# Postsecondary Co-enrollment and Baccalaureate Completion: A Look at Both Beginning 4-Year College Students and Baccalaureate Aspirants Beginning at Community Colleges

**Xueli Wang · Kelly Wickersham**

**Abstract**   Research examining diversifying college enrollment patterns has gradually gained attention in recent years. Yet, few studies have focused on postsecondary co-enrollment and its different forms such as co-enrolling at institutions of the same level (lateral co-enrollment) and attending a 4- and 2-year institution simultaneously (vertical co-enrollment), and their distinctive relationship with baccalaureate completion and college persistence. Drawing upon data from the Beginning Postsecondary Students Longitudinal Study (BPS:04/09) and the Postsecondary Education Transcript Study (PETS:09), this study investigated the relationship between co-enrollment and baccalaureate completion and college persistence among beginning 4-year institution students and baccalaureate-aspiring beginning community college students who first accessed postsecondary education in 2003–2004. Results indicated that vertical co-enrollment appeared to have a positive relationship with baccalaureate attainment and persistence among students beginning at 4-year institutions as well as baccalaureate-aspiring community college beginners, while lateral co-enrollment did not demonstrate a significant association with attainment and persistence across both student groups. Policy implications and suggestions for future research are also discussed.

**Keywords**   Postsecondary co-enrollment · Lateral co-enrollment · Vertical co-enrollment · College persistence · Time-to-degree · Baccalaureate attainment · Community colleges

## Introduction

Over the past few decades, although enrollment in postsecondary education has been on the rise (Hussar 2005; Ingels et al. 2012), degree completion rates have stagnated (Adelman

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2004; Bound et al. 2010; DesJardins et al. 2002a, 2006; Horn 2006). For those students who remain enrolled in college, the length of time it takes them to attain baccalaureate degrees has increased (Bound et al. 2007). According to the Digest of Education Statistics by the National Center for Education Statistics (NCES 2012), only 39 % of first-time, full-time students seeking a baccalaureate degree starting at 4-year institutions in the fall of 2005 completed a bachelor's degree in 4 years, and only 59 % finished in 6 years.

Although the gap between access and attainment has inspired numerous studies examining factors associated with baccalaureate completion and time-to-degree (e.g., Astin and Oseguera 2005; Astin et al. 1996; DesJardins et al. 2002a, b, 2003; Ishitani 2006; Knight and Arnold 2000; Pascarella and Terenzini 2005), research along this line has barely touched upon the potential impact of complex postsecondary attendance patterns, particularly co-enrollment,[1] which refers to enrolling at more than one postsecondary institution during the same academic term. Nationally, nearly 11 % of beginning post-secondary students co-enrolled at a certain point in their college career (Peter and Forrest Cataldi 2005). This percentage is likely to grow as students continue to seek various pathways to progress through college.

Several implications exist for students who co-enroll as well as for the institutions they attend. First of all, co-enrollment options expand course availability by affording students a larger pool of institutions and classes to choose from. This may lead to an increase in baccalaureate degree attainment closer to a 4-year time frame if required courses are consistently offered among institutions. Moreover, as college tuition continues to rise, co-enrollment options grant students the opportunity to attend multiple institutions and select courses based on affordability. Also, institutions in close proximity of one another may want to strategically consider the number of students who co-enroll and the type of courses they take. This can help determine whether it is worthwhile to offer the same courses at both institutions, or perhaps offer certain ones only at one institution or the other. As a result, the decision may open up the prospect of efficiently reallocating financial resources toward other curricular or co-curricular areas. Finally, this attendance pattern necessitates effective articulation agreements to ensure students who choose to co-enroll preserve the credits and courses completed, which in turn will ensure more efficient degree progression and completion.

Despite the pivotal policy relevance of co-enrollment, empirical evidence exploring this noteworthy attendance pattern is remarkably sparse. From a descriptive perspective, researchers have utilized national datasets to document the profiles of students attending more than one postsecondary education institution, including those who co-enroll (McCormick 2003; Peter and Forrest Cataldi 2005). Within the small body of research that has explored the relationship between co-enrollment and student outcomes such as academic performance, persistence, and degree attainment (Crisp in press; Lam 2007; McCormick 2003; Peter and Forrest Cataldi 2005; Wang and McCready 2013), no distinction has been made among the varying types of co-enrollment. For example, within the co-enrolled student group, individuals may attend institutions of the same level simultaneously (i.e., 4-year students co-enrolling at another 4-year institution or community college students co-enrolling at another community college). On the other hand, students

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[1] It is important to distinguish between postsecondary co-enrollment and high school/college dual enrollment. Co-enrollment signifies attending more than one postsecondary institution simultaneously (Crisp in press; Peter and Forrest Cataldi 2005; Wang and McCready 2013). High school/college dual enrollment also involves attending multiple institutions at the same time; however, in that scenario, students are enrolled at a high school and a postsecondary institution (Bailey et al. 2002). This study focuses solely on the phenomenon of postsecondary co-enrollment.

may enroll at institutions of different levels at the same time (i.e., 4-year students co-enrolling at a community college or vice versa). Given these intricacies, more nuanced research is needed to analyze co-enrollment and the differentiations that exist within this attendance pattern.

The potential policy implications of co-enrollment call for a more evolved, empirical understanding of how co-enrollment may contribute to baccalaureate completion and college persistence. This study is additive toward that end, seeking to distinguish co-enrollment and its different forms (i.e., lateral and vertical) from other patterns of attendance and to examine how it relates to degree progression and attainment. In this study, we rely on the most recent longitudinal data on postsecondary students and their college transcripts to answer the following question: How is postsecondary co-enrollment (including co-enrolling at institutions of the same level and co-enrolling at institutions of different levels) related to progress toward baccalaureate attainment among beginning 4-year college students and baccalaureate-aspiring students beginning at community colleges?

## Relevant Literature and Conceptual Grounding

This study builds upon previous literature on postsecondary co-enrollment and baccalaureate attainment (including time-to-degree) in order to better understand this complex attendance pattern, the potential differentiations embedded in it, and its influence on college completion.

Multiple Institution Attendance and Co-enrollment

As the number of students enrolling at multiple institutions is on the rise, patterns of attendance in postsecondary education continue to diversify (Goldrick-Rab 2006). While transfer remains one of the typical patterns of multi-institutional attendance, scholars (e.g., Bahr 2012; McCormick 2003) have gone beyond this linear attendance pattern and discussed multiple institution attendance and its many forms in light of the complexities of student mobility. In particular, McCormick (2003) explored alternating between more than one institution, called "swirling," and attending several institutions concurrently, labeled "double-dipping" (de los Santos and Wright 1990; Gose 1995). McCormick further highlighted co-enrolling at more than one institution simultaneously as *a means to accelerate an educational program or increase the availability or scheduling of courses.* Although McCormick drew upon insightful research, some of the previous studies he referenced were descriptive in nature or utilized datasets that dated back to the 1970s. Moreover, multiple institution attendance was portrayed as a broad, umbrella category, which aggregated more nuanced attendance patterns (co-enrollment, supplemental enrollment, swirling, etc.). As a result, specific attendance patterns that may have fallen under multiple institution attendance were not represented individually with their respective data. These limitations can be addressed with the availability of more recent datasets of postsecondary students along with their transcript data, which hold strong promise for revealing new information on the current state of multiple institution attendance, particularly co-enrollment and its different forms.

In their study that focused on students attending multiple institutions, Peter and Forrest Cataldi (2005) found that 40 % of the students starting in 1995–1996 as first-time enrollees attended more than one postsecondary institution by 2001 and 11 % of all students co-

enrolled. The authors also found that across all types of institutions, financially dependent students had a higher tendency of attending more than one institution than their financially independent counterparts, and females participated in co-enrollment at a slightly higher rate than males. Furthermore, younger students had a greater likelihood of co-enrolling than older students. These descriptive data provide informative profiles of students who co-enroll, but no sophisticated statistical analyses except simple correlational explorations were conducted by the authors to examine the relationship between co-enrollment and student outcomes.

Co-enrollment and Student Outcomes

A limited number of studies have explored the relationship between co-enrollment and various student outcomes including academic performance, persistence and completion, as well as time-to-degree. In regard to co-enrollment's link to academic performance measured by grade point average (GPA), Peter and Forrest Cataldi (2005) did not find a correlation between the two among students across all levels of postsecondary education. On the other hand, focusing exclusively on community college transfer students at 4-year institutions, Wang (2012a) revealed that students who ever co-enrolled reported better GPAs than those who did not. These mixed results may have been an artifact of the researchers utilizing different datasets. Peter and Forrest Cataldi (2005) drew upon BPS:96/01 and B&B:2000/01, while Wang (2012a) utilized NELS:88/2000 and PETS:2000. Furthermore, the researchers observed diverse students at different points in their academic careers, which may have affected the degree to which co-enrollment was related to GPA.

