RELATIVE IMPACT OF INTERVENTIONS TO IMPROVE ACHIEVEMENT & RETENTION IN POSTSECONDARY OCCUPATIONAL PROGRAMS

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Abstract

This study examined the relationship of community college programs and services to retention of students in four community colleges, with an emphasis on determining whether outcomes vary for students in occupational programs and how student characteristics moderate these effects, with the goal of determining what is correlated with success. Overall, the study found evidence for positive impacts resulting from having an occupational major; receiving most types of financial aid; having higher placement scores, particularly in math; taking developmental math; accessing tutoring services in the first term; and choosing an occupational major. White students were more likely than others to be retained and students who experienced multiple stressful life events, or who worried about paying tuition, were less likely to be retained. It was more useful for students to complete all the credits in which they enrolled in the first term than to enroll full-time in the first term.

Relative Impact of Interventions to Improve Achievement and Retention in Postsecondary Occupational Programs

Community colleges are considered a more nurturing environment than many four-year institutions and are perceived by students as supportive of learning (Carlan & Byxbe, 2000). However, completion rates for students at community colleges are unacceptably low. Despite the apparent benefits to students of community college degrees and credentials, fewer than half of students intending to complete an Associate degree do so within five years; outcomes are only slightly better for those working toward non-degree sub-baccalaureate credentials or certificates (Bailey, Alfonso, Scott, & Leinbach, 2004).

The Relative Impact study was a longitudinal correlational study using institutional data from four U.S. public two-year colleges in four different states that had occupational[1] programs and used common programs and services aimed at improving student retention and completion and that could be analyzed at the student level. Two cohorts of students were included in the study: those who entered college in Fall 2009 and Fall 2010, respectively. The research team initially hoped to examine the relationship between a large number of interventions and combinations of programs and services with student retention, but sufficient data for analysis were available only for a smaller number, as described below. Although many previous studies have studied individual programs and services at a single college, the Relative Impact study examined these multiple programs and services as they were implemented by multiple colleges and experienced by students throughout two to three years of enrollment. The primary audiences for this study are community college administrators, instructors, and retention specialists; postsecondary researchers and funders; and state policymakers.

The study measured associations among student characteristics and common programs and services (developmental English, reading, and writing courses; developmental math courses; financial aid; and tutoring) and student outcomes, specifically retention, completion, and grade point average (GPA). In addition, the study aimed to identify programs and services correlated with two intermediate outcomes: (a) the ratio of credits attempted to credits earned and (b) grade point average (GPA). A further objective was to determine the degree to which the programs and services were related to positive outcomes for students differing by age, sex, race, occupational versus non-occupational major (as determined by the individual colleges based on factors such as degree program and declared intent of enrollment), stress as reported in Term 1 by Cohort 2, the ratio of credits earned to credits attempted in the first term, and enrollment intensity in the first term (full-time vs. part-time enrollment).

Research Question. Our primary research question was: *What programs and services and combinations of programs and services are most strongly associated with retention and completion for students in postsecondary programs, and how do student background and other characteristics moderate those associations?*

[1] This study uses the term "occupational" to refer to programs and students for which colleges use terms such as career and technical, vocational-technical, and professional and technical. Typically, these are programs that culminate in a less-than-four-year credential that is intended to lead to employment. Colleges vary to a small degree in how they classify some programs.

Rationale and Literature Review

The nation's community colleges play a critical role in providing students with access to affordable postsecondary education. Completion of a community college degree or credential can provide a path to a career or to further education. However, only about one-third of students who enroll in a community college complete a credential (Bailey & Alfonso, 2005). The causes underlying this statistic are complex. In an ACT policy report reviewing hundreds of studies of retention at four-year institutions, Lotkowski, Robbins, and Noeth (2004) found that both academic and non-academic factors were predictive of retention; among these were socioeconomic status, high school GPA, ACT assessment scores, academic self-confidence, academic goals, social support, financial support, social involvement, and institutional commitment. A similar review of two-year college retention is not available in the literature.

Both policymakers and practitioners have noted that the traditional metrics of institutional effectiveness—graduation or completion rates of entering degree-seeking full-time students—apply more aptly to four-year institutions and fail to acknowledge the multiple missions of community colleges (Bailey, Leinbach, & Jenkins, 2005). Recent efforts to establish additional or alternative measures by the federal Committee on Measures of Student Success (Higher Education Opportunity Act of 2008) and by the American Association of Community Colleges (2011b), through its participation in the Voluntary Framework of Accountability, reflect a shift toward acknowledging the distinctive nature of community college students. With respect to the Relative Impact study, it should be noted that the study's data collection timeframe was too short to expect large numbers of students to graduate; thus our focus was primarily on retention.

Colleges could better serve students by understanding the mediating and moderating effects of factors such as age, placement scores, and receipt of financial aid, among others. A better understanding of the departure process and the relative effectiveness of programs and services may result in (a) more effective programs and services that help students attain their educational goals and (b) conceptual models with greater explanatory and predictive power.

Community college completion and workforce preparation. Community and technical colleges help students move into high-skill, high-wage, and high-demand occupations. According to the National Center for Education Statistics (2008), in 2004-2005, 64% of students seeking associate's degrees and 81% of students in certificate programs majored in occupational fields. Occupational programs at two-year public colleges play a critical role in reducing poverty among individuals and families (Hollenbeck & Huang, 2003; Kane & Rouse, 1995). Previous research has shown that when students complete their programs, they improve their economic circumstances (Hollenbeck & Huang, 2003; Mathur, Reichle, Strawn, & Wiseley, 2004; Prince & Jenkins, 2005). However, among community college students who enroll with the goal of earning an Associate degree or certificate, fewer than half actually complete a credential of any kind (Silverberg, Warner, Fong, & Goodwin, 2004). Those students who take courses without earning a credential receive little to no economic return (Grubb, 2002). Colleges are thus paying increased attention to retention, as the negative consequences of non-completion become more apparent (Upcraft, Gardner, & Barefoot, 2005).

Despite the clear benefits of completing community college programs, Bailey et al. (2004) found that more than two-thirds of occupational majors at sub-baccalaureate institutions left after

having completed a year or less of coursework over a five-year period. Their study examined completion rates of certificate, Associate, and baccalaureate degree seekers. Associate occupational degree seekers were less likely to complete their programs than either baccalaureate or certificate seekers. Bailey et al. listed some of the factors that may contribute to this differential success, such as the shorter period of time that it takes to complete most certificate programs (usually one year), and the delayed, part-time, or interrupted enrollment patterns common among Associate degree seekers.

Although some students leave college for employment in their field of study, low GPA (Metzner & Bean, 1987) and uncertainty about career choice (Pascarella & Terenzini, 1991) have been found to be among the most powerful predictors of early college departure. Other barriers to program completion include inadequate pre-college academic skills, insufficient goal commitment, limited social integration, financial pressures, family responsibilities, transportation problems, health concerns, and disability (Astin & Oseguera, 2003; Bray, Braxton, & Sullivan, 1999; Cabrera, Nora, & Castaneda, 1992; Cofer & Somers, 1999; Pascarella & Terenzini, 1991; Schlossberg, Lynch, & Chickering, 1989; St. John, Kirschstein, & Noell, 1991). Any or all of these barriers can stand in the way of engagement (integration), achievement, and successful transition into and through postsecondary education to employment (Pascarella & Terenzini, 1991, 2005).

To be sure, not all entering community college students intend to complete a degree or credential. Some students attend community college to maintain professional licensure or certification, gain supplementary job skills, or engage in personal enrichment, for example. However, many students enter community colleges with a degree or credential goal in mind, and many of these students never attain that goal. This group of students concerned us most. We collected data on student intent and major in an effort to identify as clearly as possible those students who planned to earn a degree or credential and those who planned to transfer to another institution.

Practical importance of the variables. Theory and research suggest that different programs and services will be more or less effective for individuals from different demographic groups and with different characteristics or contextual influences, but these mediating and moderating factors are not well understood. Keith (2007) found relationships between students' use of support services and their prior educational experiences, institutional barriers (e.g., class availability, class times), and situational barriers (e.g., marital status, employment status, age). For example, nontraditional students with characteristics more similar to their traditional-age peers (i.e., those who were younger, unemployed, and had experienced stress from increased tuition) used more academic services than other nontraditional students at the same institution. Likewise, a random assignment study of the Beacon Mentoring program at South Texas College (MDRC, 2010) found that:

> While the program has not improved math class pass rates or persistence in college overall, it benefited two subgroups at particular risk of failure: (1) part-time students were less likely to withdraw from and more likely to pass the math class, earned more credits, and, at least in the developmental math classes, scored higher on the final exam, and (2) developmental student were less likely to withdraw from math class than students in the

> control group, and they earned more credits in their non-math developmental courses. (Bringing Student Services into the Classroom, para. 2)

Students in community college programs have a wide range of backgrounds (American Association of Community Colleges, 2011a). For example, less than half (43%) of community college students are under the age of 21, which is often considered the "traditional" college age. Nationally, 35% of community college students are from racial or ethnic minority groups; this figure is higher at urban community colleges. Nearly 60% of community college students attend college less than full-time. Nearly 80% of community college students work either full- or part-time, and 50% work full-time. Many community college students (39%) are the first in their families to attend college, and many have additional responsibilities such as caring for children or elders (e.g., 17% are single parents). Thirteen percent of postsecondary students report that English is not the primary language spoken at home (Schuck & Larson, 2003). The percentage of youth with disabilities participating in postsecondary education more than doubled between 1987 and 2003, from 15% to 32% (Newman, 2005). In addition (42%) of students at two-year public institutions reported taking remedial coursework at some point to make up for their lack of academic preparation for college-level coursework.

