Middle School/Jr. High =1; High School = 2; College or beyond = 3.
*$p < .05$. **$p < .01$. ***$p < .001$.

Student academic characteristics are presented in Table 3. The age students started college was found to be significantly higher for former PSEOP students compared to non-PSEOP students, ($t(7954) = 2.90$, $p < 0.01$), with a small effect size of $r = 0.03$. Students in this study started college at age 17, 18, or 19. These differences are not meant to imply that students didn't go directly to college, but that students who are older in their grade were more likely to have participated in PSEOP than their younger classmates. The mean age at the time students started college was 18.41 years for those with PSEOP experience compared to 18.38 years to those students without PSEOP experience.

The time between high school graduation and the time students start college was found to be significantly lower for former PSEOP students compared to non-PSEOP students, ($t(7951) = -2.55$, $p < 0.05$). This indicated that former PSEOP students were more likely to start college right after high school graduation whereas more non-PSEOP students were likely to wait a year after high school graduation before starting college. The effect size of this difference was small, $r = 0.03$, making the practical difference difficult to distinguish since students in both groups either went directly to college or waited only one year after high school to attend college.

Students who participated in PSEOP while in high school were found to have significantly higher high school cumulative grade point averages than students who did not participate in the PSEOP, ($t(7482) = 18.37$, $p < 0.001$) with an effect size of $r = 0.21$. It should be noted that while the Ohio PSEOP does have a GPA requirement, counselors have had the latitude to enter students into the program who they felt would benefit from the experience as illustrated through the participant grade point averages described in Table 3. Aside from the lower grade point

averages, the proportion of students in the 3.5-4.0 grade point average category is notably higher for the PSEOP group as compared to the non-PSEOP group confirming that this program is attracting a higher percentage of strong academic students who could benefit from the challenge of college-level work.

Table 3 Academic Differences of the PSEOP and non-PSEOP Populations

	PSEOP Students		Non-PSEOP Students			
Characteristic	*n*	%	*n*	%	*t*	*df*
Start Age (years)					2.90**	7954
17	21	0.5	15	0.4		
18	2298	57.8	2439	61.3		
19	1659	41.7	1524	38.3		
Total	3978	100.0	3978	100.0		
Years between High School and College					-2.55*	7951
0	3956	99.4	3935	98.9		
1	21	0.5	41	1.0		
Missing/Unknown	1	0.1	2	0.1		
Total	3978	100.0	3978	100.0		
High School GPA					18.37***	7482
0.5 – 0.9 (D- to D)	3	0.1	1	0.0		
1.0 – 1.4 (D to C-)	3	0.1	1	0.0		
1.5 – 1.9 (C- to C)	4	0.1	21	0.5		
2.0 – 2.4 (C to B-)	20	0.5	130	3.3		
2.5 – 2.9 (B- to B)	142	3.6	439	11.0		
3.0 – 3.4 (B to B+)	912	22.9	1107	27.8		
3.5 – 4.0 (A- to A)	2689	67.9	2012	50.6		
Missing/Unknown	205	5.2	267	6.7		
Total	3978	100.0	3978	100.0		

Student ACT scores are perfectly correlated between the two groups. This is expected since the non-PSEOP group was constructed as a stratified sample, equal in size and matched to the ACT scores of the PSEOP group. For each PSEOP student in each of the ACT score categories, a like number of non-PSEOP students were randomly chosen to be in the comparison group. The range distributions of ACT scores for the two groups are described in Fig 1.

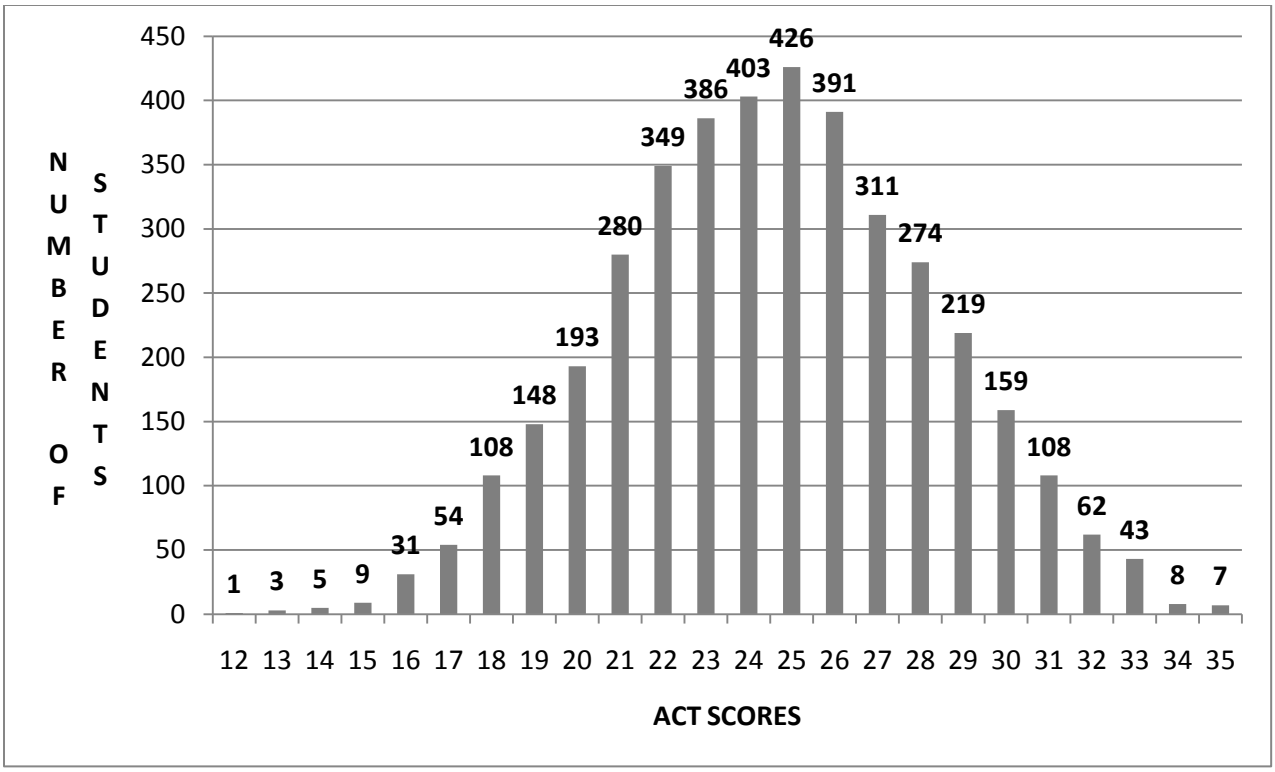

Fig 1 ACT Score Distribution

Descriptive student environmental characteristics and their significance to PSEOP experience are reported in Table 4. The University of Akron ($\chi^2(7956) = 6.38$, $p < 0.05$, $\Phi = -0.03$), University of Cincinnati ($\chi^2(7956) = 109.76$, $p < 0.001$, $\Phi = -0.12$), Cleveland State University ($\chi^2(7956) = 34.58$, $p < 0.001$, $\Phi = -0.07$), Ohio University ($\chi^2(7956) = 166.97$, $p < 0.001$, $\Phi = -0.15$), and Youngstown State University ($\chi^2(7956) = 59.34$, $p < 0.001$, $\Phi = -0.09$), all showed significantly fewer students with PSEOP experience when compared to students without PSEOP experience although the effect sizes were small. Bowling Green State University ($\chi^2(7956) = 53.55$, $p < 0.001$, $\Phi = 0.08$), The Ohio State University ($\chi^2(7956) = 53.59$, $p < 0.001$, $\Phi = 0.08$), Shawnee State University ($\chi^2(7956) = 4.63$, $p < 0.05$, $\Phi = 0.02$), and the University of Toledo ($\chi^2(7956) = 74.18$, $p < 0.001$, $\Phi = 0.10$), had a significantly higher number of students with PSEOP experience enroll when compared to students without PSEOP experience. The effect sizes for these institutions were also small.