Looking at the connection between co-enrollment and postsecondary persistence and completion, McCormick (2003) found that students who began at 4-year institutions and attended more than one institution had lower rates of persistence. However, he pointed out that the finding grouped together all patterns of multiple institution attendance, including transfer. When transfer students were removed from the analysis, the rate of persistence and bachelor's degree attainment among those who attended multiple institutions but did not transfer was greater compared to students who enrolled at one postsecondary institution. This result only applied to multiple institution attendance in general, without breaking it down further into specific enrollment patterns such as co-enrollment and swirling, or distinctions within co-enrollment (e.g., lateral versus vertical). It may have been possible that persistence rates varied even further than what McCormick presented depending on the specific type of attendance pattern.

Wang and McCready (2013) analyzed co-enrollment in relation to persistence and completion based on data from BPS:04/09 and PETS:09. They concluded that co-enrollment had a significant and positive impact on postsecondary persistence and completion among both students beginning at 4-year institutions and those who started at community colleges. Similar findings have been reported by Crisp (in press), who focused on traditional age students who started at 2-year institutions, and Peter and Forrest Cataldi (2005), who included both 2- and 4-year beginning students in their analyses.

Although these studies contributed valuable information to our evolving understanding of co-enrollment and its potential impact on college student success, several limitations and challenges plague the small body of existing empirical work on co-enrollment. First, the approaches researchers have adopted to define and measure co-enrollment have been inconsistent at best. As alluded to earlier, in prior analyses, sometimes co-enrollment was broadly conceived under multi-institutional attendance and analyzed the same way (McCormick 2003), and in one case co-enrollment was lumped together with dual

enrollment between high school and college (Lam 2007). The potential overlap between co-enrollment and other types of multi-institutional attendance notwithstanding, this aggregated approach to depicting multi-institutional attendance, with co-enrollment combined with other types of attendance, would not yield findings that specifically apply to co-enrolled students, especially those who do not follow other multi-institutional attendance patterns such as transfer.

Second and related, in empirical studies that focus exclusively on co-enrollment, this specific pattern has largely been treated as a global, binary measure without being further dealt with empirically to account for the varied types of co-enrollment. As Wang and McCready (2013) rightfully acknowledged and recommended, future research on co-enrollment should start disentangling co-enrollment by examining the complex forms of co-enrollment practiced by students, such as attending institutions of the same or different level, thus producing results that are relevant for students participating in different types of co-enrollment. This is the focus of our study.

In addition, research in this vein has barely touched upon the relationship between co-enrollment and time-to-degree.[2] This limitation is important in that when theorizing the impact of co-enrollment, scholars tend to view co-enrollment as an accelerator for degree attainment (McCormick 2003; Wang and McCready 2013). With this assumption as a point of departure, what it means empirically is that when studying co-enrollment's link to student outcomes, we must take time-to-degree into consideration in order to test if co-enrollment would potentially represent a viable attendance pattern that accelerates baccalaureate completion.

## Conceptual Grounding

In conceptualizing this study, we build upon work by Wang and McCready (2013) who examined the effect of co-enrollment on 6-year persistence and attainment. The authors maintained that co-enrollment positively influences educational efficiency by expanding attendance and course options. They argued that by offering a broader scope of academic and institutional resources, co-enrollment may accelerate student progress toward degree attainment in a timely manner. However, given the scope of their study, Wang and McCready did not empirically examine time-to-degree as a potential outcome of co-enrollment; nor did they disaggregate co-enrollment into specific forms. Drawing upon and extending that work, we contend that if adopted effectively by students, co-enrollment options and offerings may positively influence *both* attainment *and* progress to degree, and in addition, co-enrolling at institutions of the same level may have a differential influence on attainment and progress to degree than co-enrolling at colleges of different levels. Conceptually, students are "shopping" for courses, and co-enrollment options represent a wider selection of not only courses, but where they are offered and their associated costs. When the course alternatives offered through co-enrollment become appealing in terms of content, educational value, flexibility, availability, and/or costs, students then are willing to consider these alternatives available to them. That is, there is value—educational, financial, or otherwise—associated with enrolling at a college other than one's primary institution. Following this rationale, students are more likely to see this value in co-enrollment options

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[2] See Lam (2007) as an exception, though the author used the term "co-enrollment" not only to refer to attendance at more than one postsecondary institution but also high school-college "dual enrollment." Grouping these types of simultaneous enrollment together may have revealed results that are not accurate for or applicable to co-enrollment specifically at the postsecondary level.

available at an institution of a different level than their primary one. For example, for a community college student, co-enrollment options at 4-year institutions may represent a stronger possibility for upward transfer; for a 4-year college student, co-enrollment options at community colleges may help fulfill a general education requirement more efficiently (Wang and McCready 2013). This is even more plausible in our study that focuses on progress toward baccalaureate completion as the primary outcome.

Therefore, our study centers on the relationship between co-enrollment and student progression to a baccalaureate degree, accounting for the potentially different roles of co-enrolling at institutions of the same level and co-enrolling at institutions of different levels. To more accurately estimate these relationships, the conceptual framework of this study also accounts for precollege and postsecondary academic and environmental factors that, based on prior research, influence attainment and time-to-degree (e.g., Adelman 1999, 2006; Astin 1997; Bean 1980; Cabrera et al. 2005; Pascarella 1985; Pascarella and Terenzini 1991, 2005; Swail et al. 2003; Tinto 1975, 1982, 1988, 1998). These factors and variables used in the study are detailed in Table 1.

## Methods

### Data and Sample

This study drew upon the Beginning Postsecondary Students Longitudinal Study (BPS:04/09) and the Postsecondary Education Transcript Study (PETS:09). BPS:04/09 and PETS:09 followed a cohort of students who first enrolled in postsecondary education in 2003–2004. The students were involved in three rounds of data collection, which took place during their first, third, and sixth year after starting college. About 18,000 students participated in BPS:04/09 data collection. Under PETS:09, transcripts were collected from all postsecondary institutions attended by nearly 17,000 students in this cohort between July 1, 2003 and June 30, 2009. Together, BPS:04/09 and PETS:09 constitute the most recent, comprehensive national survey of students attending postsecondary institutions.

The sample was first restricted to the 12,300 BPS respondents starting at a public or private nonprofit 4-year institution or a public 2-year college, aged 23 or younger when they originally started college in 2003–2004. For the community college student group, the sample was further limited to those who expected to earn at least a bachelor's degree.[3] Given that the outcome was baccalaureate attainment, this restriction was necessary because unlike their 4-year counterparts, many community college entrants do not have a baccalaureate degree goal and including these students would bias the results.[4] After weighting using the BPS panel weight (WTB000), the final analytical sample was representative of the population of baccalaureate-aspiring students, aged 23 or younger, who entered postsecondary education for the first time during the 2003–2004 academic year. Among these students, 58.8 % began at a 4-year institution and 41.2 % started at a 2-year public community college.

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[3] We should also note that our sample includes all BPS participants who fit our sample restriction. Thus, after weighting, our sample is nationally representative of all traditional age students who started at a public or private nonprofit 4-year college and their counterparts who began at a public 2-year community college with the expectation to earn a bachelor's degree. Thus, our sample is inclusive of co-enrolled and non-co-enrolled students, as well as those who transfer institutions and those who do not.

[4] We acknowledge the imperfect measure of educational expectations, as they can be fluid and students do not always follow paths in alignment with their educational expectations.