Intervention programs. Evidence for the effectiveness of retention programs and services included in this study was reviewed in a prior report (Bremer et al., 2011). The programs and services that were ultimately included in our analyses were chosen based on the availability of sufficient data from our sites. Data for some variables were not available for all sites.

Conceptual Model

Figure 1 is a conceptual model of the Relative Impact study, including variables affecting student retention and related outcomes. This model provides a framework for an input-process-output model of student experiences and outcomes.

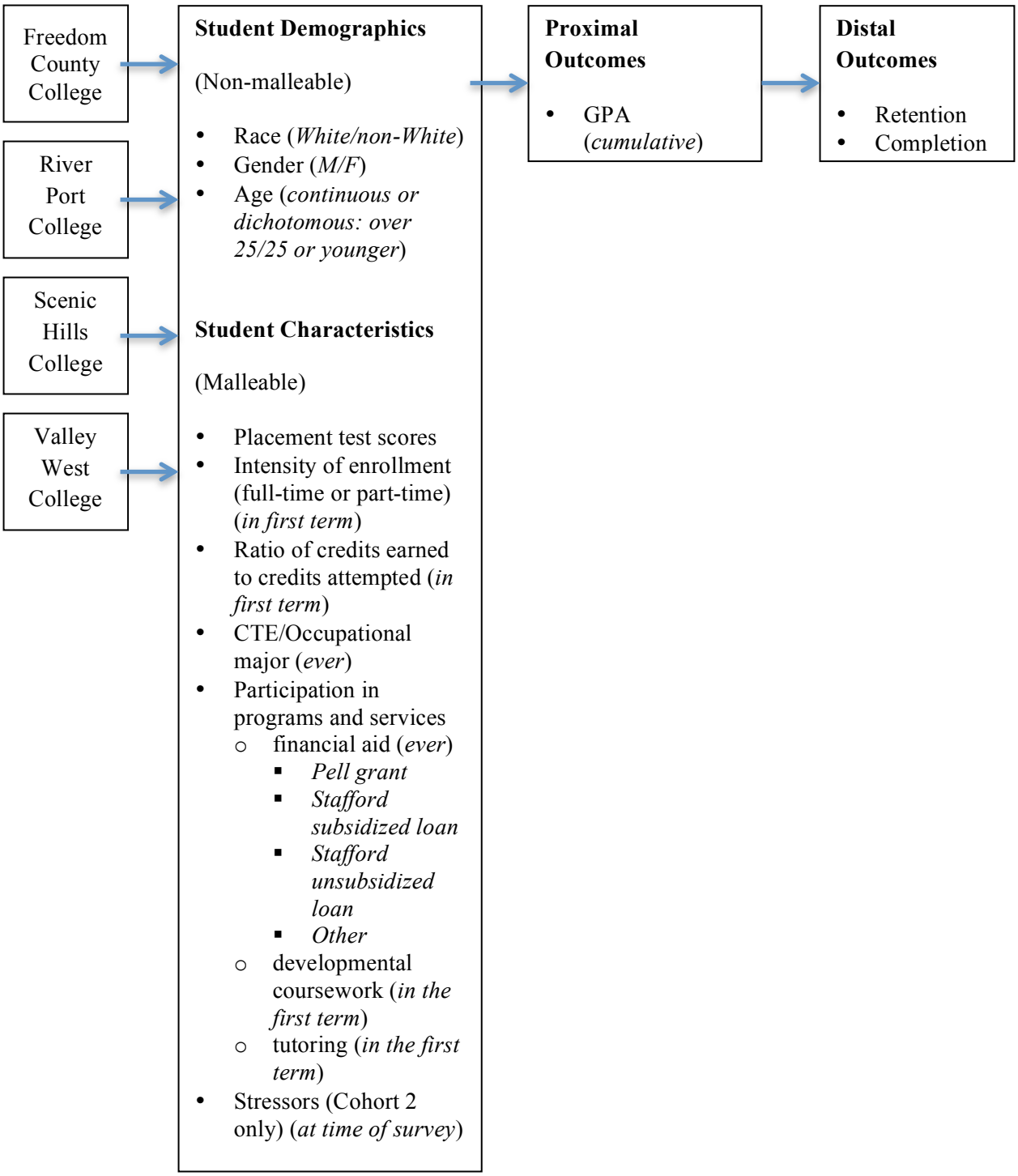

FIGURE 1. Conceptual model of the Relative Impact study. *Note.* Cohort 1 is comprised of all students who entered one of the colleges for the first time in Fall 2009; Cohort 2 is comprised of all students who entered one of the colleges for the first time in Fall 2010. Occupational (Occ) status of students was determined by each college based on factors such as degree program and declared intent. Site names are pseudonyms.

Tables 1.1, 1.2, and 1.3 show descriptive statistics for the cohorts by site.

Table 1.1: Descriptive Statistics - Total Counts

	Cohort 1		Cohort 2		Total	
Site	Count	%	Count	%	Count	%
Freedom County	1,720	30.3	1,896	32.4	3,616	31.4
River Port	1,963	34.6	2,096	35.9	4,059	35.3
Scenic Hills	905	16.0	915	15.7	1,820	15.8
Valley West	1,081	19.1	938	16.0	2,019	17.5
Total	5,669	100.0	5,845	100.0	11,514	100.0

Table 1.2: Descriptive Statistics - Continuous Variables By Site

	Freedom County				
Continuous Variables	*M*	*SD*	Valid *N*	Missing	Valid *N* %
Age	23	7	3,616	0	100
Computed cumulative GPA	1.96	1.25	3,592	24	99
Standardized placement test reading	.00	1.00	2,584	1,032	71
Standardized placement test writing	.00	1.00	24	3,592	1
Standardized placement test math	.00	1.00	3,303	313	91

	River Port				
Continuous Variables	*M*	*SD*	Valid *N*	Missing	Valid *N* %
Age	28	10	3,890	169	96
Computed cumulative GPA	2.45	1.26	3,699	360	91
Standardized placement test reading	.00	1.00	3,198	861	79
Standardized placement test writing	.00	1.00	2,434	1,625	60
Standardized placement test math	.00	1.00	3,202	857	79

	Scenic Hills				
Continuous Variables	*M*	*SD*	Valid *N*	Missing	Valid *N* %
Age	26	10	1,820	0	100
Computed cumulative GPA	2.50	1.12	1,624	196	89
Standardized placement test reading	.04	.97	1,125	695	62
Standardized placement test writing	.06	.97	1,135	685	62
Standardized placement test math	.01	1.00	1,184	636	65

	Valley West				
Continuous Variables	*M*	*SD*	Valid *N*	Missing	Valid *N* %
Age	25	10	2,019	0	100
Computed cumulative GPA	2.70	1.03	1,802	217	89
Standardized placement test reading	.00	1.00	1,940	79	96
Standardized placement test writing	.00	1.00	1,940	79	96
Standardized placement test math	.00	1.00	1,935	84	96

Continuous Variables	All Sites				
	M	*SD*	Valid *N*	Missing	Valid *N* %
Age	25	9	11,345	169	99
Computed cumulative GPA	2.34	1.23	10,717	797	93
Standardized placement test reading	.01	1.00	8,847	2,667	77
Standardized placement test writing	.01	.99	5,533	5,981	48
Standardized placement test math	.00	1.00	9,624	1,890	84

Table 1.3: Categorical Variables											
		Site									
		Freedom County		River Port		Scenic Hills		Valley West		Total	
Categorical Variables		Count	%	Count	%	Count	%	Count	%	Count	%
Student Demographics											
Female	Male	1,704	47.1	1,795	44.2	951	52.3	920	45.6	5,370	46.6
	Female	1,866	51.6	2,089	51.5	869	47.7	1,097	54.3	5,921	51.4
	Subtotal	3,570	98.7	3,884	95.7	1,820	100.0	2,017	99.9	11,291	98.1
	Missing	46	1.3	175	4.3	0	0.0	2	.1	223	1.9
White	No	572	15.8	2,136	52.6	398	21.9	377	18.7	3,483	30.3
	Yes	2,899	80.2	1,668	41.1	1,387	76.2	1,536	76.1	7490	65.1
	Subtotal	3,471	96.0	3,804	93.7	1,785	98.1	1,913	94.7	10,973	95.3
	Missing	145	4.0	255	6.3	35	1.9	106	5.3	541	4.7
Over 25 years old	25 or under	2,847	78.7	2,189	53.9	1,248	68.6	1,402	69.4	7,686	66.8
	over 25	769	21.3	1,699	41.9	572	31.4	617	30.6	3,657	31.8
	Subtotal	3,616	100.0	3,888	95.8	1,820	100.0	2,019	100.0	11,343	98.5
	Missing	0	0.0	171	4.2	0	0.0	0	0.0	171	1.5
Student Characteristics											
Attempted 12 or more credits	No	609	16.8	1,874	46.2	705	38.7	862	42.7	4,050	35.2
	Yes	2,957	81.8	2,185	53.8	1,115	61.3	1,157	57.3	7,414	64.4
	Subtotal	3,566	98.6	4,059	100.0	1,820	100.0	2,019	100.0	11,464	99.6
	Missing	50	1.4	0	0.0	0	0.0	0	0.0	50	.4
Enrolled in DevEd English, reading, or writing in the 1st term	No	2,918	80.7	3,196	78.7	1,566	86.0	1,529	75.7	9,209	80.0
	Yes	698	19.3	863	21.3	254	14.0	490	24.3	2,305	20.0
	Subtotal	3,616	100.0	4,059	100.0	1,820	100.0	2,019	100.0	11,514	100.0
Enrolled in DevEd math	No	2,639	73.0	3,405	83.9	1,244	68.4	893	44.2	8,181	71.1
	Yes	977	27.0	654	16.1	576	31.6	1,126	55.8	3,333	28.9