Logistic regression was used to determine which combination of variables significantly predicted PSEOP participation. Academic characteristics were found to be the most significant predictors of PSEOP participation. Model 1 (academic characteristics) was significant and based on the Nagelkerke R^2 statistic, accounted for 5.9% of the variance of student participation in PSEOP. Model 2 added ethnicity and gender characteristics, provided a significant improvement to Model 1, and accounted for 7.6% of the variance in PSEOP participation. Model 3 added family characteristics of income as reported for the Ohio Instructional Grant and parental education, but did

not add a significant improvement to the overall model. Model 3 remained significant overall, $\chi^2(13) = 279.67$, $p < 0.001$, with a total of 7.8% of the variance in PSEOP participation accounted for by the significant predictors. Table 5 presents these results.

Table 4 Environmental Characteristics of the PSEOP and non-PSEOP Populations

	PSEOP Students		Non-PSEOP Students			
Characteristic	*n*	%	*n*	%	χ^2	Φ
Institution Choice						
University of Akron	190	4.8	241	6.1	6.38*	-0.028
Bowling Green State University	606	15.2	390	9.8	53.55***	0.082
University of Cincinnati	137	3.4	364	9.2	109.76***	-0.117
Cleveland State University	7	0.2	52	1.3	34.58***	-0.066
Central State University	2	0.1	8	0.2	3.61	-0.021
Kent State University	359	9.0	361	9.1	0.01	-0.001
Miami University	456	11.5	454	11.4	0.01	0.001
The Ohio State University	1150	28.9	866	21.8	53.59***	0.082
Ohio University	159	4.0	470	11.8	166.97***	-0.145
Shawnee State University	64	1.6	42	1.1	4.63*	0.024
University of Toledo	599	15.1	350	8.8	74.18***	0.097
Wright State University	187	4.7	200	5.0	0.46	-0.008
Youngstown State University	62	1.6	180	4.5	59.34***	-0.086
Total	3978	100.0	3978	100.0		
Housing Choice					3.53	-0.020
Institutional	2776	69.8	2849	71.6		
Non-Institutional	1202	30.2	1129	28.4		
Total	3978	100.0	3978	100.0		

*$p < .05$. **$p < .01$. ***$p < .001$.

Table 5 Logistic Regression Predicting Participation in PSEOP

		Model 1			Model 2			Model 3		
Predictor	ΔR^{2b}	*β*	*SE*	Odds Ratio	β	SE	Odds Ratio	*β*	*SE*	Odds Ratio
Step 1	0.059***									
Constant		-5.50	1.18	0.00	-6.59	1.21	0.00	-6.75	1.22	0.00
HS GPA		0.65***	0.05	1.92	0.59***	0.05	1.81	0.59***	0.05	1.81
ACT Score		-0.04***	0.01	0.96	-0.03**	0.01	0.97	-0.03***	0.01	0.97
Yrs to College		-0.40	0.35	0.67	-0.39	0.36	0.68	-0.38	0.36	0.68
Start Age		0.15*	0.06	1.16	0.20**	0.06	1.22	0.20**	0.06	1.22
Step 2	0.017***									
Female					0.47***	0.06	1.61	0.48***	0.06	1.61
American Indian					0.50	0.52	1.65	0.48	0.52	1.62
Asian American					0.36	0.21	1.43	0.37	0.21	1.45
African American					-0.35*	0.17	0.71	-0.36*	0.17	0.70
Hispanic/Latino					0.30	0.23	1.35	0.31	0.23	1.36
Unknown[a]					0.10	0.20	1.10	0.10	0.20	1.10
Step 3	0.002									
Father Education								-0.08	0.06	0.93
Mother Education								0.15*	0.06	1.17
OIG Income								0.00	0.00	1.00
Total R^{2b}	0.078***									

Note. [a]Unknown also includes Non-resident alien of which there were two cases.
[b]Nagelkerke R^2 is reported.
*$p < .05$. **$p < .01$. ***$p < .001$.

High school cumulative grade point average was found to be a major contributor in the prediction of PSEOP participation with the likelihood of participation 1.8 times higher for each unit increase in grade point average. ACT scores were actually inversely related to PSEOP participation with a slight decrease in the odds of participation with each unit increase in ACT scores. Females were 1.6 times more likely to participate in PSEOP than males and students starting college at 19 were 1.2 times more likely than 17 year-old college freshman to have participated in PSEOP. Ethnicity had a lesser impact in the participation decision with Caucasian students 1.4 times more frequently participating than their African American counterparts. Levels of education held by the mother of the student also contributed to the student decision to participate in PSEOP with the odds of participation increasing by 1.2 times for each level of increased education earned by the mother.

Major Field of Study

The logical groupings used to investigate whether or not there were significant differences in the choice of majors between students who participated in PSEOP and students who did not were business; education; health sciences; liberal arts; math, science, and engineering; visual and performing arts; and undecided. Logistic regression analyses were used to ascertain if PSEOP participation was a significant predictor in major choice. Student input variables found significant to PSEOP involvement were entered in Model 1 and prior PSEOP experience was entered as an independent variable in Model 2 for each of these logistic regressions. PSEOP participation was found as a significant predictor for students majoring in Business, Health Science, and Liberal Arts fields. Tables 6 – 8 present the significant findings from the resulting regression models.

Table 6 presents the logistic regression results predicting a student's choice to major in business. Model 1 was significant and based on the Nagelkerke R^2 statistic, accounted for 0.9% of the variance of predicting a major in business. Model 2 improved the prediction slightly with gender, Asian American ethnicity, and prior PSEOP experience found to be statistically significant in distinguishing the likelihood of majoring in a business field ($\chi^2(8) = 27.304$, $p = .001$). In the final model, prior PSEOP experience showed an inverse relationship with non-PSEOP students 1.2 times more likely to choose business as a major than their PSEOP counterparts. Male students were 1.27 more likely than females and non-Asian Americans were 2.27 more likely than their Asian counterparts to choose business as their major.

