Examining the Effects of Contextual Factors on Students' Educational Outcomes:
A Special Focus on Community Colleges

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ABSTRACT

MICAELA MERCADO: Examining the Effects of Contextual Factors on Students' Educational
Outcomes: A Special Focus on Community Colleges
(Under the direction of Mimi Chapman)

This dissertation examines the college experience of traditional-age community college students. The objectives of this dissertation are threefold. To explain early exits from higher education, the first manuscript integrates Tinto's interactionalist theory and Coleman's theory of social capital to describe the mechanisms through which informal and formal structures (e.g., study groups, programs, services) found in community colleges affect academic performance, engagement, and persistence. The second manuscript empirically tests the relationship between two of Tinto's theoretical constructs, academic and social integration, and student educational outcomes with a nationally representative sample of traditional-age community college students and further examines the association between the community college context and educational outcomes using multilevel modeling. The final manuscript tests the impact of community-based learning programs on students' engagement and academic performance. To test the effect of these programs, propensity score methods are used to create equivalent treatment and comparison groups.

Taken together, these analyses provide important information on community college students and their college experiences. Manuscript I reviews the current state of knowledge regarding early exit from higher education and points out ways in which current theoretical frameworks used in this field of study can be enhanced. Subsequent analyses show the importance of students' pre-college characteristics to college persistence, the impact of college experiences on outcomes, and the role of institutional characteristics commonly used for preventing attrition from community college. Taken together, these three manuscripts help advance our understanding of persistence in community college

by examining the context in which students learn. These analyses create a foundation for intervention development as well as future practice and policy research.

Dedication

I dedicate my dissertation to two people who had tremendous impact in my life despite not knowing them for very long. To a life-long teacher, abuelito Raul Mercado, who contributed too many of my fond memories of trips to Bolivia. It is his example by which I strive to live. And to my friend Jose Maldonado, who at age 34 was diagnosed with terminal brain cancer, and taught me that life is a dream…and to live it to the fullest.

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Introduction

Currently the United States ranks 12th in the number of adults ages 25 to 34 with a post secondary degree. Along with efforts by high school administrators and educators to prepare students academically for college, institutions of higher education also are striving to increase degree attainment among their student populations. Specifically, the low rate of degree attainment among community college students pursuing an associate's degree is an ongoing concern. Despite accounting for 45% of the total undergraduate enrollment rate, only half of community college students persist to their second year of college. Of this group, only one-third attain an associate's degree within three years (McIntosh & Rouse, 2009).

Community colleges are affordable, nonselective, and conveniently located. Because they offer diverse degree and certificate programs and provide an array of support services to students (Phillippe & Sullivan, 2005; Porter, 2002), a disproportionate number of low-income and minority students enroll. Further, low-income and minority students are less likely to be prepared for college, thus exacerbating the disparity in degree attainment among these students. More than half of community college students are in the two lowest income quartiles, with less than 1 in 5 of students in the lowest income quartile attaining an associate's degree within six years of initial enrollment (Bailey, Jenkins, & Leinbach, 2005). Compared to 42% of White students, 26% of African Americans, and 18% of Hispanics earn an associate's degree six years after initially enrolling at a community college (Bliss & Sandiford, 2004; Soares & Mazzeo, 2008).

For community college administrators and educators, it is difficult to know "what works" because there is sparse research on the community college student population. There are significant differences between 2- and 4-year institutions, and students attending these institutions (Inman &

Mayes, 1999; Phillippe & Sullivan, 2005; Porter, 2002). For the most part, research on students' characteristics and their outcomes in higher education, including their college experiences have been studied within the context of 4-year institutions. Equally important in understanding the community college experience is examining the underlying mechanisms of programs and services that help students develop strong academic and social skills needed to graduate with a college degree. In the area of programs and services, research is sparse in the evaluation of programs and services aimed to help community college students navigate their institutions and achieve their educational objectives (Fry, 2009; Kuh, Kinzie, Buckley, Bridges & Hayek, 2006). Last, the variation in degree attainment across different sub-group of students (e.g., minority, low-income, and first-generation college students) highlights the need to develop, implement, and evaluate services to identify effective practices so all students can be successful.

This dissertation focuses on examining the college experience of traditional-age community college students in three manuscripts. The first manuscript integrates Tinto's interactionalist theory and Coleman's theory of social capital to explain early exits from higher education. By integrating these two conceptual models this paper describes the mechanisms through which informal and formal structures (i.e., study groups, programs, services) found in community colleges affect persistence, academic performance and engagement. By understanding how programs and services are used by students, community college administrators and educators may be able to identify areas of intervention to have an effect on students' educational outcomes.

The second manuscript has two objectives. First, it is a study that empirically tests the relationship between two constructs presented in the first manuscript, academic and social integration, and student outcomes. Second, this paper examines the association between the community college context and students' educational outcomes using multilevel modeling. This paper contributes to the community college literature by modeling and controlling for community college-level factors that are known to contribute to students' educational outcomes (Berger, 2000; Denson & Chang, 2009; Frost, 2007; Hurtado et al., 2007).

The final manuscript examines the impact of participating in learning communities on student outcomes. The learning community program is a strategy of grouping courses together to help students build social relations with both their peers and faculty (Scrivener et al., 2008). To test the effect of learning community programs, propensity score methods are used to create equivalent treatment and comparison groups.

Taken together, these three papers will help advance our understanding of persistence in community college by examining the context in which students learn. Further, the dissertation will provide insight into the effectiveness of a commonly used, yet unevaluated strategy, to assist community college students.

Background

Shift in Economic Infrastructure

A fundamental shift in the infrastructure of the U.S. economy has created an increased need for a labor force with at least 2 years of post high-school education (Lacey & Wright, 2009). This need is driven by the convergence of several factors, including increased globalization in the marketplace, economic shifts from manufacturing to service industries, and increased use of technology in nearly all fields; all of which directly affect the labor supply. The number of jobs in U.S. goods-producing industries has continued to decline because of the loss of manufacturers and increased automation in nearly all aspects of production. Employment in goods-producing industries declined at an annual rate of 1.3% between 1998 and 2008 (Woods, 2009). Using data from the Bureau of Labor Statistics, Woods (2009) projected employment in these industries will continue to decline annually between 2.1% and 8.1% between 2008 and 2018. On the other hand, the service sector has not only maintained existing jobs but has also been responsible for creation of most new employment opportunities (Kirsch, Braun, & Yamamoto, 2007; Lacey & Wright, 2009; Woods, 2009). However, alongside the expansion of the service sector jobs the requirements for the entry-level work force have also increased. Whereas most jobs in manufacturing and production do not require applicants to have a postsecondary credential, but instead rely heavily on worker to acquire needed skills through on-the-job training (Lacey & Wright, 2009), service sector jobs demand applicants be prepared with certain skills and background knowledge.

Service sector growth. In contrast to the declining manufacturing sector, the service sector (e.g., retail, information, financial services) increased 1.2% over the last decade, and its annual growth is estimated at 1.2% through 2018 (Woods, 2009). More than three-fourths of all industries are service-producing with expected employment gains ranging from 2.2% to 6.2% (Woods, 2009).

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Currently, service-producing industries account for 84% of U.S. hourly wage and salary jobs (Bartsch, 2009; Kirsch et al., 2007). Steady growth in the service sector over the next decade is projected to generate more than 10 million jobs in fields such as health care services, professional and business services, and social assistance services (Woods, 2009).

Whereas skills for manufacturing industries could be learned on the job or through apprenticeship programs, the service sector requires a work force that is equipped with a post-high school level of education. In part, this need for higher education in entry-level workers is driven by greater need for advanced technical skills, use of technology, and international competition. For example, the role once filled by nurses' aides required minimal training. Today, that position is filled by the licensed practical nurse (LPN), who often has specialized education in intravenous therapy or pharmacology, and whose duties often require use and understanding of sophisticated computer-assisted machinery for delivery of medication or monitoring of vital signs. This increased use of technology is mirrored in nearly every field. Consequently, the shift from a production to a predominantly service-centered economy has steadily increased the need for postsecondary education.

Changing needs of service sector jobs. Concomitant with ongoing change in the industrial sectors that affects employment needs are employers' demands for a work force with greater education and training (Bartsch, 2009). Today, nearly 3 in 10 jobs require some level of postsecondary education; however, this number is expected to double by 2018 (Lacey & Wright, 2009). Of the 30 occupations with the fastest growing employment opportunities, 21 occupations require postsecondary education credentials; of which 7 require an associate's degree (Lacey & Wright, 2009). Employment opportunities that require an associate's degree are expected to exceed opportunities for employment requiring other levels of education, including high school diploma and bachelor's degree (Lacey & Wright, 2009). Employment opportunities requiring an associate's degree or equivalent will account for more than half of all new jobs created in the service sector, with an expected growth rate of 19.1% (Lacey & Wright, 2009). By 2018, an estimated 5.3 million jobs will

be available to those with an associate's degree, and nearly half of those positions will be jobs that were newly created because of economic growth (Lacey & Wright, 2009).

In contrast, none of the top 30 occupations showing steady decline involves postsecondary education (Lacey & Wright, 2009). Further, as manufacturing jobs have been lost to overseas production sites, U.S. workers have often found that their on-the-job training did not translate to other manufacturing sites, and even though a worker had 20 years experience in one plant, that worker required extensive retraining to work in another production facility. The stagnant growth and increasing job insecurity in the manufacturing sector have emphasized the need for postsecondary education to better prepare the work force (Lacey & Wright, 2009). Over the next decade, employment needs will expand among occupations requiring entry-level worker to have postsecondary education (Bartsch, 2009).

Community College Enrollment: Response to Changing Demands

Given the fundamental shift in the economic infrastructure, the concurrent impact on the labor force, and the demand for a more educated workforce, enrollment in associate degree programs has gradually increased (Lane, 2003). Between 2007 and 2008, community college enrollment increased 1.1%, from 3.1 to 3.4 million among 18 to 24 year old students, whereas enrollment among 18 to 24 year old students at 4-year colleges reported no change (Fry, 2009). Several factors likely affected this trend. First, postsecondary enrollment usually increases during a recession because of higher unemployment rates; if laid off or unemployed, some people decide to invest their education to become more competitive in the job market whereas newly graduated high school students who cannot find employment may decide to continue their education while the economy improves (Fry, 2009). Second, community colleges are less expensive (average tuition and fee costs $2,544 per year for full-time study), than either in-state public or private 4-year institutions that are likely to cost 2.80 to 10.33 times more per year (Baum & Ma, 2011). The financial accessibility of community colleges have especially benefited women and low-income and minority populations (Lane, 2003). In addition, community colleges maintain open-admission policies that require only a high school diploma for

enrollment (Perin, 2006). These two factors, low cost and "open-door" policies have most benefited low-income individuals, many of whom are women and minorities (Bloom & Sommo, 2005; Horn, Nevill, & Griffith, 2006; Kuh, Kinzie, & Buckley, 2007).

Student characteristics. Today, minority students comprise more than half of the student population enrolled in community colleges (Horn et al., 2006; Lane, 2003). Moreover, minority students also account for a greater proportion of the student body at community colleges than at 4-year institutions (Kuh et al., 2007; Lane, 2003). Women account for 58% of the community college population (Horn et al., 2006; Lane, 2003). The increase in women students is attributable to the acceptance of women's changing roles in marriage, the workplace, and education; and the economic benefits of a college degree. Since 1972, women have steadily increased their high school graduate rates, participation rates in college, and in 2001 outnumbered men in postsecondary degrees attained (Kuh et al., 2007).

Similarly, community colleges have offered access to postsecondary education for many students who are the first in their families to go to college, termed *first-generation students*. First-generation, traditional aged students account for over one-third of all undergraduate students (36%; Horn et al., 2006), and over one-third (40.8%) of the student body at community colleges (Engle, 2007). In general, first-generation students are more likely to be Hispanic, African American, women, and low income (Horn et al., 2006; Kuh et al., 2006).

Education as Proxy for Work Readiness

Employers increasingly use postsecondary education as a proxy for work readiness which entails analytic, collaborative, and soft skills. Even though labor shortages currently exist, such shortages are expected to increase as educational attainment lags behind workforce needs (Corporate Voices for Working Families, 2008; Soares & Mazzeo, 2008). In addition to shortages, the aging workforce is approaching retirement, which will leave a high proportion of highly skilled employment opportunities and upper management level positions available. The importance of improving degree completion rates among minority students corresponds with the expected rate at

which these populations will have members entering the labor force (Soares & Mazzeo, 2008). In 2008, Hispanics comprised 14.3% of the civilian labor force with more than 7 million Hispanics expected to join the labor force by 2018 (Bartsch, 2009). Similarly, African American and Asian participation in the labor force is expected to increase within the next decade, 14.1% and 29.8%, respectively (Bartsch, 2009). As compared to a 0.5% annual growth rate for Whites' participation in the labor force, all minority groups will experience an annual increase ranging from 1.3% to 2.9% (Bartsch, 2009). These growth rates in the labor force are an increasing concern because less than one-half of community college students enroll their second year, and less than one-fourth attain an associate's degree within 6 years of enrollment (Soares & Mazzeo, 2008). In other words, the growth rates in the labor force combined with high attrition rates of community college students means that an increasing number of American young adults are going to be unprepared for employment and will face ongoing difficulty finding employment in the expanding service sector.

Attainment Gap

The disproportionate number of low-income and minority students enrolled at community colleges exacerbates the disparity in degree attainment.. More than half of community college students are in the two lowest income quartiles, with less than 1 in 5 of students in the lowest income quartile attaining an associate's degree in six years of initial enrollment (Bailey et al., 2005). An attainment gap also exists among minority status students. Less than 30% of African American and Hispanic community college students earn an associate's degree within six years (Bliss & Sandiford, 2004; Soares & Mazzeo, 2008). Moreover, degree attainment differs between men and women, with substantially more women completing their degree requirements than men (Bailey et al., 2005; Bailey, 2006; Haskins, Holzer, & Lerman, 2009). This gender disparity is the same across minority status, where substantial differences exist between African American men and women in degree attainment. However, the attainment-gap narrows for gender and minority groups as income increases (Dervarics, 2000). Low-income and minority students are disproportionately represented in

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community college enrollment but substantially underrepresented among those attaining associate degrees.

Attaining an associate's degree is related with a host of positive benefits (Crissey, 2009). Minority and female students experience greater benefits from attaining an associate's degree as compared with their non-degree earning counterparts (Lane, 2003). The median income for a person with an associate's degree is $40,600 before taxes; nearly 3.98 times higher than the federal poverty level (Baum & Ma, 2011; Soares & Mazzeo, 2008). There are also several public benefits of higher education. For example, adults holding an associate's degree paid $8,400 after tax-income; paying over $1,900 more taxes than high school graduates. Overall, as compared with peers that did not complete a college degree, for those who attain an associate's degree that achievement is the first step to establishing economic stability and deriving important social benefits.

The changing economic landscape in the United States is affecting the labor market. The increasing need for an educated workforce is a result of declining manufacturing industries and the expanding service sector. However, shortages of qualified workers already exist and such shortages will increase precipitously as the baby boomers retire despite high enrollment rates at community colleges. The shortage of workers with a postsecondary degree is due to enrollment rates exceeding the rate of degree attainment, and this attainment gap is projected to continue. More troubling is the low rate of degree completion among community college students with low income or minority status because these students are expected to represent the greatest growth in labor participation. These students disproportionately represent those who enroll but do not complete an associate's degree program. The rate of enrollment at community colleges by low-income, minority students, underscores the importance of understanding ways to improve their low rate of degree attainment.

Manuscript I: Explaining Early Exits from Higher Education: Integrating Tinto's Interactionalist

Theory and Coleman's Theory of Social Capital

Today, there are over 7.4 million students enrolled for credit at more than 1,167 community colleges in the United States (American Association of Community Colleges [AACC], 2011). Compared to four-year institutions, public community colleges are financially accessible, nonselective, and conveniently located. They offer diverse degree and certificate programs and provide an array of support services to students (Phillippe & Sullivan, 2005; Porter, 2002). Despite accounting for 45% of the total undergraduate enrollment rate, only half of first-time, full-time public community college students pursuing an associate's degree persist to their second year of college. Of those persisting, only one-third of them attain an associate's degree within three years (McIntosh & Rouse, 2009). The disproportionate number of low-income and minority students enrolled at community colleges contributes to the disparity in degree attainment compared to four-year institutions. Minority students comprise 45% of the student population enrolled in community colleges (AACC, 2011). Less than one-third of African-American and Hispanic students earn an associate's degree six years after initially enrolling at a community college (Bliss & Sandiford, 2004; Soares & Mazzeo, 2008). More than half of community college students are in the two lowest income quartiles, with less than 20% of students in the lowest income quartile attaining an associate's degree within six years of initial enrollment (Bailey, Jenkins, & Leinbach, 2005). Women account for a greater percentage of the community college population than men (Bailey et al., 2005), mainly due to their changing roles in marriage, the workplace, education and to the economic benefits of a college degree. In 2008, women outnumbered men in postsecondary degrees attained from all colleges, contributing to a growing gender disparity across higher education (AACC, 2011).

Community colleges offer access to postsecondary education for first-generation college students, or those who are the first in their families to go to college. First-generation, traditional-aged students account for over one-third of all undergraduate students (Dervarics, 2000) and 42% of the student body at community colleges (National Center for Education Statistics, 2009). In general, first-generation students are more likely to be Hispanic, African-American, female, and low-income (Kuh et al., 2006; Engle, 2007; Horn et al., 2006; Nomi, 2005). Among minority groups, Hispanic students are more likely to be first-generation students (53%), followed by Native Americans (43%), and African-American students (41%) (Nomi, 2005). First-generation students are more likely to come from low-income households; the median annual household income of first-generation students is approximately $31,000, which is lower than the household incomes of non first-generation college students (Nomi, 2005).

Overall, low-income, minority, and first-generation students are disproportionately represented in community college enrollment but substantially underrepresented among those attaining an associate's degree. Given what we know about who persists and who does not, this paper presents theoretical perspectives and models applicable to the problem of attrition and an integrated framework that can potentially provide guidance on intervention points for these students.

Literature Review

Explanations for Early Exits

There are several competing empirical and theoretical explanations of student exit from college, although these explanations are not specific to community college students. Among other often-cited perspectives, psychological, economic, and sociological perspectives propose explanations for students' early departure from college. The field of psychology offers psychosocial conceptualizations, including internal locus of control, self-efficacy, and motivation, to explain college attrition. From the economic perspective, human capital theory explains the cost-benefit of

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education as the reason for pursuing or leaving higher education. Finally, sociological frameworks propose individual-environment interrelationships that influence student exits from college.

Psychological perspective. Psychological theories explain the relationship between psychological factors and student outcomes, including academic achievement, engagement, college adjustment, and persistence (Kuh et al., 2006). For instance, one indicator of persistence in college is the perceived notion of belonging in college. College students involved in academic and social activities report higher levels of a sense of belonging compared to students not involved in such activities (Hausmann, Schofield, & Woods, 2007). Coping is another concept linked to college success. In a qualitative study of students' coping processes in college, students' responses to stressful situations involved having access to and seeking social support. Students reported that the guidance they received in these interactions helped them cope with the problem (Phinney & Haas, 2003). Another theme described by students was self-efficacy. Phinney and Hass (2003) discuss that students who believe they have the ability to succeed perceive college as a positive and helpful environment. Psychological states such as coping and self-efficacy are therefore two mechanisms that seem to affect student success in college.

Research has shown that among low-income, minority, and first-generation college students, psychological states affect students' decisions to exit early from college (Kuh et al., 2007; Ramos-Sanchez, 2007). Barefoot (2004) found that a student's decision to persist in higher education is related to his or her goal commitment, which is a function of psychological characteristics such as maturity, academic focus, or career aspirations. Wang's (2009) research identified additional factors associated with early student departure from community college, including boredom, negative attitudes towards the institution, stress, and disengagement. Yet, psychological states are not isolated characteristics, as they relate to environmental factors and life experiences of a student, such as lack of academic preparation, inaccurate or limited understanding of college expectations, and insufficient social and financial resources (Pascarella, Pierson, Wolniak, Terenzini, 2004). Among community

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college students, first-generation college students' educational aspirations, reasons, motivations, and goals for attending college differ from their peers'. These differences are associated with a higher likelihood of first-generation students' reporting depression, anxiety, low self-esteem, low self-efficacy, and isolation in college than their peers (Muraskin, Lee, Wilner, & Swail, 2004). Overall, the psychological perspective presents wide-ranging theoretical and conceptual explanations for college students' completion and non-completion from higher education.

Economic perspective. To better understand the underlying factors affecting students' decisions to exit higher education, the economic theory of human capital can be examined. The theory of human capital proposes two basic assumptions: investments in education affect an individual's economic and social outcomes; and the perceived cost-to-benefit ratio of an investment in education (i.e., financial, personal, psychological) affects an individual's decisions to invest in his or her education. The emergence of human capital theory came after Theodore Schultz's presidential speech at the American Economic Association in 1960. In his address, he emphasized the economic value of education, specifically for the individual and society (Inman & Mayes, 1999; Murtaugh, Burns, & Schuster, 1999). Soon thereafter, Gary S. Becker's (1964) seminal book, *Human Capital*, introduced an essential methodology for studying the economic and non-economic benefits of human capital investment. Using census data from 1939 and 1940 cohorts, Becker found that investments in education for high school graduates and college graduates were not "an economic waste" for individuals (Becker, 1964, p. 93). Becker's (1964) findings suggested investments in education produced positive economic benefits. Throughout the 1960s, Becker's work laid the groundwork for research on the economics of education. During this period, researchers published over 1,350 studies providing extensive empirical support for the economic value of education (Teixeira, 2000). The association between investment and economic benefit was confirmed, firmly establishing two principles central to human capital theory: investment in education affects economic performance of

the individual and society; and investment decisions are based on cost-benefit processes (Teixeira, 2000; Sweetland, 1996).

Human capital theory is based on the assumption that, in choosing to pursue education and training opportunities, individuals increase their value when competing in the labor market (Dictionary of Human Resources Management, 2008). Accordingly, a majority of students enroll in college to improve their chances of securing an economically stable job (Sweetland, 1996). However, this proposition does not take into account other barriers that may affect pursing one's education. Some key barriers to choice include poverty, discrimination, accessibility, and lack of information, resulting in inequitable human capital investment (Neenan & Orthner, 1996; Porter, 2002; Teixeira, 2000). Human capital theory trivializes formal and informal barriers, such as limits to individuals' abilities to properly invest in their human capital.

Empirical research of early student departure from college supports the assumption that students' abilities to invest in their human capital are inequitable. In other words, early college departure is more likely when students believe and determine that the costs of pursuing a college education outweigh the economic benefits. This finding echoes the second principle of human capital theory, that investment decisions are based on cost-benefit analyses (Teixeira, 2000, Sweetland, 1996). Socioeconomic status affects college persistence because it determines students' ability to pay for college. For example, students from high-income households receive about four times more financial assistance from their families than do low-income students (Baum & Payea, 2005). Lacking this financial resource, low-income students compensate by seeking various types and amounts of financial aid or employment. According to Ishitani (2006), students who do not receive financial aid are more likely to leave college compared to students who received either work-study or federal grants. The likelihood of degree attainment among students receiving work study was 81% compared to students not receiving work-study their first year. Despite these positive results, other forms of financial aid such as loans have mixed impact on degree attainment. Compared to students receiving

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federal grants, students receiving loans were 20% less likely to graduate on time (Baum & Payea, 2005). As such, low-income students' ambivalence to incurring substantial loan debt may contribute to their decision that leaving college is a rational economic decision (Ishitani, 2006).