Received Financial aids ever	No	702	19.4	842	20.7	1,077	59.2	587	29.1	3,208	27.9
	Yes	2,914	80.6	3,217	79.3	743	40.8	1,432	70.9	8,306	72.1
	Subtotal	3,616	100.0	4,059	100.0	1,820	100.0	2,019	100.0	11,514	100.0
Occupational status ever	Non-Occ	634	17.5	1,042	25.7	924	50.8	1,118	55.4	3,718	32.3
	Occ	2,982	82.5	3,017	74.3	896	49.2	901	44.6	7,796	67.7
	Subtotal	3,616	100.0	4,059	100.0	1,820	100.0	2,019	100.0	11,514	100.0
Visited tutoring center or not in the 1st term	No	3,426	94.7	3,759	92.6	0	0.0	1,592	78.9	8,777	76.2
	Yes	190	5.3	300	7.4	0	0.0	427	21.1	917	8.0
	Missing	0	0.0	0	0.0	1,820	100.0	0	0.0	1,820	15.8
	Subtotal	3616	100.0	4,059	100.0	1,820	100.0	2,019	100.0	11,514	100.0
Student Outcomes											
Enrolled in the 2nd term	No	674	18.6	1,144	28.2	549	30.2	469	23.2	2,836	24.6
	Yes	2,918	80.7	2,915	71.8	1,271	69.8	1550	76.8	8,654	75.2
	Missing	24	.7	0	0.0	0	0.0	0	0.0	24	.2
	Subtotal	3,616	100.0	4,059	100.0	1,820	100.0	2,019	100.0	11,514	100.0
Enrolled in the 1st year	No	1,595	44.1	2,317	57.1	1,042	57.3	1027	50.9	5,981	51.9
	Yes	1,997	55.2	1,742	42.9	778	42.7	992	49.1	5,509	47.8
	Missing	24	.7	0	0.0	0	0.0	0	0.0	24	.2
	Subtotal	3,616	100.0	4,059	100.0	1,820	100.0	2,019	100.0	11,514	100.0
Enrolled or not in the 2nd year	No	2,205	61.0	1,486	36.6	713	39.2	732	36.3	5,136	44.6
	Yes	1,387	38.4	477	11.8	192	10.5	349	17.3	2,405	20.9
	Missing	24	.7	2,096	51.6	915	50.3	938	46.5	3,973	34.5
	Subtotal	3,616	100.0	4,059	100.0	1,820	100.0	2,019	100.0	11,514	100.0
Graduated ever	No	3,422	94.6	3,534	87.1	1,663	91.4	1,961	97.1	10,580	91.9
	Yes	194	5.4	525	12.9	157	8.6	58	2.9	934	8.1
	Subtotal	3,616	100.0	4,059	100.0	1,820	100.0	2,019	100.0	11,514	100.0

Methods

I. Research Design

The Relative Impact study made use of a longitudinal quasi-experimental design in which data were obtained from the institutional databases of two-year community colleges participating in the study. Given that the goal was to identify the programs and services that are associated with retention and completion for students in postsecondary programs, as well as the interactions of these with other variables, we worked to statistically control for variables that might have confounded the relationship between participation in the programs and services and retention and completion.

Design and Procedure

The research protocol was approved by the Institutional Review Board at the University of Minnesota, as well as the associated institutional staff and respective IRB boards, if available, at each college. Education records were acquired in accordance with Family Educational Rights and Privacy Act guidelines. Data management specialists at each college were asked to provide data for the two cohorts following the close of each term, beginning with Fall 2009 and ending in Spring 2012.

Instrumentation and Data Preparation

Data provided by the four college sites varied in availability and completeness. For many categories, the data included educational records of equivalent content but differing coding schemes across colleges.

Enrollment in Developmental Education Courses. Each college provided course enrollment records, associated with students' research study ID numbers, and a list of developmental courses. Three dummy-coded variables were computed at each college, one for enrollment in developmental math (DM) and one for enrollment in development English, reading, or writing (DERW), and a third for students who took both DERW and DM courses. Further, the number of DERW courses and the number of DM courses taken in the first term was calculated.

Retention. Three retention outcomes were computed: immediate retention (i.e., enrollment in the second term), one-year retention (i.e., enrollment in the second fall), and two-year retention (i.e., enrollment in the third fall). Note that only Cohort 1 had data available with regard to two-year retention.

Grade point average. Grade point average (GPA) was calculated using algorithms provided by each college; for example, one college granted 4 grade points for an A-, whereas another granted 3.7 grade points. Some courses differed in whether or not they counted toward GPA calculation, such as courses taken as pass/fail. These were not included in our GPA calculations.

Three permutations of GPA were computed. First, an overall cumulative GPA was computed, combining academic performance across all enrolled terms. Next, GPA was computed for

academic performance in two specific subject areas: (a) non-developmental college-level courses in English, reading, or writing and (b) non-developmental college-level courses in math.

Completion. A student was considered to have graduated if she or he completed an Associate degree, if they were documented as transferring to another institution, or if they completed an occupational certificate offered by the college. Certificates, which typically require one year or less of full-time enrollment, demonstrate to would-be employers that the student has adequate training in a particular field. Although we hoped to include completion data concerning the awarding of nationally recognized industry credentials, such as the NCLEX (National Council Licensure Examination) nursing credential, insufficient data were available from the colleges to include these in the analyses. Outcomes for students who exited a college before completing a degree or certificate but returned in a later term during the course of this study (i.e., stopped out) were included.

Intermediate outcomes. Data were collected on course grades in non-developmental English, reading, or writing and math courses.

Institutions. Dummy variables were created to indicate the four different colleges. These were used as covariates in the analyses to account for variation in outcomes due to institutional uniqueness, such as the method used for computing GPA at each school.

Demographics. Age was at the time of enrollment. Records on ethnicity provided a number of categories that were reduced to either White/non-Hispanic or Other, due to low numbers of students from individual minority populations. Sex was limited to male or female.

Occupational status. Occupational status refers to whether students had selected a program in a career and technical education (CTE) field. These are programs that aim to make students employable after completion; credits may or may not transfer to a baccalaureate program. Non-occupational students, often referred to as transfer students, are those whose aim at the two-year college is to complete coursework that will count toward a baccalaureate degree. Either the educational records provided occupational status, or definitions using intent codes at a college were used to compute a dummy variable indicating whether a student had ever been defined as occupational at any time throughout his or her enrollment at college

Financial aid. Educational records contained a wide array of information about financial aid. The information provided was reduced to dummy variables that noted receipt of financial aid at any time throughout a student's enrollment at college in each of the following categories: (1) Federal Pell grants, (2) subsidized Stafford loans, (3) unsubsidized Stafford loans, and (4) other financial aid.

Tutoring. A dummy variable was created to indicate a student's use of tutoring services within the first term of enrollment.

Placement tests. The educational records contained placement testing data from the ASSET, ACCUPLACER, or COMPASS exam brands. Because the three brands of test measure similar content, and because there is no reason to believe the ability of the students taking these tests

would systematically differ across the three, standardized scores for each student on the tests they did take were created. That is, each student received a standardized score for reading, writing, and math, regardless of which brand of test they took. Where students took a higher or lower level math placement test, scores were adjusted for the difficulty of the test. These adjustments were based on the mean differences on the test scores, among those students who took more than one level of placement test. (This was common enough to ascertain a rough test equivalent.) Note that these tests are only approximate guides to a student's ability, only valid at the time that the test was taken, and that the equivalences are approximate at best. Even so, these scores provide a rough indication of a student's abilities in English, writing, and math at the time of entering college.

II. Sample

Site Selection and Characteristics. Site selection for this study was guided by a process of focal sampling (Anastas, 1999), in which participating community college sites or subjects were selected "not to approximate representativeness but because they are atypical in some way that specially equips them to be useful as study informants" (p. 288). For this study, the sites sought were atypical in that it was necessary to find institutions with detailed data collection procedures in place, in addition to having programs and services of interest and a strong commitment on the part of administrators to participate in the study.

To identify such sites, the project staff turned to members of a U.S. Department of Education, Office of Vocational and Adult Education-nominated expert panel of state-level officials and representatives from workforce development organizations. This panel was originally convened in 2006 for a previous NRCCTE study on career pathway programs (Bragg et al., 2007). In addition to drawing upon the recommendations of these panel members, the site selection process also included contacting experts from states, colleges, and organizations known for their high-quality work in the field. In some states, the state official who was contacted disseminated study information to all community colleges in the state. In others, experts nominated specific community colleges they viewed as well-regarded, having with strong retention programs and services, and having the kind of data sought. In addition, we identified state systems with strong data collection practices and requested nominations from administrators in those states. All four selected sites met all of the following criteria:

- The college was fully accredited.
- At least four programs and services expected to affect retention (based on the literature) were available to students (e.g., financial aid, tutoring, developmental coursework, advising).
- The college had an existing student record database that allowed for the de-identification of data and that included frequency data or other measures of intensity concerning student participation in programs and services.
- College institutional research personnel were willing and able to provide the data to the researchers.
- College administrators and staff were highly committed to participating in the study.

In addition, three of four sites met the following criterion:

- The college's entering student body for Fall 2009 was comprised of at least 10% minority students.

After completing the initial site identification process, we visited each site during Summer 2009 to ensure that (a) the site would be able to meet the study's data provision requirements for access, quality, and transferability, and (b) that the programs and services claimed by each site were in place and accessible to students. A site visit in each subsequent year allowed us to update information about current intervention design and current data availability.