Table 6 Logistic Regression Predicting the Likelihood of Majoring in Business

		Model 1			Model 2		
Predictor	ΔR^{2a}	β	*SE*	Odds Ratio	β	SE	Odds Ratio
Step 1	0.009**						
Constant		-3.89*	1.67		-4.12*	1.68	
Female		-0.26**	0.09	0.77	-0.24**	0.09	0.79
Asian American		-0.82*	0.39	0.44	-0.81*	0.39	0.44
African American		0.09	0.22	1.09	0.07	0.22	1.08
Start Age		0.11	0.09	1.12	0.12	0.09	1.13
Yrs to College		0.12	0.45	1.13	0.11	0.45	1.12
HS GPA		-0.06	0.06	0.95	-0.03	0.06	0.97
Mother Education		0.15	0.08	1.16	0.16	0.08	1.17
Step 2	0.001*						
Prior PSEOP					-0.19*	0.09	0.83
Total R^{2a}	0.010**						

Note. [a]Nagelkerke R^2 is reported.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 7 presents the logistic regression results predicting a student's decision to major in a health science field. Model 1 was significant and based on the Nagelkerke R^2 statistic, accounted for 5.8% of the variance of predicting the choice of majoring in a health science field. Model 2 was significant, ($\chi^2(8) = 151.713$, $p < .001$), and regression results further determined gender, Asian American ethnicity, high school cumulative grade point average, mother's education level, and prior PSEOP experience to be all statistically significant in distinguishing the likelihood of choosing a health science major. Gender was the most significant covariate predictor with odds 2.9 times greater of females choosing a health science major in comparison with their male counterparts. Asian students were 1.8 times more likely to choose a health science major than their non-Asian counterparts. Students graduating from high school with some PSEOP experience were 1.5 times more likely to choose a health science major than those who did not pursue PSEOP. High school cumulative grade point averages were a significant predictor with students 1.2 times more likely to choose a health science major for each unit increase in their high school cumulative grade point average. The education level of the student's mother had a significant, but inverse relationship in choosing a health science major indicating that students with mothers who had a lower level of education were more likely to choose a major in this area than students with more educated mothers.

Table 7 Logistic Regression Predicting the Likelihood of Majoring in Health Science Fields

		Model 1			Model 2		
Predictor	ΔR^{2a}	*β*	*SE*	Odds Ratio	β	SE	Odds Ratio
Step 1	0.058***						
Constant		-3.67	1.91		-3.21	1.92	
Female		1.10***	0.12	3.01	1.06***	0.12	2.88
Asian American		0.65*	0.26	1.91	0.61*	0.26	1.84
African American		-0.14	0.25	0.87	-0.11	0.25	0.90
Start Age		-0.01	0.10	0.99	-0.03	0.10	0.97
Yrs to College		-0.50	0.74	0.61	-0.48	0.74	0.62
HS GPA		0.24**	0.08	1.27	0.20*	0.08	1.22
Mother Education		-0.28**	0.09	0.76	-0.29**	0.09	0.75
Step 2	0.006***						
Prior PSEOP					0.41***	0.11	1.50
Total R^{2a}	0.064***						

Note. [a]Nagelkerke R^2 is reported.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 8 Logistic Regression Predicting the Likelihood of Majoring in Liberal Arts Fields

		Model 1			Model 2		
Predictor	ΔR^{2a}	*β*	*SE*	Odds Ratio	β	SE	Odds Ratio
Step 1	0.029***						
Constant		-0.43	1.29		-0.61	1.30	
Female		0.49***	0.07	1.63	0.51***	0.07	1.66
Asian American		-0.18	0.23	0.84	-0.16	0.23	0.85
African American		0.08	0.16	1.08	0.07	0.16	1.07
Start Age		0.05	0.07	1.05	0.06	0.07	1.06
Yrs to College		-0.23	0.39	0.79	-0.24	0.39	0.79
HS GPA		-0.31***	0.04	0.73	-0.30***	0.04	0.74
Mother Education		0.04	0.06	1.04	0.05	0.06	1.05
Step 2	0.001*						
Prior PSEOP					-0.14*	0.07	0.87
Total R^{2a}	0.030***						

Note. [a]Nagelkerke R^2 is reported.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 8 presents the logistic regression results of predicting a student's decision to major in a liberal arts field. Model 1 was significant and based on the Nagelkerke R^2 statistic, accounted for 2.9% of the variance of predicting the choice of a liberal arts major. Model 2 regression results further determined gender, high school cumulative grade point average, and prior PSEOP experience were all statistically significant in the likelihood of a student choosing a liberal arts major ($\chi^2(8) = 99.670$, $p < .001$). Gender was the strongest significant covariate predictor with the odds 1.6 times greater for females to choose a major in the liberal arts compared to their male counterparts. Student PSEOP participation and high school cumulative grade point average had an inverse relationship to the likelihood of majoring in a liberal arts field. Non-PSEOP students were 1.15 times more likely to

choose a liberal arts major than their PSEOP counterparts. For each unit decrease in high school cumulative grade point average, a student was 1.35 times more likely to choose in major in a liberal arts discipline in contrast to another major area.

First-Year Retention Rates

Logistic regression was used to determine if significant differences existed between first-year retention rates of former Ohio PSEOP students compared to non-PSEOP Ohio college students. For the purpose of this study, retention was analyzed based on whether or not the student returned to some public Ohio institution for the second year or whether the student returned to the same institution he/she started at for the second year. While controlling for the effects of demographic covariates found significant to PSEOP participation and the environmental variables representing the first-term institution and institutional housing, PSEOP participation was found not to be a statistically significant predictor using either definition of retention.

First-Year Cumulative and Graduation Grade Point Averages

Analysis of covariance was used to determine if significant differences existed in grade point averages between former Ohio PSEOP students compared to non-PSEOP Ohio college students at the end of the first-year and at graduation. While controlling for any effects caused by demographic characteristics found significant to PSEOP participation and the environmental variables of institution attended and first-year housing arrangements, PSEOP participation was not found to be a significant predictor of cumulative grade point averages either at the end of the first-year or at graduation time.

Graduation Rates

Logistic regression was used to investigate if significant differences existed between graduation rates of former Ohio PSEOP students compared to non-PSEOP Ohio college students. All students in the study started their degrees between the years 2000 and 2003 and those that graduated did so between the years of 2002 and 2010. For the purpose of this study, graduation rates were analyzed based on whether or not the student graduated from the institution in which he/she started his/her degree program or whether the student graduated with a baccalaureate degree from any Ohio institution of higher education during the given time period. Of those who graduated, this difference was less than one percent. After controlling for the effects of demographic covariates found significant to PSEOP participation and the environmental variables of institution matriculated to and institutional housing during the first-year, PSEOP participation was found not to be a statistically significant predictor of graduation using either definition.

Time-To-Degree Attainment

Analysis of covariance was used to determine whether or not significant differences existed in the time-to-degree completion between former Ohio PSEOP students and non-PSEOP Ohio college students while controlling for any effects caused through demographic or environmental inputs. Time-to-degree was measured in semesters, counting only fall and spring terms. For students attending institutions operating on a quarter term system, the winter term was combined with the consecutive spring term. For students who graduated during the summer term, that term was counted as a fall term. All other summer terms were ignored. Descriptive measures of time-to-degree data are presented in Table 9 with ANCOVA results presented in Table 10.

Table 9 Time-to-Degree Means and Standard Deviations as a Function of PSEOP Participation

	Without Covariates			*With Covariates*		
PSEOP Participation	*n*	*M*	*SD*	*n*	*M*	*SD*
Yes	2842	8.53	1.58	2049	8.54	1.63
No	2630	9.03	1.62	1327	8.99	1.49

Note. Time-to-degree is measured in semesters.