Muraskin and colleagues (2004) suggest that even with financial assistance for college, students may resist loss of income. Evidence of full- or part-time employment, especially among community college students, is high compared to students attending four-year institutions. Schoeni and Ross (2005) indicate that about 41% of community college students worked full time in 2003. Degree-seeking students at community college students working full-time while enrolled in 2003 had lower odds of retention at their first institution than did part-time or non-employed students and lower odds of re-enrollment after their first year of college (Haskins, Holzer, & Lerman, 2009). In addition to time constraints due to work, barriers to human capital investment among community college students include indirect financial costs and family obligations such as caring for a parent or a child (Horn et al., 2006). Hiring an independent caregiver or enrolling a child in daycare are economic costs that low-income students cannot afford. Compared to moderate- and high-income students, attrition from higher education among low-income students is associated with caring for dependents, working more hours per week relative to their peers, attending college part-time, being a single parent, and reporting higher levels of financial stress and family responsibilities (Horn, 2009). Low-income students' direct and indirect costs associated with attending college clearly exacerbate early exits from higher education and thus undermine the benefits of persisting and completing college.

Sociological perspective. Human capital theorists faced unsettling criticism in the 1970s, despite efforts to use robust statistical applications to estimate rates of return to education. Critics identified several substantive and methodological issues with human capital theory, including inaccuracies in computing education costs, disregard for non-economic benefits to education, few attempts to measure education quality, and overreliance of cross-sectional rather than longitudinal data (Teixeira, 2000). Most concerning was relationships among education; and economic and social

mobility. Education sociologists highlighted the dubious role of education in promoting social mobility through equitable income distribution (Cain, 1976). In other words, although subsequent levels of education demonstrating increases in economic returns were readily accepted, the variance within educational cohorts (i.e., high school diploma, college degree, or graduate degree) was found to be more significant than the variance between cohorts (Bosanquet & Doeringer, 1973). For example, significant income differences among high school graduates were found between advantaged and disadvantaged groups characterized by race and socioeconomic levels.

Skepticism surrounding the association between educational attainment and economic mobility extended into the 1980s. This uncertainty drew attention to social, psychological, and economic factors associated with educational attainment and outcomes. Consequently, the overwhelming inequalities in educational outcomes were attributed to fundamental differences in access to community and school resources and to a greater extent, to individual attributes and psychological characteristics (Blaug, 1976, 1985; Bourdieu, 1986; Coleman, 1967).

Following the 1970s, cultural capital theory became an explanation for disparities in educational attainment. Within the context of higher education, cultural capital is the accumulation of non-monetary resources acquired through the process of socialization of the student through interactions with faculty, peers, and college administrators. Students enter higher education with cultural backgrounds that may be consistent or inconsistent with the culture of higher education. In order to be successful, students who do not already possess cultural capital consistent with the culture of higher education must obtain it in order to reach their educational objectives. For first-generation students, the lack of cultural capital may be due to the absence of intergenerational factors associated with having college-educated parents. Cultural capital includes resources such as "knowledge of socially valued norms, behaviors, competencies, information, and beliefs" (Garnett, Guppy & Veenstra, 2008, p. 145) that serve to facilitate a student's college experience and that are strongly linked to educational success. According to Garnett and colleagues (2008), acquisition of cultural

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capital is not sufficient to fit in with the dominant culture, but it is necessary. Moreover, Robbins (2005) suggests that the value of cultural capital is its exchange between one's own culture and the dominant culture (i.e., unfamiliar cultures). Accordingly, cultural capital alongside students' social and economic characteristics impacts departure from higher education (Phinney & Haas, 2003).

Despite the contributions of psychological, sociological, and economic perspectives to explain student exit from higher education, a psychosocioeconomic perspective to understand the longitudinal process of students' decision-making was needed. In 1975, Tinto incorporated these three theoretical perspectives into a comprehensive, longitudinal framework to explain student exit from higher education (Neuville et al., 2007; Tinto, 1975; Tinto, 1993). Figure 1 illustrate of Tinto's model in which students' academic attributes and socioeconomic and psychological characteristics affect their integration within the college environment, and thus affect their goals and commitment to pursing higher education.

Tinto's Interactionalist Theory

Tinto's interactionalist theory is a widely-cited, comprehensive model combining psychological, economic, and sociological perspectives to explain exit from higher education (Tinto, 1975). Although more research is needed, studies have found that Tinto's model is applicable to community college students (Lohfink, 2005; Young, 2007). In brief, Tinto's model posits that the college institution is a social system founded on a set of values and social structures to which the student adheres in order to form an attachment to that organization or system (Fox, 1986; Guarino, Michael, & Hocevar, 1998; Karp, Hughes, & Gara, 2008). Normative integration, the convergence of an individual's value system and societal values, and collective integration, the extent to which an individual is affiliated with a social group, influence college departure (Durkheim, 1951; Elkins, 2000; Karp et al., 2008; Tinto, 1975). Within the college context, Tinto refers to these two forms of integration as academic and social integration, with academic integration referring to a students' ability to accept academic norms (i.e., attending class, seeking academic assistance, and earning

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passing grades) to achieve academic success (Neuville et al., 2007; Tinto, 1975) and social integration defined as the extent to which the college environment complements or satisfies students' preferences and strengthens their institutional commitment or affiliation (Guarino et al., 1998). Both academic and social integration influence academic success. Thus, attachment to and exit from college are conditioned on the associations among an individual's educational values, the values of the educational institution, and the extent to which the individual interacts with members of the college system (Elkins, 2000; Tinto, 1975).

Tinto (1975) proposed additional factors that predict levels of normative and collective integration, such as socioeconomic status and high school grades, which he assumed were related to educational persistence. Further, Tinto's model includes individuals' psychological attributes such as motivation and educational expectations to explain college departure (Elkins, 2000; Tinto & Pusser, 2006; Tinto, 1975). For instance, a student engages in normative and collective integration in college by means of his or her commitment to an educational goal (Tinto, 1975). In addition, institutional commitment, referring to individuals' predispositions to attend specific institutions over other optional colleges, is hypothesized to have a significant influence on educational persistence (Elkins, 2000; Tinto, 1975). Tinto argues that a predictive model must include data relevant to institutional commitment to substantiate conclusions about students' educational persistence. Including these components, that is varying forms of individual characteristics and psychological (e.g., motivation, expectations) attributes, may help explain students' educational outcomes.

Given individuals' background characteristics, goal commitments, and institutional commitments, Tinto's theoretical model further recognizes the interaction between these conditions and the college experience over time (Karp et al., 2008). As specified in the model, individuals' predispositions (i.e., individual characteristics, psychological attributes, goal and institutional commitments) predict the manner in which normative and collective integration occurs in the academic and social settings of the college experience (Tinto, 1975). Tinto argued that academic and

social integration are situated in a longitudinal process; further, integration has an effect on goal and institutional commitments (Tinto, 1993).

Tinto also posited that external pressures (e.g., employment, childcare responsibilities) concurrently affect individuals' commitments rather than directly affecting their educational outcomes. Tinto's argument is based on the economic theory of cost-benefit analysis, in which an individual's decision to persevere outweighs the costs of an activity relative to other options (Engle, 2007). In Tinto's model, cost-benefit analysis is specified as a change in an individual's commitment level. Accordingly, this analysis supports the assumption that integration affects commitment. In summary, it is through the academic and social college experience that individuals' initial goal and institutional commitments are modified, and those modifications subsequently affect student exit from higher education.

Despite the comprehensive explanation of student departure given by Tinto, this interactionalist theory falls short of explaining how students develop academic and social integration within a college setting. Although Tinto's framework provides insight into why some students persist and others do not, his paradigm does not clarify the role of and processes underlying students' college experiences, important components in explaining college exits. To fill this gap in Tinto's theory, I employ Coleman's theory of social capital to show in students' college experiences are affected by their academic and social integration while in college. Integrating Coleman's theory of social capital with Tinto's interactionalist theory illuminates the role and processes by which social capital relates to students' college experiences (i.e., social and academic integration) and departure from higher education.

An Integrated Explanatory Model of Early Exits

Tinto's framework significantly contributes to our understanding of the academic (e.g., classroom, student-faculty interactions) and social (e.g., participation in sports, clubs) environments' effects on early exits from college. Research findings suggest an association between integration and

student departure (Kuh et al., 2006). However, Tinto and Pusser (2006) detail the need to identify and explain how academic and social interactions occur and why these interactions affect integration. Understanding the mechanisms by which integration occurs is important because these mechanisms may help explain the variation found in students' academic and social integration experiences. Further, the processes underlying integration may also facilitate ways to mitigate early exit from college. For these reasons, an integrated model is proposed using Coleman's theory of social capital to explain how Tinto's conceptualizations of academic and social integration develop within the context of the college environment. By proposing the integration of these two theoretical perspectives, I suggest that early exit from higher education may be better understood as a function of social capital. Accordingly, an integrated explanatory model of early exit incorporating social capital is appropriate (see Figure 2).

Coleman's Theory of Social Capital

Sociologists and social workers have long posited that individuals' actions are shaped by their environment. Expanding the sociological perspective, Coleman (1988) applied rational choice economic theory to suggest that individuals choose to maximize the benefits over costs of their behaviors and that rational or purposive behaviors in combination with social context explain individuals' actions. Coleman further emphasized that maximizing the benefits of one's own behaviors is particular to social settings and contributes to the development of social structures. Building from this framework, Coleman (1988) suggested that social capital is "defined by its function" (p. 305); in other words, the function of social capital is derived from an individual's interaction with a social structure and actions within the social structure. The interaction between individual and social structure can be examined through Coleman's conceptualization of social capital.

In his work, Coleman (1988) discusses the notion of closure as a function of social capital to explain social structures and relations among individuals. Closure is a set of sanctions or rewards that

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guide and monitor behavior that characterize social relations (Adler, 2002; Perna, 2005; Talburt, 2005; Zhao & Kuh, 2004). In the absence of sanctioning, Coleman (1988) argued that a collective has limited influence on a member's actions. The effect of closure on degree attainment can be described as the way in which the social system (i.e., faculty, peers, students, and staff), with set expectations and obligations that connect members in particular ways, can influence student behavior. For example, in a regular classroom, students do not have mechanisms to sanction or reward each other. However, in particular social structures like group projects, peer assessment is one mechanism that allows student group members to hold each other accountable by providing feedback and evaluating each other's work. This method provides a process by which sanctions (e.g., negative feedback or grade) and rewards (e.g., positive feedback or grade) help group members collectively guide and monitor their behaviors. Variations of closure as a mechanism, such as closure in student-tutor or student-faculty social relations, also set norms to direct positive behavior and reduce deviant behavior (Coleman, 1988). The notion of closure as a characteristic of social structures and relations is important for two reasons. First, closure is more likely to ensure the implementation of effective social norms (Xiao & Lucking, 2008). Second, closure strengthens trustworthiness of social relations, consequently expanding collective obligations and expectations (Karp, 2011). Thus, closure of social relations produces "trustworthiness in a social structure" (Coleman, 1988, p. S108).

Student-faculty relationship is an example of a dyad that is important and relevant to the effect of closure on student outcomes. In a qualitative study of minority community college students, faculty who were personable and approachable, worked individually with students, and provided meaningful feedback to students appeared to positively affect student attitudes and behavior. Rendon (1994) found that validation, a process initiated by faculty, peers, or staff to acknowledge a student academically and interpersonally, helped students gain trust, meet academic expectations, and persist in college. In addition, validation encouraged and strengthened students' attitudes and behaviors towards college success. In contrast, students' doubts in their academic ability or decision to leave

college coincided with faculty who did not seem to demonstrate concern for students, confusing learning experiences, and lack of close, meaningful relationships with faculty, peers, or college staff. Closure appears to be an important mechanism for guiding student behavior and attitudes, which are important precursors to persistence in college.

Another mechanism that fosters closure is norms. Norms guide and monitor individual behavior and are usually prescribed by a group (Rendon, 1994). Prescriptive norms are in some cases internalized by the individual or reinforced by external pressures, thus facilitating or constraining action (Bhandari, 2009; Coleman, 1988). In his work, Tinto (1993) contends departure from college is a result of students' inability to understand and internalize norms, specifically institutional norms. However, Tinto does not posit how norms develop. Coleman (1988) contends norms are instituted through closure and that they also serve as a mechanism that guides student behavior. Coleman (1988) further asserted that norms may guide action in one direction and away from alternative activities. The applicability of prescribed norms to the community college environment is evident. Students are informed about the consequences of policies and regulations that guide behavior, and students interact within formal and informal contexts in which their peers, faculty, and other staff reinforce behavior that promotes educational success. Thus, norms in a community college environment that provide effective reinforcements for degree attainment facilitate the purpose of the college.

The function of social capital is also derived from social exchange inherent in social relations. Tinto's model provides no information about how students form social relations within academic and social systems or about the effects of social relations on student outcomes. Tinto (2006) acknowledges the need for further understanding of social exchange in the college environment, specifically faculty interactions with students, and the subsequent effect that social exchange has on student behavior. Social capital theory allows for the integration of this social exchange component into Tinto's model, so social relations complement the mechanisms of closure and norms. Social

relation is defined as social exchanges that facilitate the accumulation of capital resources for individuals. Coleman (1988) identified three reciprocal mechanisms of social exchange: obligations, expectations, and trustworthiness (Karp, 2011; Perna, 2005). For example, if a student performs a task for a colleague, the student will trust the colleague to reciprocate in the future. As such, an expectation by the student and an obligation by the colleague are established. In another example, students and faculty in a mentoring relationship trust in one another to exchange information and collaborate. This social relation is a form of social capital within a reciprocal system of obligations, expectations, and trustworthiness. Coleman also explained that obligation is a function of two elements, trust and accountability, both of which are framed by the social environment in terms of the way in which repayment will occur and the extent to which accountability is applied (Coleman, 1990). In the mentorship example, obligation is characterized by the extent of trust the student has in the faculty member as a legitimate source of social capital and vice versa. Within this same social exchange, accountability is the process in which the student and faculty member hold each other responsible for their respective obligations. Thus, the mechanisms of trust, obligations, and expectations in social relations facilitate closure and norms that guide student behavior.

In addition to mechanisms of social exchange, social relations also facilitate information exchange. Information serves as the basis for action (Folger, Carter, & Chase, 2004). Given the costly process of acquiring information, Coleman (1988) suggested social relations provide information that facilitates action. These social relations are important merely for the information they provide, rather than for the debt accrued from an owed obligation. One illustration of information exchange prevalent in community colleges is peer-to-peer interactions through small group discussions, group work projects, social events or activities, and formalized programs such as learning communities (Coleman, 1988).

At higher education institutions, a number of activities such as mentorship programs, professional student organizations, and study groups are thought to impact student persistence and

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academic performance. Though not explicitly grounded in theory, the stated goals of these activities or interventions mirror a number of Coleman's concepts. Applying Coleman's (1988) conceptualization, college students' access to and participation in the aforementioned activities may affect their social capital. For example, participating in a professional organization (e.g., practical nurse student organization, student occupational therapy association) builds social capital that can be accessed by students for professional development thereby providing social resources that aid in moving students from individual professional training (i.e., course work) to professional affiliation. The professional organization represents social capital that facilitates the attainment of resources or goals that may not otherwise be realized (Coleman, 1988; Karp, 2011; Palmer & Gasman, 2008).

Learning communities are defined as a social structure designed within an academic setting to create social capital through relationships developed within them. Implemented at two- and four-year institutions, learning communities are designed to engage students in the college environment through an institutionalized educational social structure. The learning community strategy groups students together in a set of semester courses. The premise of learning communities is that students actively participate in learning while building relationships through interactions with faculty and peers. Specifically, assigning tutors and counselors, faculty-team teaching, and required study group sessions are programmatic components intended to affect students' social relations and educational outcomes. Students' in learning communities have been shown to have higher rates of engagement, increased levels of college satisfaction and belonging, higher course pass rates, improved academic performance, and enrollment in the third semester (Bloom & Sommo, 2005; Zhao & Kuh, 2004). According to Zhao and Kuh (2004), learning communities provide students with both social and academic experiences that are integral for student success. These programmatic components are not explicitly grounded in any particular theoretical framework, yet these components closely follow Coleman's conceptualization of the value of social capital as inherent in functions of social structures.

In Folger and colleagues' (2004) small group intervention, social relations as a function of social capital fostered information exchange. Students were introduced to resources on campus, educational and social activities, academic assistance, career counseling, and advising services. Students were also given information on how to connect and engage with faculty, staff, and other students on campus. In interviews with students at two urban community colleges, Karp and colleagues (2008) found that social exchange served as a mechanism for relaying information. For instance, social relations facilitated information exchange through word of mouth and campus tours with faculty and peers. Participants acquired important information about their college, institutional procedures, particular courses or faculty, support services on campus, and graduation requirements from peers, faculty and staff. Karp and colleagues (2008) also noted that the mechanisms of social relations, such as expectations and trust, not only facilitated information exchange but also strengthened students' institutional commitment and persistence in college. Despite its association with college persistence or exit, information exchange is conceptually absent from Tinto's framework. Coleman contributes to Tinto's model by accounting for the importance of information exchange inherent in community college students' academic and social relations.

Implications

This integrated framework provides opportunities to test new hypotheses examining the processes and mechanisms inherent in the function of social capital to explain academic and social integration. First, in the casual model, Tinto's theory would serve as a good foundation and Coleman's addition may better explain variance in persistence. Second, testing this integrated model may produce benefits for college administrators who seek to improve practices that directly affect students' academic and social integration. By examining the role of social capital in the development of academic and social integration, early exit from higher education may be mitigated, especially at community colleges.

By serving a diverse student population with differing goals and providing numerous pathways to achieving those goals, community colleges may be able to further impact student educational outcomes. The extent to which community colleges actively enhance academic and social integration to assist students in meshing their goals with those of the institution can have a powerful effect on developing social capital among students. Community colleges should attempt to disrupt college departure by creating conditions that develop, enhance, and strengthen social capital. Drawing from existing research on higher education, the integrated framework proposed in this paper has several implications for community college faculty, institutional policy, and future research.

Education Practice

The role of community college faculty and their educational practices are essential components in conceptualizing Coleman's social capital framework, while also complementing Tinto's interactionalist theory. Known to mitigate early college exit, two areas that require thoughtful reconsideration are faculty-student interactions and faculty's teaching practices. College instructors who promote and implement academically purposeful activities both in and out of class and positively interact with students are more effective than those who do not (Karp, 2011). For example, an open-door policy, where a professor sets times to meet with students, is one method where faculty can engage with students about their academic work, provide assistance, and learn about challenges they face both in and out of college (Karp et al., 2008). These methods help build social capital to affect students' social and academic integration. Therefore, faculty and the techniques they use in and outside of class can help foster a college culture where integration shapes students' goals and institutional commitments.

Peer interactions and mentoring programs are two ways to cultivate social capital. Mentoring groups and meaningful student relationships comprise social structures that provide a student with psychological and social support, a venue to discuss goals and career aspirations, academic assistance, and a mentor or peer to hold him or her accountable (Baird, 2003; Schroeder, 2003).

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Although research is limited to four-year institutions, mentoring programs involving peers, faculty, or college staff have had positive effects on students' perceived social support, college satisfaction and adjustment, academic performance, and persistence (Palmer & Gasman, 2008). For these reasons, the development and implementation of mentoring programs in community colleges; and their effects on low-income, minority, and first-generation students need to be strongly considered.

The role of student affairs professionals, specifically social workers, counselors, advisors, and mental health specialists at community colleges, is to provide supplemental support for students. These professionals are the primary social, emotional, and behavioral resources for students with diverse needs and barriers to college success. Currently, community colleges offer academic and social support programs such as remedial and student support services. However, this traditional method of providing services is not ideal for several reasons. First, students are not compelled to seek these services unless they are referred, they are required to enroll, or there is an urgent situation or emergency that may affect a student's academic progress. Second, students may not have adequate information or they may be unaware of how student services can help them meet their educational objectives. To ensure all students have equal opportunity to succeed in college, student support services need to complement rather than supplement academic services.

Last, several practice methods are available to provide comprehensive academic and support services (Crisp & Cruz, 2009). One practice method gaining importance at community colleges is assessing students' academic and social progress over time. For example, at the outset of a student's college experience, it is essential for service providers to assess each student's strengths and the potential barriers she or he might face over time. By recognizing these diverse characteristics and gathering adequate information, student service professionals have a distinctive role in positively shaping students' college experiences (i.e., academic and social integration) during their educational careers.

Institutional Policy

Institutional policies are essential for transmitting and reinforcing norms that inform all students of regulations and requirements needed to graduate. Because these policies, such as degree requirements, are explicitly stated, the means to provide timely information of student progress to practitioners is important. Timely information is essential because appropriate actions by instructors could be taken if student progress is negatively affected in some way. One approach gaining momentum among community colleges is employing data-driven systems to collect and use data to address difficulties students face. For instance, collecting data from a faculty-student mentorship program may demonstrate if weekly meetings with a faculty member have an effect on students' academic performance and social involvement. Further, incorporating student feedback in data collection allows for continuous improvement of institutional practices, and institutional policies. Another objective of implementing a data-driven system should be to identify students at risk of early departure and to target resources such as first-year interventions or programs, student services, tutoring, or counseling to mitigate challenges students may face while in college. This early warning system should reinforce institution norms, values, and expectations communicated to students upon matriculation while also providing students with timely feedback and safety nets. Finally, community colleges should reconsider the classroom as the focal point for creating a college culture amenable to academic and social learning. Learning communities may improve community college students' academic learning through social relations in the classroom because these are predominantly commuter students, and their time spent on campus is predominantly in the classroom.

Future Research

In examining the association between integration and student early departure from higher education, findings have been mixed (Kuh, et al., 2006). In large part, researchers have conducted studies to explore integration predominantly at four-year colleges (Crisp, 2009). However, these mixed results are due to both institution characteristics and, to a certain extent, to students' college experiences. Research on students' college experiences has been limited by assessing integration at

one particular point in time and by using small sample sizes (Bridges, 2008; Kuh et al., 2006). Community colleges attract a significantly different student population than do four-year colleges (Inman & Mayes, 1999). Accordingly, students' college experiences may differ based on the type of institution they attend.

For these reasons, research examining the relationship between social capital and integration is needed to better understand the social structure, social relations, and institution norms of community colleges. Further, social capital provides a lens to examine students' community college experiences. Psychometric properties of social capital need to be developed and tested. Subsequently, research and measures of social capital need to be assessed. Studies using nationally representative samples of community college students and longitudinal research designs are necessary to analyze social capital and integration covariates that may change over time and affect early college departure. Similarly, robust methods, such as growth curve analysis, are needed to control for time-varying and time-invariant covariates. These methods must also test for student subpopulations (e.g., first-generation students, minority students) effects and multi-level interactions between state, institution, and student-level factors. Two methods for analyzing these multi-level, covarying data include hierarchical linear modeling (HLM) and propensity score analysis, an innovative method that examines causality with quasi-experimental data, such as the effect of intervention programs on students' social capital development.

Conclusions

Compared to their peers, early college departure among low-income, minority, and first-generation students is a cause for concern. A multi-disciplinary perspective grounded in psychology, economics, and sociology elucidates our conceptual understanding of college exit and helps explain the mechanisms underlying students' decisions to drop out. These mechanisms may include intentions to enroll in college, commitment to invest time and money in postsecondary education, or the goal of attaining a college degree. As discussed in this paper, Tinto's interactionalist theory is a

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well-established paradigm that incorporates these multiple perspectives yet lacks explanations for mechanisms that affect students' social and academic integration. I argue that Coleman's theory of social capital fills this gap by clarifying the role and processes by which social capital may encourage students' academic and social integration–that is, their college experiences–therefore, enhancing our understanding of early departure from higher education.