Enrollment. The four sites enrolled a total of 5,674 incoming students in Fall 2009 and 5,733 students in Fall 2010 who were identified as fitting the study's parameters. Participants at each college were selected by a number of inclusion and exclusion criteria. First, two cohorts of students were included in the study: those who entered college in Fall 2009 and Fall 2010. To be included in either of these cohorts, students needed to be at least 18 years old and enrolled in one or more courses in their first term of enrollment. Also included were students whose chosen postsecondary program was designed to include one or more initial courses taken during the summer prior to Fall 2009 or Fall 2010. Students who indicated that they did not have any intention of pursuing a degree or certificate (e.g., they were taking courses for personal enrichment) were excluded, as were students attending the college while still in high school and students attending Adult Basic Education or GED classes at the college. Also excluded were any students who at the time of enrollment specifically declared a non-completion, non-transfer intent for taking courses (such as "personal enrichment"). Overall, the sample of students ranged in age from 18 to 73, with a mean age of 26.60 (SD = 10.07). The sample had a slightly greater proportion of females (51.3%) than males (46.4%; 2.2% unreported or missing) and a greater proportion of individuals of White/non-Hispanic ethnicity (58.1%) compared to other ethnicities (36.9%; 5.0% missing or unreported). All Cohort 1 and 2 students were followed using institutional data.

To assess the adequacy of the sample size obtained by this project, the necessary sample size was determined using GPower 3.1.3, a statistical power calculation program (Faul, Erdfelder, Lang, & Buchner, 2007). Because the outcomes of interest (retention and completion) are dichotomous outcomes, an odds ratio was used as the effect size (within the context of a logistic regression) for calculation of sample size. Within the context of logistic regression, an odds ratio of 1.5 is typically considered a small effect size (Cohen, 1988). However we chose the even more conservative value of 1.3. The value of 1.3 is consistent with studies assessing the impact of programs and services on retention for at-risk postsecondary students as reported by Valentine et al. (2011). The estimate was conditioned on a value of .80 for statistical power, as well as an R^2 value of .15 for the other covariates in the model. Finally, the distribution of the covariate of interest (intervention) was set to binomial (as these covariates represent a dichotomous variable: student participated/did not participate) with a probability of .2, as this reflects the lowest probability of participation across the programs and services observed in our sample. The sample size necessary to achieve statistical power of .80 under the above conditions is 4,772, suggesting that we had a large enough sample to detect a relatively small effect size for the programs and services of interest when at least two of our colleges provided the intervention of interest. Figure

2 presents a plot of statistical power as a function of sample size under these conditions.

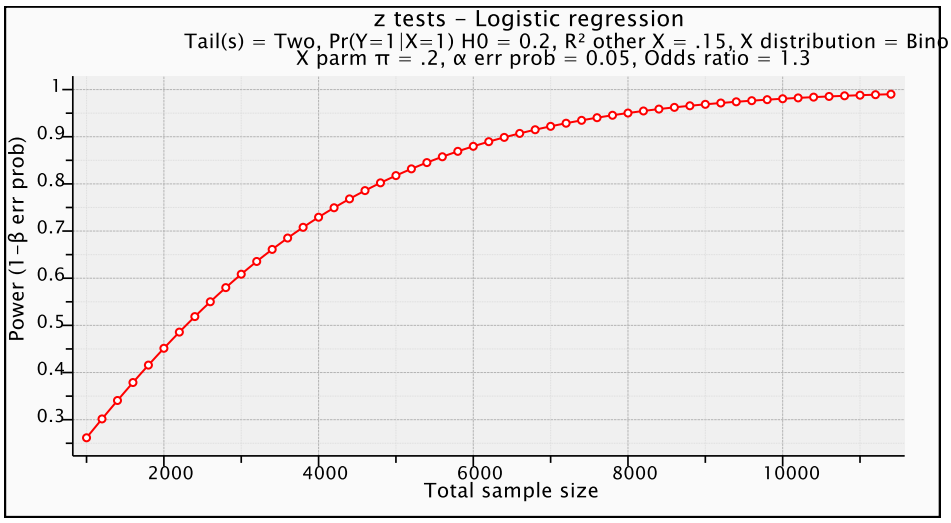

FIGURE 2. Plot of statistical power by sample size.

III. Data Sources

Data sources included institutional data, student surveys, student and staff interviews, and publicly available sources such as course catalogs and websites. Institutional data were collected on two incoming cohorts of community college students (all entering students in Fall 2009 and Fall 2010, including former dual enrollment students who exited high school and subsequently enrolled in college) at four sites over a three-year period (Fall 2009 through Spring 2012).

Institutional data. We collected available institutional data from all sites on several variables of interest for the two cohorts and received available data on demographic variables (e.g., age, sex, ethnicity), enrollment status, placement test scores, financial aid, registration with disability services, credits attempted, credits earned, grades, and participation in programs and services. If there was no record of a student's participation in an intervention, it was assumed that the student did not participate. The institutional database had missing data to the extent that some types of program participation data were simply not collected by the institution or students did not fill out some optional fields on their applications. Data were most complete for those items already in each college's main database, such as demographic data, courses taken, grades, and receipt of financial aid. Initially, as indicated by prior reports on this study, we had hoped to include several more programs and services in the study (e.g., learning communities, student success courses, participation in student activities). However, the lack of some programs and services (e.g., federal TRIO programs) at some sites, and the lack of sufficient data across sites for other programs and services (e.g., student activity participation), limited our ability to consider the full range of programs and services thought to aid retention and completion.

Student survey data and methodology. We collected survey data from samples of students in both of the cohorts being studied in order to contextualize and supplement the institutional data. Specifically, the purpose of the surveys was to provide a more detailed account of student backgrounds, barriers to learning, and experiences with the programs and services offered by

each institution (Upcraft et al., 2005).

Survey questions covered variables that have been identified as affecting retention but which are likely to be known only by the students themselves, such as social support for the student's decision to attend college, participation in co-curricular activities, satisfaction with course availability, informal contact with faculty (Gerdes & Mallinckrodt, 1994), personal commitment to obtaining a credential (Lotkowski et al., 2004), sense of belonging in the institution (Karp, Hughes, & O'Gara, 2008), , and academic self-confidence (Lotkowski et al., 2004). However, the range of responses to some questions provided an inadequate basis for statistical analysis.

Samples of Cohort 1 students at all four colleges were surveyed twice each year in 2009-2010 and 2010-2011. A stratified random sample of 200 students was identified, with 55 additional students added to replace non-respondents at each site. Within samples, there was oversampling of students who declared an occupational major, with the samples consisting of at least two-thirds occupational students. The initial survey, sent in February and March 2010, asked about these students' experiences during the Fall 2009 term (quarter or semester) using a core of items from existing ACT surveys for two-year college students, with some edits and additions. Students who responded to the first survey were sent another survey in May 2010 and were followed with semi-annual surveys through Spring 2012. The type of survey they received at each juncture depended on whether they were still enrolled or had not re-enrolled at the college that term. In the subsequent two years, abbreviated versions of the Student Experience Survey and the Withdrawing/Nonreturning Student Survey were used, and students who completed their programs were surveyed to understand their post-college experiences. (The Cohort 2 Student Experience Survey is provided in Appendix A.) Overall, 1,495 students were surveyed: 236 from Cohort 1 and 1,259 students from Cohort 2. Students who returned a survey provided permission to link their survey responses to their de-identified institutional data, including courses taken and grades, so that these two data sources could be used to supplement and contextualize each other.

Surveys were administered electronically. Students were initially sent an e-mail with a link to the survey and a cover note from a college administrator at each site. This email was followed by reminder emails and phone calls to non-respondents. Respondents received a $20 gift card for completing each survey. Despite this incentive, the response rate to the first administration of the Cohort 1 survey was quite low, ranging from 18.4% at Freedom County to 28.2% at Valley West. The overall response rate was 23.3% and became even lower over subsequent administrations. We therefore decided to take a different approach for Cohort 2. First, we used the Cohort 1 survey results to identify items that would be of greater use on the Cohort 2 survey. Then, surveys were handed out in classrooms as paper forms that were completed and returned during the class period. The Cohort 2 surveys proved to be of the greatest use for statistical analysis. Non-respondents constituted missing data for the survey.

We were particularly interested in two variables included on the survey: career integration (a construct first described in Hirschy, Bremer, and Castellano, 2011) and stressful life events, including concern about one's ability to pay tuition.

Interview data. Interviews with administrators, staff, and students provided context for the institutional and survey data collected for this study. Most interviews with college staff were

conducted with individuals rather than groups, and involved two researchers, with one serving as note-taker. If the interviewee was willing, audio recordings were made in order to improve the quality of our interview notes.

Interviews of college administrators and staff members were conducted in 2009 and 2010. These interviews provided information about college philosophies, data systems, and the specifics of each college's retention programs. Those selected to be interviewed had knowledge specific to the needs of this study and were identified to us by our primary contact at each site.

Interviews of students took place during site visits in the 2011-2012 academic year. These interviews provided information about how students decided to attend college, how they chose a major, how they learned about the retention services and programs available to them, and what kinds of experiences they had in their programs.

IV. Data Analysis

Analyses of the effects of retention programs using institutional data employed logistic regression because the dependent variables of interest (retention and completion) are dichotomous variables. The general form of the logistic regressions employed in this study is given by the equation:

$$\log\left(\frac{P(Y_i = 1)}{1 - P(Y_i = 1)}\right) = \beta_0 + \sum_{1}^{q} \beta_q X_{qi}$$

where q is a given covariate, X_{qi} is a value for student i on covariate q, β_q is the coefficient for covariate q and therefore the effect of the covariate on the outcome of interest Y_i, $P(Y_i = 1)$ is the probability of a successful outcome (i.e. student was retained) for student i and therefore $1 - P(Y_i = 1)$ is the probability of an unsuccessful outcome. The outcome of retention was observed on a semester by semester basis, therefore this outcome was analyzed through the logistic regression for each semester for each year of data. The outcome of completion was assessed with four years of data, allowing students sufficient time to complete their degree/certification.