**Table 1** List of variables used in the study

| Variable name | Description |
| --- | --- |
| Dependent variable | |
| Baccalaureate completion | Categories of dependent variable |
| | (a) Completed a bachelor's degree in 4 years or less since postsecondary entry |
| | (b) Completed a bachelor's degree in 5–6 years but more than 4 years since postsecondary entry |
| | (c) Continuously enrolled in postsecondary education without earning a bachelor's degree yet |
| | (d) Left postsecondary education without earning a bachelor's degree (reference category against which each above category is compared) |
| Categories of independent variable | |
| Postsecondary lateral co-enrollment | Derived from PETS:09 transcript data: Indicator for ever being laterally co-enrolled at institutions of the same level as student's first institution, either 2-year or 4-year, but not both, 1 = yes, 0 = no |
| Postsecondary vertical co-enrollment | Derived from PETS:09 transcript data: Indicator for ever being vertically co-enrolled at institutions of different levels than student's first institution, i.e., ever co-enrolled at both 2-year and 4-year schools at the same time, 1 = yes, 0 = no |
| Never co-enrolled | Derived from PETS:09 transcript data: No co-enrollment records on transcript; omitted reference category in the analysis |
| Control variables | |
| Demographic background | |
| Respondent's age | Age when first enrolled (limited to 23 and below) |
| Respondent's gender | Binary variable (1 = female, 0 = male) |
| Respondent's race/ethnicity | A series of dummy variables indicating Black, Hispanic, Asian, Other minorities, with White as the reference category (White is the omitted reference category) |
| Respondent's parental education | Whether respondent is a first-generation college student, recoded from parents' highest level of education (1 = yes, 0 = no) |
| Family income | Income group in 2003–2004 (1 = 1st quartile, 2 = 2nd quartile, 3 = 3rd quartile, 4 = 4th quartile) |
| Pell grant amount | Amount of Pell grant funds received in 2003–2004 (in unit of $1,000) |
| Respondent's primary language | Whether English is the primary language in 2003–2004 (1 = yes, 0 = no) |
| Respondent's single parent status | Single parent status in 2003–2004 (1 = single parent, 0 = not a single parent) |
| Distance from first institution | Distance from first institution in 2003–2004 (in unit of 1,000 miles) |
| Delayed entry | Whether student delayed postsecondary enrollment (1 = yes, 0 = no) |
| Graduate degree expectations | Expecting to earn a graduate degree (1 = yes, 0 = no) |

**Table 1** continued

| Variable name | Description |
|---|---|
| High school academic preparation | |
| High school GPA rank | High school grade point average (GPA) (1 = 0.5–0.9, 2 = 1.0–1.4, 3 = 1.5–1.9, 4 = 2.0–2.4, 5 = 2.5–2.9, 6 = 3.0–3.4, 7 = 3.5–4.0) |
| High school math | Highest level of high school mathematics (4 = highest level) 0 = None of these, 1 = algebra 2, 2 = trigonometry/ algebra II, 3 = pre-calculus, 4 = calculus |
| Postsecondary experience | |
| Academic performance 1st year | Transcript GPA in year 1 of attendance (4.0 scale) |
| Distance education | Whether student took distance education courses in 2004 (1 = yes, 0 = no) |
| Academic integration in 2004 | |
| Items measured on a 3-point scale (0 = never, 1 = sometimes, 2 = often) | Frequency 2004: Faculty informal meeting |
| | Frequency 2004: Faculty talk outside class |
| | Frequency 2004: Meet academic advisor |
| | Frequency 2004: Study groups |
| Social integration in 2004 | |
| Items measured on a 3-point scale (0 = never, 1 = sometimes, 2 = often) | Fine arts activities |
| | School clubs |
| | School sports |
| Remediation | Transcript: Ratio of remedial courses to all courses |
| Withdrawal/repeats | Transcript: Ratio of withdraw/repeats to all courses |
| Work hours in 2004 | Job while enrolled in 2004: Hours worked per week (excl. work study) |
| Attendance intensity pattern | |
| Always part-time | Always full-time is the omitted reference category |
| Mix of part-time and full-time | |
| Months enrolled through 2009 | Total number of months respondent was enrolled at any institutions through 2009 |

*Classifying Co-enrollment*

To delve into the nuances and complexity of the co-enrollment phenomenon, this attendance pattern was further classified as (a) *lateral co-enrollment* where students simultaneously enrolled at institutions of the same level as their first institution (i.e., exclusively attending multiple 2-year colleges or exclusively attending multiple 4-year colleges), and (b) *vertical co-enrollment*[5] where students had ever concurrently attended multiple

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[5] Although we considered employing the terms *upward co-enrollment* and *downward co-enrollment*, we did not wish to attach any potentially negative attributes to the postsecondary institutions students use to navigate higher education (e.g., moving "downward" to a community college). In order to maintain a neutral connotation, we decided to utilize *vertical co-enrollment*, which speaks to the fact that the type of co-enrollment that involves both 2- and 4-year colleges as a phenomenon is vertical in both directions, despite students' primary institutions.

institutions of different levels (i.e., ever attending both 2- and 4-year colleges at the same time). Thus, according to this definition, a number of students who co-enrolled both vertically and laterally were classified into the vertical co-enrollment pattern. Judging by the transcript records during the 6-year time window, a small number of students co-enrolled after they left their first postsecondary institution, thus posing a challenge in defining vertical and lateral co-enrollment among the two beginning postsecondary cohorts (community college cohort and 4-year college cohort). To be specific, 0.32 % of the students beginning at community colleges were involved in co-enrollment exclusively at 4-year institutions. Although technically this would count as "lateral" co-enrollment (across 4-year institutions), it is very different from lateral co-enrollment across community colleges. Therefore, these students were grouped together with vertical co-enrollees among beginning community college students, indicating an upward direction of their co-enrollment behavior. Among the beginning 4-year college cohort, 0.11 % of the students engaged in co-enrollment exclusively at community colleges and 0.02 % had co-enrolled laterally at community colleges and also co-enrolled laterally at 4-year institutions. These students were also treated as vertical co-enrollees among students beginning at 4-year colleges. Dropping these students from the analysis did not alter the results substantively.

Based on this classification, the main independent variable in this study, co-enrollment, was coded as a series of dummy variables: (a) *lateral co-enrollment* which involved one school level only and (b) *vertical co-enrollment* which involved two different school levels, with *no co-enrollment* as the omitted reference category. Note that all analyses were performed separately for beginning community college students and those starting at 4-year institutions. Thus, lateral co-enrollment indicated co-enrolling at multiple 4-year institutions for the beginning 4-year group while it meant simultaneous attendance at multiple 2-year colleges for the beginning 2-year college group. The operationalized definition for vertical co-enrollment was the same across both student populations.

When coding co-enrollment, detailed transcript data from PETS:09 were used to sort out the beginning and end of terms as well as the types of schools at which students co-enrolled. To begin with, transcript data of those who had overlapped terms were identified by examining overlapped durations at different institutions.[6] Then, for each co-enrolled student, the level of attended institutions (i.e., 2- or 4-year) of co-enrolled terms were identified and summarized based on the definitions presented earlier. Of the beginning 4-year group, about 2.2 % had engaged in lateral co-enrollment (having co-enrolled at 4-year institutions exclusively by 2009), and about 6.5 % of the students in the sample were involved in vertical co-enrollment (having co-enrolled at both 2- and 4-year institutions). Among the baccalaureate-aspiring community college beginners, approximately 1.5 % of the students reported lateral co-enrollment (having co-enrolled at 2-year institutions exclusively by 2009), and about 6.2 % experienced vertical co-enrollment (having ever co-enrolled at both 2- and 4-year institutions).

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[6] A double-looping search method was utilized to create cross matching of the student term records from different institutions. It should be noted that students' term records from the same institution were not cross matched, for the records from the same institution are not co-enrollment records. In addition, summer co-enrollment at an institution other than students' primary institution was included in the counting of co-enrollment as long as both enrollments occurred simultaneously. For example, if a student was enrolled at a 4-year college and took one single course in the summer at a community college at the same time, the student was classified as being vertically co-enrolled.

*A Note on Co-enrollment and Transfer*

Prior research has shown an intersection between transfer and co-enrollment (also referred to as simultaneous or concurrent enrollment) at multiple institutions. For example, in an exploration of the role of community colleges in student transfer and bachelor's degree attainment, Palmer and Pugh (1993) indicated that regardless at which point students transferred, it was possible that co-enrollment between 2- and 4-year institutions might have occurred. Moreover, in Bahr's (2012) work that examined lateral transfer between community colleges, he found that lateral transfer might have been a result of students enrolling simultaneously at more than one institution, thus illustrating the intertwined nature of various multi-institutional attendance patterns, especially between co-enrollment and transfer. In light of this complexity, we descriptively explored co-enrollment in relation to students' first transfer during the 6-year time frame in this study. The timing of the co-enrolled term (based on the term end date) in relation to the beginning date of the first transfer was analyzed to present a descriptive picture to illustrate the interrelationship between co-enrollment and transfer.