Pre-entry Attributes   Goals/   Institutional   Integration   Goals/   Outcome
                       Commitments   Experiences   Commitments

Academic System

Formal

| Family Background | | Intentions | | Academic Performance |

| Skills and Abilities | | Goal and Institutional Commitments | | Faculty/Staff Interactions |

Informal

| Prior Schooling | | External Commitments |

Academic Integration

Formal

| Extracurricular Activities |

Social Integration

| Peer Group Interactions |

Informal

Intentions

Goal and Institutional Commitment

Departure Decision

External Commitments

Social System

External Community

Time(T) ⟶

Figure 1. Tinto's interactionalist theory

Goals/Commitments	Student's College Experience	Social Capital	Integration	Outcome

Pre-entry Attributes:
- Family background
- Skills and abilities
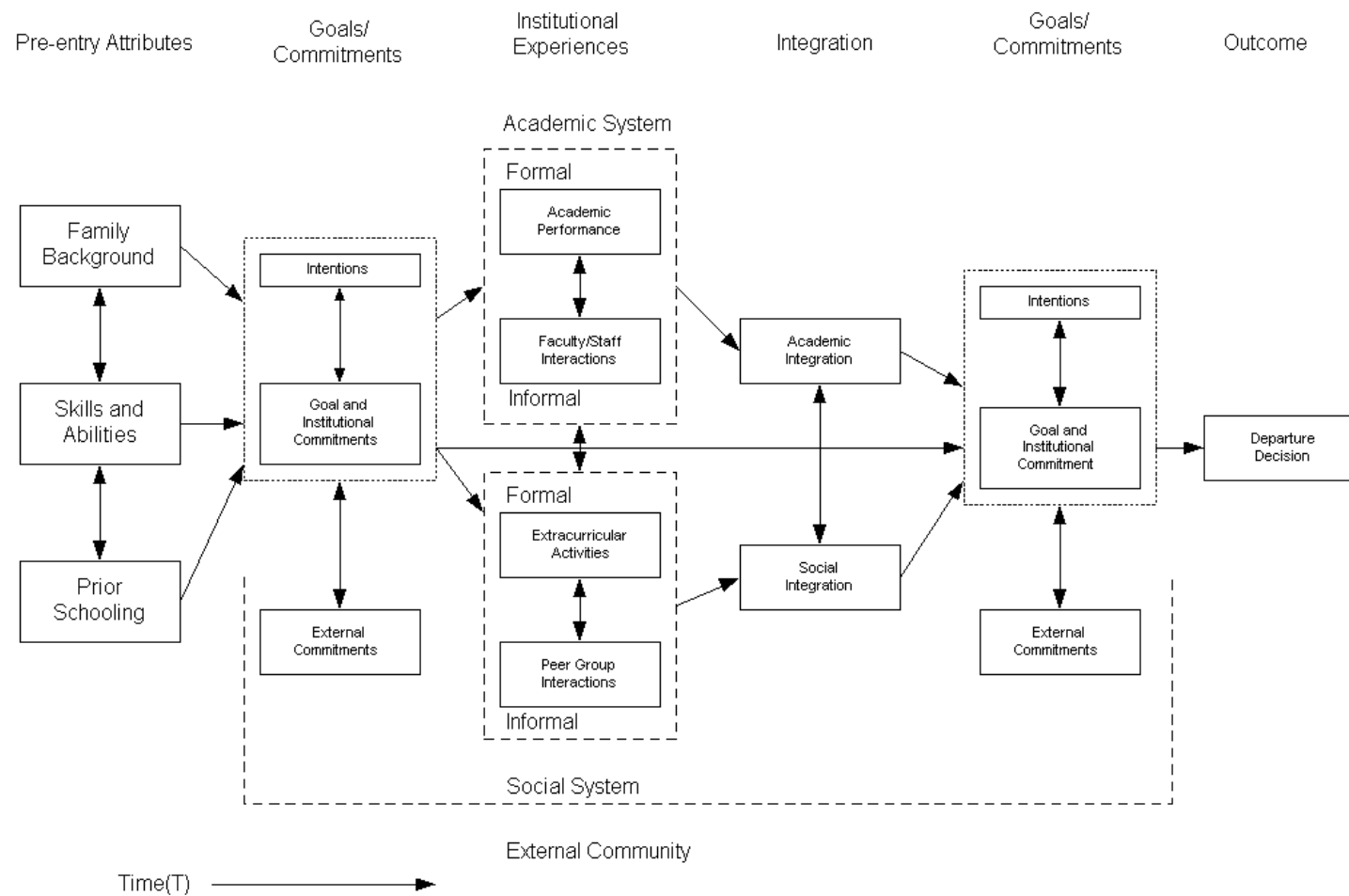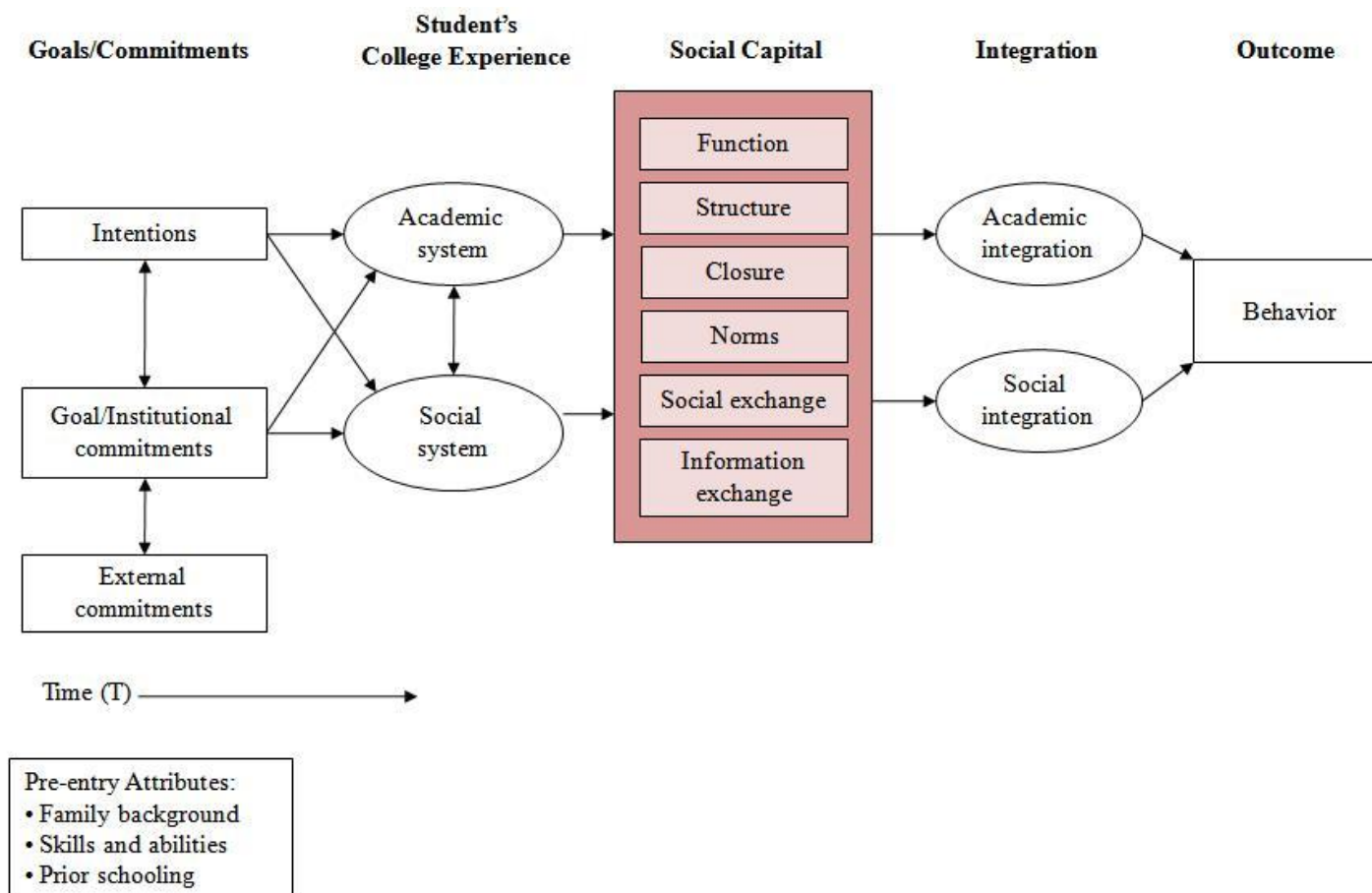- Prior schooling

Figure 2. Integrating Tinto's interactionalist theory and Coleman's theory of social capital

Manuscript II: A Multilevel Study Examining First-Generation College Status, Academic and Social Integration, and Educational Outcomes among Community College Students

Public community college enrollment has increased 475% since the 1960s, in part due to increased enrollment rates of low-income and minority students, many of whom are first in their families to go to college, termed *first-generation college students* (Phillippe & Sullivan, 2005). As a group, first-generation college students have the lowest rate of persistence and degree attainment (Arnold, 1999; Garcia, 2010). This group is especially vulnerable to leaving college without a degree for three reasons. The majority of these students are low income and minorities who lack the requisite social capital that can reinforce their motivation to complete their degree (Horn, Nevill, & Griffith, 2006; Lane, 2003). Specifically, these students' parents may not know or may not have reinforced the behaviors needed to succeed in college. In addition, students' limited understanding of norms and social relations that can support their learning may hinder their academic progress as well as their sense of belonging in college. Many first-generation college students therefore lack adequate preparation for college-level work and do know about the benefits of participating in academic activities, which in turn lessen their opportunity for academic integration, an important component for attaining a college degree (Garcia, 2010). Finally, first-generation college students often have difficulty with social integration, or fitting into the college environment (Tym, McMillion, Barone, & Webster, 2004). For example, these students are less likely to join social organizations and thus experience higher levels of social disengagement. Although community colleges provide access to low-cost, high-quality education, ensuring students meet their educational objectives is equally important.

This paper contributes to the higher education literature by examining the relationship between community college students' experiences and social capital factors posited to affect persistence and academic performance through modeling student characteristics as well as community college level factors. For this study, the first aim is to disaggregate student- and college-level factors and then examine relationships between multilevel factors and educational outcomes. Multilevel relationships are imperative to the study of education because context contributes to student educational outcomes (Berger, 2000; Denson & Chang, 2009; Frost, 2007; Hurtado, Han, Saenz, Espinosa, Cabrera, & Cerna, 2007). The final aim of this study is to explore student-level interactions and the consequences of these interactions for educational outcomes.

Literature Review

Community College Students

Compared to four-year institutions, community colleges are financially accessible, nonselective, conveniently located, offer diverse degree and certificate programs, and provide an array of support services to students (Phillippe & Sullivan, 2005; Porter, 2002). Given the benefits of going to college, the low rate of degree attainment specifically among community college students pursuing an associate's degree is an ongoing concern. Today, minority students comprise more than half of the student population enrolled in community colleges, yet they are disproportionately less likely to graduate with a college degree (Horn, Nevill, & Griffith, 2006; Lane, 2003). Less than 30% of minority students attain an associate's degree six years after initially enrolling at a community college. There are also gaps in educational attainment between men and women. Women account for a greater percentage (58%) of the community college population than do men (Horn et al., 2006; Lane, 2003), mainly due to their changing roles in marriage, the workplace, and education and to the economic benefits of a college degree. Since 2001, women outnumbered men in postsecondary degrees attained (Kuh, Kinzie, & Buckley, 2007).

First-generation College Students

Similarly, community colleges offer access to postsecondary education for many students who are the first in their families to go to college. First-generation, traditional-aged college students account for over one-third of all undergraduate students (Horn et al., 2006) and over 40% of the student body at community colleges (Engle, 2007; Pascarella, Pierson, Wolniak, Terenzini, 2004; Phillippe & Sullivan, 2005). About 68% of first-generation college students are women (Nomi, 2005). Among minority students enrolled at community colleges, first-generation college students comprise a greater percent (35%) than minority students whose parents had moderate (27%) or high (29%) education levels (Nomi, 2005). Within minority groups, Hispanic students are more likely to be first-generation college students (53%), followed by Native Americans (43%), and African-American students (41%) (Nomi, 2005). Additionally, first-generation college students are more likely to come from low-income households. The median annual household income of first-generation college students is approximately $31,000, which is lower than the household incomes of peers with parents with moderate or high education, $39,000 and $55,000, respectively (Nomi, 2005). In general, first-generation college students are more likely to be Hispanic, African-American, female, and low income (Horn et al., 2006; Kuh, Kinzie, Buckley, Bridges, & Hayek, 2006).

Theory

Various reasons are given to students' early exit from community college. Two factors that affect student success in community colleges are academic and social integration, which stem from Tinto's theory of student persistence. Tinto's (1993) theory provides a framework for understanding the components and the processes by which academic and social integration affects student behavior. The college institution is a social system founded on a set of values and social structures (Elkins, 2000; Tinto, 1975). Following Tinto's line of thinking, academic integration occurs when a student perceives his or her educational values and aspirations as matching that of his or her institution. In the same context, social integration can be described as a student's ability to develop relationships and strengthen his or her affiliations with social groups such as honor societies, pre-professional

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organizations, and intramural sports teams. Thus, students' educational outcomes are conditioned on the association between an individual students' educational values and the extent to which the student interacts with members of the college system (Elkins, 2000; Tinto & Pusser, 2006; Tinto, 1975).

Academic Integration

Academic preparation directly affects students' academic integration in college. *Academic integration* refers to a student's ability to accept academic norms (e.g., attending class, seeking academic assistance, and earning passing grades) of an institution and to comply with these norms to achieve academic success (Kuh, Kinzie, & Buckley, 2007). In college, first-generation college students are less likely than students of college-educated parents to participate in academic activities like professional development or academic organizations, to interact with faculty, and to spend time preparing and studying for courses (Engle, 2007), all indications that academic integration is lower.

The circumstances surrounding first-generation college students' low academic integration at community college may be attributable to two causes. Despite qualifying for federal aid, the majority of first-generation college students lack the financial resources to pay for college and therefore take time away from class and study to work (Hertel, 2002). To afford the cost of tuition, the majority of first-generation college students work more hours per week than do other peer groups (Hertel, 2002; Phinney & Haas, 2003). Among first-generation college students who work, those who work full-time are less likely to build a strong academic connection (Engle, 2007; Kuh et al., 2007) and take fewer courses in community college (Nunez & Cuccaro, 1998). For financial reasons, twice as many first-generation college students attend community college part-time (Nunez & Cuccaro, 1998). Thus, time on campus for attending courses is these students' only opportunity for academic integration (Kuh et al., 2007).

The second cause for low academic integration among first-generation college students may be a lack of academic preparation. Low academic preparedness may frustrate students and lessen their sense of self-efficacy, academic self-esteem, and self-confidence (Barron & D'Annunzio-Green,

2009; Engle, 2007; Inman & Mayes, 1999). However, analyses of first-generation student outcomes that control for academic preparedness showed that first-generation college students still graduated from college at lower rates than other students with similar characteristics (Engle, 2007; Kuh et al., 2007). In sum, the effects of employment, part-time enrollment, and academic preparedness on persistence in college may explain low rates of degree attainment among first-generation college students.

Social Integration

Similar to academic integration, social integration affects degree completion among first-generation college students. *Social integration* is defined as the extent to which the college environment complements or satisfies students' preferences and strengthens their institutional commitment (Engle, 2007). About 38% of first-generation college students compared to non-first-generation college students (19%) report low levels of social integration (Tym et al., 2004). Many first-generation college students have difficulty adjusting to the demands of the new social context and are more likely to experience culture shock than are their peers whose family histories may have prepared them for the college environment (Barry, Hudley, Kelly, & Cho, 2009; College Board, 2007; Engle, 2007; Inman & Mayes, 1999; Pike, 2005; Thayer, 2000). In fact, fewer than half of all low-income students reported having received helpful assistance from an adult in preparing for college (Ad Council, 2002; El-Khawas, 2003; Ishitani, 2003; Thayer, 2000). This lack of preparation is compounded for first-generation college students because their families lack familiarity with the culture of higher education and have no experience in navigating the college environment and systems (Phinney & Haas, 2003). For example, first-generation college students may feel burdened by obligations set by parents unaware of the demands of higher education (Phinney & Haas, 2003). Whereas their peers may be able to get advice from their parents, siblings, or other relatives about resources available in the college system, first-generation college students have to forge a path on their own with little, if any, guidance from others (Engle, 2007). In community college, first-

generation college students are less likely to interact with faculty, access student social services, or engage in campus social and professional activities, and thus many of them develop inaccurate or misaligned expectations about college (Inman & Mayes, 1999). Lack of knowledge may lead to feelings of isolation and disengagement, which may translate into depression, anxiety, low self-esteem, low self-efficacy, and isolation for many first-generation college students (Center for Community College Student Engagement, 2009; Inman & Mayes, 1999). There is strong support for the idea that social integration affects first-generation college students' ability to earn an associate's degree (Bliss & Sandiford, 2004; Hand, 2008; Kuh et al., 2007).

Institutional Characteristics

Research on college-level factors is sparse in the community college literature, despite the high proportion of minority and low-income student enrollment. Studies of four-year colleges are more common and conclude that there is a relationship between college characteristics and students' expected outcomes (Calcagno et al., 2008; Change, 1999). This relationship also reflects socioeconomic and social class differences among minority students (Southworth & Mickelson, 2008). The relationships between college-level factors such as proportion of minority student enrollment and educational outcomes suggest that racial composition is correlated with aggregate socioeconomic and academic performances (Frost, 2007; Southworth & Mickelson, 2008). Consequently, institutional characteristics may also have an effect on college student outcomes.

College-level factors may affect minority students' educational outcomes, such as educational expectations, persistence, and academic performance, in important ways (Berger, 2000; Denson & Chang, 2009; Hurtado et al., 2007). Further, relevant college-level factors help distinguish social and academic environments between institutions. In one study of students attending four-year institutions, increased student diversity measured by racial composition of college campuses was found to foster positive academic and social growth among minority students (Gurin, Dey, Hurtado, & Gurin, 2002). In another study, Hurtado and colleagues (2007) explored the impact of campuses' racial dynamics on

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freshmen students' academic engagement and sense of integration. Colleges with diverse racial composition positively affected minority students' sense of belonging; that is, a student's sense of social integration in the college environment (Hurtado et al., 2007). Cole (2007) found a similar relationship between minority enrollment and academic performance. After disaggregating racial and ethnic groups, significant correlations existed between the college environment and GPA (Cole, 2007).

Because differences between four- and two-year institution characteristics are significant and student populations and experiences differ between these types of institutions, it is necessary to examine community college contexts separate from those of four-year institutions. To address this gap in higher education research, this study examines the college experiences of a representative sample of community college students within the U.S. using data collected in 2004 and 2006 by looking at variation in educational outcomes between community colleges. Investigating college-level differences may generate new knowledge about the relationship between college-level characteristics and student outcomes.

Because two-year institutions provide accessible and affordable options for postsecondary education, the results of this research will add value to what we know about persistence and degree attainment among populations more likely to enroll at these institutions. Student-level interaction terms are also tested to examine if the relationship between students' college experiences and outcomes is moderated by first-generation college status, minority status, and risk factors. For this study, the proposed research questions and diagrams illustrate the multilevel influences being tested (Snijders & Bosker, 1999), where Y is an educational outcome; X is a covariate measured at the student level, and Z is a college-level covariate. The questions this study seeks to answer include:

1. What are the characteristics of the community college student sample?

2. Do students' educational outcomes, persistence, and academic performance vary between community colleges?

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3. What are the relationships between academic and social integration and students'

   educational outcomes? Do these relationships vary by first-generation college status,

   minority status, and risk factors?

   Micro or student-level proposition:
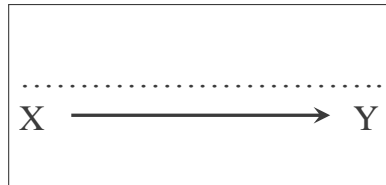
4. Do community college-level factors affect students' educational outcomes?

   Multi-level proposition:
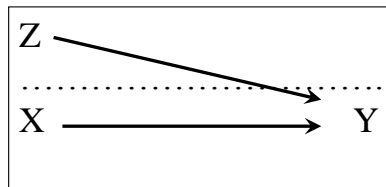
Research Methods

Study Design

Derived from the *National Postsecondary Student Aid Study* (NPSAS:04), the 2004/2006

Beginning Postsecondary Students Longitudinal Study (BPS) was used to answer the research

questions. To analyze institutional characteristics, a second dataset, the *Integrated Postsecondary*

Educational Data System (IPEDS), was merged with BPS data. IPEDS is a federally mandated annual

survey conducted by the National Center for Education Statistics of all postsecondary institutions that

participate in federal student financial aid programs. Data are collected on institutional characteristics

such as tuition, student enrollment, financial aid, conferred degrees and certificates, and fiscal

resources.

To participate in NPSAS:04, eligible institutions had to meet four requirements: a) offer an

educational program designed for persons who have completed a high school education; b) offer at

least one academic, occupational, or vocational program of study lasting at least 3 months or 300

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clock hours; c) offer courses that are open to more than the employees or members of the company or group (e.g., union) that administers the institution; and d) be located in the 50 United States, the District of Columbia, or Puerto Rico (Berkner, He, Mason, Wheeless, Hunt-White, 2007). The student sampling rates were fixed for each sample institution for NPSAS:04. To be eligible students had to be enrolled in an academic program, in at least one credit-course applicable for a postsecondary degree at the institution, or enrolled in an program requiring 300 clock hours or 12 weeks of instruction to receive a degree, and not simultaneously enrolled in a high school program like General Educational Development. The NPSAS:04 consisted of 92,690 undergraduate students, including community college students. As part of NPSAS:04, a longitudinal cohort of approximately 18,640 students was identified for additional study as part of the Beginning Postsecondary Students (BPS) Longitudinal Study, which follows first-time beginning students (FTBs) residing in the United States and Puerto Rico. Due to the sampling design of the study, analyses incorporate scaled sampling weights to provide least biases estimates of weighted sampling design data (Pfeffermann et al., 1998). Results for all three methods–unweighted, Method A, and Method B are provided upon request. Because the results for both sampling methods were similar, here I discuss the results for Method A following conventional practice. More information about estimating and scaling sampling weights can be found in Appendix A.

Data

This study only analyzed first wave data from BPS:04 to draw associations with outcome data collected in 2006. About 76% (N=4,819) of students attending a public, associate-degree granting institution and of traditional age (younger than 24 years old) were retained. Interviews conducted in 2006 had a weighted response rate of 77%.

Variables

Dependent variables. There are two continuous dependent variables.

1. Persistence: Number of months enrolled at any institution while on track through 2006, ranging from 1 to 36 months. The number of months enrolled is a proxy for persistence in college and a distal outcome for degree attainment (Arnold, 1999).

2. Student academic performance: Student's grade point average in 2006, ranging from 0 points to 4.0 points, served as a proxy for academic performance and (Lohfink, 2005; Muraskin, Lee, Wilner, & Swail, 2004).

Student-level variables. Measured between 2003 and 2004 and grand-mean centered.

3. Social integration 2004: An index of students' participation in fine arts activities (Garcia, 2010), school clubs (Lohfink, 2005), and school sports (Windschitl, 2008), between 0 and 6 points.

4. Academic integration 2004: Similarly, this variable is an index of students' meeting with faculty outside class, informally meeting with faculty, meeting with an academic advisor, and participating in a study group, ranging 0 to 8 points.

5. Race: Three dummy variables comprised of three race groups: African American, Hispanic, and other. White is the reference group.

6. Job earnings: A measure of student's earnings including work-study ranging between $0 and $120,000.

7. Parental education: Three dummy variables of mother's and father's educational attainment where neither or either parent has earned a high school diploma or GED or less (first-generation college status); mother has some college experience or a college degree, but father only has a high school diploma or GED or less; and father has some college experience or a college degree, but mother has a high school diploma or GED or less. The reference group is "both parents have some college experience or a college degree".

8. High school grade point average: A categorical measure of 0.50 incremental responses ranging 0.50 points to 3.5 points.

9. Academic preparation in high school: Three dummy variables consisting of students who earned advance placement (AP) credit and college credit (CC) in high school; CC in high school, and CC at college while in high school; and AP credit, CC in high school, and CC credit at college while in high school. Students who did not receive any credit were the reference group. This variable measures students' academic preparation while in high school (Goldrick-Rab, 2007; Reid & Moore, 2008).

10. Risk index: Two dummy coded variables that include one risk factor or two or more risk factors. No risk factor" is the reference group. Risk factors include delayed college enrollment, no high school diploma, part-time enrollment, financially independent, dependents, single parent, working full-time while enrolled.