Although students were nested within the four two-year community colleges, and this may impose a dependence of the observations within colleges, the sample of four institutions is not sufficient to analyze the data using a hierarchical linear model. Therefore, the community college a student attends is treated as a student-level covariate reflected through three dummy-coded variables where the fourth community college serves as a reference group. (The dummy variables are not included in the tables.) This was done to statistically control for the effect of the college a student attends on the outcomes of interest. The inclusion of college as a covariate was not done in an attempt to make comparisons between colleges but merely to control for its potential effect on the outcomes so that a meaningful statement can be made about the relationship between use of programs and services and outcomes.

College data also varied by site in that two sites (Freedom County and River Port) used semesters and two (Scenic Hills and Valley West) used quarters.

Retention data were calculated at three points in time: retention into the second term of the first academic year, retention into the first term of the second academic year, and (for both Cohorts at Freedom County and only Cohort 1 at the other three colleges) retention into the first term of the third academic year. (Freedom County provided additional data following the completion of the study, which allowed inclusion of both of their cohorts at the third retention point.) Two colleges used the semester system (Freedom County and River Port whereas two use the quarter system (Scenic Hills and Valley West), thus the second term was spring for two of the colleges and winter for the other two.

Demographic and student characteristic variables included in our analyses are shown in Tables 1.1, 1.2, and 1.3 and described below.

Student demographics. Race was treated as a binary variable: White and non-White. All students not classified as White or as White/non-Hispanic (this varied by campus) were combined in a single category due to low numbers in individual subgroups. Gender was treated as binary. Age is continuous for most analyses (noted as *Age* in tables) but was treated as dichotomous (under 25 vs. 25+) for other analyses (noted as *Age 25+* in tables). In those analyses where either (a) we were looking for specific interactions or (b) the construct we were looking for was thought to be related to younger students or older students as a group, we treated age as a dichotomous variable. Age 25 is frequently used as a cutoff in the literature.

Student characteristics. Placement test scores (in reading, writing, and math) were used as student characteristic variables because students entered college with skill levels measured by these tests and this characteristic, determined at a student's point of entry into the college, was not malleable by the college. We wanted to see how students with different placement scores fared later in college.

Intensity of enrollment (Full-Time vs. Part-Time). Although the ratio of credits attempted to credits earned in the first term is a type of intermediate outcome, this variable is treated as a student characteristic, in a separate analysis, because we were interested to find out if this aspect of the first-term experience had an impact on future retention; it is analyzed in combination with full-time versus part-time enrollment in the first term. It should be noted that this ratio was highly correlated with the simple variable of credits earned.

Occupational major was also used as a student characteristic type of variable rather than as an outcome variable for purposes of analysis. Students were classified as occupational if they had an occupational major (as defined by the individual college) at any time during the course of data collection. Although choosing an occupational major may be a malleable characteristic (similar to credits attempted/earned and intensity of enrollment), we were more concerned with whether occupational and non-occupational students were differently affected by participation in programs and services or were more likely to be retained.

Stress. Overall stress and pay stress, as measured on the Cohort 2 survey given in late Fall 2010, are also considered student characteristics. Stress was measured in a first-term survey (see Appendix A) of Cohort 2 students and was analyzed for respondents as two separate variables:

"stress" (i.e., number of stressful life events reported for the past year) and "pay stress" (i.e., stress specifically about paying tuition). Events included in the count of overall stress were (a) change or loss of job, (b) death of family member or close friend, (c) increase in family responsibilities, (d) financial setbacks, and (e) worry about being able to pay for classes at college (pay stress).

Intermediate outcomes. GPA in non-developmental courses (calculated cumulatively throughout the course of the study) was an intermediate outcome considered in our analyses.

Findings

Overall, our analyses indicated that occupational students were more likely to be retained, as were students taking developmental courses in the first term, older students, female students, White students, and those receiving financial aid (see Table 2). White students were more likely than non-White students to be retained into the second term and second year (first and second retention points), but this effect faded with time and was no longer significant at the third retention point. Considering placement scores, and controlling for other variables, Math placement scores were predictive of retention at all three points in time. Reading placement scores predicted retention into the second term and second year, but not into the third year. Writing placement scores did not significantly predict retention at any point in time, though a weak relationship ($p = .09$) was observed in retention to the second term.

Table 2: Developmental Enrollment (Term 1), Placement, and Retention

	Retention to 2nd term ($N = 5{,}060$)		Retention to Term 1 of 2nd year ($N = 5{,}060$)		Retention to Term 1 of 3rd year Cohort 1 plus Freedom County Cohort 2 ($N = 2{,}928$)	
Variable	*b*	*p*	*b*	*p*	*b*	*p*
DERW_1	.347	.004	.453	.000	.301	.049
DMath_1	.219	.019	.022	.775	.249	.032
DERW_1xDM_1	-.103	.524	-.268	.050	-.350	.082
Reading Placement	.111	.023	.122	.005	.069	.284
Writing Placement	.084	.090	.015	.730	.049	.448
Math Placement	.313	.000	.327	.000	.267	.000
Age	.004	.308	.010	.002	.016	.001
White	.304	.000	.264	.000	-.126	.223
Female	.086	.227	.154	.011	.327	.000
Occupational	.297	.000	.357	.000	.333	.001
Financial Aid	1.293	.000	.726	.000	.502	.000

Table 3: Descriptive Statistics for GPA, Developmental Course Enrollment, Placement Tests, Age, Race, Gender, Occupational Major, and Financial Aid			
Variable	*M*	*SD*	*N*
GPA Non-Developmental ERW/Math	2.4389	1.18395	4546
DERW_1	.23	.421	4546
DMath_1	.39	.487	4546
DERW_1xDM_1	.12	.321	4546
Reading Placement	.0614	.94919	4546
Writing Placement	.0701	.95909	4546
Math Placement	.0362	.99263	4546
Age	25.03	9.345	4546
White	.65	.478	4546
Female	.51	.500	4546
Occupational	.59	.491	4546
Financial Aid	.74	.438	4546

Occupational students, older students, female students, White students, students receiving financial aid, and students taking developmental math in the first term had higher GPAs in non-developmental courses (see Table 4). Scores on each of the three types of placement test were predictive of higher GPA in non-developmental courses (see Table 4).

Table 4: Developmental Enrollment (Term 1), Placement, and Nondevelopmental GPA				
Variable	*b*	*SE*	*β*	*p*
DERW_1	0.072	0.060	0.025	0.233
DMath_1	-0.178	0.044	-0.073	0.000
DERW_1xDM_1	0.070	0.079	0.019	0.376
Reading Placement	0.056	0.024	0.045	0.022
Writing Placement	0.065	0.024	0.053	0.008
Math Placement	0.218	0.020	0.183	0.000
Age	0.021	0.002	0.162	0.000
White	0.338	0.039	0.136	0.000
Female	0.202	0.034	0.085	0.000
Occupational	0.141	0.037	0.059	0.000
Financial Aid	0.119	0.040	0.044	0.003

Both overall stress and pay stress were predictive of non-retention (see Tables 5, 6).

Table 5: Overall Stress and Retention						
	Retention to 2nd term (*N* = 1,021)		Retention to Term 1 of 2nd year (*N* = 1,021)		Retention to Term 1 of 3rd year (Cohort 1 only) (*N* = 648)	
Variable	*b*	*p*	*b*	*p*	*b*	*p*
Stress mean	-.789	.013	-.964	.000	-.790	.027
Financial Aid	.516	.214	-.264	.362	-.532	.101
StressxFinAid	.568	.120	.781	.008	.521	.173
Occupational	-.337	.260	-.107	.529	-.319	.131
Female	.004	.595	.000	.473	.000	.933
White	-.090	.738	.297	.057	.606	.012
Age 25+	-.182	.472	-.218	.163	.140	.534

Table 6: Stress about Paying Tuition and Retention						
	Retention to 2nd term (*N* = 1,031)		Retention to Term 1 of 2nd year (*N* = 1,010)		Retention to Term 1 of 3rd year (Cohort 1 only) (*N* = 655)	
Variable	*b*	*p*	*b*	*p*	*b*	*p*
Pay Stress	-.703	.000	-.705	.000	-.085	.697
Financial Aid	.606	.097	-.191	.433	-.052	.847
PayStressxFinAid	.405	.071	.628	.001	-.175	.462
Occupational	-.272	.357	-.050	.766	-.281	.181
Female	.004	.602	.000	.491	.000	.972
White	-.099	.716	.281	.073	.662	.006
Age 25+	-.183	.473	-.274	.078	.083	.706

Financial Aid. Students who ever received financial aid (when measured as a cumulative, dichotomous variable across all terms) were more likely to be retained at each retention point. Students receiving financial aid had higher GPAs in non-developmental courses. Most students (68%) who received financial aid began receiving it during their first term. When controlling for Occupational major, race, sex, age, and placement scores, and looking at types of financial aid by category, students receiving Pell grants, Stafford subsidized loans, and Other types of financial aid were retained at significantly higher levels than similar students not receiving financial aid, whereas those receiving unsubsidized Stafford loans were not retained at a significantly higher level than those receiving no financial aid (see Table 7). Controlling for placement scores did not appreciably alter these results.