Outcome and Control Measures

Because timely completion of a baccalaureate degree was of interest, the main dependent variable went beyond a binary estimate of baccalaureate attainment and was measured as a multi-categorical variable indicating whether as of 2009, students had (a) completed a bachelor's degree in 4 years or less since postsecondary entry, or (b) completed a bachelor's degree in five or 6 years since postsecondary entry, or (c) still been enrolled in postsecondary education without earning a bachelor's degree yet, or (d) left postsecondary education without earning a bachelor's degree. To adjust for other important factors related to baccalaureate attainment, this study also controlled for a range of precollege variables (e.g., high school academic preparation and expecting a graduate degree), postsecondary variables (e.g., academic and social integration, educational experiences, working hours, and number of months students were enrolled), and socio-demographic background (e.g., age, gender, race/ethnicity, and first-generation status) as discussed in the literature review section (see Table 1 for detailed descriptions of these control variables).

Analytical Approaches

Traditionally, college outcome measures such as persistence and degree completion are often captured using a dichotomous variable, thus lending themselves to statistical analyses relying on binary logit or probit models. However, given this study's expanded definition of baccalaureate attainment that took into account progress to degree, techniques modeling multi-categorical outcomes needed to be employed. The multinomial logistic (MNL) regression analysis has been a popular approach to this scenario. MNL regression extends from the general binary logistic regression analysis to model dependent variables with more than two discrete outcomes, as in this study. This type of analysis, however, relies on the assumption of independence of irrelevant alternatives (IIA), which requires that the relative risk (i.e., odds) of selecting between any outcomes does not depend on the availability of other (irrelevant) outcomes. Metaphorically, if a person prefers oranges to apples, then adding or removing mangos (or any other fruit) as an alternative option will not change the person's preference of oranges to apples. If this assumption is violated, the MNL estimation may not produce accurate parameters and alternative methods would become necessary. In particular, the

multinomial probit (MNP) model is robust to violations of the IIA assumption by allowing for the correlations between the errors for the comparison between the alternatives to be estimated, without assuming the errors to be independently distributed from each other (Jones-White et al. 2010). Despite this advantage over the MNL model, the MNP model involves more complex parameter estimation and its result is less intuitive to understand. In this study, a MNL model was first conducted to estimate the relationship between baccalaureate attainment (the dependent variable in the model) and lateral/vertical co-enrollment (the key independent variables in the model) while adjusting for a number of covariates that may also influence attainment. Then, two post-estimation tests of the IIA assumption, the Hausman test and the Small–Hsiao test, were performed based on the MNL model. Results were mixed in regard to the IIA assumption in this study. Therefore, a MNP model was employed to provide additional estimations to be compared with the MNL estimations.

## Missing Data

Missing data are inherent to survey research. This study was no exception. About 13 % of the student records contained missing values. A comparison of these records with those without missing data indicated that there were no significant differences on the dependent and independent variables between these two record sets. To impute these missing values, multiple imputation, a state of the art missing data handling technique (Schafer and Graham 2002), was applied to derive five imputed datasets using Stata's multiple imputation commands. The MNL and MNP regression analyses were then conducted based on the imputed data.

All analyses were conducted separately for the 4-year college beginner group and the community college beginner group, using the Stata statistical software and adjusted for the complex survey designs of BPS and PETS through Stata's survey commands. Additionally, the Visual Basic for Applications (VBA) of the Microsoft Excel program was used to search for overlapped co-enrolled terms and to summarize co-enrolled school types to create the key independent variables (i.e., lateral and vertical co-enrollment) as described earlier.

## Limitations of the Study

A few limitations need to be considered along with the study's findings. First of all, although this research draws on robust longitudinal survey and transcript data, there is a lack of information pertaining to specific reasons as to why students co-enroll. As a result, this study is unable to account for motivational factors or perceived benefits of co-enrollment that drive students' decision to co-enroll.

A second limitation is the lack of causal inference in the findings presented in the study. BPS:04/09 and PETS:09 offer rich data, but they are purely observational and rely on information on students who already made the decision to co-enroll or not. Although the discussion section provides possible explanations for the relationships between co-enrollment and baccalaureate attainment, these relationships should not be construed as causal effects.

A third limitation is that other types of co-enrollment beyond lateral and vertical co-enrollment are not addressed given the scope of this research. Due to the lack of relevant data in PETS:09, it is difficult to tease out more specific information regarding the various forms of co-enrollment. For example, this study is unable to determine the modes of delivery of the courses in which students co-enrolled. Therefore, it is not possible to ascertain whether the co-enrolled courses were offered online or in a physical classroom.

**Table 2** Summary of sample characteristics (weighted %)

| Within row % | Beginning 4-year institution | | | | Beginning community college | | | |
|---|---|---|---|---|---|---|---|---|
| | Lateral (2.19 %) | Vertical (6.50 %) | Not co-enrolled (91.31 %) | Total (100 %) | Lateral (1.50 %) | Vertical (6.16 %) | Not co-enrolled (92.34 %) | Total (100 %) |
| Demographic background (within column %) | | | | | | | | |
| Race/ethnicity | | | | | | | | |
| Black | 10.10 | 8.22 | 10.68 | 10.51 | 8.57 | 13.71 | 15.62 | 15.39 |
| Hispanic | 6.99 | 10.13 | 9.28 | 9.28 | 29.67 | 12.70 | 15.15 | 15.22 |
| Asian | 5.32 | 10.53 | 6.91 | 7.11 | 16.16 | 10.39 | 5.82 | 6.25 |
| Other | 4.95 | 3.52 | 3.06 | 3.13 | 0.73 | 2.76 | 3.74 | 3.64 |
| White | 72.64 | 67.60 | 70.08 | 69.97 | 44.87 | 60.44 | 59.67 | 59.50 |
| Gender | | | | | | | | |
| Male | 41.63 | 36.00 | 45.38 | 44.69 | 34.47 | 37.17 | 48.48 | 47.57 |
| Female | 58.37 | 64.00 | 54.62 | 55.31 | 65.53 | 62.83 | 51.52 | 52.43 |
| Income group | | | | | | | | |
| 1st Quartile | 13.97 | 18.60 | 19.70 | 19.50 | 20.19 | 28.27 | 30.12 | 29.86 |
| 2nd Quartile | 23.14 | 21.70 | 23.50 | 23.37 | 34.04 | 18.08 | 27.42 | 26.94 |
| 3rd Quartile | 28.42 | 25.79 | 25.39 | 25.48 | 35.43 | 29.68 | 24.44 | 24.93 |
| 4th Quartile | 34.47 | 33.90 | 31.42 | 31.64 | 10.35 | 23.97 | 18.02 | 18.27 |
| HS GPA rank | | | | | | | | |
| 1 | 0.00 | 0.00 | 0.07 | 0.07 | 0.00 | 0.55 | 0.17 | 0.19 |
| 2 | 0.00 | 0.00 | 0.27 | 0.25 | 0.00 | 0.79 | 1.14 | 1.10 |
| 3 | 0.54 | 0.32 | 0.69 | 0.67 | 2.67 | 0.79 | 4.36 | 4.11 |
| 4 | 3.17 | 2.63 | 5.50 | 5.26 | 18.77 | 16.39 | 17.65 | 17.59 |
| 5 | 5.31 | 9.49 | 9.86 | 9.74 | 13.92 | 16.25 | 17.55 | 17.41 |
| 6 | 27.54 | 34.39 | 33.39 | 33.32 | 45.34 | 33.01 | 33.16 | 33.33 |
| 7 | 58.31 | 46.58 | 46.31 | 46.59 | 6.78 | 24.39 | 15.59 | 16.00 |

**Table 2** continued

| Within row % | Beginning 4-year institution | | | | Beginning community college | | | |
|---|---|---|---|---|---|---|---|---|
| | Lateral (2.19 %) | Vertical (6.50 %) | Not co-enrolled (91.31 %) | Total (100 %) | Lateral (1.50 %) | Vertical (6.16 %) | Not co-enrolled (92.34 %) | Total (100 %) |
| Other background (single column %) | | | | | | | | |
| First-generation | 9.85 | 21.43 | 18.81 | 18.79 | 32.39 | 22.56 | 33.90 | 33.18 |
| Single parent | 0.42 | 1.15 | 1.17 | 1.16 | 1.89 | 2.51 | 6.61 | 6.28 |
| Engl. as prim. language | 93.54 | 88.08 | 89.83 | 89.80 | 88.32 | 87.40 | 87.48 | 87.48 |
| Grad. deg. expectation | 79.72 | 73.69 | 74.64 | 74.69 | 75.01 | 67.56 | 54.98 | 56.06 |
| Delayed entry | 6.13 | 5.63 | 7.58 | 7.42 | 21.97 | 20.43 | 28.13 | 27.56 |