In this analysis, the results of Levene's test were significant indicating that the group variances were not equal and that the assumption of homogeneity of variance had been violated. To confirm the findings of Levene's test, a secondary test was performed to determine whether or not the variances were unequal enough to cause problems in the interpretation of the analysis of covariance. The variances of time-to-degree completion for the PSEOP and non-PSEOP groups were calculated by squaring the standard deviations (with covariates) given in Table 9. Dividing the highest variance of 2.657 by the lowest variance of 2.220 yielded a quotient of 1.197 which was less than 2.0 indicating that the variances were not unequal enough to cause problems and allowing the analysis to continue.

After significant adjustments by the covariates of gender, high school cumulative grade point average, institutional living arrangements, and university enrollment at Bowling Green, Cincinnati, or Miami, participation in PSEOP was found to be significant for the number of semesters it took for the student to complete his/her baccalaureate degree, $F(1,3354) = 25.14$, $p < 0.001$. Students who participated in PSEOP during their high school years graduated in an average of 8.54 semesters compared to their non-PSEOP counterparts who took 8.99 semesters to graduate. Based on the correlation presented in Table 11, students who were female, had strong high school cumulative grade point averages, and lived in institutional housing during their first year characterized those who graduated earlier. Students who matriculated to Bowling Green State University or Miami University also appear to graduate earlier than those matriculating to the University of Cincinnati.

Table 10 Time-to-Degree Differences between PSEOP and Non-PSEOP Participation with Demographic Inputs and Environmental Variables as Covariates

Source	*df*	*SS*	*MS*	*F*	η_p^2
Gender	1	146.46	146.46	64.65***	0.019
Asian American	1	3.28	3.28	1.45	0.000
African American	1	6.65	6.65	2.93	0.001
Mother Education	1	5.65	5.65	2.50	0.001
Start Age	1	0.20	0.20	0.09	0.000
Years to College	1	1.22	1.22	0.54	0.000
High School GPA	1	186.27	186.27	82.23***	0.24
Universities					
Akron	1	0.60	0.60	0.27	0.000
Bowling Green	1	38.15	38.15	16.84***	0.005
Cincinnati	1	76.38	76.38	33.72***	0.010
Cleveland State	1	4.13	4.13	1.82	0.001
Central State	1	0.72	0.72	0.32	0.000
Kent State	1	0.58	0.58	0.26	0.000
Miami	1	115.29	115.29	50.89***	0.015
Ohio University	1	1.94	1.94	0.86	0.000
Shawnee State	1	2.54	2.54	1.12	0.000
Toledo	1	3.24	3.24	1.43	0.000
Wright State	1	4.24	4.24	1.87	0.001
Youngstown State	1	0.87	0.87	0.38	0.000
Institutional Living	1	34.07	34.07	15.04***	0.004
Prior PSEOP (Fixed Factor)	1	56.96	56.96	25.14***	0.007
Error	3354	7598.03	2.27		
Total	3376	264901.00			

Note. The Ohio State University serves as the contrast institution.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 11 Intercorrelations for Time-to-Degree and Significant Covariates

Measure	1
1. Time-to-Degree	--
2. Female	-0.185***
3. High School Cumulative GPA	-0.214***
4. Bowling Green State University	-0.067***
5. Miami University	-0.145***
6. University of Cincinnati	0.175***
7. Living in Institutional Housing	-0.074***

*$p < .05$. **$p < .01$. ***$p < .001$.

Pursuit of Graduate Studies

For the final question posed in this study, logistic regression was used to investigate the existence of significant differences between former Ohio PSEOP students and non-PSEOP Ohio college students in the pursuit of graduation or professional studies within one year of baccalaureate degree completion. These data were somewhat incomplete as information was only available for those students who continued their education within the State of Ohio. Students leaving the state for graduate or professional school were not reflected in these data. After

controlling for the effects of input variables significant to PSEOP participation and environmental effects, PSEOP experience was not found to be a significant predictor of continued graduate or professional studies.

Discussion

The key findings of this study centered on the attributes which were significantly related to PSEOP participation and outcomes to which participation in the PSEOP were a significant contributor. Attributes of gender, ethnicity, academic performance, and family characteristics were all related to the decision of whether or not to pursue PSEOP as a high school student. Students that did participate in PSEOP during their high school years showed this experience as a significant factor in choosing certain majors and students who participated in PSEOP had a statistically significant shorter time-to-degree completion than those students who did not participate in PSEOP.

Participation in PSEOP

Significant differences were found in gender and ethnicity between students starting college who participated in PSEOP as a high school student and those who did not. This study found females more likely to have participated in PSEOP than males during their high school years and is consistent with the findings by KnowledgeWorks indicating almost a 2:1 ratio of females to males who participated in PSEOP (KnowledgeWorks & WICHE 2007). In addition, there were significantly more Asian American university students who had participated in PSEOP than not, and significantly fewer African American university students who had participated in PSEOP as a high school student. Ethnic participation was also consistent with the previous findings of the KnowledgeWorks study which compared the ethnic percentage of participation in PSEOP as a high school student to the ethnic percentage within the entire population of public high school students. The percentage of Asian Americans that participated in PSEOP was higher than the population percentage would suggest and the percentage of African Americans who participated in PSEOP was lower than the population percentage suggested (KnowledgeWorks & WICHE 2007).

Parental education, as viewed through first-generation status, was not significantly different for students who participated in PSEOP as compared to those who did not. Pascarella and Terenzini (2005) found significant differences in the pursuit of higher education between students who had at least one parent with some college education compared to students who had parents with no college education. These findings suggest that first-generation students have not always had the same educational opportunities as those students with college-educated parents have had. The lack of statistically significant differences in the current study may be attributed to the manner in which the dataset was constructed. The group of students who did not participate in PSEOP during their high school years was chosen to match the PSEOP group based on ACT scores. It may be the case that had the

groups not been matched by academic talent, the first-generation variable would have been significantly different in the groups.

Astin's (1993) work suggested a higher level of predictive power comes from viewing individual socioeconomic measures such as parental education and family income as separate variables. In creating separate variables for family income and the educational levels of the father and mother, the current study found the educational level of the student's mother to be significantly higher for students who participated in PSEOP when compared to those who did not. This significance suggests consistency with the state and national trend of more women, in terms of the mothers of the students, going to college while the education of men, represented by the fathers, has continued to decline (NCES 2009d).

High school cumulative grade point averages proved to be significantly different between the PSEOP and non-PSEOP groups. The descriptive distribution of grade point averages was interesting as the PSEOP group had more students with the lowest averages as well as the majority who had the highest averages while the non-PSEOP group had a higher number of average students. Although the policy for PSEOP states that student participants must have a cumulative grade point average of a 3.0 or higher in the subject area, this only holds true if the student has taken courses in that subject area in high school. It also suggests that counselors have used PSEOP as an incentive to perhaps spark interest in a capable high school student who was underachieving in the high school environment. Even though the PSEOP group had higher high school cumulative grade point averages overall, the non-PSEOP group still had 50% of the students with a cumulative grade point average over 3.5. The question of why these students were not enrolled in PSEOP could be attributed to the practical availability of institutions close enough to make participation feasible, a wide range of AP offerings that students alternatively participated in, or simply lack of knowledge about the opportunities that the PSEOP experience could provide.