Table 7: Financial Aid Only						
	Retention to 2nd term (*N* = 7,898)		Retention to Term 1 of 2nd year (*N* = 7,898)		Retention to Term 1 of 3rd year Cohort 1 plus Freedom County Cohort 2 (*N* = 3,949)	
Variable	*b*	*p*	*b*	*p*	*b*	*p*
Pell	.636	.000	.160	.002	.269	.001
Stafford Subsidized Loan	.527	.000	.275	.000	.234	.060
Stafford Unsubsidized Loan	.166	.098	.161	.050	.310	.015
Other FinAid	1.287	.000	1.038	.000	.711	.000

Developmental Education. We divided developmental courses into Developmental Mathematics (DM) and Developmental English, reading, or writing (DERW) courses. Twenty percent had enrolled in DERW and 29% had enrolled in DM (see Table 1). Students who took DM were more likely to be retained into the second term of the first year and the first term of the third year, but not into the first term of the second year, than students who did not take DM (see Table 2). This was true even without accounting for placement test scores. Students who took DERW were retained at a significantly higher rate at each of the three points in time.

Tutoring. Tutoring data were available from three colleges. Students who received tutoring in their first term at college were more likely to be retained at all three retention points (see Table 8). This is true even though we did not adjust the results for college readiness as measured by placement test scores. These data suggest that students who avail themselves of tutoring are more likely to be retained.

Table 8: Tutoring in First Term and Retention						
	Retention to 2nd term (*N* =3,950)		Retention to Term 1 of 2nd year (*N* =3,950)		Retention to Term 1 of 3rd year (Cohort 1 only) (*N* =2,348)	
Variable	*b*	*p*	*b*	*p*	*b*	*p*
DERW_1	.313	.020	.494	.000	.222	.187
DMath_1	.175	.118	.069	.470	.098	.476
DERWxDMath	-.201	.275	-.462	.003	-.394	.081
Tutoring_1	.841	.000	.578	.000	.488	.000
Reading Placement	.113	.051	.134	.009	.116	.113
Writing Placement	.073	.198	.012	.813	.006	.930
Math Placement	.300	.000	.344	.000	.286	.000
Age	-.001	.744	.007	.064	.014	.007
White	.377	.000	.361	.000	-.005	.968
Female	.092	.255	.167	.015	.344	.001
Occupational	.298	.001	.332	.000	.430	.000
FinAid	1.368	.000	.812	.000	.799	.000

Intensity of enrollment and ratio of credits earned to credits attempted. Students who enrolled full-time in the first semester showed higher retention rates than those enrolling part-time. Students who completed all of the credits they enrolled in were more likely to be retained (see Table 9). The value of completing all credits attempted in the first term greatly exceeded the value of enrolling full-time in the first term (Figures 3a and 3b).

Table 9: Retention and Credits Attempted/Credits Earned		
Retention to First Term of Second Year		
Credit Status	Full Time (%)	Part Time (%)
Completed all credits attempted	74	64
Completed some credits attempted	46	31
Retention to First Term of Third Year		
Credit Status	Full Time (%)	Part Time (%)
Completed all credits attempted	51	42
Completed some credits attempted	26	18

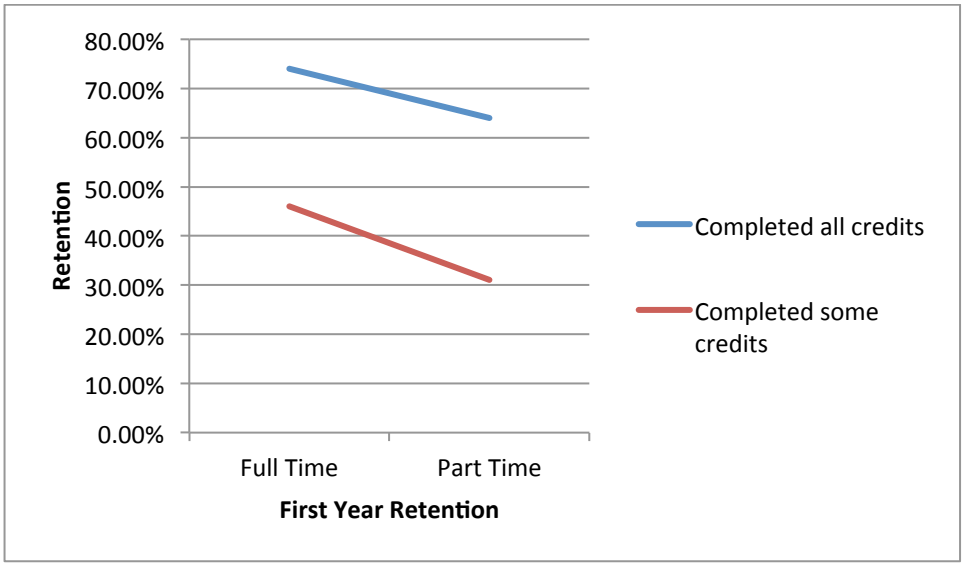

FIGURE 3a. Retention to first term of second year.

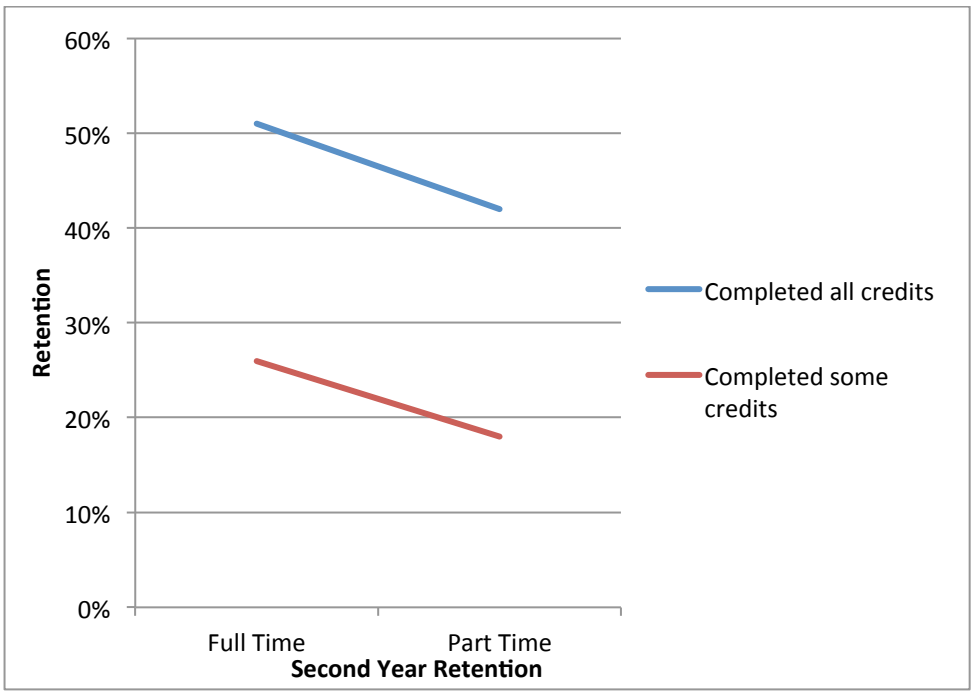

FIGURE 3b. Retention to first term of third year.

Interactions

In order to determine what worked for whom, we examined several interactions to determine whether some groups of students were differently affected by participation in programs and services. Our literature review identified a number of interactions related to the variables under consideration. In particular, age may moderate the effect of developmental education (Jepsen, 2006). Our results related to this interaction were mixed. Overall, older students had better retention at the second and third retention points, but there was no significant difference at the first retention point. For retention at the first and third retention points, there was no interaction between DM and age. DM appeared useful for older students at the second retention point. DERW was associated with better retention for younger students at the first two retention points. The literature also suggested that college readiness (as measured by placement scores) may moderate the effect of tutoring (Maxwell, 1990), and that race may moderate the effect of type of financial aid (see Table 10). Our data did not provide support for either of these possibilities.

In analyzing the interaction between race and financial aid, each of which aided retention on its own, we found that these were essentially independent in their impact on retention, with no significant interaction (see Table 10). This was true regardless of whether we used total financial aid or its constituent types.

Table 10: Race, Financial Aid, and Retention						
	Retention to 2nd term (*N* = 10,948)		Retention to Term 1 of 2nd year (*N* = 10,948)		Retention to Term 1 of 3rd year (Cohort 1 only) (*N* = 7,248)	
Variable	*b*	*p*	*b*	*p*	*b*	*p*
White	.590	.000	.415	.000	.410	.010
Financial Aid	1.270	.000	.562	.000	.458	.004
WhitexFinAid	-.174	.110	.032	.771	-.057	.739
Occupational	.165	.001	.213	.000	.175	.003
Female	.000	.609	.000	.990	.000	.384
Age 25+	-.246	.000	-.134	.001	-.096	.092

The interaction between occupational major and financial aid also failed to reach significance (see Table 11).

Table 11: Occupational Status, Financial Aid, and Retention						
	Retention to 2nd term (*N* = 10,948)		Retention to Term 1 of 2nd year (*N* = 10,948)		Retention to Term 1 of 3rd year (Cohort 1 only) (*N* = 7,248)	
Variable	*b*	*p*	*b*	*p*	*b*	*p*
Occupational	.247	.001	.332	.000	.323	.005
Financial Aid	1.229	.000	.696	.000	.549	.000
OccxFinAid	-.136	.170	-.172	.062	-.201	.129
Female	.000	.610	.000	.993	.000	.386
Age 25+	-.246	.000	-.135	.001	-.096	.091
White	.464	.000	.438	.000	.360	.000

There was no interaction between occupational major and race (see Table 12) or occupational major and gender (see Table 13).