11. Remediation: Student report of enrolling in remediation in 2004 where "no" is the reference group.

12. College GPA in 2004: Student's cumulative grade point average through academic year 2004, ranging from 0 points to 4.0 points.

13. Gender: Dichotomous variable where female is the reference group.

14. Age at start of postsecondary education. Continuous variable ranging from 14 years to 24 years.

College-level variables. To account for college-level effects on educational outcomes, institutional characteristics were included in the model as group-mean variables.

15. Proportion of female enrollment at institution

16. Proportion of African American student enrollment at institution

17. Proportion of Hispanic student enrollment at institution

18. Proportion of 'other' multi-racial and ethnic student enrollment at institution

19. Proportion of risk factors reported by students at institution

Study Sample

Students in the sample were FTB students who attended public institutions that offered two- but less than four-years degree and certificate programs in 2006. This subsample of institutions represents 443 public two-year institutions. The final study sample comprised 4,819 students.

Data Analysis Approach

Hierarchical linear modeling. For this study, hierarchical linear modeling (HLM) is an appropriate statistical method because the observed data are multilevel, thus violating the assumption of independence assumed under OLS regression. The HLM methodology has several advantages (Astin & Denson, 2009). HLM obtains estimated variances explained by the multilevel predictors (Guo, 2005). HLM also has advantages over disaggregating or aggregating data because disaggregating data from level-2 to level-1 violates the assumption of independence. Violating the assumption of independence leads to biased estimated standard errors and spurious significant results. Similarly, aggregating data may result in substantial loss of information pertinent to the multilevel nature of the data. For these reasons, HLM is an appropriate method for this study.

Because the nature of this data may contain redundant information (i.e., autocorrelation) the assumption of independent measures may be violated. Further, autocorrelation may result in biased statistical conclusions because estimated standard errors are incorrect. HLM is one approach that corrects for autocorrelation. To assess the level of autocorrelation, the proportion of variance in the outcome between colleges is calculated using the intra-class correlation (ICC) coefficient (Raudenbush & Bryk, 2002). The ICC is measured by the following equation:

$$r = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_e^2}$$

where, σ_u^2 is the between-group variance, and σ_e^2 is the within-group variance.

The first step in HLM analysis is deriving a fully unconditional model (i.e., one-way ANOVA with random effects). This model does not specify any student-level (Level 1) or college-level (Level 2) predictors. Essentially this model calculates the ICC coefficient, and provides information about how much variation in each of the outcomes lies within and between institutions and the reliability of each institution's sample mean as an estimate of the true population mean. The following equation illustrates a student's outcome as a function of his or her institution's average on the outcome measure.

Equation 1   *Student-level*: $Y_{ij} = \beta_{0j} + r_{ij}$ $r_{ij} \sim N(0,\sigma^2)$,

Where, $i = 1, 2, \ldots, n_j$ students in institution j; $j = 1, 2, \ldots, j$ institutions. Each student has a unique outcome score. Each student's outcome, Y_{ij}, is a function of his or her institution's average on the outcome measure, β_{0j}, and random effect, r_{ij}. The r_{ij} is assumed to be normally distributed with a mean of zero and variance σ^2. The σ^2 represents the within-institution variance.

Equation 2   *College-level*: $\beta_{0j} = \gamma_{00} + u_{0j}$ $u_{0j} \sim N(0, \tau_{00})$.

In equation 2, the institution average on the outcome measure, β_{0j}, is characterized by the function of the mean on the outcome measure for all institutions in the sample, γ_{00}, and a random effect, u_{0j}. The random effect for this equation is also assumed to be normally distributed with a mean of zero and variance τ_{00}. The variance of the random effect represents the between-institution variance. The following equation illustrates the combined equation:

$$Y_{ij} = \beta_{0j} + u_{0j} + r_{ij}$$

Subsequent models examine conditional multilevel models with main and interaction effects The rationale for choosing interaction terms stem from Tym, et al. (2004) and Engle's (2007) research which highlights the need to examine how first-generation college status moderates integration. Other moderating variables hypothesized to affect integration are race, ethnicity, and risk factors. The final outcome model is expressed by the following equation which is written as a combined model for simplicity of exposition:

$$Y_{ij} = \beta_{00} + \sum_{s=1}^{S} \beta_{s0} X_{si} + \sum_{q=1}^{Q} \beta_{0q} W_{qj} + \beta_{s+1,0} X_{1i} X_{2i} + r_{0j} + e_{ij},$$

where Y_{ij} is the outcome Y for student i from the jth college, X_{si} are S student-level covariates, W_{qj} are Q college-level covariates, $X_{1i} X_{2i}$ is a student-level interaction, r_{0j} is a random intercept effect, and e_{ij} is a level-1 residual. In the model e_{ij} is normally distributed with mean zero and variance σ^2 and r_{0j} is normally distributed with mean zero and variance $\tau 00$. In this setup, we have only one student-level interaction. In the real analysis, the number of student-level interactions is determined by research interest and prior studies, and therefore, are more than what are shown in the above equation. r_{0j} (for j=1, 2, ... J colleges) are random effects associated with the intercept. They don't have substantive meaning; they are included in the model in order for us to control for clustering effects. The current analysis followed Snijders and Bosker (1999, Chapter 4) to include random intercept effects only to make the specification of the final model parsimonious while meaningful. A maximum likelihood estimator provided by Stata version 10 was employed in the analysis.

Results

Research Question 1: What are the characteristics of the community college student sample?

Descriptive statistics for student- and college-level variables are presented in Table 1. The sample consisted of 443 community colleges with an average enrollment of 8,600 students. About 17% of the community colleges were Hispanic-serving institutions, and less than 2% were historically Black colleges.

In this sample of 4,819 students, the average age was about 19 years old, 53% were women, one-third were first-generation college students, and 39% were minority students. Twenty percent of students enrolled both part- and full-time, with the majority enrolling full-time (48%). Over half of students were at risk, reporting one or more risk factors. The average high school GPA for this sample was 2.68, and more than three-fourths of students did not receive any college-level academic

preparation in high school. About 68% of students in this sample did not enroll in developmental or remedial courses. Eighty-six percent of students planned to attain a bachelor's degree or higher.

Bivariate statistics were computed to examine the relationship between student characteristics and the dependent variable, persistence (see Table 2). Results for gender were nonsignificant. For race and ethnicity, significant differences were found in persistence between minority students and their counterparts. White (M=20.89, SD=10.30), and Asian (M=21.17, SD=10.70), students persisted longer than African-American (M=19.52, SD=10.37), Hispanic (M=19.63, SD=10.64), and students of other races or ethnicities (M=19.63, SD=10.79), $F(4, 4814)=24.40$, $p < 0.001$. There were statistically significant differences for students attending college full-time, part-time, or both. Full-time students persisted longer (M=21.08, SD=10.35) than part-time students (M=20.01, SD=10.58) and students with mixed status (M=19.70, SD=10.79), $F(2, 4816)=7.99$, $p < 0.001$. ANOVA results indicated significant differences in student report of risk factors, $F(2, 4816)=60.24$, $p < 0.01$. Post hoc analyses using the Bonferroni post hoc criterion for significance indicated persistence was higher among students with no risk factors ($M = 21.46$, $SD = 10.35$) than students reporting one risk factor ($M = 20.05$, $SD = 10.43$) and students reporting two or more risk factors ($M = 19.65$, $SD = 10.42$), $F(2, 4816)=13.63$, $p < 0.001$. There was no significant difference between one risk factor and two or more risk factors.

The relationships between student characteristics and grade point average (GPA) in 2006 were also examined (see Table 3). Gender was significant, $F(1, 3761)=34.99$, p<.001 in that women had a higher GPA in 2006 (M=3.09, SD=0.06) than did men (M=2.97, SD=0.63). One-way ANOVA results indicate race is significant, $F(4, 3758)=10.44$, $p < .001$. Post hoc analyses indicated White students ($M = 3.08$, $SD = 0.63$) had a higher GPA in 2006 compared to African-American students ($M = 2.94$, $SD = 0.56$) and Hispanic students ($M = 2.94$, $SD = 0.61$). The relationship between students' high school academic performance and college academic performance was also significant. Specifically, a one-point increase in high school GPA increases a student's college GPA in 2006 by

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0.11 points, (b=2.74, SE=0.07, $p<.001$). Students' levels of academic preparation in high school was also significant, $F(3, 3742)=3.23, p< .05$. Post hoc analyses indicated students reporting no college credit in high school had the lowest GPA in 2006 ($M = 3.02, SD = 0.62$) compared to two groups of students receiving college preparation in high school. For the first group, the mean GPA of students reporting advance placement credit, college credit in high school, and college credit in college while in high school was 3.11 points ($SD = 0.60$). Among students in the second group, that is, students who earned college credit in high school and college credit in college while in high school, the mean GPA was 3.09 points ($SD = 0.59$). There was no significant difference in GPA between the two groups of students receiving college preparation in high school. Students who enrolled in remedial college courses had lower GPA scores in 2006 ($M=2.96, SD=0.65$) than did their counterparts ($M=3.08, SD=0.60$). The relationship between students' college GPA in 2004 and GPA in 2006 was significant (b=2.48, SE=0.06, p< .001). For every one-point increase in GPA scores in 2004 students had GPA scores 0.20 points higher in 2006. ANOVA results show significant differences of students' risk factors, $F (2, 3760) = 6.73, p < .001$. Post hoc analyses indicated a higher GPA in 2006 for students with two or more risk factors ($M = 3.09, SD = 0.64$), compared to students with no risk factors ($M = 3.03, SD = 0.60$) or students with one risk factor ($M = 3.01, SD = 0.63$). Although students with no risk factors had a better GPA than students with one risk factor, this was not significant. Although significant findings were found, these analyses do not take into account the multilevel nature of the data. The following analyses examine and control for college-level characteristics.

Research Question 2: Do students' educational outcomes, persistence and academic performance, vary between community colleges?

The community college sample size suggests that multilevel analysis has adequate statistical power. For the unconditional models, restricted maximum likelihood point estimate for the grand mean (γ_{00}) and the estimated values of the within-institution variance (σ^2) and between-institution

variance (τ_{00}) for persistence and academic performance were calculated. The grand mean estimate for persistence was 20.40 months. The variance components for persistence were significantly different than zero. These estimates suggest that institutions differ in average month enrollment (persistence). The ICC, ρ, estimated the proportion of variance due to between-institution differences for persistence (Raudenbush & Bryk, 2002). About 24% of the variance in persistence was found between institutions. Differences between institutions accounted for a statistically significant ($p <$ .001) portion of the variance in persistence, indicating a need for utilizing multilevel modeling. The grand mean for academic performance in 2006 was a grade point average of 3.03 points. The variance components for academic performance, although statistically significantly, were low. The ICC for both outcomes suggests that the majority of the variance in academic performance and persistence lies between institutional.

Research Question 3: What are the relationships between integration and students' educational outcomes? And do these relationships vary by first-generation college status, minority status, and risk factors?

Main effects were found to be statistically significant between integration and persistence, after controlling for college-level factors. Results for persistence are presented in Table 4. Academic integration was significantly and negatively associated with persistence. For every one point increase in academic integration, persistence decreased an average of 0.27 months. In contrast, social integration was positively and significantly correlated with duration of enrollment. For every one point increase in social integration, average month enrollment increased by 0.56 points.

Interaction terms were also examined to determine if persistence and academic performance varied by sub-group characteristics (e.g., first-generation college status, minority status, and risk factors). The association between students' social integration and average month enrollment did vary by parental education. Figure 3 illustrates the relationship between parental education and persistence by first-generation college status, mother's educational status, father's educational status, and the

reference group. The relationship between social integration and persistence among students whose mothers had some postsecondary experiences or a college degree when fathers have no college degree was significant.

The relationship between social integration and persistence varied by risk factors. Figure 4 shows a significant relationship between persistence and social integration among students who reported two or more risk factors compared to students with one or no risk factors. Students reporting two or more risk factors persisted relatively longer than did their counterparts. The relationship between academic integration and persistence was moderated by Hispanic status. Shown in Figure 5, the association between academic integration and persistence was significant for Hispanic students, but not for African-American, multi-racial and multi-ethnic, or White students. Hispanic students persisted relatively longer than did their peers.

Controlling for college-level factors, the second model tested the relationships between integration and academic performance in 2006. Table 5 presents findings for this model. Results were statistically significant for academic and social integration. For every one unit increase in social integration, GPA decreased 0.04 points. In contrast, every one unit increase in academic integration increased GPA 0.02 points. One interaction term was found to be significant. Figure 6 illustrates a significant association between social integration and academic performance among students who reported one risk factor and nonsignificant findings for the reference group and for students reporting two or more risk factors. Relative to their peers, students reporting one risk factor had higher GPA scores.

Research Question 4: Do community college-level factors affect student educational outcomes?

To examine if the proportions of females, minorities, and risk factors on campus affected student persistence and academic performance, college-level factors were included in the both models. Controlling for student-level factors, there were significant relationships between college-level factors and persistence. Community colleges with a higher proportion of women than men

differed in months persisted, although this relationship was moderate. For example, a 10% increase in the proportion of women enrolled at a community college resulted in men enrolling an average of 2.85 fewer months than women. There was also a positive but moderately significant relationship between the proportion of Hispanic students at an institution and average month enrollment. For every 10% increase in Hispanic student enrollment at an institution, Hispanic students attended on average 3.02 more months. Similarly, there was a positive and moderately significant relationship between the proportion of multi-racial students at an institution and month enrollment. A 10% increase in enrollment among multi-racial and multi-ethnic students, increased persistence by an average of 4.53 months. Results indicated a negative relationship between the proportion of risk factors and month enrollment. A 10% increase in the proportion of students reporting one risk factor was associated with an average of 3.27 fewer months' enrollment. Among students reporting two or more risk factors, a 10% increase in enrollment was associated with an average of 6.26 fewer months' enrollment at an institution.

Relationships between college-level factors and academic performance were also examined, and one relationship was found to be moderately significant. For every 10% increase in the proportion of students reporting two or more risk factors, the average GPA in 2006 decreased by 0.15 points. Conclusions drawn from the covariance parameter estimates for both models suggest that the variability in the intercept, or the difference between institutions in outcomes after controlling for student- and college-level covariates, is small. Compared to the unconditional models, the final model for academic performance with the added covariates was insignificant, and the final model for persistence with the added covariates accounted for less than 5% of the variation seen in persistence.

Limitations

There are several limitations associated with the research methodology proposed in this study. Because these analyses were limited to traditional-age students, there are many community college students for whom these results do not apply. As such, these results cannot be generalized to

the broader community college student population. Second, an accurate depiction of persistence among community college students spans at least six years. These data spanned four years with measures at only two time points, 2004 and 2006. Therefore, the data are treated as cross-sectional rather than as longitudinal because repeated measures to correctly estimate the effects of integration on students' educational outcomes were not available. Similarly, transfer rates to gauge persistence across different institutions were not yet available. Newly released data will allow future research to incorporate multilevel models of change with these data. The third limitation relates to the accuracy of measures. Students self-reported academic and social integration rather than being directly observed, which may have affected the accuracy of these measures. Despite these limitations, this study contributes new knowledge about community college student experiences. Using a nationally representative sample of traditional-age community college students, it examines the relationship between multilevel factors and educational outcomes.

Discussion and Conclusion

Implications

For administrators, these results have several implications for traditional-age community college students. First, there is a 24% variation in months of enrollment between institutions. This suggests that some community colleges, like some four-year institutions, are better at retaining students than others (Carey, 2008). Although articulation agreements and other state or institutional policies may account for differences across community colleges, it is evident that some campuses are implementing specific programs or policies that are ensuring students persist at their initial institutions. Identifying these features and tailoring them to specific institution settings is the first step to finding out how to maintain high persistence rates among traditional-age community college students. For example, in a study of first-generation and low-income college students at six community colleges in Texas, two strategies were recommended to help students persist and either graduate from their initial institution or transfer to a four-year institution (Smith, Miller, & Bermeo,

2009). The first strategy articulated a structured academic pathway that led to either an associate's degree at the initial institution or a successful transfer to a university. One component of articulation agreements is for community colleges and four-year institutions to partner and establish clear course and credit requirements for seamless transition between institutions. The idea is for community college students to follow course guidelines that explicitly lead to a degree upon transfer to a university, thus facilitating and increasing graduation rates. These mechanisms may allow students to stay informed about courses needed to meet transfer requirements and to be motivated to meet their educational objectives.

The second strategy focused on developing a data system comprised of student information. The system would allow administrators to track and identify challenges common among struggling low-income and first-generation college students such as passing development math, reading, and English courses; maintaining adequate academic performance; and earning credits in a timely manner. From this data system, an early warning system could be designed to identify students matriculating with risk factors (e.g., delayed college enrollment, no high school diploma, part-time enrollment, financially independent, dependents, single parent, working full-time while enrolled) and tracking their academic progress while attending community college. As a tool, this data-driven system may allow college administrators to effectively target academic and social support services or reduce premature transfers by adequately preparing students for university. Accordingly, administrators who incorporate data-driven systems and early warning systems into their policies and practices may increase the probability of degree attainment among the general community college student population.

Findings for academic integration were different for persistence and academic performance. The results suggest that academic integration positively affects college academic performance but negatively affects persistence. As discussed in Tinto's model, it appears that academic integration does reinforce educational values and aspirations for community college students. Activities that

appear to do this are meeting with faculty outside of class, meeting with an academic advisor, and participating in study groups. The negative relationship between academic integration and persistence is puzzling. It seems that academic integration hinders student persistence in college. Although this finding is significant, it should be interpreted with caution for two reasons. First, we know that community college students attend college for about six years. This finding conveys a discrete story spanning two years of students' college experiences and does not capture the full extent of the relationship between academic integration and persistence over time. Second, measuring academic integration is difficult, and more work is needed to understand this phenomenon within the context of community college students' experiences. Related to this discrepant finding are the different contexts students encounter, such that academic integration may not necessarily be consistent across semesters, and may affect persistence. For example, if students do well in one class, they may not do so well in another, which may result in varying trends.

For practitioners, one implication of these findings is to view practices associated with academic integration independent of practices associated with persistence. Whereas academic integration may be a short-term goal specific to a class, persistence is a process that needs to be continuously evaluated to ensure external factors, irrespective of academic performance, do not interrupt students' subsequent enrollment. Despite these different findings, practitioners should take note of the positive influence of academic integration on both persistence and academic performance among Hispanic students. The implication of this finding suggests that resources, which may include English as a second language (ESL) courses or services tailored specifically to Hispanic students, promoting academic integration affect Hispanic students differently than their counterparts. More research is needed to examine why academic integration may be positively affecting Hispanic students' academic performance and persistence in community college.

Results for social integration were also different for both educational outcomes. Social integration positively affected persistence but negatively affected students' academic performance. It

appears social integration affects students' ability to develop relationships and strengthen their affiliations with extracurricular activities, but it does not appear to be related to students' educational values or aspirations. Also of interest is why social integration positively affects academic performance among students reporting two or more risk factors relative to their counterparts. Although being a single parent and working full- or part-time are risks to persistence, this positive finding suggests students may be strengthening their relationships and affiliations, thus obtaining social support that mitigates poor academic performance. For example, students with multiple risk factors may be asking for additional time to turn in assignments, requesting extra credit, rescheduling exams, or using academic support services to maintain their GPAs. For practitioners, this finding is important because it seems at-risk students, specifically students reporting more than two risk factors, are reaching out to instructors or peers or are seeking services when they face challenges.

These findings draw attention to how risk affects academic performance differently than persistence. Because community college students may seek academic and social services in times of crises (e.g., being placed on academic probation, failing a course, or experiencing a family issue), proactive strategies to mitigate any interruptions to students' educational progress may be necessary. This is why community college administrators should be mindful of students who report one risk factor. There are several known strategies that aim to improve at-risk students' progress in community colleges, such as accelerating students' academic progress using self-paced modules, facilitating active learning by contextualizing coursework, and providing supplemental support services that incorporate time management and study skills. These strategies show potential for reaching a wide range of students in need of academic assistance, those who are struggling to maintain a strong grip on their education progress, and those who are seeking social support to attain their educational objectives.

In conclusion, this study examined community college students' experiences at their institutions by controlling for college-level factors known to contribute to educational success. Based

on Tinto's theory of student persistence, the relationship between conceptual factors, specifically academic and social integration, and student outcomes – persistence and academic performance – were examined. The research findings support Tinto's assumption that there is a relationship between integration and student outcomes. Further examination revealed that these relationships differed for persistence and academic performance. To understand these disparate outcomes, moderating factors were included; these findings showed that academic and social integration vary by important student sub-group characteristics and that further research is needed to examine these associations.

Table 1.

Descriptive statistics

Student characteristics (N=4,819)	**Frequency (%)/Mean (SD)**
Gender: Female	2,537 (52.64%)
Race/Ethnicity	
White	2,903 (60.25%)
African-American	637 (13.22%)
Hispanic	771 (15.99%)
Other	508 (10.54%)
Attendance status	
Full-time	2,271 (47.61%)
Part-time	1,611 (33.42%)
Both	938 (19.46%)
Parents' income	$55,154 ($51,328)
Student income including work study	$4,879 ($6,254)
Parental education	
Either or both parents have a high school diploma/GED or less	1,445 (33.06%)
Mother: College experience/degree; Father HS diploma/GED or less	843 (19.27%)
Father: College experience/degree; Mother HS diploma/GED or less	634 (14.51%)
Both parents: College experience/degree	1,450 (33.16%)
Age at start of postsecondary education	18.94 (1.35)
High school GPA	2.68 (0.61)
Academic preparation in high school	
None	3,733 (77.86%)
Earned AP credit and college credit (CC) in high school (HS)	185 (3.86%)
Earned CC in HS, and CC at college while in HS	554 (11.56%)
Earned AP credit, CC in HS, and CC at college while in HS	322 (6.72%)
Risk Index	
0 risk factors	1,766 (36.65%)
1 risk factor	1,675 (34.75%)
2 or more risk factors	1,378 (28.59%)
Degree goal	
Certificate or none	109 (2.27%)
Associate's degree	550 (11.41%)
Bachelor's degree	1,845 (38.28%)
Post Bachelor	2,315 (48.04%)
Plans to transfer: No	1,762 (36.57%)
Remediation: No	3,288 (68.23%)
GPA 2004	2.78 (0.85)

Student characteristics (continued)	Frequency (%)/Mean (SD)
Integration 2004	
Academic integration	2.21 (1.70)
Social integration	0.59 (1.06)
Dependent Variables	
Months enrolled (persistence)	20.45 (10.43)
GPA in 2006 (academic performance)	3.04 (0.62)
College characteristics, 2003-2004 (N=443)	
Enrollment size	8,599 (8,446)
Hispanic-serving institution: Yes	74 (16.77%)
Historically black college indicator: Yes	7 (1.65%)

Note: The N is from the sample, but the frequency (%) and mean is based on weighted analysis.

Table 2.

Weighted bivariate analyses of two-year college students' characteristics and persistence (n=4,819)

Variable	χ^2	Mean (SD)
Gender	1.40	
Women		20.31 (10.44)
Men		20.61 (10.41)
Race/Ethnicity	24.40***	
White		20.89 (10.30)
African-American		19.52 (10.37)
Hispanic		19.63 (10.64)
Asian		21.17 (10.70)
Other		19.63 (10.79)
Attendance status	131.28***	
Full-time		21.08 (10.35)
Part-time		20.01 (10.58)
Both		19.70 (10.27)
Parental education	2.90	
Either or both parents have a high school diploma/GED or less		20.22 (10.43)
Mother: College exp./degree; father HS diploma/GED or less		20.44 (10.67)
Father: College exp./degree; mother HS diploma/GED or less		21.15 (10.16)
Both parents: College experience/degree		20.59 (10.36)
Academic preparation in high school	6.38	
None		20.46 (10.39)
Earned AP credit and college credit (CC) in high school (HS)		19.46 (11.12)
Earned CC in HS, and CC at college while in HS		20.17 (10.51)
Earned AP credit, CC in HS, and CC at college while in HS		21.77 (10.42)
Risk index	60.24***	
0 risk factors		21.46 (10.35)
1 risk factor		20.05 (10.43)
2 or more risk factors		19.65 (10.42)
Remediation	0.45	
No		20.58 (10.35)
Yes		20.17 (10.59)
	t	Coef. (SE)
Parents' income	3.18***	>0.01 (>0.01)
Student income including work study	-1.12	>-0.01 (>0.01)
GPA in 2004	1.74	0.42 (0.24)
Academic integration in 2004	-0.60	-0.07 (0.12)
Social integration in 2004	0.43	0.08 (0.19)

Note: * p<.05; ** p<.01; *** p<.001

Table 3.