Overall the characteristics of high school cumulative grade point average and being female were the highest predictors of participation in Ohio's PSEOP. These findings were both consistent with current trends on college attendance. Where males were the clear majority pursuing a baccalaureate degree in 1971, females are now the majority by a comparable margin ahead of males (NCES 2008). The age of the student when he/she started college was also a strong predictor which suggested that the older students in the class, who were perhaps more mature, were the ones more likely to pursue PSEOP as a high school student. All students in the study were between the ages of 17 and 19 when they started their undergraduate education. The data showed approximately 10% more males than females who were 19 years old rather than 18 years old when starting his/her undergraduate education directly after high school graduation. This coincides with a popular trend in society of sometimes waiting a bit longer to send boys to school to make sure that they are ready. None of the students waited more than one year past

high school graduation before starting college. Maintaining continuous enrollment from high school to college has been shown by Adelman (1999) to be a major predictor of higher education success.

Although the effect size was small, the educational background of the student's mother was another significant predictor to PSEOP participation. As the mother's educational level increased, so did the probability of PSEOP involvement. This was consistent with the findings of Pascarella and Terenzini (2005) whose research suggested that the education of parents positively impacts that of their children and that "education begets education" (p. 440). The increased number of females who have attained a higher education credential during the 1970's and 1980's, who are now the mothers of the 17-19 year-olds of this study, have perhaps served their children as role models and mentors in student decisions to pursue higher education. In addition, the educated mother role model has likely contributed to the continued increase of females in higher education. This is consistent with the research of Chevalier, Harmon, O'Sullivan, and Walker (2010) who found that after controlling for paternal income, the educational level of the mother was a stronger predictor in the educational attainment of the children, particular in the case of daughters. The fact that the father's education was not a significant contributor to PSEOP involvement may be due to the declining trend of male college attainment and the higher level of influence the mother has in child rearing.

Characteristics which negatively impacted participation in PSEOP included student performance on the ACT college entrance exam and having African American ethnicity. PSEOP is only one form of dual enrollment available to Ohio high school students. AP courses are also popular in high schools and are taught as honor courses in many Ohio high schools. Due to the historically high reputation of AP courses and the rigor they provide, many of the most talented students choose these courses in contrast to PSEOP participation. This was consistent with the quantitative and qualitative research findings of Smith, Place, Biddle, Raisch, Johnson, and Widenhaus (2007) where Ohio high school students enrolled in AP classes saw themselves as part of an elite subset of students capable of rigorous study and as such found these classes satisfying and comparable to college classes. Students of African American ethnicity were 1.4 times less likely to participate in PSEOP than students who were not African American. This research is consistent with the KnowledgeWorks study which noted a lower proportion of African American high school students participating in PSEOP than the proportion of total African American students would indicate (KnowledgeWorks & WICHE 2007).

Major Field of Study

Participation in PSEOP had the most significant influence in predicting that a student would major in a health science field. Other significant covariates in choosing to be a health science major included being female, of Asian ethnicity, and having a strong high school cumulative grade point average. The significance of choosing a

health science profession as a female is consistent with common societal views of females being more suitable in health professions because of their nurturing nature. Maternal education levels actually provided an inverse relationship indicating a lower chance of majoring in a health science field when having a more educated mother. Perhaps students who knew they wanted to pursue a health science major, many of which require more than four years to complete, wanted to get a head start on earning college credits through PSEOP dual enrollment. The data were not available for this study to prove or disprove this speculation.

In choosing majors in business or the liberal arts, PSEOP participation was an inverse predictor indicating that students who did not participate in PSEOP as a high school student were more inclined to choose a major in business or in liberal arts in comparison to those students who did participate in PSEOP. High school cumulative grade point average was also a significant inverse predictor for these two major choices. This indicates that majoring in the areas of business and liberal arts were more attractive to an average student who did not participate in PSEOP during their high school years.

Student participation in PSEOP was found to be statistically non-significant in the prediction of a student choosing a major from the STEM fields of science, technology, engineering, and mathematics. Although the overall model was significant and confirmed the trends of male domination, strong academic backgrounds, and the tendencies of Asian Americans to choose this major, there was not a significant likelihood of PSEOP participation predicting a student to major in this area. With additional information on student participation in AP courses, it is likely that these students chose to remain in high school to prepare for college through AP coursework rather than through PSEOP classes. It would benefit the state for more students to pursue PSEOP coursework in this area, particularly in the area of computer science where it would be rare to have a high school teacher with appropriate credentials to teach a college-level computer science course.

First-Year Success Indicators

Two main indicators of success for first-year students are illustrated by first-year cumulative grade point average and whether or not students were retained to the second fall. This study looked at both of these indicators and found that participation in PSEOP was not a statistically significant indicator of success for these outcomes. The construction of a high-ability comparison group may have contributed to the lack of a statistical significance difference between the two groups.

In looking more specifically at the two groups, it is clear that the students who participated in PSEOP during their high school years out-performed the group of students who did not participate in PSEOP. First-year outcomes are illustrated in Fig 2. Students with PSEOP experience were retained at higher percentages than those students who did not participate in PSEOP during high school. Both the PSEOP and non-PSEOP groups had an

identical ACT composite score average of 24.55 which is higher than the state average of 21.4 (ACT 2011). Consistent with Adelman's conclusions on the importance of secondary school academic preparation, it is not surprising that both groups produced retention rates higher than the 2004 Ohio 4-yr public institution retention rate of 73% (National Center for Higher Education Management Systems 2009a). Students with PSEOP experience also out-performed students without PSEOP experience by having more students with 3.0 or higher cumulative grade point averages at the end of the first-year of his/her undergraduate experience.

Other factors which likely enhanced student retention and first-year success are campus housing, learning communities, and student involvement on campus (Astin 1993; Pascarella & Terenzini 2005; Tinto 1993). Of the students with PSEOP experience, 69.8% of these students lived in institutional housing during their first-year compared to 71.6% of the non-PSEOP students. Specific information on student participation in learning communities and campus activities was not available within the dataset for this study, but the effects of these programs may have shown up indirectly based on the institution the student attended.