Table 12: Occupational Status, Race, and Retention						
	Retention to 2nd term (*N* = 10,948)		Retention to Term 1 of 2nd year (*N* = 10,948)		Retention to Term 1 of 3rd year (Cohort 1 only) (*N* = 7,248)	
Variable	*b*	*p*	*b*	*p*	*b*	*p*
Occupational	.305	.000	.190	.012	.215	.066
White	.259	.001	.262	.000	.295	.011
OccupationalxWhite	-.005	.959	.125	.167	.007	.961
Female	.000	.495	.000	.924	.000	.372
Age 25+	-.227	.000	-.128	.002	-.087	.124

Table 13: Occupational Status, Sex, and Retention						
	Retention to 2nd term (N = 10,948)		Retention to Term 1 of 2nd year (N = 10,948)		Retention to Term 1 of 3rd year (Cohort 1 only) (N = 7,248)	
Variables	*b*	*p*	*b*	*p*	*b*	*p*
Occupational	.305	.000	.278	.000	.217	.000
Female	.001	.275	.000	.795	.000	.993
OccxFemale	-.001	.333	.000	.811	.000	.639
Age 25+	-.226	.000	-.129	.002	-.088	.121
White	.256	.000	.349	.000	.300	.000

Considering occupational major and math placement (see Table 14), there was a significant interaction for retention at the third retention point (beginning of third year); having both an occupational major and higher math placement was predictive of retention (p = .018).

Table 14: Occupational Status, Math Placement, and Retention						
	Retention to 2nd term (N = 9,171)		Retention to Term 1 of 2nd year (N = 9,171)		Retention to Term 1 of 3rd year (Cohort 1 only) (N = 6,276)	
Variables	*b*	*p*	*b*	*p*	*b*	*p*
Occupational	.274	.000	.265	.000	.174	.006
Math Placement	.227	.000	.250	.000	.058	.261
OccupationalxMath Placement	-.047	.378	-.028	.535	.144	.018
Female	.001	.305	.000	.919	.000	.337
Age 25+	.011	.843	.051	.287	.054	.397
White	.296	.000	.394	.000	.375	.000

There was an interaction between age and occupational major (see Table 15).

Table 15: Occupational Status, Age, and Retention						
	Retention to 2nd term (N = 10,948)		Retention to Term 1 of 2nd year (N = 10,948)		Retention to Term 1 of 3rd year (Cohort 1 only) (N = 7,248)	
Variables	*b*	*p*	*b*	*p*	*b*	*p*
Occupational	.166	.003	.204	.000	.217	.001
Age 25+	-.557	.000	-.346	.000	-.096	.450
OccxAge 25+	.468	.000	.288	.003	.011	.937
Female	.000	.536	.000	.951	.000	.373
White	.260	.000	.351	.000	.301	.000

At the first two retention points, it helped to be both an occupational student and young. At the third retention point, older students had caught up to younger students. At this third retention point, there was no interaction between age and occupational status. Math placement and age each affected retention individually, but there was no significant interaction between these variables (see Table 16).

Table 16: Math Placement, Age, and Retention

	Retention to 2nd term (*N* = 9,171)		Retention to Term 1 of 2nd year (*N* = 9,171)		Retention to Term 1 of 3rd year (Cohort 1 only) (*N* = 6,276)	
Variables	*b*	*p*	*b*	*p*	*b*	*p*
Math Placement	.197	.000	.213	.000	.147	.000
Age 25+	.036	.532	.090	.061	.075	.240
MathxAge 25+	-.040	.507	.036	.466	.030	.649
Female	.001	.285	.000	.880	.000	.360
White	.291	.000	.390	.000	.383	.000

Considering stress variables, students with lower overall stress and with lower pay stress were more likely to be retained (see Tables 5, 6) We looked at whether financial aid alleviated stress and pay stress and found that financial aid significantly reduced the negative retention impact of both types of stress, and completely counteracted the impact of pay stress on retention (see Tables 5 and 6). This analysis was conducted using a single financial aid variable.

Discussion

Notably, the higher retention rate for occupational students found in this study stands in contrast to data from the Beginning Postsecondary Students Longitudinal Study, which showed a higher persistence rate for academic (transfer) students (57%) than for CTE students (51%; National Center for Educational Statistics, n.d.). We speculate that our finding may be partly attributable to occupational students having clearer goals for attending college, or their programs being more cohort-like and offering fewer choices than other programs.

When examining placement scores, math ability as measured at the time of college entrance is a powerful predictor of student success. Although it should not be surprising that students with higher prior math ability do better in college (see Attewell, Lavin, Domina, & Levey, 2006), the lack of a similar effect for prior reading or writing skills is of interest. The sheer breadth of measures on which students of higher math ability did better is remarkable: Math placement scores predicted better retention at all time periods, higher cumulative GPA for all non-developmental courses, and better performance in non-developmental math classes. Surprisingly, math placement scores also predicted higher GPA in non-developmental English courses (i.e., those counting toward a degree or credential); notably, writing placement scores did not. Students with higher writing placement scores showed only one benefit—a higher cumulative GPA for all non-developmental courses. Unsurprisingly, grades were helped by better prior writing skills, but students with better prior writing scores were no more likely to be retained or to complete their programs than other students.

Analyses were conducted adjusting for ability. We chose to adjust for initial ability in order to see the impact of developmental course-taking and other variables of interest on changes in outcomes, holding all other variables constant. Using this regression approach, participation in DERW classes in the first term contributed to next-term and second-year retention. However, participating in DM classes in the first term had no such effect. Participating in DM classes negated the positive effect of taking DERW classes if both classes were taken in the first term. Participating in DM classes was also negatively associated with both cumulative GPA and graduation. Because we controlled for initial ability as well as all other variables, this finding is especially noteworthy. Other researchers have found that enrollment in developmental coursework varies in usefulness based on student characteristics (e.g., Boatman & Long, 2010) and our findings do not refute theirs. We did not have sufficient sample size to examine only students near placement cutoffs or to consider students needing the most remediation as a separate group.

Financial aid has previously been found to contribute to college retention and completion (Kennamer, Katsinas, & Schumaker, 2011; Prince & Jenkins, 2005), and our findings supported this. Students who received financial aid were more likely to be retained. When broken out by type of financial aid, however, those receiving unsubsidized loans did not share in this benefit, suggesting that the interest rate charged on a loan may have an impact on student persistence. Given current national policy discussions regarding student loan subsidies, this result suggests that careful attention should be paid to how variations in student loans may support or undermine our significant national investment in postsecondary education.

We also found that older students, White/non-Hispanic students, women, and students with occupational majors were more likely to be retained. Lacking data to determine the reasons for this, we can only speculate that these findings may reflect the impact of other unmeasured but correlated variables, including parents' level of education, clarity of goals for attending college, variations in instruction or structure of occupational programs versus non-occupational programs, and/or availability of short-term or emergency financial support from employment or from students' families.

Participating in tutoring services during the first term in college was surprisingly useful to students throughout their college careers. Those who chose to use their college's tutoring service during their first term in college had better retention into the second term, second year, and third year, and had higher cumulative and non-developmental English, reading, and writing GPAs. As with other analyses, this analysis adjusted for ability and other covariates, so this finding seems to support the value of tutoring services—a topic little-studied in prior higher education research. However, our data did not allow us to determine whether the apparent benefits of tutoring were due to the tutoring itself, to the interpersonal connection created by the tutoring relationship, or to the individual characteristics of students who chose to utilize these services.

Although the use of placement tests has been questioned (e.g., Hughes & Scott-Clayton, 2011), our results indicate that placement test scores, particularly in math, are predictive of retention and GPA in non-developmental English, reading, and writing and math coursework, and developmental coursework has some value in promoting retention. We found math placement testing a more useful predictor of retention than reading placement, with writing placement

showing little value for this purpose. The utility of reading placement as a predictor and enrollment in DERW classes were both limited to early retention (into the second year). Neither DERW nor DM classes helped students' GPA in non-developmental classes in the same discipline. Financial aid and tutoring were much more clearly related to student success than developmental coursework. Community colleges may wish to consider more factors in deciding which students need to take developmental coursework, offer more pre-assessment information to students about how placement testing is used, provide more re-testing opportunities, or offer more specialized remediation based on placement subscales or student majors.

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Appendix A: Cohort 2 Student Experience Survey

STUDENT EXPERIENCE SURVEY

Please use a check (R) to mark your answers.

A. General Background

1. Is English your first or primary language?

- ❒ Yes
- ❒ No

2. Please mark all of the following people who you live with. (Mark all that apply.)

- ❒ I live alone
- ❒ Spouse or partner
- ❒ Parent(s) or guardian(s)
- ❒ Friend(s) or roommate(s)
- ❒ Brother(s) or sister(s)
- ❒ Child(ren) age birth to 5
- ❒ Child(ren) age 6-17
- ❒ Adult children
- ❒ Other relative(s)

3. How supportive are the following people of you going to school?

	Not supportive	Supportive	Very supportive	Does not apply
Your spouse/partner	❒	❒	❒	❒
Your child(ren)	❒	❒	❒	❒
Your best friend(s)	❒	❒	❒	❒
Your boss	❒	❒	❒	❒
Your co-workers	❒	❒	❒	❒

4. About how far from this college do you live, in miles?

- ❒ Less than 1 mile
- ❒ 1-5 miles
- ❒ 6-25 miles
- ❒ More than 25 miles

5. Have you experienced any of the following during the PAST YEAR? (Mark all that apply.)

- ❒ Change or loss of job
- ❒ Death of family member or close friend
- ❒ Increase in family responsibilities
- ❒ Financial setbacks
- ❒ None of the above

6. Are you employed?

- ❒ I have a job now
- ❒ I do not have a job now *(If you do not have a job now, please skip to Question 7)*

6a. About how many hours per week do you work?

- ❒ 1-10 hours per week
- ❒ 11-30 hours per week
- ❒ 31-40 hours per week
- ❒ More than 40 hours per week

6b. Do you work on-campus or off-campus?