All reported percentages are weighted. Percentages of demographic characteristics are reported as within column %. Percentages for other background, all binary characteristics are single column %

## Results

Weighted percentage distributions of students' background characteristics are provided in Table 2 with the beginning 4-year group and the beginning community college group reported separately. Of the beginning 4-year group, about 2.2 % were involved in lateral co-enrollment and 6.5 % were vertically co-enrolled students. The same pattern held true among the beginning community college group, with 1.5 % of the community college entrants involved in lateral co-enrollment and approximately 6.2 % in vertical co-enrollment. The fact that the bulk of co-enrollment occurred vertically suggested that in terms of course-taking, the boundary between different levels of colleges seemed to be blurred: Both community and 4-year colleges seemed to provide courses for and attracted students from institutions at a different level. A few notable descriptive differences across student backgrounds in light of their co-enrollment behavior include the following: Disproportionately, fewer Black students beginning at community colleges participated in lateral co-enrollment. This is different from participation patterns exhibited by other minorities, such as Hispanic students who were more likely to engage in lateral co-enrollment if they started at a community college, but less so if they began at a 4-year school, or Asian American students who tended to be overrepresented in vertical co-enrollees among the 4-year group and in both types of co-enrollment among the 2-year group. In regard to gender, female students were more likely to co-enroll than male students and this was especially true among baccalaureate aspirants beginning at community colleges. Community college beginners in middle income groups were more likely to participate in lateral co-enrollment. However, among 4-year beginners, no obviously distinctive co-enrollment patterns were observed across different income groups. More detailed socio-demographic breakdowns within each type of co-enrollment (percentage within column) are presented in the table.

To make sense of the potential intersection between co-enrollment and transfer as identified by Bahr (2012), a series of descriptive statistics are provided in Tables 3 and 4. In Table 3, the timing of co-enrolled terms (based on the term end date) in relation to the beginning date of students' first transfer (if any) are summarized.

After examining the timing of co-enrolled terms in relation to first transfer, co-enrollees were further classified according to the timing and types of their co-enrollment in relation

**Table 3** Timing of co-enrolled terms in relation to first transfer beginning date

| Type of co-enrolled term | Before transfer | | After transfer | | Not transferred | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Count | % | Count | % | Count | % | Count | % |
| 2 + 2 Lateral | 149 | 28.9 | 235 | 45.6 | 131 | 25.4 | 515 | 100 |
| 2 + 2 Lateral and 2 + 4 vertical | 12 | 10.4 | 55 | 47.8 | 48 | 41.7 | 115 | 100 |
| 2 + 4 Vertical | 597 | 17.9 | 1,225 | 33.8 | 1,505 | 45.2 | 3,327 | 100 |
| 2 + 4 Vertical and 4 + 4 lateral | 18 | 17.8 | 40 | 39.6 | 43 | 42.6 | 101 | 100 |
| 4 + 4 Lateral | 216 | 18.3 | 443 | 37.6 | 520 | 44.1 | 1,179 | 100 |
| Total | 992 | 18.9 | 1,998 | 38.2 | 2,247 | 42.9 | 5,237 | 100 |

The counts are the number of co-enrolled terms. Whether co-enrolled terms occurred before or after first transfer is based on a comparison between the enrollment date of first transfer and the end date of the co-enrolled term

2 + 2 Lateral co-enrollment across 2-year colleges

2 + 4 Vertical co-enrollment across 2-year and 4-year colleges

4 + 4 Lateral co-enrollment across 4-year colleges

**Table 4** Transfer behaviors of co-enrolled students (in weighted % of column)

| Timing of co-enrollment versus first transfer | Type of co-enrollment | Beginning 4-year institution | | | | Beginning community college | | | | Total (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Direction of the first transfer | | | | | | | | |
| | | N (%) | H (%) | R (%) | Total (%) | N (%) | H (%) | V (%) | Total (%) | |
| Not transferred | Lateral only | 28 | | | 17 | 55 | | | 7 | 13 |
| | Vertical only | 64 | | | 39 | 44 | | | 6 | 26 |
| | Both | 9 | | | 5 | 1 | | | 0 | 3 |
| | Sub-total | 100 | | | 62 | 100 | | | 13 | 42 |
| Co-enrolled before transfer | Lateral only | | 18 | 1 | 4 | | 15 | 7 | 8 | 6 |
| | Vertical only | | 12 | 26 | 7 | | 1 | 15 | 10 | 8 |
| | Both | | 1 | 3 | 1 | | 0 | 1 | 1 | 1 |
| | Sub-total | | 31 | 29 | 12 | | 16 | 24 | 19 | 14 |
| Co-enrolled after transfer | Lateral only | | 28 | 10 | 8 | | 29 | 7 | 11 | 9 |
| | Vertical only | | 15 | 40 | 10 | | 29 | 43 | 34 | 19 |
| | Both | | 2 | 3 | 1 | | 5 | 6 | 5 | 3 |
| | Sub-total | | 46 | 53 | 19 | | 63 | 55 | 50 | 31 |
| Co-enrolled before and after transfer | Lateral only | | 8 | 1 | 2 | | 17 | 1 | 5 | 3 |
| | Vertical only | | 9 | 13 | 4 | | 2 | 15 | 9 | 6 |
| | Both | | 6 | 3 | 2 | | 2 | 5 | 4 | 3 |
| | Sub-total | | 23 | 18 | 8 | | 21 | 21 | 18 | 12 |
| Total | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

All reported % are weighted

*N* not transferred, *H* horizontal transfer, *V* vertical transfer (community college group only), *R* reverse transfer (4-year college group only)

*Lateral only* student participated in same-level (lateral) co-enrollment exclusively

*Vertical only* student participated in different-level (vertical) co-enrollment exclusively

*Both* student participated in both lateral and vertical co-enrollment

to transfer. Along the timing dimension, co-enrollees were classified as (1) not transferred, (2) co-enrolled before transfer, (3) co-enrolled after transfer, and (4) co-enrolled both before and after transfer. Along the co-enrollment type dimension, co-enrollees were classified as (1) lateral only, (2) vertical only, and (3) both lateral and vertical. Along the transfer direction dimension, co-enrollees were classified as (1) not transferred, (2) horizontal transfer, (3) vertical transfer (upward transfer by community college beginners only), and (4) reverse transfer (by 4-year beginners only). Table 4 summarizes co-enrollees' weighted percent distribution based on these three dimensions of student classifications.

In summary, a few compelling patterns emerged from the analyses detailed in Tables 3 and 4. First, judging by the enrollment records, there is a substantial overlap between co-enrollment and transfer behaviors, with over half of the co-enrolled terms reported by students who transferred institutions at least once. Of the identified co-enrolled terms, more than 50 % were registered by transfer students (18.9 % by those prior to the first transfer and 38.2 % by those after the first transfer) and only 42.9 % were registered by students who did not transfer institutions (Table 3). This intersection between co-enrollment and

transfer was even more notable for the $2 + 2$ lateral co-enrollment terms, which were mostly registered by students who eventually transferred. Second, when examining this intersection between co-enrollment and transfer based on where students started postsecondary education, it becomes more obvious that the intersection is more prominent among baccalaureate-aspiring students beginning at community colleges. As indicated in Table 4, nearly 62 % of the beginning 4-year co-enrollees did not transfer institutions and by sharp contrast, only 13 % of the co-enrollees beginning at community colleges did not transfer institutions. This discrepancy seems to indicate a marked difference in the purposes for which beginning community college students use co-enrollment compared to their 4-year college counterparts. Third and related, it is worth noting that among beginning community college co-enrollees who transferred to 4-year institutions, the majority engaged in vertical co-enrollment (see column V of Table 4).

While the analyses reported in Tables 3 and 4 offer several descriptive approaches to disentangling the interconnectedness between co-enrollment and transfer, we should caution that given the focus and scope of the study, these analyses cannot attend to all the complexities regarding transfer, co-enrollment, and other types of multi-institutional attendance. For example, patterns outlined in Tables 3 and 4 are based on students' enrollment records pertaining to the first institutional transfer. While this approach allows us to include all students who transferred institutions during the 6-year data collection time frame of BPS:04/09 and PETS:09, it does not necessarily offer a complete account for the "swirling" patterns among students who move back and forth among institutions.