Weighted bivariate analyses of two-year college students' characteristics and GPA in 2006

(n=4,819)

Variable	χ^2	Coefficient/ Mean (SE)
Gender	10.62***	
Women		3.09 (0.60)
Men		2.97 (0.63)
Race/Ethnicity	33.10***	
White		3.08 (0.63)
African-American		2.94 (0.56)
Hispanic		2.94 (0.61)
Asian		3.02 (0.60)
Other		3.06 (0.61)
Attendance status	104.83***	
Full-time		3.03 (0.61)
Part-time		3.07 (0.63)
Both		3.01 (0.61)
Parental education	10.18*	
Either or both parents have a high school diploma/GED or less		3.04 (0.61)
Mother: College exp./degree; father HS diploma/GED or less		3.02 (0.61)
Father: College exp./degree; mother HS diploma/GED or less		3.02 (0.65)
Both parents: College experience/degree		3.05 (0.60)
Academic preparation in high school	1.26	
None		3.02 (0.62)
Earned AP credit and college credit (CC) in high school (HS)		3.07 (0.63)
Earned CC in HS, and CC at college while in HS		3.09 (0.59)
Earned AP credit, CC in HS, and CC at college while in HS		3.11 (0.60)
Risk index	83.84***	
0 risk factors		3.03 (0.60)
1 risk factor		3.01 (0.63)
2 or more risk factors		3.09 (0.64)
Remediation	3.43	
No		3.08 (0.60)
Yes		2.96 (0.65)
	t	Coef. (SE)
Parents' income	0.71	<.01 (<.01)
Student income including work study	1.60	<.01 (<.01)
Age at start of postsecondary education	2.44*	0.03 (0.01)
High school GPA	4.25***	0.11 (0.03)
GPA in 2004	10.35***	0.20 (0.02)
Academic integration in 2004	0.12	0.001 (0.01)
Social integration in 2004	-1.86	-0.02 (0.01)

Note: * p<.05; ** p<.01; *** p<.001

Table 4.

Results of weighted multilevel model, persistence as outcome

Fixed Effects	β (SE)
Student-level variables	
Intercept	24.09 (1.48)
Gender: Male	0.21 (0.33)
African-American	-1.33 (0.58)*
Hispanic	-2.10 (0.62)***
Other race/ethnicity	-1.29 (0.64)*
First-generation college student	-0.13 (0.41)
Mother only, some postsecondary	-0.47 (0.60)
Father only, some postsecondary	0.36 (0.56)
Age at start of postsecondary education	0.09 (0.20)
High school GPA	-0.32 (0.33)
1 risk factor	-0.42 (0.44)
2 or more risk factors	-0.80 (0.64)
College GPA in 2004	0.32 (0.21)
Student income including work study	<0.01 (<0.01)
Academic integration in 2004	-0.27 (0.11)*
Social integration in 2004	0.56 (0.21)**
Interactions at student level	
FG college student*Academic integration	-0.17 (0.27)
FG college student *Social integration	-0.52 (0.39)
Mother, postsecondary*Academic integration	-0.20 (0.33)
Mother, postsecondary *Social integration	-1.02 (0.52)*
Father, postsecondary*Academic integration	0.37 (0.34)
Father, postsecondary *Social integration	0.64 (0.45)
Hispanic*Academic integration	0.62 (0.31)*
Hispanic*Social integration	0.09 (0.54)
African American*Academic integration	0.22 (0.36)
African American *Social integration	-0.27 (0.48)
Other*Academic integration	0.17 (0.35)
Other*Social integration	0.82 (0.61)
1 risk*Academic integration	0.08 (0.24)
1 risk*Social integration	0.15 (0.35)
2 or more risks *Academic integration	0.07 (0.27)
2 or more risks *Social integration	1.45 (0.59)**
College-level variables	
Proportion of females	-2.85 (1.54)[+]
Proportion of African-Americans	0.73 (1.81)
Proportion of Hispanics	3.02 (1.75)[+]
Proportion of other race/ethnicity	4.53 (2.44)[+]
Proportion of students reporting 1 risk factor	-3.27 (1.70)*
Proportion of students reporting 2 or more risk factors	-6.26 (1.80)***
Random Effects	
σ^2	82.03 (2.77)

τ_{00}	19.54 (1.85)

Note: [+]p<0.10; * p<0.05; ** p<0.01; *** p<0.001; two-tailed test

Table 5.

Results of weighted multilevel model, academic performance (GPA in 2006) as outcome

Fixed Effects	Coefficient (SE)
Student-level variables	
Intercept	3.05 (0.06)
Gender	-0.10 (0.03)***
African-American	-0.05 (0.05)
Hispanic	-0.09 (0.05)*
Other	0.02 (0.05)
First-generation college student	0.02 (0.03)
Mother only, postsecondary	0.01 (0.03)
Father only, postsecondary	-0.002 (0.04)
Age at start of postsecondary education	0.02 (0.01)
High school GPA	0.04 (0.02)[+]
Earned AP credit and college credit (CC) in HS	0.07 (0.04)[+]
Earned CC in HS, and CC at college while in HS	0.08 (0.04)*
Earned AP credit, CC in HS, and CC at college while in HS	0.06 (0.05)
1 risk factor	0.02 (0.03)
2 or more risk factors	0.07 (0.04)[+]
Remediation	-0.10 (0.03)***
College GPA in 2004	0.21 (0.02)***
Academic integration in 2004	0.02 (0.01)**
Social integration in 2004	-0.04 (0.02)*
Interactions at student-level	
FG college student*Academic integration	-0.01 (0.02)
FG college student *Social integration	-0.01 (0.03)
Mother, postsecondary*Academic integration	0.001 (0.02)
Mother, postsecondary *Social integration	0.01 (0.03)
Father, postsecondary*Academic integration	-0.004 (0.03)
Father, postsecondary *Social integration	-0.004 (0.04)
Hispanic*Academic integration	0.03 (0.02)
Hispanic* Social integration	0.02 (0.04)
African American*Academic integration	-0.002 (0.03)
African American *Social integration	0.03 (0.04)
Other*Academic integration	-0.02 (0.03)
Other*Social integration	0.003 (0.05)
1 risk factor*Academic integration	-0.01 (0.02)
1 risk factor*Social integration	-0.10 (0.03)**
2 or more risks *Academic integration	-0.02 (0.02)
2 or more risks *Social integration	-0.02 (0.04)
College-level variables	
Proportion of females	-0.02 (0.08)
Proportion of African-Americans	0.03 (0.08)
Proportion of Hispanics	0.01 (0.08)
Proportion of other race/ethnicity	-0.01 (0.10)
Proportion of 1 risk factor	-0.13 (0.08)
Proportion of 2 or more risk factors	-0.15 (0.09)[+]
Proportion of remediation	0.11 (0.07)

Random Effects	
σ^2	0.32 (0.01)
τ_{00}	0.01 (0.003)

Note: [+]p<0.10; * p<0.05; ** p<0.01; *** p<0.001; two-tailed test
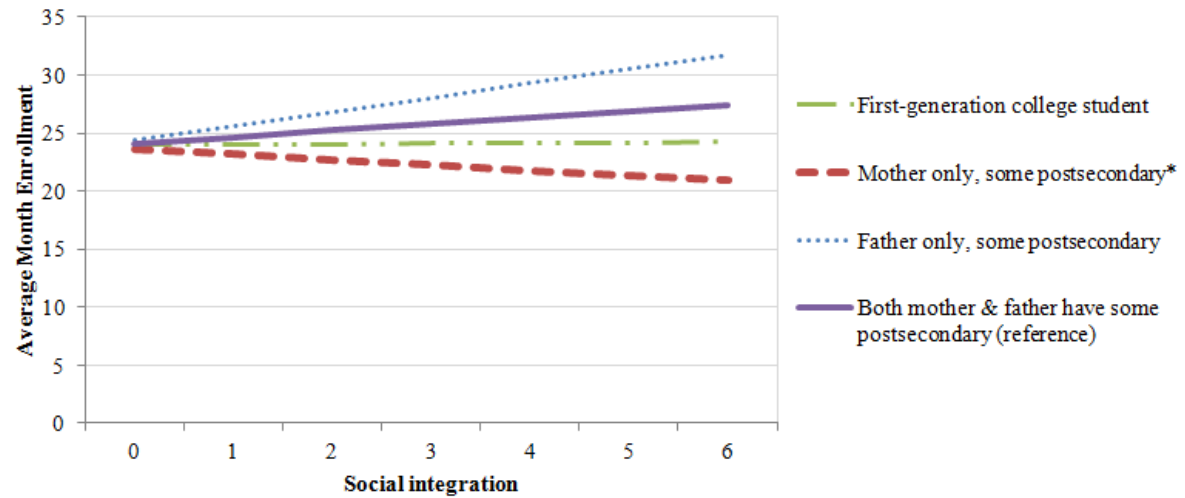
Figure 3. Relationship between parental education and persistence by first-generation college status, mother's educational status, father's educational status, and the reference group. Mother's educational status was significant, p<0.05.
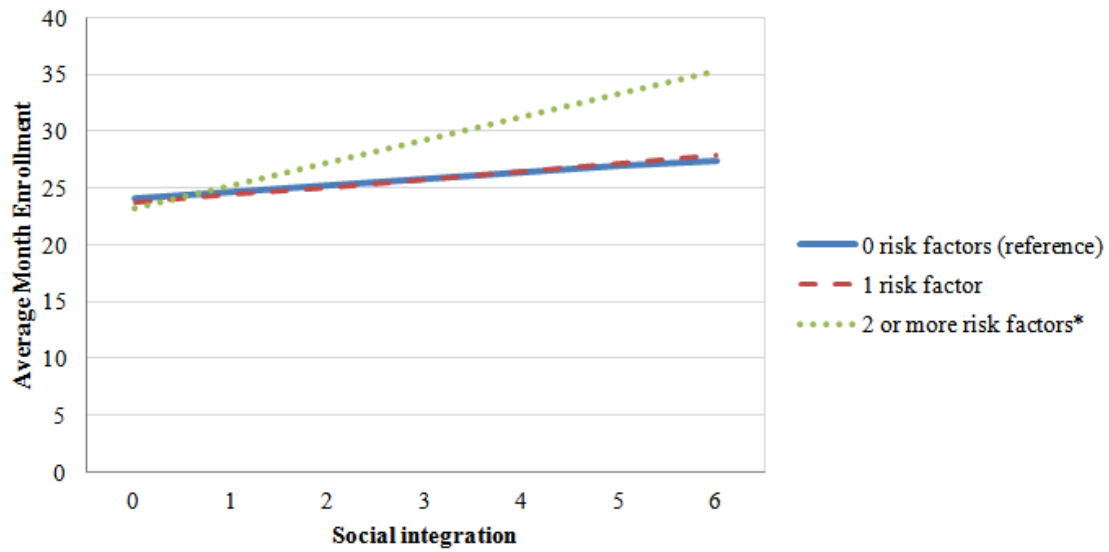
Figure 4. Relationship between social integration and persistence among students who reported two or more risk factors compared with than students with less than one or no risk factors. Significant result for two or more risk factors, p<0.05.
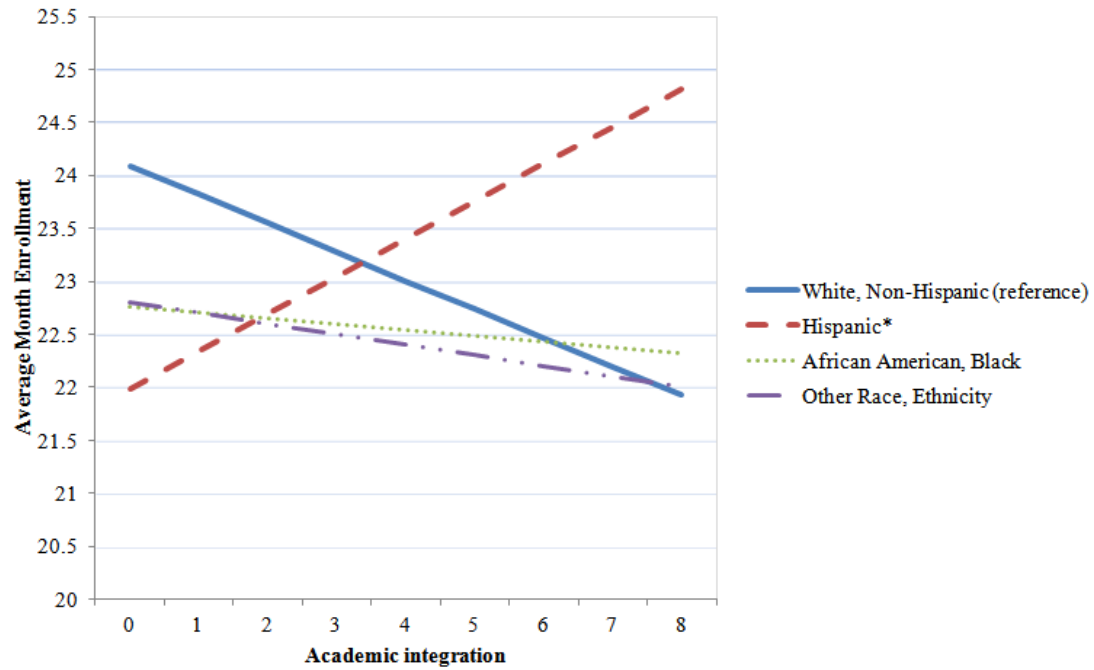
Figure 5. Association between academic integration and persistence was significant for Hispanic students, but not for African-American, multi-racial and ethnic, or White students. Significant result for Hispanic students, p<0.05.
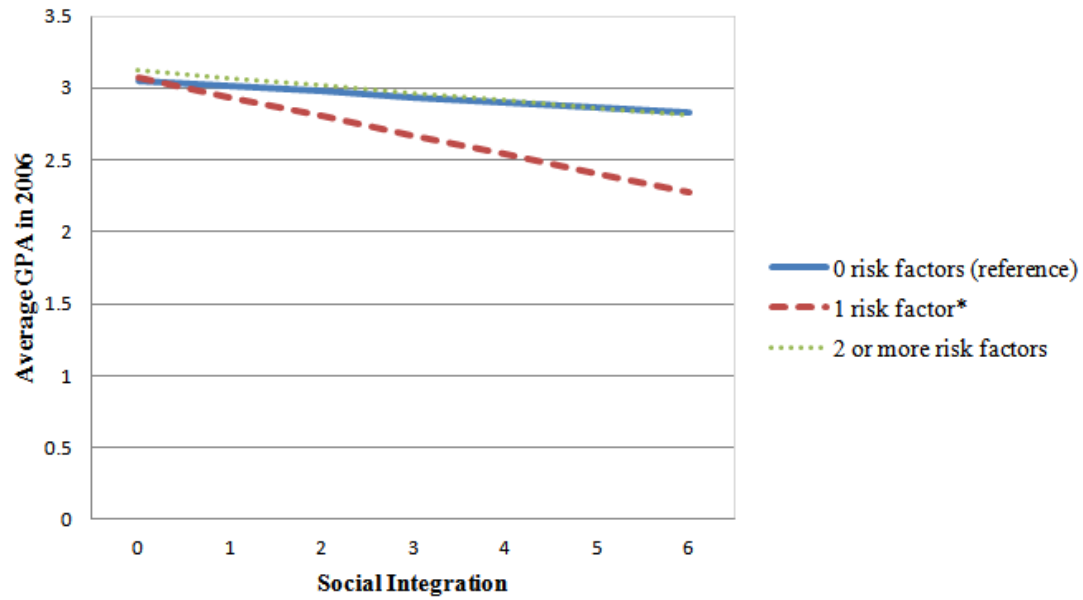
Figure 6. Association between social integration and academic performance among students who reported one risk factor and nonsignificant findings for the reference group and students reporting two or more risk factors. Significant result for one risk factor, p<0.05.

Manuscript III: Examining the Effects of Learning Communities on Engagement and Academic

Performance among Community College Students

For students limited by academic and financial constraints, community colleges provide a pathway to higher education (Bloom & Sommo, 2005). Compared to four-year institutions, community colleges are more affordable, inclusive of all students regardless of their high school academic qualifications, and provide diverse degree pathways and choices. For these reasons, student populations differ between two- and four-year institutions, and a disproportionate number of low-income and minority students enroll in community colleges.

Currently, less than 20% of first-time, full-time public community college students pursuing an associate's degree attain a degree within three years (McIntosh & Rouse, 2009). While these rates have remained stagnant over the last decades, higher community college enrollment among minority and low-income students has exacerbated the disparity in degree attainment (Bailey, Jenkins, & Leinbach, 2005; Bliss & Sandiford, 2004; Haskins, Holzer, & Lerman, 2009; Soares & Mazzeo, 2008). Less than 25% of Hispanic and African-American students and less than 20% of low-income students earn an associate's degree within six years of initially enrolling at a community college (Bailey, Jenkins, & Leinbach, 2005; Bliss & Sandiford, 2004; Soares & Mazzeo, 2008).

Stemming from research on early college departure, learning communities (LCs) are one type of intervention community colleges have implemented to improve persistence and degree attainment rates (Minkler, 2002; Richburg-Hayes, Visher, & Bloom, 2008; Weiss et al., 2010). LC programs are grouped college courses integrated within the social environment and designed to engage students in their colleges. The purpose of LCs is to provide a venue for students to acclimate to the college environment by helping them build social relations with both their peers and faculty, while also

preparing students for college-level work by enhancing their academic skills (Scrivener et al., 2008). Although not grounded in any particular theoretical framework, the programmatic features of LCs seem to closely align with Coleman's (1988) theory of social capital and its inherent function in social structures. The rationale for LCs also seems to parallel Tinto's (1993) interactionalist theory and his discussion of the effects of social and academic systems on students' integration in college. However, research on the effects of LCs on academic and social outcomes among community college students remains inconclusive because of the challenge of conducting randomized control trials in community college settings (Scrivener et al., 2008). To help fill this gap, this paper aims to examine the impact of LCs on engagement and academic performance among minority and first-generation community college students participating in the *Community College Survey of Student Engagement* (CCSSE). Using nonrandomized survey data, propensity score analysis is applied to gauge the effect of LCs on student outcomes.

Literature Review

Although no particular theory is referenced in the literature on learning communities, the intervention reflects several frameworks that have been used to explain students' learning and early exits from college (Astin, 1999; Bean & Eaton, 2002; Price, 2005; Tinto 1975, 1993). One of several conceptual paradigms is Tinto's (1993) interactionalist theory. Tinto (1993) interrelates students' psychological dispositions and characteristics, external demands, and college experiences as factors affecting students' decisions to exit higher education. Preliminary studies of students at community colleges suggest contextual and psychosocial factors affect students' college experiences, which subsequently affect persistence and degree attainment (Garcia, 2010). Relevant to LCs, Tinto's (1993) model points to students' academic and social integration, or lack thereof, to explain student engagement and academic performance, persistence in college, and early departure from college.

Academic and social integration are two ways of promoting engagement and academic performance to reduce attrition at community colleges. By accepting academic norms and meeting

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faculty, administrators, and peers' expectations, students are more likely to integrate into the academic environment at their college, thus increasing their academic performance and chances to meet their educational objectives (Engle, 2007). Socially integrated students are more likely to be committed to their institution when their college environment is conducive to their needs and preferences, also increasing their likelihood of graduating from college (Elkins, Braxton, & James, 2000; Flowers, 2006). Integration plays a significant role in engagement and degree attainment among community college students. Using the Beginning Postsecondary Students Longitudinal Study (BPS 96/01), Deil-Amen (2005) confirmed that academic and social integration matter for community college students, establishing that integration has a complementary effect on student attrition, even after controlling for student characteristics.

By means of integration, students seek out opportunities and learn to engage with their academic and social college environment. Student engagement is defined as the extent to which a student participates in meaningful educational activities in college (Kuh, Kinzie, & Buckley, 2007). There is empirical evidence that confirms the effect of student engagement on college persistence (McClenney & Marti, 2006, McClenney, 2007). Although derived from students attending four-year institutions, Chickering and Gamson's (1987) seminal work outlines seven practical guidelines to impact student engagement and success in college: student-faculty interactions; peer cooperation; active-learning; prompt feedback; time on task; high expectations; and respect for diverse talents and ways of learning. By emphasizing these educational practices, institutions can affect learning, student engagement, the quality of the college experience, persistence, and degree attainment among students (Savitz-Romer, Jager-Hyman, & Coles, 2009). For example, the quality of student-faculty interactions positively affects students' academic experiences in college (Savitz-Romer et al., 2009). Further, these relationships develop within a context of diverse instructional activities beyond the classroom. Student engagement in extracurricular experiences such as student organizations and career and student support services) also influences students' satisfaction with their college

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environment (Bui, 2002; Lohfink, 2005; Terenzini, 1996). In many college environments, institutional-level factors (e.g., availability of academic tutoring, mentorship programs, student support services) affect students' self-esteem, self-efficacy, and social integration (Bui, 2002; Kuh et al., 2007; Lohfink, 2005; Ramos-Sanchez, 2007). For example, classes with high levels of active learning (e.g., discussions, cooperative learning) were found to have a positive effect on students' perceived abilities to complete their work and on their views of the college environment (Kuh, et al., 2007). These positive outcomes illustrate why community colleges implement and offer LCs to their students.

Academic performance is a measure of student's academic proficiency to complete college-level work. Academic performance in college affects persistence (Adelman, 1999; Murtaugh, Burns, & Schuster, 1999; Pascarella & Terenzini, 2005; Reason, 2003; Wang, 2009). Strong academic performance ensures students progress to subsequent courses, increasing their likelihood of timely degree attainment (Kuh et al., 2007). It is not surprising that degree attainment is also associated with student engagement and academic performance in college.

Learning Communities

Starting in the 1930s and growing in prominence since the 1970s, learning community programs have become general practice in higher education (Barefoot, 2002). In a national survey of academic practices, 60% of community colleges offered learning community programs (i.e., paired or clustered courses) to their first-year students, but under 20% of these community colleges enroll more than 10% of their student population in LCs (Barefoot, 2002). Although participation of students in LCs is not widespread, community colleges implement these programs with the expectation that LCs will positively affect persistence and degree attainment.

LCs are grounded on the assumption that students who actively participate in learning while building relationships through interactions with faculty and peers are more likely to succeed in

college (Talburt, 2005). There are four variations of learning community programs that group students together in a set of semester courses (Bloom & Sommo, 2005; Zhao & Kuh, 2004) :

Cohorts in large courses. This learning community structure provides opportunities for students in large lecture courses to meet in small groups throughout the semester for discussion sessions, writing courses, and seminars.

Paired or clustered courses. In this model, 20 to 30 students are enrolled in two or more semester courses that are linked by common themes across the curricula; enrollment in one course requires enrollment in the linked courses.

Team-taught programs. Under this model, two or more faculty members design courses based on a theme. Students meet as one group but also have opportunities to interact in smaller group discussions.

Residential programs. This learning community model is designed for residential students enrolled in two or more courses together, most commonly found at four-year institutions.