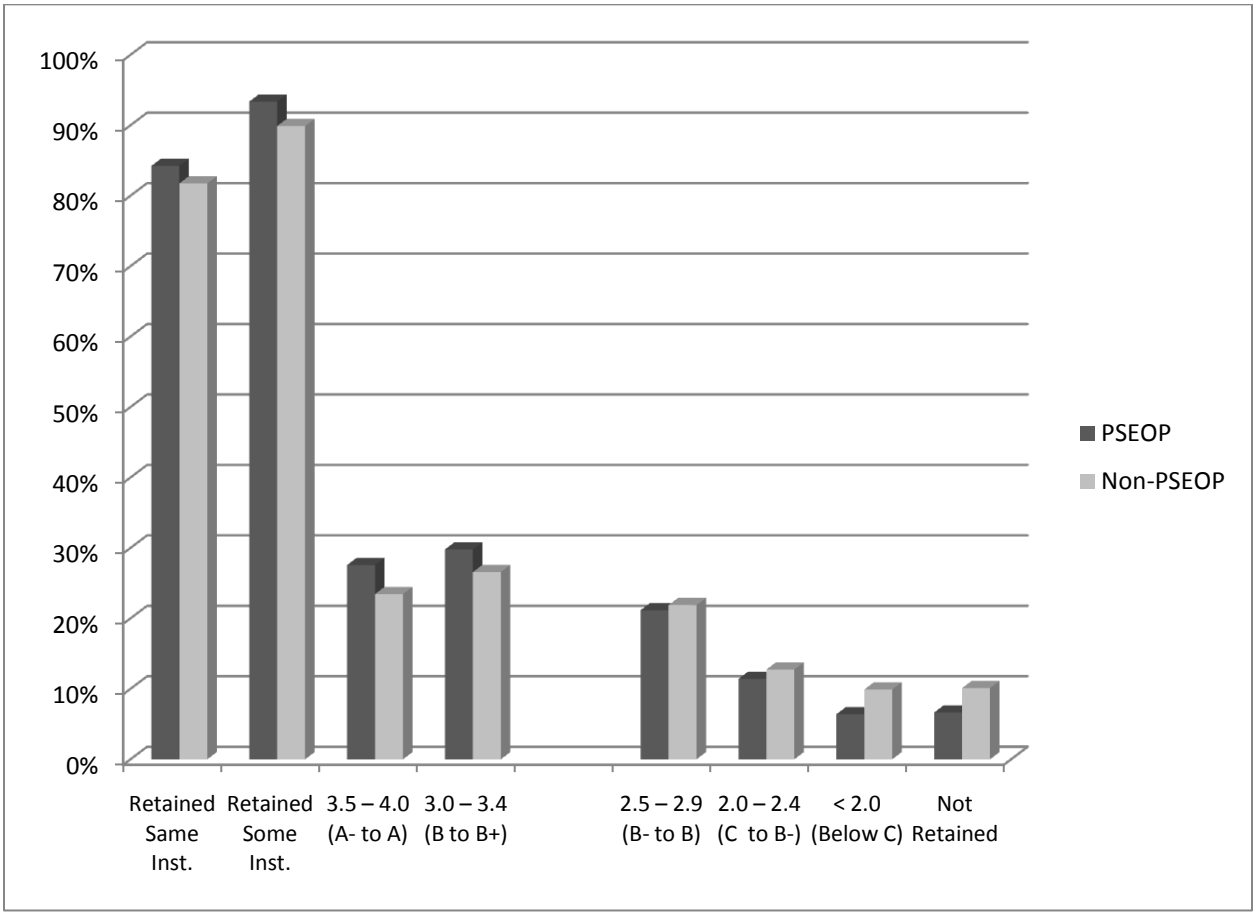

Fig 2 First-year outcomes of retention and cumulative grade point averages

Time-to-Degree Attainment

Students who participate in PSEOP as a high school student earn college credits that typically transfer to the undergraduate institution to which they matriculate. Much like a transfer student, this can result in fewer hours needed for graduation. Of course this depends on whether or not the credits earned were accepted by the institution the student is now attending and whether or not the courses contributed hours that were useful toward graduation.

Previous studies have shown that students who participate in dual enrollment graduate sooner than students who have not (State of Washington State Board for Community and Technical Colleges 2004). This study supports these findings by showing that students who participated in PSEOP graduated in less time than their non-PSEOP counterparts after controlling for input and environmental covariates. While this result was statistically significant, the effect size of this outcome was small, reducing the practical significance of this finding. The data for this study did not include how many hours each student completed through participation in PSEOP. Obviously the more hours a student took in the program, the more likely he/she would be to graduate in fewer semesters. However, it is reasonable to consider that even if time-to-degree attainment is reduced by a single semester it provides considerable savings to the student and family.

Graduation Outcomes

Two important indicators of success at the end of a collegiate career are whether or not the student graduated and the final cumulative grade point average earned. This study looked at both of these indicators and found that participation in PSEOP was not a statistically significant predictor for either of these outcomes. The construction of a high-ability comparison group perhaps contributed to the lack of a statistical significance difference between the two groups. Further investigation into these outcomes showed that students who participated in PSEOP during his/her high school years clearly out-performed the group of students who did not participate in PSEOP. Graduation outcomes are illustrated in Fig 3.

Students with PSEOP experience graduated at higher rates than their non-PSEOP counterparts. In addition, these same students had higher earned cumulative grade point averages at graduation time and finished in fewer semesters than the students who did not have PSEOP experience. The PSEOP group had a 6-year graduation rate of 70% compared to the 64% graduation rate of the non-PSEOP group, both which exceeded the Ohio average 6-year baccalaureate graduation rate of 55% for the years of 2002-2008 (National Center for Higher Education Management Systems 2009b). The average time-to-completion for the PSEOP group was 8.5 semesters compared to 9.0 semesters for the non-PSEOP group. Both of these groups on average finished faster than the 10 semesters found in Adelman's (1999) research which again is likely indicative of the strong academic talent possessed by both the PSEOP and non-PSEOP groups.