- ❒ On-campus
- ❒ Off-campus
- ❒ Both on-campus and off-campus

7. Do you have a certain career field in mind for what you want to do after college?

- ❒ Yes
- ❒ No *(If you do not have a career field in mind, skip to Section B: Educational Background)*

7a. How related is your current job to your planned career?

- ❒ Very related
- ❒ Kind of related
- ❒ Not related
- ❒ I do not have a current job

7b. For the following items, choose Yes or No:

	Yes	No
I have participated in a work-related learning experience (internship, cooperative work experience/CWE, etc.)	☐	☐
Guest speakers have come to one or more of my college classes to talk about their jobs in my planned career.	☐	☐
I have talked to people who have the kind of career I want.	☐	☐
I have talked with local employers in my future career field.	☐	☐
I have been to a job fair for my planned career.	☐	☐
I have had opportunities to network with professionals in the career I want.	☐	☐
I have visited a workplace in my planned career area.	☐	☐

7c. How much do you agree with the following statements about your planned career?

	Strongly disagree	Disagree	Agree	Strongly agree
The career I am planning seems like a good fit for me.	☐	☐	☐	☐
This kind of work will be satisfying to me.	☐	☐	☐	☐
I understand what kinds of skills and knowledge I need to be successful in this career.	☐	☐	☐	☐
I expect to be successful in this career.	☐	☐	☐	☐

B. Educational Background

1. In high school, mark whether you were primarily an:

- ❒ A student
- ❒ B student
- ❒ C student
- ❒ D student
- ❒ F student
- ❒ Don't know
- ❒ Does not apply

2. What is the highest level of education you have completed?

- ❒ High school diploma
- ❒ GED
- ❒ Some college courses
- ❒ Vocational or technical certificate
- ❒ Associate or other 2-year degree
- ❒ Bachelor's or other 4-year degree
- ❒ Master's, doctoral, or professional degree
- ❒ None of the above

3. Which of the following was true for you when you first came to this college?

- ❒ Came directly from high school
- ❒ Came after working for a period of time (excluding summer work)
- ❒ Came after a period of caring for my family full-time
- ❒ Came after serving in the military
- ❒ Transferred from another 2-year college
- ❒ Transferred from a 4-year college
- ❒ Other

4. How important was each of the following for you when you decided to enroll at this college?

	Not important	Kind of important	Important	Very important
To meet requirements for my planned career	❒	❒	❒	❒
To advance in my current job	❒	❒	❒	❒
To keep up with requirements of my current job	❒	❒	❒	❒
To make more money	❒	❒	❒	❒
My family wanted me to go back to school	❒	❒	❒	❒
My high school teacher or counselor encouraged me	❒	❒	❒	❒
My employer encouraged me	❒	❒	❒	❒
To improve my English language	❒	❒	❒	❒

skills				
To get financial aid	❒	❒	❒	❒
To change careers	❒	❒	❒	❒
To get back to work after time at home	❒	❒	❒	❒
To learn new skills while job hunting	❒	❒	❒	❒

5. What were your goals for taking classes at this college? (Mark all that apply.)

- ❒ To prepare for a GED or high school diploma
- ❒ To get a job in my planned career field
- ❒ To *get* a license or certification
- ❒ To *keep* a license or certification
- ❒ To finish a vocational or technical program
- ❒ To finish an associate or other 2-year degree
- ❒ To transfer to a 4-year college

5a. How important is it to you to achieve ALL of the goals you marked above?

- ❒ Not important
- ❒ Kind of important
- ❒ Important
- ❒ Very important

6. How important were the following in your decision to come to this college?

	Not important	Kind of important	Important	Very important
A specific program	❒	❒	❒	❒
How far the college is from where I live	❒	❒	❒	❒
How far the college is from where I work	❒	❒	❒	❒
Cost of attending the college	❒	❒	❒	❒
Financial aid or scholarship	❒	❒	❒	❒
Chance to work part-time on campus	❒	❒	❒	❒
Entrance requirements I could meet	❒	❒	❒	❒

C. Current College Experience

1. As a student this term, how much of a problem has each of the following been for you? Please mark "Does not apply" if the statement does not apply to you.

	Not a problem	Minor problem	Problem	Major problem	Does not apply
Transportation (cost, parking, access to public transportation, etc.)	☐	☐	☐	☐	☐
Cost or availability of books and related materials	☐	☐	☐	☐	☐
Access to computer or internet	☐	☐	☐	☐	☐
Money problems	☐	☐	☐	☐	☐
Family responsibilities	☐	☐	☐	☐	☐

2. Are you worried about being able to pay for your classes at this college?

- ❒ I do not worry about paying for classes
- ❒ I worry a little about paying for classes
- ❒ I worry a lot about paying for classes

3. For each college service or program listed below, mark your current level of satisfaction with it. If you have not used the service or program or if your college does not offer the service or program, please mark "Does not apply".

	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied	Does not apply
Academic advising or course planning services	☐	☐	☐	☐	☐
Counseling for personal concerns or problems	☐	☐	☐	☐	☐
Help with transferring to another college	☐	☐	☐	☐	☐
Career guidance and planning services	☐	☐	☐	☐	☐
Financial aid services	☐	☐	☐	☐	☐
Computer labs	☐	☐	☐	☐	☐
Library	☐	☐	☐	☐	☐
Tutoring or learning resource center services	☐	☐	☐	☐	☐
College orientation program	☐	☐	☐	☐	☐
College-sponsored social activities	☐	☐	☐	☐	☐
Cultural programs and activities	☐	☐	☐	☐	☐
Student clubs/organizations	☐	☐	☐	☐	☐

Sports/athletics	☐	☐	☐	☐	☐
Disability services	☐	☐	☐	☐	☐
Student health service	☐	☐	☐	☐	☐
Student employment services	☐	☐	☐	☐	☐
On-campus Veterans services	☐	☐	☐	☐	☐
On-campus day care	☐	☐	☐	☐	☐

4. Thinking about the current term, how much do you agree with the following statements about your experiences at this college?

	Strongly disagree	Disagree	Agree	Strongly agree
I am satisfied with the preparation I am getting for my planned career.	☐	☐	☐	☐
The classes I want to take are available at times I can take them.	☐	☐	☐	☐
My interest in my planned career has grown since coming to this college.	☐	☐	☐	☐
My classes are useful in helping me build the skills and knowledge I need for work.	☐	☐	☐	☐
My classes will help me get a job.	☐	☐	☐	☐
My classes will help me advance in my planned career.	☐	☐	☐	☐
My classes allow me to learn hands-on what I need for my planned career.	☐	☐	☐	☐
My instructors have work experience in the career I want, and they share that with us in class.	☐	☐	☐	☐
My instructors plan events outside of class that help me learn more about my future career.	☐	☐	☐	☐

5. Thinking about the current term, do you agree with the following statements about your experiences with other students at this college?

	Strongly disagree	Disagree	Agree	Strongly agree
I have developed good relationships with other students.	☐	☐	☐	☐
Most of my friends at this college are serious about school.	☐	☐	☐	☐
It has been hard for me to meet and make friends with other students.	☐	☐	☐	☐
The friendships I have at this college have been personally satisfying.	☐	☐	☐	☐
If I had a personal problem, I could talk about it with a student friend at this college.	☐	☐	☐	☐
Most students here have values and attitudes that are similar to mine.	☐	☐	☐	☐

I know the name of at least one other student in each of my classes.	☐	☐	☐	☐
I am satisfied with the racial harmony at this college.	☐	☐	☐	☐

6. Thinking about the current term, do you agree with the following statements about your experiences with faculty and staff at this college?

	Strongly disagree	Disagree	Agree	Strongly agree
In general, I know who to go to if I need information.	☐	☐	☐	☐
Most of the instructors I've had work hard to be good teachers.	☐	☐	☐	☐
Most instructors I've had care about students.	☐	☐	☐	☐
Most other college staff members I have met really care about students.	☐	☐	☐	☐
I have had negative interactions with instructors.	☐	☐	☐	☐
I have had negative interactions with other college staff.	☐	☐	☐	☐
Most of the instructors I've had work hard to be good teachers.	☐	☐	☐	☐
Most instructors I know at this college support my efforts to get a job in my planned career.	☐	☐	☐	☐

7. If you could go back and decide again, would you choose to attend this college?

- ❒ Definitely yes
- ❒ Probably yes
- ❒ Probably no
- ❒ Definitely no

THANK YOU!

Appendix B: Project Publications and Presentations

Bremer, C., Center, B., Opsal, C., & Castellano, M. (2011, April). *Using data to assess community college retention initiatives: The relative impact study*. Paper presented at the conference of the Council for the Study of Community Colleges, New Orleans, LA.

Bremer, C. D., Center, B. A., Opsal, C. L., Medhanie, A., Jang, Y. J., & Geise, A. C. (2013). Outcome trajectories of developmental students in community colleges. *Community College Review, 41*, 154–175.

Bremer, C. D., Opsal, C., Hirschy, A., Castellano, M., Center, B., Geise, A., & Medhanie, A. (2011, July). *Relative impact of interventions to improve achievement and retention in postsecondary occupational programs*. Louisville, KY: National Research Center for Career and Technical Education.

Hirschy, A. S., Bremer, C. D., & Castellano, M. (2011). Career and technical education (CTE) student success in community colleges: A conceptual model. *Community College Review, 39*, 296-318.

Opsal, C., Center, B. A., Bremer, C. D., & Jang, Y. J. (2013). *The effect of federal financial aid on the retention of occupational and nonoccupational students at four community colleges*. Paper presented at the conference of the American Educational Research Association, San Francisco, CA.

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