Although programmatic differences exist, LCs are primarily structured to increase student engagement necessary for college completion (Tinto, 1997). Students' experiences in LCs have been shown to have a positive relationship with engagement, college satisfaction, academic performance, and persistence (Zhao & Kuh, 2004; Kuh et al., 2008; Savitz-Romber et al., 2009). However, existing research is limited in scope, focusing more on the effects of learning communities at four-year institutions rather than community colleges and on the implementation practices and participants' experiences in the program, rather than on rigorous evaluation of the effect of LCs on students' educational outcomes and the limitations of conducting randomized control trials at these institutions (Bloom & Sommo, 2005). Karp (2011) also cites the absence of longitudinal studies, appropriate use of control or comparison groups, and small samples sizes as methodological concerns specific to learning community research.

In 2005, Bloom and Sommo conducted one of the first random assignment research designs to test the effectiveness of LCs at Kingsborough Community College (Brooklyn, NY). Students were selected during the fall of 2003, spring and fall of 2004, and the spring of 2005. The selection criteria for the study required students to be native English speakers between ages 17 and 34 years who were first-time, full-time students. Students were also selected for study participation based on reading and writing competency scores, which determined their English placement course. In an attempt to rigorously evaluate this model, students were randomly assigned to a learning community (treatment condition) or existing student services (comparison condition). The total sample included 1,534 students.

Participants randomly assigned to the treatment condition were placed in groups of up to 25 students, forming a total of 40 learning communities. Each learning community cohort was enrolled together in three first-semester courses with integrated curricula. Because the program targeted first-year students who failed one or more of the competency and skills tests that all incoming students complete, the learning community courses typically included an English or math class at the remedial level, a second academic course such as psychology, and a freshmen orientation class (Bloom & Sommo, 2005). In addition, each learning community had an assigned tutor and counselor, and each student received a $225 voucher to offset costs for books. In contrast, the comparison group enrolled in regular classes that were not linked and were able to seek existing counseling and tutoring services available to all students. Most students assigned to learning communities were younger than 21 years (75%); 38% were African-American, 27% were White, and 20% were Hispanic. Despite random assignment, the baseline survey indicated that the comparison group (n=765) was statistically different from the treatment group based on gender, race, age, use of unemployment benefits, GED and high school completion. Seventy percent of respondents (n=1,075) were surveyed at the 12-month follow-up period. Respondent characteristics were comparable to that of the comparison group (e.g., gender, age, marital status, race, public assistance, employment, English proficiency, legal

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status, and college credits). However, respondents who had attrited were found to be statistically different on several variables (e.g., gender, age, and race).

Using independent two-sample t-tests, preliminary results indicated that students in LCs enrolled in more courses and had higher course pass rates than did the comparison group students. Treatment participants were more likely to complete remedial English requirements than were the comparison group (Bloom & Sommo, 2005). LCs also influenced students' social integration by improving students' college experiences. According to students' self-reports, learning community participants felt part of the college community and participated in more college activities than did students in the comparison group.

However, the Kingsborough LC program yielded mixed evidence on student persistence. During the two semesters subsequent to their participation in the LC program, student persistence was not statistically significant between the treatment and comparison groups. However, by the third semester, treatment participants were 4.9 percentage points more likely than comparison group participants to still be enrolled in a two-year college. Although the Kingsborough Community College LC program showed promising gains in course completion, social integration, and persistence, Bloom and Sommo (2005) point to several limitations confounding the results.

Despite using a reliable research design, Bloom and Sommo (2005) discuss the limitations of using random assignment in the real world. First, the preliminary results are confounded by significant differences between treatment and comparison group participants. Second, these disparities were augmented by unobserved differences because students self-selected to participate in the program. That is, the process of gaining consent may be influenced by unknown differences between students who consented and those who did not consent to volunteer in the study (Zelen, 1979). Third, although randomized assignment strengthens the internal validity of an intervention, Bloom and Sommo (2005) indicated that the results could not be generalized to the boarder student population. Specifically, some students who were eligible for the program chose not to participate,

and other students were omitted because course sections were full. Such limitations compromise the external validity of the results.

In another study at Hillsborough Community College (Tampa Bay, FL), three cohorts of students were randomly assigned to LCs or to regular courses (Weiss et al., 2010). The study recruited students in their first semester whose college placement tests scores required them to enroll in developmental reading courses (Weiss et al., 2010). Unlike the study at Kingsborough Community College, there were no significant differences between treatment and comparison groups in credits earned, persistence, or the likelihood of completing developmental reading among the first and second cohorts. However, significant differences between treatment and comparison groups in credits earned and persistence were found among the third cohort participants. Weiss and colleagues (2010) posit that because the learning community program at Hillsborough underwent several changes after the first two cohorts, these revisions were the primary reason for the observed treatment effects.

Because preliminary evidence of the effects of LCs are promising and suggest positive student outcomes (Brock, Jenkins, Ellwein, & Miller, 2007; Scrivener et al., 2008), this manuscript aims to contribute to this research area by examining (a) the effect of LCs on engagement, specifically active-collaborative learning and student-faculty interactions, (b) the effect of LCs on student academic performance, and (c) the moderating effects of minority status and first-generation college status on all three outcomes. For this paper, the proposed research questions are:

1. Which students enroll in LC programs?
2. What is the effect of LCs observed on treatment and comparison groups in regard to active-collaborative learning, student-faculty interactions, and student academic performance?
3. Do treatment effects observed between treatment and comparison groups vary by minority and first-generation college status?

Research Methods

Study Design

The *Community College Student Report* (CCSR) is a survey administered to students by community colleges that voluntarily participate in the *Community College Survey of Student Engagement* (CCSSE). There are 313 community colleges from 39 states that participated in this study in 2009. During the spring semester, only students in randomly selected credit courses were surveyed at each community college. The number of credit courses selected was determined by "the total sample size needed to reduce sampling error and to ensure valid results" (Center for Community College Student Engagement, 2010). Based on institutional size, the target sample per college ranged between 600 and 1,200 students. Due to requirements needed to obtain confidential data, college-level data were not requested for this study.

Data

Using the *Community College Survey of Student Engagement*, student data were collected in spring 2009. For this study, 92% of the sample size (n=139,339) was retained after dropping international students. The study sample after list-wise deletion of missing data (n=1,160) was n=129,400, where approximately 93% of the sample size was retained. Because this study examined only students who either completed or planned to enroll in LCs, the final sample size was 35,761 (28%) students. Of these students, 12,816 (36%) actually completed a learning community program.

Measurements

The CCSR was developed to measure student engagement in order for administrators to assess and improve teaching practices and learning outcomes of their students (Marti, 2009). This itemized survey gauges the quality of education practices such as the amount of time students spend engaging in meaningful collaborative activities with peers and faculty and teaching techniques conducive to active learning (Marti, 2009). To test the reliability and validity of the instrument, Marti (2009) conducted exploratory factor analysis (EFA) and then confirmatory factor analysis (CFA). The CFA model resulted in a nine-factor structure having good model fit (Marti, 2009). Reported Cronbach's alpha values for active collaborative learning (ACL) and student-faculty interactions

(SFI) were α=0.66 (test-retest r=0.73) and α=0.67 (test-retest r=0.73), respectively. Results of the test-retest reliability indicated a high degree of consistency between the first and second test (Marti, 2009).

For this study, ACL and SFI were used as dependent variables. ACL is a seven item scale consisting of the following items asked of respondents: asked questions in class or contributed to class discussions, made a class presentation, worked with other students on projects during class, worked with classmates outside of class to prepare class assignments, tutored or taught other students (paid or voluntary), participated in a community-based project as a part of a regular course, discussed ideas from your readings or classes with others outside of class (students, family members, co-workers, etc.). For SFI, an index of five items was used as the dependent variable. Participants were asked if they used email to communicate with an instructor, discussed grades or assignments with an instructor, talked about career plans with an instructor or advisor, discussed ideas from their readings or classes with instructors outside of class, and worked with instructors on activities other than coursework. Overall, the CCSSR is a valid measure of ACL and SFI.

Variables

Dependent variables. For this study, active-collaborative learning and student-faculty interactions served as proxies for student engagement. Academic performance was measured using student grade point average (GPA).

1. Active-collaborative learning (ACL) scale: A composite score comprised of 7 items ranging between 0 and 21 points. Cronbach's alpha for the scale used for these analyses was α=0.67.

2. Student-faculty interactions (SFI) index: Also a composite score of 5 items, ranging from 0 to 15 points. The reliability of this measure was α=0.72.

3. Academic performance: Categorical variable treated as continuous measuring students' self-reported GPA. The measure consists of 0.50 intervals ranging between 2.0 (C or lower) and 4.0 (A).

Treatment conditions.

4. For this study, the treatment group represents students who completed a learning community and the comparison group represents students who indicated they plan to enroll in a learning community at their college. Treatment is a dichotomous variable consisting of a comparison group (0) and a treatment group (1).

Variables used for selection and outcome model.

5. Gender: Female is the reference group.

6. Race: Four dummy variables include White (reference group), African American, Hispanic, or Other.

7. Age: Dummy variable consisting of non-traditional age or traditional age. Traditional age is the reference group.

8. Generation college status: First-generation college student (father and mother have a high school diploma/GED or less), or not a first-generation college student (father and/or mother has at least some college, an associate's degree, or higher). Not a first-generation college student is the reference group.

9. Academic credential: Variable comprised of students with a high school diploma/GED (reference group), or students with a vocational/technical certificate or higher.

10. College status: Variable indicating where a student began college "started here" or "started elsewhere" (reference group).

11. Enrollment status: College-going status as a full-time student or less than full-time student (reference group).

Independent variables used for outcome model.

12. Degree goal: A categorical variable measuring students' primary and secondary college goals. This included certificate and associate's degree are not primary or secondary goals (reference group); certificate is a primary goal; associate's degree is a primary goal; and both certificate and associate's degree are primary goals.

13. Work hours: Variable indicating student worked 20 hours or less (reference group), or 21 hours or more.

14. Income: Categorical variable indicating a student's use of his or her "own income/savings" a minor source, or a major source for paying tuition, or not a source (reference group).

15. Dependents: Dichotomous variable indicating if student provides 1 hour or more of care to dependents living with him or her including parents, children, and/or spouse. Reference group is "no".

16. Marriage status: Dichotomous variable where "no", not married, is the reference group.

17. College support: Two variables measuring student's perceived support for college success and social support at his or her institution. Responses range from 0 (low support) to 3 points (high support).

18. Relationships: Three variables measuring students' relationships with peers, instructors, and administrative personnel. Responses range from 0 (unfriendly, unsupportive, sense of alienation) to 6 points (friendly, supportive, sense of belonging).

19. Course enrollment: Index ranging from 0 to 5 points indicating the number of developmental writing, developmental mathematics, developmental reading, study skill course, or orientation program a student participated or enrolled at his or her college.

Data Analysis Approach

It is necessary that LCs are evaluated with careful attention to selection bias to ensure that student outcomes are attributable to the program. In this study, random assignment of students to LCs

was not conducted. A randomized-control trial (RCT) is an ideal solution to control for selectivity which may otherwise bias estimates of the treatment effects. The difficulty in conducting RCT research is due to the ethical challenge in introducing an untested intervention to one group and not the other. Furthermore, RCTs are sometimes not practical for social science research. Accordingly, the implementation of non-randomized interventions, the most common form of outcome evaluation studies, casts doubt on the causal relationship between the treatment and observed outcomes.

Establishing causality follows three criteria: (a) the treatment must precede the effect; (b) the two variables must be empirically correlated; and (c) the correlation is not spurious. Fundamentally, these criteria reinforce the causal inferences made between treatment and effect, establishing internal validity of an intervention. However, non-randomized studies violate the assumption of internal validity primarily due to the threat of selection bias. The statistical explanation of selection bias is a nonzero correlation between the treatment assignment and error term. Because this study violates the independence of outcomes from treatment assignment, other statistical methods are necessary to accurately estimate treatment effects. For this study, propensity score analysis (PSA) is applied to ensure that student outcomes are attributable to LCs.

Propensity score analysis. Propensity score analysis (PSA) serves three objectives when drawing casual inferences from observational data. First, the method aims to balance data when assignment to treatment is selective or nonignorable. Second, the modeling process generates a propensity score which "reduces multidimensional covariates to a one-dimensional score" (Guo & Fraser, 2010, p.12). Last, the treatment effect is evaluated using nonrandomized or nonexperimental methods. As previously mentioned, controlling for selection bias minimizes threat to internal validity, that is, the effect selectivity may have on outcomes other than the intervention itself.

To account for treatment assignment in the modeling process, covariates that may determine participation in an intervention are used to control for the effects selectivity may have on the results. The modeling process involves estimating a propensity score, which is "the conditional probability of

assignment to a particular treatment given a vector of observed covariates" (Guo & Fraser, 2010, p.

127). In this way, PSA controls for selection bias by using a propensity score to balance covariates

between participants and nonparticipants. No longer violating the assumption for independence, a

propensity score gives researchers the ability to analyze treatment effects with conventional

regression methods.

Guided by the fundamental principles of *Neyman-Rubin's counterfactual framework*, Rubin's

(1974) work illustrated causal effects in both randomized and nonrandomized studies. The *Neyman-*

Rubin counterfactual framework states that all cases (i.e., individuals, study participants) in a study

have two potential outcomes: the observed outcome and the unobserved outcome had the treatment

not been implemented (Guo & Fraser, 2010). As such, the counterfactual is an unobservable, missing,

and hypothetical value, imputed by analyzing observed data. The *Neyman-Rubin counterfactual*

framework is expressed in the following equation:

$$Y_i = W_i Y_{1i} + (1 - W_i)\ Y_{0i}.$$

In this equation, Y_{0i} and Y_{1i} are two potential outcomes; $W_i=1$ denotes receipt of treatment, $W_i=0$

denotes no receipt of treatment; and Y_i is the measured outcome variable. Through this equation,

estimates of the counterfactual are examined by the average outcome of participants receiving

treatment and the average outcome of participants in the nonreceipt group. The following equation

assesses the difference in mean outcomes between the two groups:

$E(Y_0|W=0)$ comprises the mean outcome of the nontreatment group; and

$E(Y_1|W=1)$ comprises the mean outcome of the treatment group.

Both mean outcomes are observable, and therefore the difference between these values yields the

treatment effect, known as the *standard estimator for the average treatment effect*:

$$\tau = E(Y_1|W=1) - E(Y_0|W=0).$$

An important part of this discussion involves two fundamental assumptions: strongly ignorable

treatment assignment (SITA) and stable unit treatment value assumption (SUTVA; Guo & Fraser,

2010). SITA assumes that outcomes are independent of the treatment assignment conditioned on a vector of covariates *X*. To apply the *Neyman-Rubin counterfactual framework* to observational data, SITA must be considered. This assumption is illustrated in the following equation:

$$(Y_0, Y_1) \perp W|X.$$

SITA is comparable to the assumption in OLS regression, where the measurement error is independent of treatment assignment. Thus, the hypothetical randomized experiment created by applying propensity score methods correct for the violation of SITA (i.e., endogeneity bias of *W*). The violation occurs because unmeasured or omitted variables "have been lost" and they are no longer available to inform the treatment assignment condition. The second assumption, SUTVA, posits that treatment across units is the same and outcomes between units are independent. Although Heckman (1976) argues that this assumption is too restrictive, SUTVA helps justify why analyzing average treatment effects of a sample is more informative than the effect on a population, and facilitates estimation of the counterfactual and different treatment effects (Guo & Fraser, 2010).

To estimate the effect of LCs on student engagement, PSA is considered the appropriate analytic method for this study because treatment or assignment to LCs was not random; thus violating the assumption of independence. For this study, I use propensity score weighting to conduct multivariate analyses. Before outlining this technical procedure, I discuss the criteria by which the study design is appropriate for testing causal inference with propensity score methods.

Study design. Using Rubin's (2008) criteria for designing an objective observational study, the following components were examined: treatment condition, outcome variables, sample size, treatment assignment, covariate measures, and treatment-comparison group balance. To begin with, the treatment condition is completion of a learning community program. There are three outcomes variables: active-collaborative learning scale; faculty-student interactions index, and academic performance. For this study, the sample size is 35,761 students. Since treatment assignment varied across institutions, reliable covariates were selected to serve as proxies for treatment selection (i.e.,

selection model). Research suggests students' background characteristics, such as minority status or enrolling in college part- or full-time, increases the likelihood of enrolling in LCs. For example, regardless of the college institution or state exemption policies, minority status is associated with student's level of academic preparedness. Similarly, students who enroll full-time are more likely to enroll in a learning community, than part-time students. The covariates selected for the selection model were gender, race, age, generation college status, academic preparedness, college status, and enrollment status. The rationale for including selection covariates in the outcome model suggests these selected covariates also may affect the outcome. The last step to design a hypothesized experiment is balancing the covariates between treatment and comparison groups. In these analyses, the treatment group is identified as students that completed a learning community, while the comparison group is students who plan to enroll in a learning community. Accordingly, a hypothetically randomized experiment using *CCSSE* data is created using propensity score weights to balance both groups for subsequent multivariate analyses.

Propensity score weighting method. Unlike other propensity score methods (e.g., greedy matching, Mahalanobis metric distance matching), propensity score weighting retains all study participants. Propensity score weighting is based on the probability for inclusion in either the treatment or nontreatment sample using propensity scores (Guo & Fraser, 2010). This method is similar to reweighting conducted in survey sampling procedures. Two estimates are generated with propensity score weighting: average treatment effect (ATE) and the average treatment effect for the treated (ATT). ATT refers to the effect of the intervention only on students in the treatment group, while ATE is the difference between the average causal difference of the treatment group mean and the comparison group mean. Subsequent analyses include checking imbalance between treatment and nontreatment groups using weighted simple regression or weighted simple logistic regression (Guo & Fraser, 2010). These analyses indicate if propensity score weighting has removed the statistically

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significant differences between both groups. If propensity score weighting is successful, the estimated treatment effects are assumed to be unbiased.

Results

The study sample consists of 35,761 students who indicated either having completed (36%) or planning to enroll (64%) in a learning community program. Table 6 describes characteristics of students in the sample and those who completed LCs. Approximately 38% of women and 33% of men completed LCs. Less than half of White students (40%) and less than one-third of African-American students (28%) and Hispanic (29%) students completed a learning community program. About twice as many traditional-age students completed LCs than non-traditional-age students, although both were proportionately similar, 35% and 38% respectively. Similarly, twice as many non-first generation college students completed LCs than did first-generation college students. Among first-generation college students, 34% reported completing the program. Although the majority of students received a high school diploma (82%), students with a vocational/technical certificate or a college degree disproportionally enrolled in LCs (45%). About 75% of students reported starting at their current college, and over one-third of these completed a learning community program. As the literature suggests, full-time students enrolled in LCs at higher rates (38%) than did their part-time peers (29%). Among students attending college to attain an associate's degree (41%), about 37% enrolled in LCs.

Mean differences on the dependent variables – active-collaborative learning, student-faculty interactions, and academic performance – between treatment conditions with independent-sample t tests were tested prior to using propensity score weighting. Mean differences between the two populations in the dependent variables were statistically significant (see Table 7). Students who completed LCs reported higher rates of active-collaborative learning (9.85 points) than did their counterparts (8.58 points; t=-33.56, p<.001). Student-faculty interactions for completers was also statistically significant (t=-27.45, p<.001). Reports of student-faculty interactions for completers were

7.20 points compared to 6.29 points for their peers. Student academic performance was also statistically significant. Students who had participated in LCs had higher GPAs (3.10 points) than did the comparison group (3.01 points; t=-13.23, p<.001). Although these findings were significant, caution must be taken in interpreting these results because selection bias was not taken into account. Subsequent analyses control for selection bias, and treatment effects are substantially different.

To answer the first research question "Which students enroll in LCs?" logistic regression predicting which students completed LCs was conducted (see Table 8). For men, the odds of participating in a learning community program were 23% lower than the odds for women. Among minority students, African-Americans (43%), Hispanics (35%), and students' of other racial backgrounds (18%) had lower odds of participating in LCs than did their White counterparts. First-generation college students also had lower odds (15%) of participating in LCs than did non-first generation college students. The odds for completing LCs were higher among students with a certificate or college degree (65%) than for students with a high school diploma. Full-time students also had higher odds of participating in LCs (45%) than did part-time students. There were no statistically significant differences between traditional- and non-traditional-age students, or students who started at the college and students who started elsewhere. This analysis illustrates that for this sample, the type of student who completed a learning community was likely female, White, a non-first-generation college student, had prior college experience, or was enrolled full-time. Further, this logistic regression provides estimation of propensity scores for all study participants, and these estimated propensity scores are used in the subsequent propensity score weighting analysis.

Pre– and Post-propensity Score Weighting

Bivariate relationships between covariates and learning community participation were statistically significant prior to weighting (see Table 9). These results indicate violation of the ignorable treatment assignment assumption and justify the use of measures to correct the violation.

Propensity scores were estimated with logistic regression using the binary treatment variable and the following covariates: gender, race, age, generation status, academic credentials, college status, and enrollment status. Estimated propensity scores were used to create weights for estimating average treatment effect (ATE) and estimating average treatment effect for the treated (ATT). Post-weighting imbalance for each covariate with weighted simple logistic regression was conducted. These results are presented in Table 10. All *p*-values on the observed covariates are not statistically significant at .05 level. Therefore, results suggest that after propensity score weighting, the two groups (i.e., students who completed LCs and those who did not) are balanced on observed covariates. Given this finding, further differences on outcome variables may be linked to treatment, or at least, the differences are not a function of the observed covariates.

Outcome Analysis

   Multivariate regression analysis. Results for both methods–ATE and ATT– are provided upon request. Because the results for both methods were similar, here I discuss the results for ATE. Three multivariate regression models for active-collaborative learning (ACL), student-faculty interactions (SFI), and academic performance (GPA) with propensity score weighting were conducted. Table 11 presents the evaluation of LCs which reports the main effects of the treatment-only model. These models answer the second research question, "what is the effect of LCs observed on treatment and comparison groups in regard to active-collaborative learning, student-faculty interactions, and student academic performance?" The effects of LCs on the three outcomes were positive and significant. The treatment effect on ACL was 0.93 points higher for completers than the comparison group. Students' who completed LCs scored 0.64 points higher on SFI than those students who planned to enroll in LCs. LCs also had an effect on students' academic performance, in which those students who completed LCs had higher GPAs (0.05 points) than did the comparison group.

To test the third research question –"do treatment effects observed between treatment and comparison groups vary by minority and first-generation college status?" –interaction terms were included in the treatment-only models. Among students who completed LCs, those students enrolled full-time had relatively higher average ACL scores than the comparison group (see Figure 7). For all racial and ethnic groups, the average ACL scores, when compared, were relatively the same. First-generation college students who completed LCs had relatively lower ACL scores than non-first generation college, although this finding was moderately significant (see Figure 8). Relative to women, men who completed LCs had lower average ACL scores. Figure 9 presents the results for the estimated treatment effects for interaction terms for SFI. Students who completed LCs and enrolled full-time had an average SFI score that was relatively higher than the comparison group (see Figure 10). Figure 11 shows that the average SFI score for African-American students who completed LCs was relatively higher than the comparison group. Results for interaction terms for academic performance (GPA) are presented in Figure 12. Among full-time students who completed LCs, their average GPA score was relatively higher than the comparison group.

<center>**Discussion and Conclusions**</center>

Limitations

In this study, propensity score weighting was applied to reduce selection bias to estimate treatment effects of LCs on student outcomes. Fundamentally, propensity score analysis aims to enhance causal inferences between treatment and outcomes. However, these strategies are limited due to unobservable covariates. Unlike randomized control trials that account for both observable and unobservable measures, unobservable measures are not included in calculating propensity scores. A second limitation to creating propensity scores is the availability of observed or measured covariates which may not necessarily include important selection variables. For example, selection criteria that service providers use to enroll or assign students to LCs, such as high school academic records, were not available. Third, propensity score methods do not differentiate the relationship between covariates

and treatment assignment, or covariates related to both treatment assignment and outcome (Freedman & Berk, 2008).

In addition to limitations with the methodology, the structures and procedures by which LCs are implemented vary across campuses. Because these characteristics are indistinguishable and not taken into account in the analyses, the treatment effects of LCs on student outcomes should be interpreted with caution.