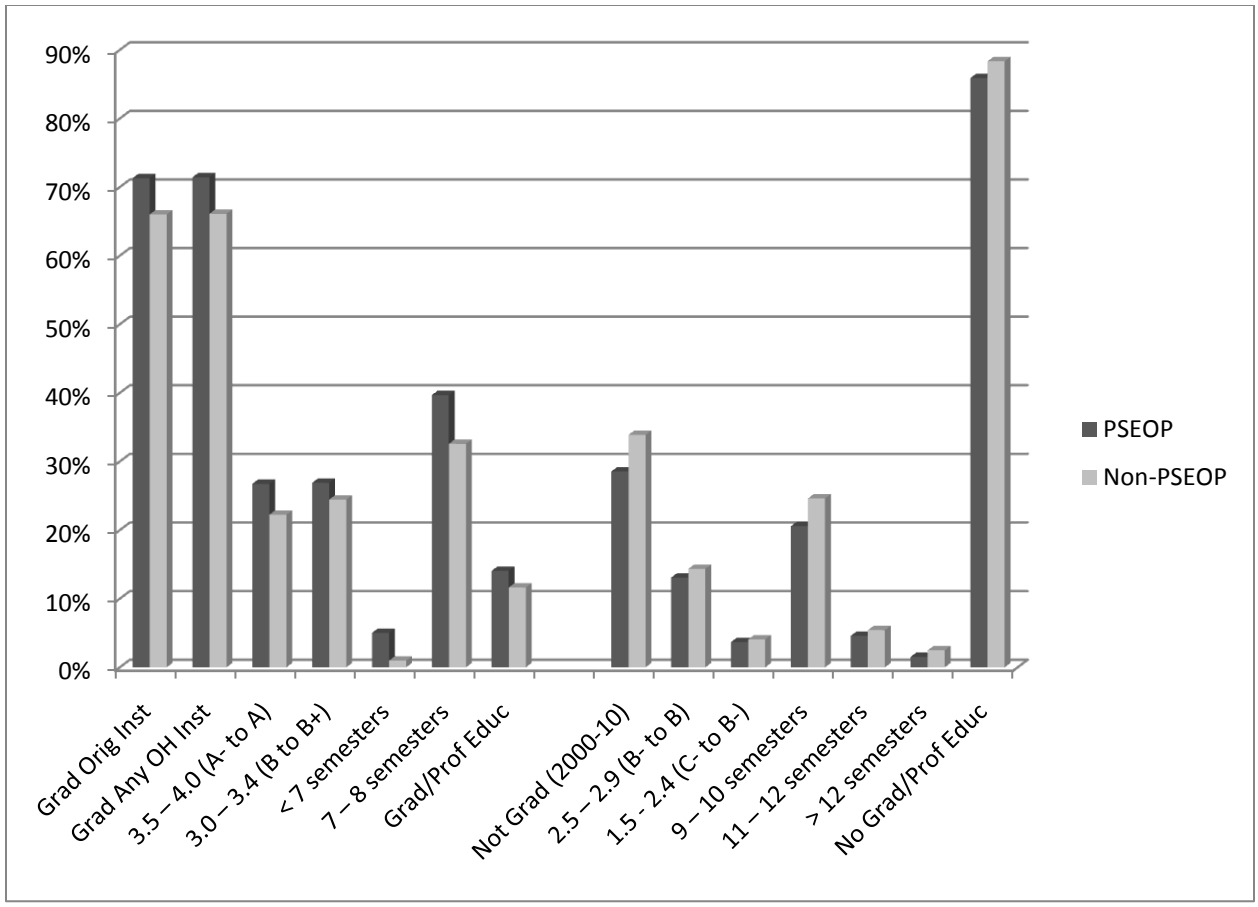

Fig 3 Rates, cumulative grade point average, and time-to-degree graduation outcomes

Accountability for student achievement was one of the cornerstone topics of the 2006 Spellings Commission Report (The Secretary of Education's Commission on the Future of Higher Education 2006). Institutions were asked to measure student achievement based on the "value-added" to students after matriculating to the institution. Adelman (1999) defined "value added" as a graduation cumulative grade point average higher than the cumulative grade point average earned at the end of the first-year. PSEOP students showed slightly more "value-added" as a group with 59% of the students achieving a higher graduation cumulative grade point average than his/her first-year cumulative grade point average. The non-PSEOP group had 58% of the students graduating with "value-added" based on the comparison of earned grade point averages at graduation and the end of the first-year.

While PSEOP experience showed no statistical significance in most of the graduation outcome measures, clearly those students which participated in PSEOP showed more positive outcomes in each of the measures. According to Pascarella and Terenzini (2005), what matters most in the outcomes of college are the experiences a student has after matriculation. One of the most important parts of Astin's I-E-O Model is the environment

experienced by the student during their undergraduate education (Astin 1993). The data used for this study lacked important environmental characteristics such as participation in learning communities, sports, and clubs; courses taken; and interactions with faculty and staff. The only connection that can perhaps be made here is that students who were involved in PSEOP were involved students in high school as exemplified by their PSEOP participation and these behaviors of involvement continued after they matriculated to their undergraduate institution.

Implications to PSEOP and Higher Education

Participation in Ohio's PSEOP has steadily increased, moving from 2.7% participation in the 1997-98 academic year to 4.8% in the 2006-07 academic year (KnowledgeWorks Foundation & WICHE 2007; ODE 2007, 2010a, 2010b, 2010c, 2010d, 2010e). However, according to Hoffman et al. (2009), this percentage is considerably lower than the estimated 13% of juniors and seniors nationally who are participating in dual enrollment. Some of the explanation of the wide difference in percentages is due to the fact that PSEOP is only one form of dual enrollment in Ohio. The 4.8% participation does not count dual enrollment programs that take place on the high school campuses. Minnesota's PSEO is similar to Ohio's PSEOP and had a 5.2% participation rate by high school juniors and seniors in 2007-2008 with 14.3% participation in forms of dual enrollment other than PSEO (Minnesota Department of Education 2008; Minnesota Office of Higher Education n.d.). This again suggests that more dual enrollment is taking place on the high school campuses rather than on the college campuses.

Participation in Ohio's PSEOP has likely been prohibited for some students through geographic and socioeconomic transportation barriers while others who could have participated simply chose not to. Additional advertising of the program to students and parents combined with added high school counseling resources could serve to increase the level of participation in PSEOP. The many benefits dual enrollment has to offer students and society suggests increasing the percentage of participation in PSEOP would be advantageous. Previous research has shown that students who participate in programs like PSEOP make their senior year studies more challenging and meaningful; bridge the transition to college through experiencing the demands of college-level learning as a high school student; and save significant dollars on tuition, fees, and books that lower the overall cost of a college education (Bailey et al. 2002; KnowledgeWorks Foundation & WICHE 2007).

As Ohio seeks to increase the number of college graduates, PSEOP has the potential to be a powerful recruitment gateway through which more students could enter higher education. By providing transition to the rigors of college-life through coursework taken on a college campus, it is stronger than other forms of dual enrollment which are taught on the high school campus. PSEOP has the potential to widen the access to higher education for a broader spectrum of students, by giving students the opportunity to experience college-level coursework with minimal financial and academic risk.

Data from this study showed specific areas where student participation in PSEOP could be greatly improved. In particular, male students participate in PSEOP at lower rates than female high school students. Current research additionally shows that male students are earning baccalaureate degrees at lower rates than females (NCES 2008). Attracting more males to participate in the PSEOP could potentially provide these students with greater motivation and the needed confidence for smoothing the transition to college, resulting in greater retention. African American students were also found to participate in PSEOP in lower proportions as indicated by the significant difference of students between the PSEOP and non-PSEOP data groups. The fact that these two groups were constructed to have equivalent academic talent makes it reasonable to conclude that qualified students are, for whatever reason, not taking advantage of an opportunity that would benefit them financially and provide them with a head start on their college education. Additional resources to improve program advertising and provide individual counseling with under-represented students are needed in the high schools to help address these problems.

The lack of statistical significance in long-term outcomes was somewhat of a surprise in this study. After controlling for input and environmental variables, PSEOP was found to be a non-significant statistical predictor of success for student retention, first-year or graduation cumulative grade point averages, and the pursuit of graduate/professional studies within one year of baccalaureate attainment. Matching the groups by ACT scores likely contributed to this non-statistical significance. Although these outcomes were not statistically significant, it should be noted that descriptively the PSEOP group did reach higher levels of success in each of these variables of interest. Statistically, PSEOP was shown to have significant differences in time-to-degree outcomes and in choice of major, both more reflective of entry-level benefits where the long-term characteristics of academic success were more likely to be attributed to influences by student experiences within the institution after matriculation as suggested by Pascarella & Terenzini (2005).

The PSEOP legislation was passed in 1989 with the purpose "to promote rigorous academic pursuits and expose students to options beyond the high school classroom" (ODE 2006, p. 2). In general, students who participated in PSEOP had higher high school grade point averages than those who did not, however 50.6% of the students who did not participate in PSEOP had high school grade point averages between 3.5 and 4.0. The question is why didn't these students participate? Scheduling problems combined with the geographic location of institutions may have been an obstacle to participation. Many PSEOP participants take only part of their high school coursework for dual credit. Once required classes are scheduled at their high school, unless the college or university campus is close, a student could be excluded from taking college courses due to scheduling conflicts and instead end up taking less rigorous high school courses (Folly 2007). Although the State of Ohio currently has over 200 institutions of higher education counting public main campuses, branch campuses, two-year colleges, and private

institutions, not all high schools are close enough to a college campus to allow for an easy commute between the two campuses.