The MNL regression results for the beginning 4-year and beginning community college groups are presented in Tables 5 and 6, respectively. No substantive differences existed between the MNL and MNP models and the differences in the estimated coefficients between the two approaches were minimal, indicating the potential violation of the IIA assumption may not have been a serious empirical issue in this study. Therefore, the following discussion is based on the relatively more intuitive results from the MNL.

Interpreting Results from the MNL Model

Analysis of the MNL model generated a set of multinomial logit coefficients that were estimated for each outcome category of the dependent variable, baccalaureate attainment (attaining a baccalaureate in 4 years, attaining a baccalaureate in 5–6 years, and persistence), relative to the base category—having left postsecondary education without a baccalaureate degree (hereafter referred to as *departure* for ease of reading). To facilitate interpretation of these coefficients, relative risk ratios (RRR) were obtained by exponentiating the multinomial logit coefficients. While relative risk (RR, also called odds) refers to the ratio of the probability of choosing one outcome category over the probability of choosing the base category, RRR refers to the ratio of RR (or ratio of odds, i.e., odds ratio) and calculates, for a unit increase in the predictor variable, the factor by which the relative risk of choosing the outcome relative to the base category is expected to change given that the rest of the independent variables in the model are held constant. To illustrate, among beginning 4-year institution students, the RRR associated with vertical co-enrollment is 1.712 for 4-year attainment relative to departure. That is, for vertically co-enrolled students compared to non-co-enrolled students, the relative risk of attaining a baccalaureate degree in 4 years relative to departure would be expected to increase by a factor of 1.712, holding other variables in the model constant. In other words, vertical co-enrollment increases co-enrollees' likelihood of attainment within 4 years as compared to departure. Depending on the values of RRR being greater or less than one, the other RRR values in Tables 5 and 6

**Table 5** Multinomial logistic regression parameter estimates: students beginning at 4-year institutions

| Attainment level | Attained bachelor's degree in 4 years versus no degree and not enrolled | | | Attained bachelor's degree in 5 to 6 years versus no degree and not enrolled | | | Enrolled but no bachelor's degree versus no degree and not enrolled | | |
|---|---|---|---|---|---|---|---|---|---|
| | b | se | RRR | b | se | RRR | b | se | RRR |
| Laterally co-enrolled | 0.278 | 0.292 | 1.321 | 0.036 | 0.304 | 1.036 | 0.542 | 0.398 | 1.719 |
| Vertically co-enrolled | 0.538* | 0.254 | 1.712 | 0.646* | 0.274 | 1.908 | 0.823** | 0.284 | 2.278 |
| Age | 0.044 | 0.071 | 1.045 | 0.146 | 0.097 | 1.157 | 0.172 | 0.103 | 1.187 |
| Female | 0.338*** | 0.094 | 1.402 | 0.061 | 0.115 | 1.063 | −0.147 | 0.167 | 0.864 |
| Black | −0.362* | 0.165 | 0.696 | −0.274 | 0.192 | 0.760 | −0.070 | 0.239 | 0.932 |
| Hispanic | −0.113 | 0.196 | 0.893 | −0.056 | 0.215 | 0.945 | 0.248 | 0.237 | 1.282 |
| Asian | −0.025 | 0.220 | 0.975 | 0.073 | 0.260 | 1.076 | −0.384 | 0.315 | 0.681 |
| Other minorities | −0.293 | 0.206 | 0.746 | 0.013 | 0.244 | 1.013 | 0.176 | 0.320 | 1.193 |
| First-generation | −0.099 | 0.143 | 0.905 | −0.068 | 0.154 | 0.934 | −0.203 | 0.178 | 0.816 |
| Family income | 0.192** | 0.063 | 1.212 | 0.037 | 0.066 | 1.038 | −0.069 | 0.098 | 0.933 |
| English as primary language | 0.098 | 0.203 | 1.102 | 0.152 | 0.220 | 1.164 | −0.251 | 0.240 | 0.778 |
| Single parent | 0.306 | 0.401 | 1.358 | 0.409 | 0.622 | 1.506 | 1.495** | 0.547 | 4.459 |
| Distance from 1st institution | −0.087 | 0.050 | 0.917 | −0.013 | 0.050 | 0.987 | −0.071 | 0.075 | 0.932 |
| Delayed entry | −0.401 | 0.271 | 0.670 | −0.384 | 0.296 | 0.681 | 0.196 | 0.301 | 1.216 |
| Expect a graduate degree | −0.021 | 0.120 | 0.979 | −0.059 | 0.139 | 0.943 | −0.032 | 0.167 | 0.968 |
| High school GPA | 0.171** | 0.066 | 1.187 | 0.200*** | 0.062 | 1.221 | −0.004 | 0.077 | 0.996 |
| High school math | 0.102* | 0.042 | 1.107 | −0.023 | 0.048 | 0.977 | 0.007 | 0.059 | 1.007 |
| Pell grant amount | −0.056 | 0.050 | 0.946 | −0.155** | 0.051 | 0.857 | −0.142* | 0.068 | 0.867 |
| GPA in year 1 of attendance | 0.739*** | 0.079 | 2.094 | 0.350*** | 0.093 | 1.420 | −0.238* | 0.116 | 0.788 |
| Distance education | 0.482* | 0.204 | 1.619 | 0.576** | 0.209 | 1.779 | 0.339 | 0.235 | 1.404 |
| Faculty informal meeting | −0.109 | 0.080 | 0.897 | −0.084 | 0.090 | 0.920 | −0.078 | 0.117 | 0.925 |
| Faculty talk outside class | −0.060 | 0.091 | 0.942 | −0.027 | 0.099 | 0.974 | −0.177 | 0.149 | 0.838 |
| Meet academic advisor | 0.052 | 0.099 | 1.053 | −0.103 | 0.096 | 0.903 | 0.029 | 0.117 | 1.030 |
| Study groups | 0.016 | 0.077 | 1.017 | −0.004 | 0.093 | 0.996 | −0.188 | 0.120 | 0.829 |

**Table 5** continued

| Attainment level | Attained bachelor's degree in 4 years versus no degree and not enrolled | | | Attained bachelor's degree in 5 to 6 years versus no degree and not enrolled | | | Enrolled but no bachelor's degree versus no degree and not enrolled | | |
|---|---|---|---|---|---|---|---|---|---|
| | b | se | RRR | b | se | RRR | b | se | RRR |
| Fine arts activities | 0.034 | 0.077 | 1.035 | 0.043 | 0.080 | 1.044 | 0.201 | 0.116 | 1.223 |
| School clubs | 0.147* | 0.067 | 1.158 | 0.044 | 0.079 | 1.045 | −0.035 | 0.091 | 0.966 |
| School sports | −0.009 | 0.064 | 0.991 | −0.063 | 0.075 | 0.939 | −0.183 | 0.102 | 0.833 |
| Remediation | −7.719*** | 2.085 | 0.000 | −3.249 | 2.016 | 0.039 | 0.626 | 1.430 | 1.870 |
| Withdrawal/repeats | −9.731*** | 0.998 | 0.000 | −5.787*** | 0.825 | 0.003 | 0.777 | 0.681 | 2.175 |
| Always part-time enrolled | −1.031*** | 0.206 | 0.357 | −1.002*** | 0.248 | 0.367 | 0.204 | 0.242 | 1.227 |
| Mix full- and part-time | −1.256*** | 0.128 | 0.285 | −0.810*** | 0.140 | 0.445 | −0.168 | 0.155 | 0.845 |
| Weekly work hours | −0.013** | 0.004 | 0.987 | −0.008 | 0.005 | 0.992 | 0.004 | 0.007 | 1.004 |
| Months enrolled through 2009 | 0.031*** | 0.005 | 1.032 | 0.178*** | 0.009 | 1.195 | 0.121*** | 0.011 | 1.129 |
| Constant | −4.627*** | 1.446 | 0.010 | −11.318*** | 2.000 | 0.000 | −7.818*** | 2.070 | 0.000 |

b Regression coefficient, se standard error, RRR relative risk ratio, obtained by taking the exponential of the regression coefficients