Despite these limitations, this study does contribute to research on the treatment effects of LCs on student engagement and academic performance among community college students who completed the programs and a comparison group. Moreover, this research is unique in that it analyzes a large sample of community college students from all over the United States. Second, it specifically examines the impact of LCs intended to affect engagement and academic performance, precursors to degree attainment among community college students. Last, propensity score weighting is an innovative methodology that attempts to estimate the treatment effects of nonrandomized data when randomization is not feasible.

Implications

Research. The financial constraints and ethical concerns of conducting randomized-control trials suggest the need for robust statistical strategies to discern treatment effects in non-randomized studies. Even in studies that successfully randomized participants into treatment and control groups, randomization is threatened by differential attrition rates between groups, contamination or spillover of treatment to the control group, and missing data caused by absence of participants over the course of the study. For these reasons, researchers need to consider several approaches when internal validity is threatened. In this study, propensity score weighting was applied to measure treatment effects of LCs on students' social and academic outcomes using observational data.

Future studies testing the effects of LCs on student outcomes using propensity scores must consider three potential challenges for creating a hypothetical randomized experiment. First, it is

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essential for researchers to understand the process of assigning students into LCs to make accurate decisions to balance the data. For example, researchers need to explore, identify, and gauge key covariates associated with the likelihood of being assigned to treatment and non-treatment conditions prior to data collection. Second, researchers need to examine how LCs are implemented at the community college. By identifying and measuring the effects of programmatic components on student outcomes, treatment effects of LCs may be better understood. Currently, characteristics of LCs are not standardized, and variations across programs are not well researched. Last, researchers need to consider the consequences of enrolling in LCs on students' long-term educational objectives. For example, some students enroll in LCs because the program is designed for their specific major. In this case, the incentive for students to be engaged may be different than for students enrolled in LCs not intended for a specific major. Further, other institutions incorporate non-credit-bearing developmental courses in learning community programs that do not apply to students' college GPA. Similarly, the incentive to pass non-credit courses may affect student outcomes measured by treatment effect models. Although research on treatment effects of LCs is growing rapidly, researchers must be cognizant of examining the selection or assignment process, programmatic components comprising LCs, and consequences of students' enrolling in LCs to fully understand the potential benefits LCs may have on students' social and academic outcomes.

Practice. Results of the outcome analyses suggest that LCs had effects on social and academic outcomes among students who completed the program. Treatment effects appear to improve students' active-collaborative learning, student-faculty interactions and their academic performance. The implications of these results suggest LCs are doing a good job engaging students in the classroom (e.g., students ask questions in class, contribute to class discussions, make a class presentation, work with other students on projects), with faculty (e.g., have discussion with faculty), and affecting their academic performance.

The treatment effects on the outcomes were moderately significant for minority and first-generation college students. First-generation college students who completed LCs had relatively worse GPA scores than non-first generation students. It appears LCs are not be necessarily helping first-generation college students achieve academic proficiency or interact with their instructors. To help first-generation college students, practitioners need to acknowledge that these students face myriad challenges compared to students from households with at least some college experience. To address these concerns, administrators need to build mechanisms within the social structure of the learning community to promote meaningful interaction and collaborative-learning opportunities between faculty and first-generation college students. Teaching methods and programmatic strategies tailored for first-generation college students may include increasing their knowledge of what is expected of them in college, providing resources to accelerate their academic skills, enhancing their study skills and time management skills, and ensuring they are actively involved with teacher and student groups (McConnell, 2000). Although some of these activities may be present, specific efforts to target first-generation college students may affect their behaviors differently than do existing or common practices that reach the general student audience.

Hispanic students' engagement and academic performance were no different than White students' scores. These similar outcomes suggest that LCs are working in the same way for Hispanic students as for White students, despite the fact that Hispanic students are less likely to actively engage in the classroom, participate in collaborative learning activities with their peers, approach or interact with faculty in the classroom or outside of class time, and be academically prepared for college-level work. It seems that the social structures and curricula of LCs help Hispanic students engage in learning and social relations.

African-American students who participated in LCs did not differ in active-collaborative learning or academic performance relative to White students, but they did benefit in terms of interacting with faculty. This suggests that the effect of LCs, although the same for both groups,

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provides the mechanism for positive social relations and interactions with instructors for African-American students. In the classroom, LCs seem to help African-American students engage with their instructors via email, discuss grades or assignments, or work with them on activities. These activities produce an additional benefit for African-American students relative to their peers.

Policy. This study provides a general assessment of the effects of LCs on student outcomes. Results showed that across this sample of community college students, LCs have a positive effect on student engagement but no effect on academic performance. This result is important because academic performance determines if a student can enroll in subsequent college courses to reach his or her educational objective. Regarding program structure, one consideration is to incorporate mentoring or other academic support services along with LCs, thus helping students meet academic standards and expectations while addressing non-academic issues. By restructuring LCs to include academic services, students may be better able to assess their academic progress. In addition, implementing academic services at the onset of a students' educational career may mitigate academic problems students encounter in the classroom.

Further, for policymakers interested in "what works" for students, the lack of academic performance enhancement indicates a need to reconsider the purpose of LCs. To do this, the components and implementation processes of LCs must be considered. By examining program structures and features of LCS independently at each institution or within community college systems, we may be able to point out how or why LCs may be affecting engagement differently from academic performance. Thus, understanding the cohort experiences across various learning community programs may enable us to understand what programmatic mechanisms may be needed to improve program structures, and thus affect both academic and social outcomes.

Although prior studies demonstrate that participating students were more engaged in their community college environment than were students not enrolled in learning communities (Bloom & Sommo, 2005; Scrivener et al., 2008), the results of this study highlight that the effect of LCs is

relatively lower for first-generation college students, Hispanic students, and African-American students compared to White students. In view of these differences, community college policies centered on persistence and degree attainment need to consider additional support mechanisms for first-generation college students and minorities besides LCs or should consider tailor learning community experiences to the needs of these populations.

Conclusions

Learning communities are one strategy implemented by community colleges to increase engagement and academic performance and to address the low persistence and degree attainment rates among their student populations. This study contributes to the community college literature by testing the effect of LCs on three outcomes: active-collaborative learning, student-faculty interactions, and student grade point average. Results suggest LCs do not have an effect on academic performance but do have significant and positive treatment effects on active-collaborative learning and student-faculty interactions. Despite these positive results, there were nonsignificant findings for first-generation college students and moderately significant findings for minority students. Because community colleges comprise a higher proportion of African-American, Hispanic, and first-generation college students than do four-year colleges, these findings may help community college administrators seeking to implement LCs inform their understanding of how to increase engagement and academic performance for these populations.

Table 6.

Sample description and characteristics of students who completed learning community programs

Variable	N (%)	Learning Community Completed N (%)	Bivariate χ^2 Test p Value
Total	35,761	12,816 (35.8)	
Student Characteristics			
Gender			<0.001
Women	21,745 (60.8)	8,248 (37.9)	
Men	14,016 (39.2)	4,568 (32.6)	
Race/Ethnicity			<0.001
White	20,664 (57.8)	8,301 (40.2)	
African-American	5,933 (16.6)	1,645 (27.7)	
Hispanic	5,307 (14.8)	1,512 (28.5)	
Other	3,857 (10.8)	1,358 (35.2)	
Age			<0.001
Traditional-age student	24,591 (68.8)	8,601 (35.0)	
Non-traditional-age student	11,170 (31.2)	4,215 (37.7)	
First-generation college status			<0.001
First-generation college student	9,882 (35.4)	3,375 (34.2)	
Non-first-generation college student	18,024 (64.6)	7,005 (38.9)	
Academic credential earned			<0.001
High school diploma/GED	29,253 (81.8)	9,893 (33.8)	
Certificate or higher	6,508 (18.2)	2,923 (44.9)	
College status			<0.01
Started at college	26,639 (74.5)	9,435 (35.4)	
Started elsewhere	9,122 (25.5)	3,381 (37.1)	
Enrollment status			<0.001
Less than full-time	8,079 (22.6)	2,375 (29.4)	
Full-time	27,682 (77.4)	10,441 (37.7)	
Degree goal			<0.001
No degree goal	8,551 (23.9)	2,922 (34.2)	
Certificate	2,932 (8.2)	1,034 (35.3)	
Associate's degree	14,732 (41.2)	5,449 (37.0)	
Both certificate & AA degree	9,546 (26.7)	3,411 (35.7)	

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Table 7.

Mean differences on dependent variables between treatment conditions with independent-sample t

tests (N=35,761)

Variable	*t*	Mean (SD)
Dependent Variables		
Active-collaborative learning	-33.56***	
Treatment group		9.85 (3.62)
Comparison group		8.58 (3.33)
Student-faculty interaction	-27.45***	
Treatment group		7.20 (3.15)
Comparison group		6.29 (2.95)
Academic performance (GPA)	-13.22***	
Treatment group		3.10 (0.59)
Comparison group		3.01 (0.60)

Note: * p<0.05; ** p<0.01; *** p<0.001; two-tailed test

Table 8.

Logistic regression predicting participation in LCs

Variable	Log Odds (SE)
Gender: Male	0.77 (0.02)***
Race/Ethnicity: White	
African-American	0.57 (0.02)***
Hispanic	0.65 (0.03)***
Other	0.82 (0.04)***
Age: Non-traditional-age student	0.97 (0.03)
Generation: First-generation college student	0.85 (0.02)***
Academic credentials earned	1.65 (0.06)***
College status: Started at college	1.01 (0.03)
Enrollment status: Full-time	1.54 (0.05)***

Note: * p<0.05; ** p<0.01; *** p<0.001

Table 9.

Covariate imbalance before propensity score weighting

	p-value of Regression Coefficient of Treatment (Learning Community)	
Covariate	**ATE**	**ATT**
College status	p = 0.02	p = 0.02
Enrollment status	p<0.001	p<0.001
Academic credential earned	p<0.001	p<0.001
Age	p<0.001	p<0.001
First-generation college status	p<0.001	p<0.001
Gender	p<0.001	p<0.001
African-American	p<0.001	p<0.001
Hispanic	p<0.001	p<0.001
Other	p = 0.20	p = 0.20

Note: Average treatment effect (ATE) where weight for a treated case is $1/p$, for a control case is $1/(1-p)$; and average treatment effect for the treated (ATT) where weight for a treated case is 1, and for a control case is $p/(1-p)$.

Table 10.

Covariate imbalance after propensity score weighting

Covariate	p-value of Regression Coefficient of Treatment (Learning Community)	
	ATE	ATT
College status	.991	.930
Enrollment status	.775	.814
Academic credential earned	.887	.861
Age	.875	.980
First-generation college status	.923	.843
Gender	.737	.744
African-American	.768	.893
Hispanic	.823	.812
Other	.983	.884

Note: Average treatment effect (ATE) where weight for a treated case is 1/p, for a control case is 1/(1-p); and average treatment effect for the treated (ATT) where weight for a treated case is 1, and for a control case is p/(1-p).

Table 11.

Regression analysis with propensity score weighting: Average treatment effect of active collaborative learning (ACL), student-faculty interactions (SFI) and academic performance (GPA)

Predictor Variable	Estimated Regression Coefficient (Robust SE)		
	ACL	SFI	GPA
Indicator for treatment: Completed LC	0.93 (0.05)***	0.64 (0 .04)***	0.05 (0.01)***
Enrollment status: Full-time status	1.13 (0.06)***	0.99 (0 .05)***	0.02 (0.01)*
Generation: 1st-generation college student	-0.26 (0.05)***	-0.18 (0.04)***	-0.05 (0.01)***
Gender: Male	0.01 (0.05)	-0.05 (0.04)	-0.08 (0.01)***
African-American	0.06 (0.07)	0.01 (0.06)	-0.21 (0.01)***
Hispanic	-0.14 (0.07)*	-0.36 (0.06)***	-0.11 (0.01)***
Support for college success	0.27 (0.03)***	0.27 (0.03)***	0.06 (0.01)***
Social support	0.59 (0.03)***	0.63 (0.03)***	-0.02 (0.005)***
Hours worked: 21 hours or more	-0.11 (0.05)*	0.04 (0.04)	-0.03 (0.01)***
Quality of peer relations	0.47 (0.02)***	0.14 (0.02)***	0.01 (0.004)***
Quality of instructor relations	0.10 (0.02)***	0.23 (0.02)***	0.07 (0.004)*
Quality of administrative relations	-0.11 (0.02)***	-0.06 (0.02 ***	-0.01 (0.003)***
Income as source for tuition	0.35 (0.03)***	0.20 (0.03)***	0.02 (0.01)***
Care for dependent: Yes	0.50 (0.05)***	0.37 (0.04)***	-0.003 (0.01)
Marital status: Married	0.09 (0.06)	-0.25(0.05)***	0.22 (0.01)***
Degree goal	0.09 (0.02)***	0.13 (0.02)***	-0.02 (0.004)***
Course enrollment	0.08 (0.02)***	0.11 (0.01)***	-0.02 (0.003)***
Constant	3.31 (0.14)	1.99 (0.12)	2.71 (0.02)
Number of participants	*23,771*	*23,769*	*23,172*

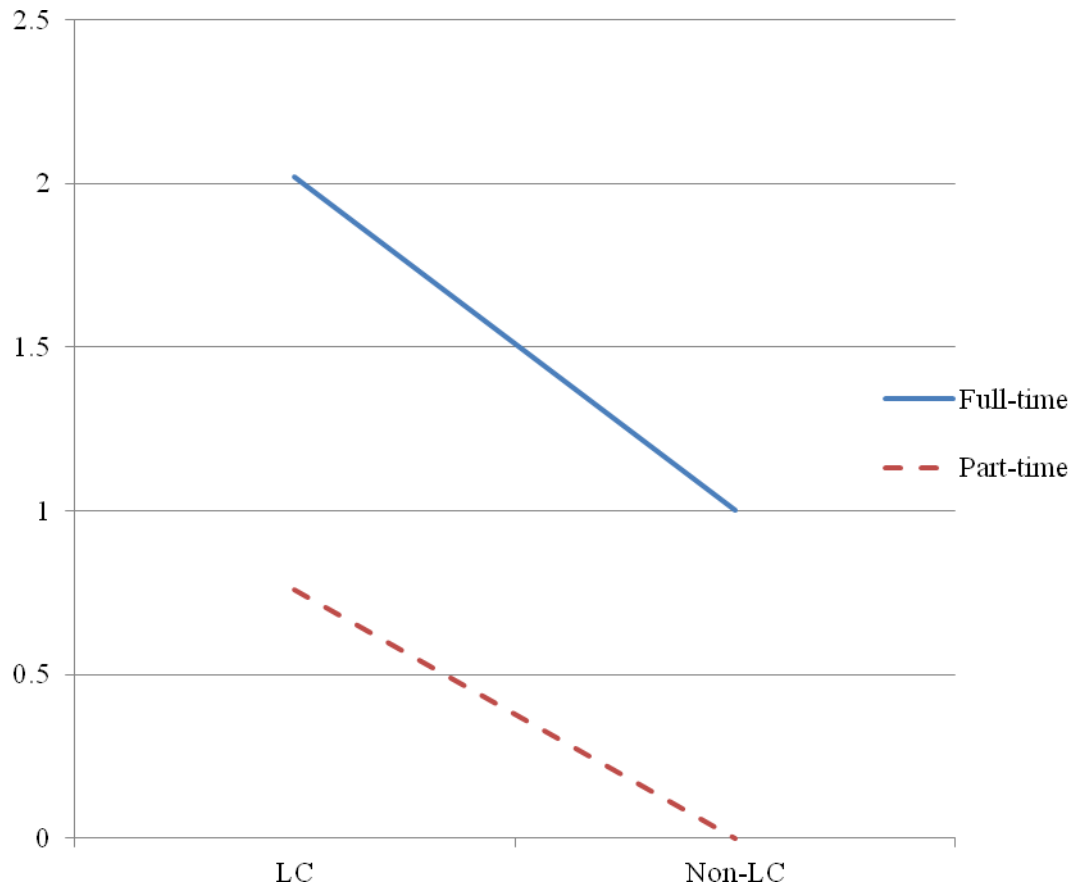*Note:* * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; two-tailed test

Figure 7. Relationship between LC participation and enrollment status. Students who completed LCs while enrolled full-time had relatively higher average ACL scores than the comparison group.
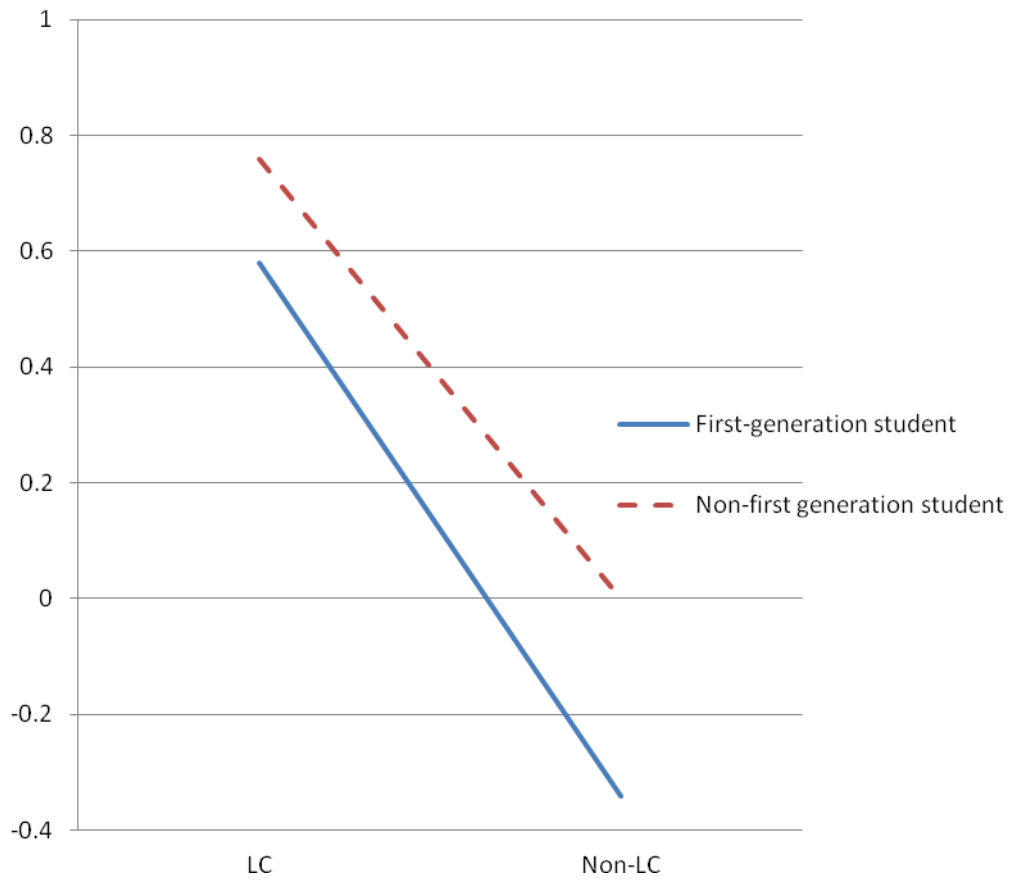
Figure 8. Relationship between LC participation and first-generation college status. First-generation college students who completed LCs had relatively lower average ACL scores than non-first generation college students, although this finding was moderately significant.
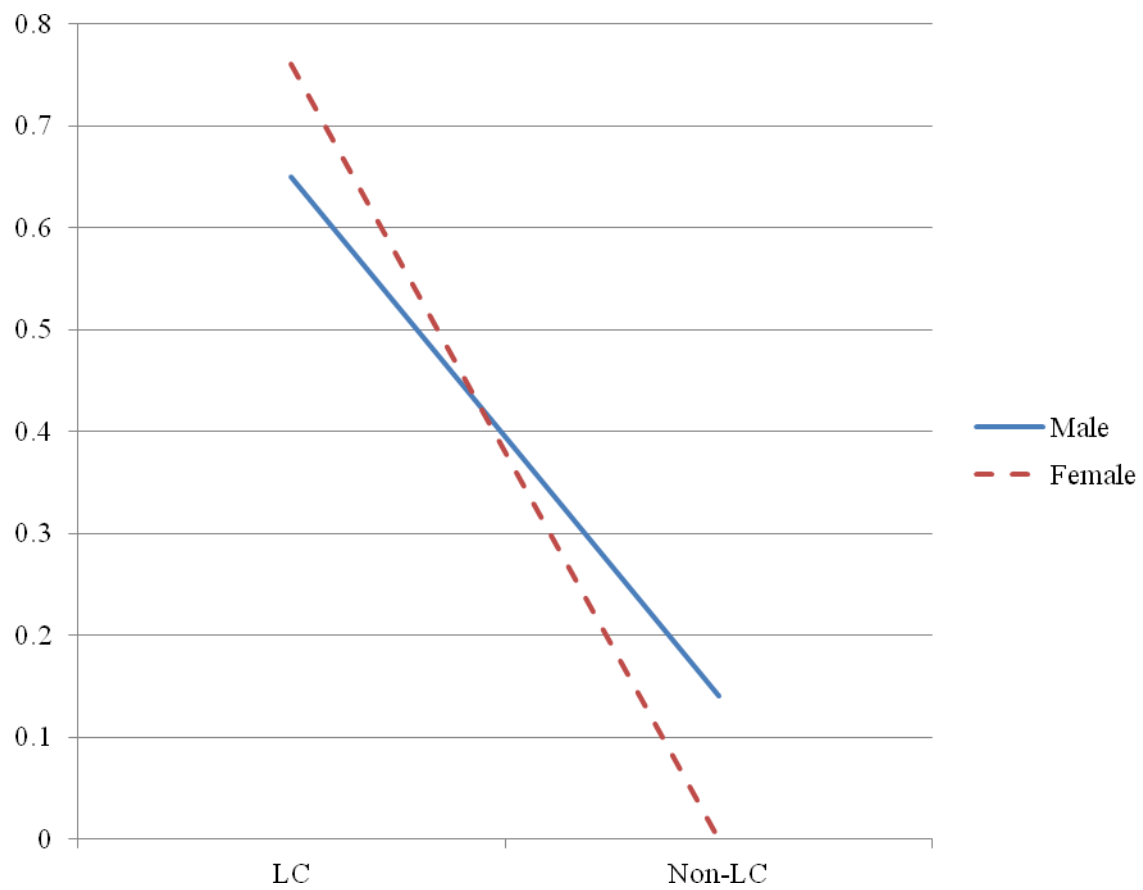
Figure 9. Relationship between LC participation and gender. Men who completed LCs had relatively