Some students also prefer participation in AP courses based on their strong reputation for rigor and ability to prepare students for college even though they do not guarantee college credit. Since there are requirements and limitations to the number of students that can take AP courses, students sometimes see these as an "elite" alternative and a way they can maintain comfortable relationships with their peers. A mixed methods study to investigate why Ohio high school students chose to participate in AP classes rather than participate in PSEOP found that in general AP students were indifferent to the advantages of PSEOP participation and were more focused on the academic rigor AP courses provided, even if it did not provide them with college credit in the end (Smith et al. 2007).

Ohio's economic need for graduates strong in STEM (Science, Technology, Engineering, and Mathematics) fields is apparent. The *Buckeye Top Fifty* lists occupations in Ohio with wages in excess of $59,600 that are currently in demand and projected to remain in demand through 2018. Of the top ten occupations in this list requiring a baccalaureate degree or higher, five occupations are in the area of math, science, and engineering; three are in business; and the remaining two are in health sciences. Of the three business occupations, two of them require strong skills in mathematics and/or engineering. Of the occupations in math, science, and engineering, all are computer science careers (Ohio Department of Job and Family Services 2011).

Students graduating from Ohio high schools currently have graduation requirements which require only three units each of mathematics and science. While technology and computer literacy instruction exists in virtually all Ohio high schools to "use technology effectively", little computer science instruction to "create technology" takes place as the state only recently re-established a computer science teaching licensure. Students leave high school uninformed about computer science as a major and its related career possibilities. PSEOP coursework could be used to supplement the fourth year of math and science and provide an introduction to computer science as a discipline. Through faculty-student interactions, students having the aptitude to be majors could be identified and encouraged into STEM careers resulting in a stronger economic base for Ohio.

Data in this study confirmed classic gender stereotypes for major choices by females in health science fields and males in STEM fields. Institutions need to minimize these stereotypes through the creation of environments which are accepting and encouraging of student achievements. Faculty role models, positive student-faculty interactions, and peer interactions would help overcome these gender-biased major choices (Astin 1993; Pascarella & Terenzini 2005).

Limitations to the Study

Although dual enrollment has gained much attention over recent years, research is lacking to the overall effectiveness of dual enrollment programs. Many of the problems associated with this lack of research are related to the inabilities to obtain necessary and complete data. While Ohio is one of the states which has a unit record system for monitoring higher education progress, complete data are only collected for public institutions. Of Ohio's 213 higher education institutions, only 60 of these are public institutions (Finken 2003; NCES 2009d). The results of this study might have been different had data from private institutions been combined with that from the 13 public universities. This lack of data leaves many unanswered questions on the overall impact of PSEOP in the state.

Additionally, Ohio's Higher Education Information (HEI) data are isolated from ODE's K-12 educational data making it impossible to follow a student through his/her time as a high school PSEOP student continued by his/her subsequent college education (Finken 2003). Data from ODE are collected in aggregate form making it impossible to connect back to an individual student. Answering research questions focusing on whether or not former PSEOP students enrolled as degree-seeking students at the same or similar institutions where they earned PSEOP credits is simply not feasible. Only a few states, such as Florida, have a true K-20 data warehousing system giving researchers the ability to follow a student through their entire educational program. Because of the quality of data collected by Florida, much of the existing dual enrollment research uses Florida as an example.

Current data being collected are inadequate to answer questions of interest. Data such as second majors were not easily obtainable and only possible for those who earned dual degrees or a second degree in the future. Much of the research done for this study accounted for only a small amount of the variability in the differences between the PSEOP and non-PSEOP groups. Other environmental variables are needed, but obtaining these data on a state-wide level would likely be as difficult as acquiring second majors. A more complete state-wide data warehousing system would enable researchers to provide better-quality results from which PSEOP could be evaluated and improved.

A standard for integrating state-level data to national-level data is necessary to enable more effective and accurate research. Students who did not attend an Ohio public institution were not able to be tracked. A student who transferred to an institution in a different state would have appeared in this study to have dropped out of college even though they may have attained a degree. A student that graduated and then continued to a graduate or professional program in another state was not able to be tracked. While the National Student Clearinghouse does maintain data from most institutions, they needed information to track these students that OBR was unable to directly provide to a student researcher. A national student identifier would alleviate this problem.

Recommendations for Future Research

Additional and continuing research needs done to further assess the effectiveness of PSEOP. The current study could be extended with the ability to join data with those from the National Student Clearinghouse. Students who have changed institutions or pursued graduate and professional studies outside of the State of Ohio could be detected and included from the additional data source. With integrated K-16 data, research focusing on the student from the time they participating in the PSEOP through matriculation to college would give us information pertaining to how many left the state for undergraduate education. The current data may show that someone waited to start college when actually the student left the state and then decided after a semester or two to transfer back to Ohio. Combining data from the National Student Clearinghouse with K-16 data from a state data warehouse could fill in some of the gaps for these students.

As dual enrollment grows, more dual enrollment classes are being taught on the high school campus. How does this experience compare to that of students who participate on a college campus? Are there differences in the ability to successfully transition to college and in students' subsequent academic success? In terms of data collection, how would the researcher know whether or not these classes are taught on a high school or college campus? Much can be done in this area to assess quality and provide needed direction to future policy decisions regarding dual enrollment in Ohio.

Conclusion

Dual enrollment programs hold the promise and potential to expand the access of higher education to a wider audience through providing a better transition into postsecondary education, providing a more rigorous senior year with the opportunity for expanded curricular offerings, reducing the time-to-degree attainment, and providing college credits at substantially lower cost to students and their families (American Association of State Colleges and Universities 2002; Andrews 2004; Bailey et al. 2002). This access should not be exclusive for the top achievers, but used as an opportunity to motivate middle and low achievers who have been shown to benefit from the higher expectations dual enrollment provides (Greenberg 1988). As stated by then Governor Ted Strickland (2008) in his 2008 State of the State Address:

> Higher education is a major driver of our economy. Our colleges and universities provide the workers, the ideas, and jobs that our state needs to grow. Ohio used to have one of the most highly educated workforces in the country, but that is no longer true. It is clear that we must increase the number of college graduates in Ohio if our citizens are going to have good jobs and rising incomes in the coming years. … Whether through college or technical training, our young people must be brought up with the expectation that they need to continue their education beyond high school.

According to the American Association of State Colleges and Universities (2002), "Dual enrollment can also help to ensure that our educational institutions are producing the quality citizenry to meet the ever-changing demands of business and society."

This study conducted a longitudinal study to investigate outcomes from Ohio's PSEOP. By learning more about the students who participate in the program and the benefits they accrue, a more effective program can emerge which widens the access to more of our high school students. With these goals in mind, continued research is necessary to ensure that dual enrollment is achieving its intent to increase higher education access to today's students and as such create a more educated citizenry for the future of Ohio.

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