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

**Table 6** Multinomial logistic regression parameter estimates: baccalaureate aspirants beginning at community colleges

| Attainment level | Attained bachelor's degree in 4 years versus no degree and not enrolled | | | Attained bachelor's degree in 5–6 years versus no degree and not enrolled | | | Enrolled but no bachelor's degree versus no degree and not enrolled | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | b | se | RRR | b | se | RRR | b | se | RRR |
| Laterally co-enrolled | 0.302 | 0.426 | 1.352 | 0.376 | 0.475 | 1.457 | 0.934 | 0.495 | 2.546 |
| Vertically co-enrolled | 1.094*** | 0.272 | 2.986 | 1.069*** | 0.248 | 2.913 | 0.996*** | 0.290 | 2.706 |
| Age | 0.050 | 0.080 | 1.051 | 0.025 | 0.061 | 1.026 | 0.015 | 0.074 | 1.015 |
| Female | 0.380* | 0.155 | 1.463 | 0.204 | 0.155 | 1.226 | 0.110 | 0.146 | 1.116 |
| Black | −0.295 | 0.204 | 0.745 | −0.594* | 0.256 | 0.552 | −0.214 | 0.200 | 0.808 |
| Hispanic | −0.255 | 0.188 | 0.775 | −0.356 | 0.238 | 0.700 | 0.077 | 0.256 | 1.080 |
| Asian | −0.604 | 0.342 | 0.547 | −0.417 | 0.328 | 0.659 | −0.399 | 0.353 | 0.671 |
| Other minorities | −0.050 | 0.263 | 0.951 | −0.274 | 0.337 | 0.760 | 0.241 | 0.275 | 1.272 |
| First-generation | −0.096 | 0.152 | 0.908 | −0.457** | 0.160 | 0.633 | −0.015 | 0.181 | 0.986 |
| Family income | 0.015 | 0.093 | 1.016 | 0.101 | 0.075 | 1.107 | 0.025 | 0.077 | 1.025 |
| English as primary language | −0.444* | 0.200 | 0.642 | −0.191 | 0.243 | 0.826 | −0.050 | 0.296 | 0.951 |
| Single parent | −0.563* | 0.281 | 0.569 | −0.394 | 0.413 | 0.674 | 0.501 | 0.281 | 1.650 |
| Distance from 1st institution | 0.425* | 0.187 | 1.530 | 0.280 | 0.218 | 1.323 | 0.454 | 0.272 | 1.574 |
| Delayed entry | −0.464 | 0.262 | 0.629 | 0.162 | 0.207 | 1.176 | 0.137 | 0.247 | 1.147 |
| Expect a graduate degree | −0.270* | 0.133 | 0.763 | −0.314* | 0.138 | 0.731 | −0.082 | 0.136 | 0.922 |
| High school GPA | 0.148* | 0.066 | 1.160 | 0.046 | 0.066 | 1.047 | 0.028 | 0.071 | 1.029 |
| High school math | −0.033 | 0.063 | 0.967 | 0.066 | 0.058 | 1.068 | −0.002 | 0.064 | 0.998 |
| Pell grant amount | −0.001 | 0.064 | 0.999 | −0.079 | 0.060 | 0.924 | −0.078 | 0.064 | 0.925 |
| GPA in year 1 of attendance | 0.358*** | 0.096 | 1.431 | 0.109 | 0.080 | 1.116 | −0.156 | 0.095 | 0.856 |
| Distance education | −0.029 | 0.226 | 0.971 | −0.018 | 0.210 | 0.982 | −0.390 | 0.243 | 0.677 |
| Faculty informal meeting | 0.022 | 0.109 | 1.022 | −0.071 | 0.142 | 0.931 | 0.151 | 0.152 | 1.163 |
| Faculty talk outside class | 0.021 | 0.119 | 1.021 | −0.149 | 0.133 | 0.862 | −0.541*** | 0.116 | 0.582 |
| Meet academic advisor | 0.270* | 0.117 | 1.309 | 0.153 | 0.128 | 1.165 | 0.350** | 0.130 | 1.419 |
| Study groups | −0.219* | 0.106 | 0.803 | −0.181 | 0.124 | 0.835 | −0.100 | 0.143 | 0.905 |

**Table 6** continued

| Attainment level | Attained bachelor's degree in 4 years versus no degree and not enrolled | | | Attained bachelor's degree in 5–6 years versus no degree and not enrolled | | | Enrolled but no bachelor's degree versus no degree and not enrolled | | |
|---|---|---|---|---|---|---|---|---|---|
| | b | se | RRR | b | se | RRR | b | se | RRR |
| Fine arts activities | −0.006 | 0.114 | 0.994 | 0.144 | 0.133 | 1.155 | −0.296* | 0.117 | 0.744 |
| School clubs | 0.207 | 0.132 | 1.230 | 0.135 | 0.146 | 1.144 | −0.068 | 0.167 | 0.934 |
| School sports | −0.047 | 0.133 | 0.954 | −0.237 | 0.174 | 0.789 | −0.401** | 0.154 | 0.669 |
| Remediation | −3.888*** | 0.890 | 0.020 | 1.905* | 0.932 | 6.717 | −0.390 | 0.738 | 0.677 |
| Withdrawal/repeats | −4.816*** | 0.846 | 0.008 | −2.864*** | 0.616 | 0.057 | −0.535 | 0.535 | 0.586 |
| Always part-time enrolled | −0.884*** | 0.260 | 0.413 | −0.387 | 0.236 | 0.679 | 0.155 | 0.253 | 1.167 |
| Mix full- and part-time | −0.394** | 0.141 | 0.674 | −0.496** | 0.171 | 0.609 | 0.140 | 0.175 | 1.150 |
| Weekly work hours | 0.011** | 0.004 | 1.012 | 0.023*** | 0.005 | 1.023 | 0.008 | 0.005 | 1.008 |
| Months enrolled through 2009 | 0.055*** | 0.005 | 1.057 | 0.102*** | 0.005 | 1.108 | 0.079*** | 0.005 | 1.082 |
| Constant | −4.187** | 1.510 | 0.015 | −5.526*** | 1.241 | 0.004 | −3.829* | 1.546 | 0.022 |

*b* Regression coefficient, *se* standard error, *RRR* relative risk ratio, obtained by taking the exponential of the regression coefficients

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

**Table 7** Predicted probabilities of being in each outcome category in relation to type of co-enrollment

| Co-enroll. type | | Probability of being in each outcome category | | | | |
|---|---|---|---|---|---|---|
| Lateral | Vertical | Departure | Attain in 4 years | Attain in 5–6 years | Persist in year 6 | |
| 4-Year institution beginners | | | | | | |
| | | *Pr(1)* | *Pr(2)* | *Pr(3)* | *Pr(4)* | Σ *Pr* |
| No | No | 0.246 | 0.403 | 0.279 | 0.071 | 1.000 |
| Yes | No | 0.207 | 0.448 | 0.243 | 0.102 | 1.000 |
| No | Yes | 0.151 | 0.423 | 0.327 | 0.099 | 1.000 |
| Relative risk (RR) | | | *Pr(2)/Pr(1)* | *Pr(3)/Pr(1)* | *Pr(4)/Pr(1)* | |
| No | No | *Row(a)* | 1.638 | 1.134 | 0.287 | |
| Yes | No | *Row(b)* | 2.163 | 1.176 | 0.494 | |
| No | Yes | *Row(c)* | 2.804 | 2.165 | 0.654 | |
| Relative risk ratio (RRR) | | | | | | |
| Yes | No | *(b)/(a)* | 1.321 | 1.036 | 1.719 | |
| No | Yes | *(c)/(a)* | 1.712 | 1.908 | 2.278 | |
| Community college beginners | | | | | | |
| | | *Pr(1)* | *Pr(2)* | *Pr(3)* | *Pr(4)* | Σ *Pr* |
| No | No | 0.544 | 0.173 | 0.132 | 0.150 | 1.000 |
| Yes | No | 0.402 | 0.173 | 0.142 | 0.283 | 1.000 |
| No | Yes | 0.294 | 0.279 | 0.207 | 0.220 | 1.000 |
| Relative risk (RR) | | | *Pr(2)/Pr(1)* | *Pr(3)/Pr(1)* | *Pr(4)/Pr(1)* | |
| No | No | *Row(a)* | 0.318 | 0.242 | 0.276 | |
| Yes | No | *Row(b)* | 0.431 | 0.353 | 0.703 | |
| No | Yes | *Row(c)* | 0.951 | 0.706 | 0.747 | |
| Relative risk ratio (RRR) | | | | | | |
| Yes | No | *(b)/(a)* | 1.352 | 1.457 | 2.546 | |
| No | Yes | *(c)/(a)* | 2.986 | 2.913 | 2.706 | |

The calculated RRRs from predicted probabilities were exactly the same as those reported in Tables 5 and 6 by taking the exponential of the regression coefficients

can be similarly interpreted as increasing or decreasing the likelihood of selecting one of the success outcomes as compared to departure.