lower average ACL scores than did women
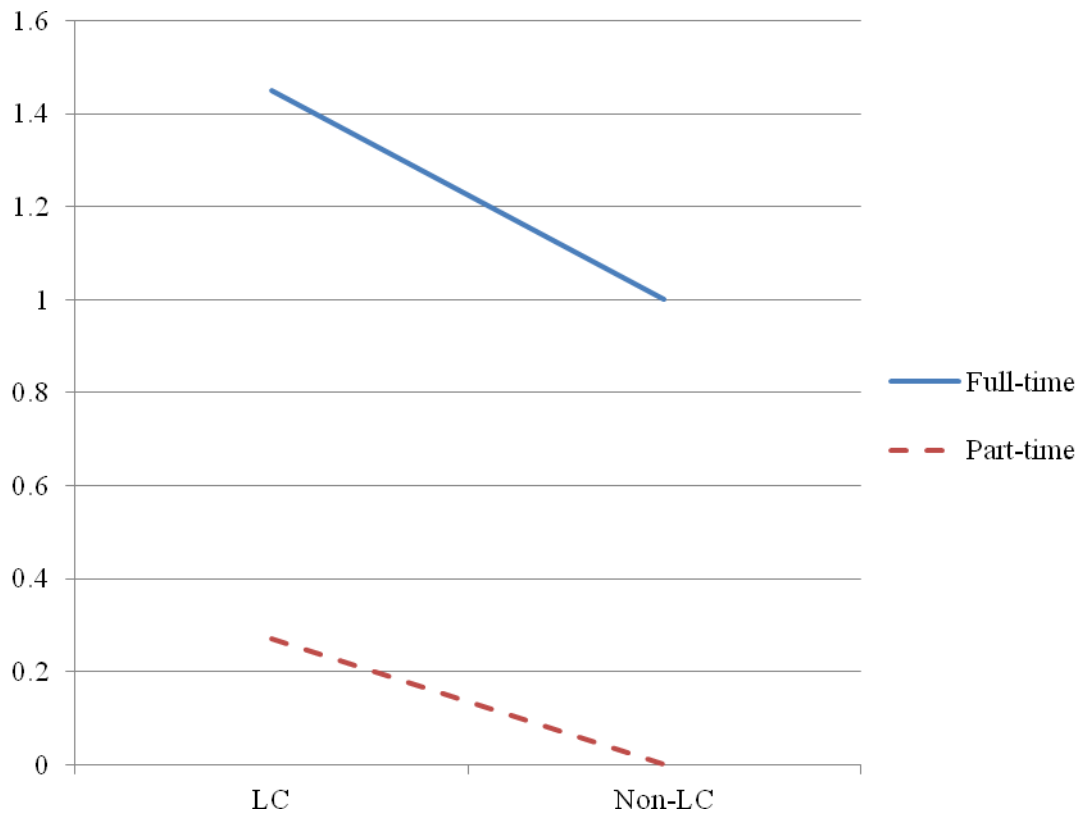
Figure 10. Relationship between LC participation and enrollment status. Full-time students who completed LCs had relatively higher SFI scores than did the comparison group.
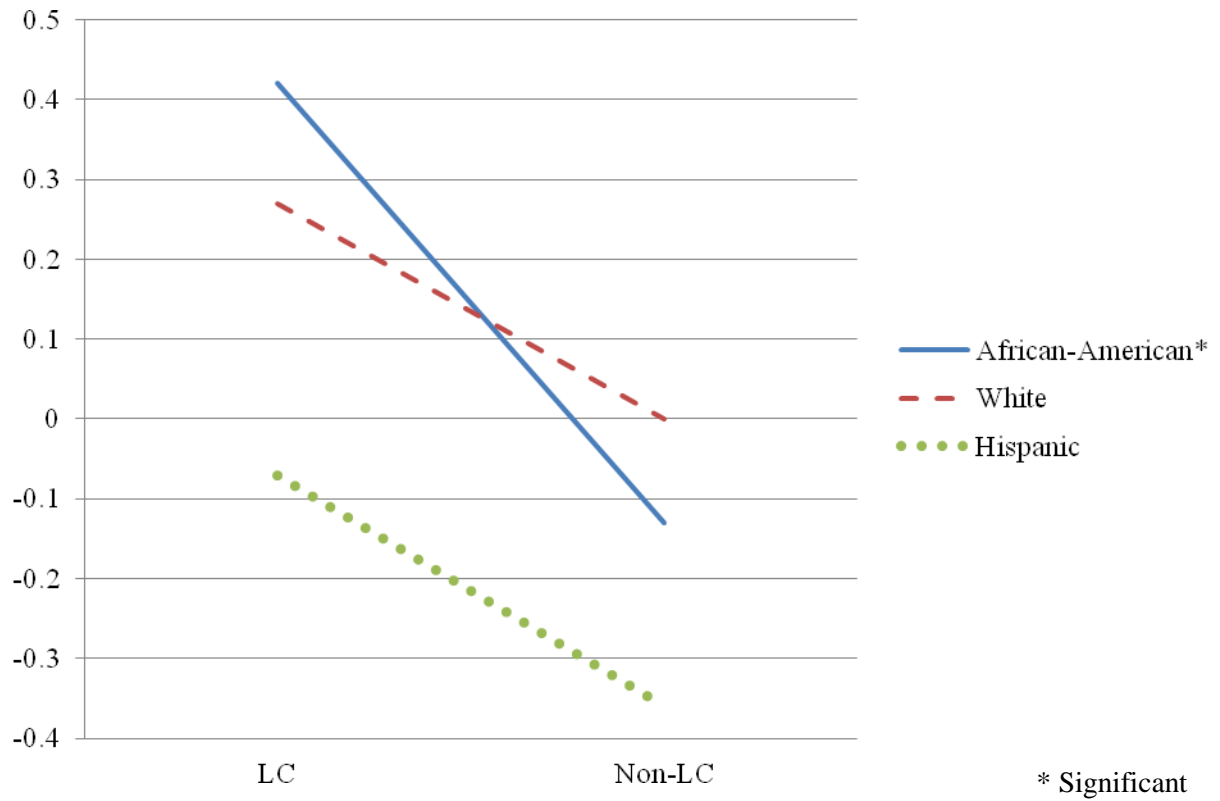
Figure 11. Relationship between LC participation and race/ethnicity. The average SFI score for African-American students who completed LCs was relatively higher than for White students.
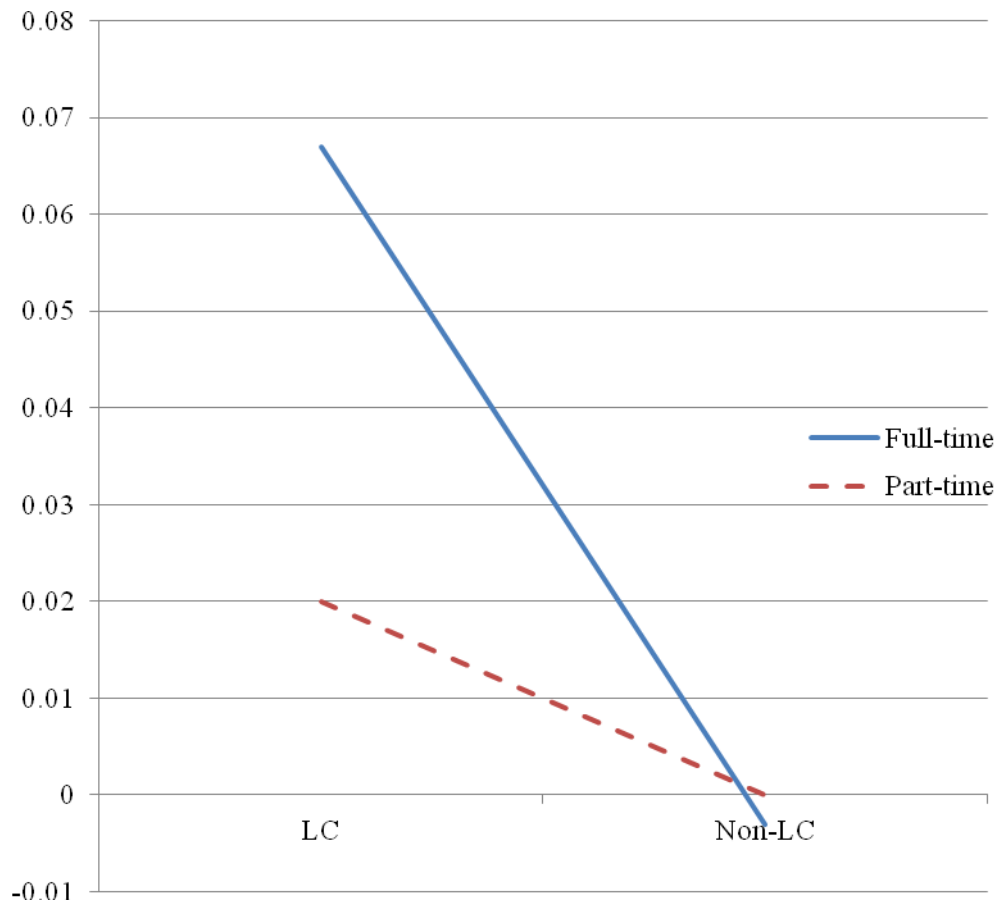
Figure 12. Relationship between LC and enrollment status. Students who completed LCs and enrolled full-time had relatively higher GPA scores than the comparison group.

Conclusion

The objectives of this dissertation were threefold: 1) to explain the mechanisms by which Tinto's concepts of academic and social integration can be expanded using Coleman's theory of social capital; 2) to empirically test the relationship between integration and student outcomes accounting for institutional characteristics; and 3) to test the effect of a program aimed at impacting students' social and academic integration.

Taken together, these analyses tell us important things about community college students and their college experiences. First, the theoretical proposition discussed in Manuscript I draws attention to how the college environment creates conditions that affect early exit from higher education. Because Tinto's interactionalist theory lacks explanation for examining processes and mechanisms inherent in how students develop academic and social integration, I argue that the incorporation of social capital may fill this gap. By testing hypotheses associated with the function of social capital proposed in this new framework, researchers may be able to learn how the college environment affects students' behaviors and identify and improve practices that directly influence academic and social integration, thus mitigating early college departure.

Second, students' precollege characteristics matter. Generally, low-income and minority students attend community college. These traits should not impede their ability to persist, succeed academically, or graduate from college. However, minority and low-income students also bring to college a multitude of issues, which include a lack of adequate academic preparation in high school, enrolling part-time in college, caring for dependents, and working full-time. These characteristics and risk factors paint a picture of the challenges students face not only as African-American or Hispanic students, but also as individuals unable to devote all their time to their education due to substantial responsibilities or academic deficiencies. Including precollege characteristics in these analyses helps

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determine which students struggle during college, but also how resources may be effectively allocated.

Another important finding of these analyses is that students' college experiences affect student outcomes. Students' perception of how helpful, supportive, or receptive their environment is affects their behaviors or interactions with peers and instructors. These findings suggest students are more likely to engage with instructors, take initiative in their learning, and participate in the classroom when college environments promote these activities. For community college administrators, evaluating students' satisfaction with services and programs administered at the college is one area that needs further exploration. Further, improving services that matter most to students may help them meet their longer-term educational goals.

Last, institutional characteristics need to be considered in analyses because these factors explain how the college environment as a whole affects student outcomes. These findings suggest that the proportion of minority students at an institution affects persistence. Unlike disaggregate (i.e., individual characteristic) results where all racial categories negatively influenced outcomes, aggregate racial compositions appear to affect outcomes differently. In the second manuscript, Hispanic and multi-racial students persisted longer as the proportion of their respective groups increased. Yet, the proportion of African-American students at an institution made no difference to student persistence. This discrepancy may be explained by how community colleges respond to the needs of particular student populations. It seems that community college campuses with high proportions of Hispanic or multi-racial students may be providing programs, services, or environments that support the needs of these student populations. Taken as a whole, institutional characteristics seem to affect student outcomes, which underscore the importance of including these factors in analyses of community college students.

The aim of this dissertation was to propose a new theoretical understanding of how academic and social integration develop among college students and test the validity of these concepts using

quantitative methods. In an effort to contribute to the community college literature, these analyses show promising implications for practice, research, and institutional policy to ensure all community college students successfully meet their educational objectives.

Social workers are regularly employed by community colleges and involved in efforts to impact student persistence, even though this line of work is not generally featured in social work literature. Because social work is dedicated to improving the well-being of oppressed and vulnerable populations, research and intervention with community college populations makes sense. This dissertation has highlighted the racial and ethnic diversity of community college populations and some of the challenges that community college students, particularly low-income students, may face in education settings. Further, first generation-college students, who make up more of the student body of community colleges than four-year colleges, may lack social capital, which may intersect with challenges they face coming from families of lower economic status and as racial or ethnic minorities. Social work practitioners have skills in assessment and advocacy and their role in higher education may benefit these students when life crises or other factors hinder student achievement. Social work researchers, highly focused on intervention research, have much to contribute by applying theoretical knowledge and rigorous methods to construct and test community college-based interventions to enhance the social well-being and academic performance of these students.

Appendix A:

Using Design Weights in Hierarchical Linear Modeling of Survey Data

This section provides a description of the *Beginning Postsecondary Students Longitudinal Study* (BPS: 04/06) sampling weights. In addition, information about computing scaling weights incorporated for analysis in this study is discussed.

The weights for BPS: 04/06 data were derived from the *National Postsecondary Student Aid Study* (NPSAS: 04) weights. The NAPSAS weights account for the "unequal probability of selection of institutions and students in NPSAS: 04 sample" (Cominole et al., 2007, p. 67). In addition to adjusting for selection, the NPSAS weights also adjust for "multiplicity at the institution a student levels, unknown student eligibility, nonresponse, and poststratification" (Cominole et al., 2007, p. 67). Institution weight was also used to estimate the student weight (Cominole et al., 2007). The weight for respondents of the NPSAS is the product of 13 weight components which include:

- institution sampling weight (WT1);

- institution multiplicity adjustment (WT2);

- institution poststratification adjustment (WT3);

- institution poststratification adjustment (WT3);

- institution nonresponse adjustment (WT4);

- student sampling weight (WT5);

- student subsampling weight (WT6);

- first student multiplicity adjustment (WT7);

- student unknown eligibility adjustment (WT8);

- student not located adjustment (WT9);

- student refusal adjustment (WT10);

- student other nonresponse adjustment (WT11);

- second student multiplicity adjustment (WT12); and

- student poststratification adjustment (WT13).

For BPS:04/06, base weights for each student are computed as the product of the first eight NPSAS adjustment factors:

$$W\_BPS0 = WT1 \times WT2 \times WT3 \times WT4 \times WT5 \times WT6 \times WT7 \times WT8.$$

The BPS weight is a product of student - and institution –level weights, resulting in a clustered or non-independent sampling plan (Carle, 2009). For example, sampling design identifies a grouping scheme, such as districts within a state, and then samples a cluster of districts excluding other districts. Subsequently, data is collected from individuals within selected districts. Because individual-level data are clustered within districts, it is likely the data within a cluster are similar than data from non-sampled clusters. Therefore, the nature of clustering in survey data and incorporating sampling weights to account for unequal selection probabilities are important to consider in multilevel modeling analyses (Chantala, 2006). When clustering and sampling weights are not taken into account in multilevel modeling analysis, standard errors and parameters may be biased (Carle, 2009; Rabe-Hesketh & Skrondal, 2006). This can lead researchers to incorrectly reject null hypotheses, thus increasing the probability of committing Type I errors.

To include sampling weights in multilevel models, weights must be scaled to provide the least biased estimates (Pfeffermann, et al., 1998). Two types of scaling methods are available to provide better estimates than conducting unweighted analyses (i.e., using raw weights). The first method, Method A, scales new weights that sum to the cluster sample size. Method A is estimated in the following equation:

$$WA_{ij} = w_{ij} \left(n_j / \Sigma_i w_{ij} \right)$$

where, WA_{ij} is the Method A scaled weight for individual i in cluster j; w_{ij} is the raw or unscaled weight for individual i in cluster j; and n_j is the number of sample units in cluster j.

Because cluster sampling results in "loss of effectiveness," individuals from a cluster provide less new information than individuals selected from independent clusters (Shackman, 2001). Method

B scales new weights which sum to the effective cluster size. Computation for Method B is illustrated below:

$$WB_{ij} = w_{ij}(\Sigma_i w_{ij} / \Sigma_i w^2_{ij})$$

where, WB_{ij} is the Method B scaled weight for individual i in cluster j; w_{ij} is the raw or unscaled weight for individual i in cluster j; and w^2_{ij} is the square of the unscaled weight for individual i in cluster j.

In this study, Method A and Method B scaling methods were used to gauge estimates biased by unweighted weights in multilevel modeling. Overall, results across all three methods were consistent. However, results for Method A and Method B suggest estimates were particularly sensitive to scaling weights.

Appendix B:

Residual Analysis

The section offers an overview of residual analysis for a two-level mixed model and residual diagnostics pertaining to this study. Residuals are defined as the difference between the observed score and the predicted score. The need for residual analysis follows the assumptions embedded in multiple regression analysis. To check if the model meets these assumptions, outcome variables are checked by assessing random errors. There are three assumptions used to check the model assumptions (Larsen, 2008).

- First, the error terms are independent.

- Second, the error terms are normally distributed.

- Third, the error terms have the same variance σ^2.

To test the tenability of these assumptions, conditional studentized residual for the outcome variables were used. Studentized residuals are the raw residuals divided by the standard error of the residual with the ith case deleted. Studentized residuals are computed by the following equation (Yaffee, n.d.):

$$e_i^{\,s} = \frac{e_i}{\sqrt{s^2_{(i)}(1-h_i)}}$$

where, $e_i^{\,s}$ is the studentized residual, points $S_{(i)}$ is the standard deviation where the ith case is deleted, and h_i is the leverage statistic. A leverage point is an observed value that has influence on the analysis and these points comprise the hat-matrix (Larsen, 2008; Schabengerger, 2004). First, the conditional studentized residuals are checked for normality. The following illustrates the normal probability plot of the conditional studentized residuals:
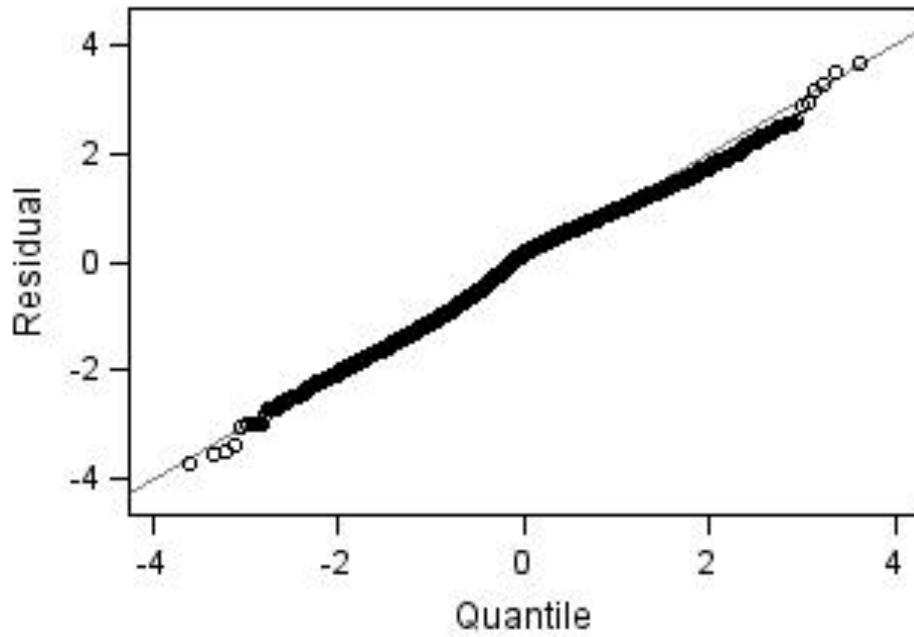
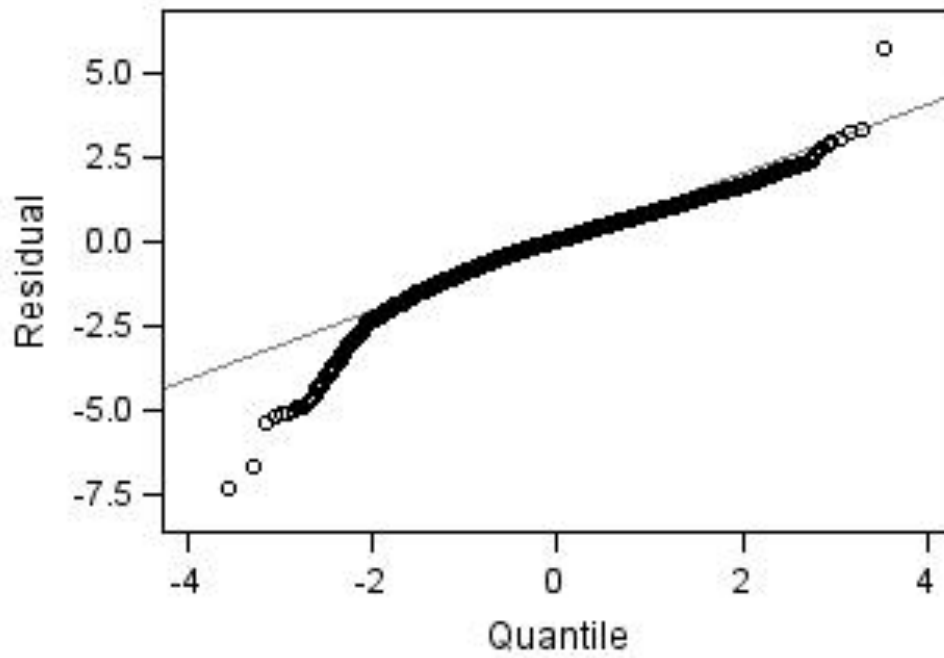*Figure 13.* Conditional studentized residuals, Persistence (months enrolled)

Figure 14. Conditional studentized residuals, Academic performance (GPA)

Figure 13 illustrates a straight line supporting the assumption that the observed sample comes from a normal distribution. For academic performance, Figure 14 illustrates a moderate deviation from the line indicating that the observed sample may be violating the normality assumption. Next, diagnostics for homoscedasticity and linearity were checked. A scatter plot of the conditional studentized residuals is fitted against predicted values.
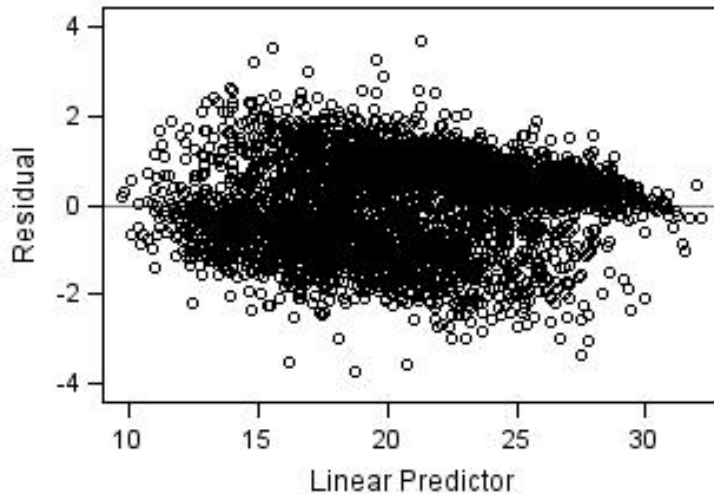

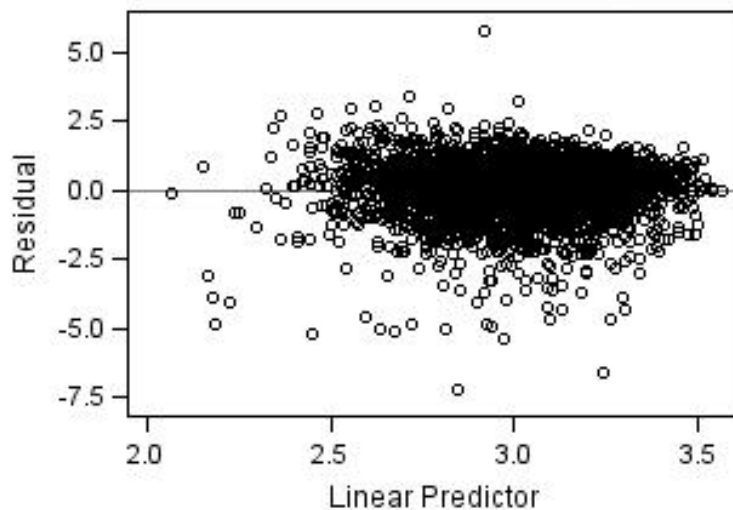*Figure 15*. Conditional studentized residuals, Persistence

Figure 16. Conditional studentized residuals, Academic performance

Results for Figure 15 illustrate a residual plot of the relationship between persistence and predictor variables. The data points appear to be randomly scattered around zero. In the same way, the

scatter plot in Figure 16 shows the relationship between academic performance and predictor variables. Both plots show no distinct pattern around zero. As a result, both scatter plots do not suggest violations of the assumptions of zero means and constant variance of the random errors. For this study, diagnostics for two multilevel models were conducted to test the tenability of statistical assumptions. These assumptions included examining residual normality, linearity, and homogeneity of the variance. In sum, the tenability of the assumptions was met for both models analyzed in this study.

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