As shown in Table 5, for students beginning at 4-year institutions, vertical co-enrollment (i.e., co-enrolling at a community college) had a statistically significant and positive relationship with the likelihood of students attaining a baccalaureate and persistence. Lateral co-enrollment—co-enrolling at another 4-year institution—did not show any significant link to attainment and persistence. In regard to the effect size of vertical co-enrollment, its strongest positive association was with persistence, followed by 6-year baccalaureate attainment and 4-year attainment.

For baccalaureate-aspiring students beginning at community colleges, results shown in Table 6 indicate that vertical co-enrollment had a consistently positive relationship with attainment and persistence, and the effect sizes were slightly larger for 4- and 6-year baccalaureate attainment. By contrast, lateral co-enrollment did not show any significant influence on the likelihood of college persistence and attaining a baccalaureate.

To make even more intuitive sense of these result patterns, it is helpful to examine the predicted probabilities for being in different outcome categories (with departure as the

base category) in relation to the type of co-enrollment and how those probabilities (relative to departure) change as the enrollment patterns change from non-co-enrollment to either type of co-enrollment (Table 7). The values under each of the *Pr(i)* column are the predicted probabilities of each outcome occurring under different co-enrollment categories. The sum of *Pr(i)* is equal to 1, because students must be in one of the outcome categories. To illustrate, a 4-year beginning student's predicted probability of departure (leaving postsecondary education without completing a baccalaureate degree) is 0.246 if the student did not engage in co-enrollment, but this predicted probability is reduced to 0.151 if the student participated in vertical co-enrollment. Taking a community college beginner as another example, if the student reported no co-enrollment behavior, the student's predicted probability of departure is 0.544; this predicted probability becomes smaller if the student laterally co-enrolled (0.402) and substantially smaller if the student engaged in vertical co-enrollment (0.294). These predicted probabilities were calculated from the MNL analysis using Stata's *margins* command. The relative risk (RR) sections of Table 7 calculated the odds of each success outcome category in relation to the base outcome category (departure). The Relative Risk Ratio (RRR) sections of Table 7 calculated the odds ratio of each co-enrollment type (in each outcome category) in relation to non-co-enrollment. Note that the calculated RRRs from predicted probabilities were exactly the same as those reported in Tables 5 and 6 by taking the exponential of the regression coefficients.

## Discussion

The study's findings extend beyond prior research that did not distinguish among different forms of co-enrollment (e.g., Crisp in press; Peter and Forrest Cataldi 2005; Wang and McCready 2013). By disaggregating co-enrollment further into lateral and vertical, this study allows for more nuanced results illuminating the distinctive relationship between each form of co-enrollment and progress toward baccalaureate completion. That is, the way we define co-enrollment in the study results in a much clearer understanding of what kind of co-enrollment options benefit students, and thus greatly extends limited prior research along this line that by and large indicates the positive connection between co-enrollment and student outcomes without specifying why and how (Crisp in press; Wang and McCready 2013). Although we do not assume that our study fully attends to all the nuances and complexities of the issue, our empirical evidence is a major step toward that direction, especially in revealing that the positive link between co-enrollment and student outcomes indicated in prior literature may in fact be attributed to vertical co-enrollment alone, as demonstrated by the significant and positive association between vertical co-enrollment (instead of lateral co-enrollment) and student outcomes. This renewed insight contributes to a larger discussion of student use of postsecondary education and the growing complexities of enrollment patterns.

Student Use of Co-enrollment Patterns

The findings from this study unfold a larger picture in which students use postsecondary institutions and their co-enrollment options to move toward baccalaureate completion or at least stay in the system. In light of the positive connection between vertical co-enrollment and baccalaureate completion and persistence among beginning 4-year college students, our study highlights the pivotal role community colleges play in shaping not only the

educational journey of those students beginning at these institutions, but also those primarily attending 4-year institutions who co-enroll at community colleges. That is, community colleges may provide courses that allow 4-year college students to complete general degree requirements (Palmer and Pugh 1993) that are less appealing at their own institutions (Wang and McCready 2013), only available during particular academic sessions, or more flexible in terms of scheduling at a fraction of the price (Herzog 2005; Townsend 2001). Considering that the cost of tuition has consistently risen at 4-year institutions (Long and Riley 2007), an increasing number of students may turn to co-enrollment options at community colleges to make the most out of their tuition dollars, particularly students from lower socioeconomic backgrounds. Rather than being limited to what is available at 4-year institutions, students can utilize vertical co-enrollment to expand their curricular options in a flexible, more affordable way.

When we shift the perspective and look at the context in which a community college student is vertically co-enrolled at a 4-year institution, although we observe the same positive association between vertical co-enrollment and baccalaureate completion, the issues of flexibility and cost may not be as relevant. Instead, the most viable explanation for the benefit of vertical co-enrollment in *baccalaureate* completion among *baccalaureate*-aspiring community college students is that vertical co-enrollment facilitates the flow from community colleges to 4-year institutions. As a matter of fact, as indicated in Table 4, among all beginning community college students who ever co-enrolled and also transferred to 4-year institutions, most of them (73 %[7]) engaged in vertical co-enrollment. Some of the recent literature that examines upward transfer from community colleges to 4-year institutions (e.g., Bahr et al. 2013; Eagan and Jaeger 2009; Hagedorn et al. 2008; Ishitani 2008; Roksa 2009; Tobolowsky and Cox 2012; Wang 2012b) illuminates a multitude of potential barriers facing community college students before, during, and after upward transfer, such as exposure to part-time faculty (Eagan and Jaeger 2009), "transfer shock" (Ishitani 2008), and loss of credits during the transfer (Roksa 2009). Vertical co-enrollment, by allowing students to get their feet wet in the 4-year college "water," naturally appeals to baccalaureate-aspiring community college students who would likely use this co-enrollment pattern as a means to pave the transfer path and initiate the first step in the process of eventually transferring to a 4-year institution. That way, students may have access to more full-time faculty, experience less "transfer shock" and better transfer receptivity (i.e., 4-year institutional support for community college student transfer success; Bahr et al. 2013), and obtain the necessary articulation policy information to preserve credits after transfer.

Although unlike vertical co-enrollment, lateral co-enrollment does not markedly benefit degree progression among both 2- and 4-year college student populations, this particular attendance pattern does not lead to increased student attrition either. This finding may point to lateral co-enrollment being used as a way to navigate postsecondary education for *exploration* rather than *efficiency*. At both 4-year institutions and community colleges, notably the latter, students may not decide on a particular major area of study (Zeidenberg 2012), especially as early as scripted in the traditional 4-year college attendance model. These students may use lateral co-enrollment as a means to explore and enroll in various courses so that they can eventually determine what degree program they would like to complete. Of course, if this assumption of exploratory course-taking featuring lateral co-enrollment is true, students may not experience returns such as timely baccalaureate attainment, as indicated in our study. On a similar note, students may enroll at other

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[7] See column V of Table 4: 15 + 43 + 15 % = 73 %.

institutions of the same level, 2- or 4-year, in order to find a better institutional fit or major (Li 2010). As a result, the focus is on selecting an institution or major field of study that is better suited to the students rather than ensuring timely degree completion. Given these considerations and the literature discussed previously, the null relationship between lateral co-enrollment and baccalaureate completion and persistence may be an artifact of students using co-enrollment to shape, define, and redefine their educational goals, instead of achieving a speedy completion.

Additionally, while students may engage in lateral co-enrollment in order to explore their educational trajectory or for other academic reasons, other students may do so as a way to overcome any external barriers or life circumstances without the intent to transfer or speed up their completion. This is especially true of community college students who are often employed, come from lower socioeconomic backgrounds, and have family responsibilities (Bryant 2001; Cohen and Brawer 2008; Deil-Amen 2011). They are likely to use lateral co-enrollment as a means to manage employment, minimize the costs of postsecondary education, and support a family. Rather than leaving college due to a conflict of students' work schedules and family obligations (Zhai and Monzon 2001) with the unfavorable scheduling of courses at one community college, they can co-enroll at another community college in order to take the classes they may need to progress in their studies. Having a larger pool of institutions and courses to choose from and enroll in allows students the ability to maintain employment and other responsibilities while staying in school. However, these external demands also have the potential to detract from students' ability to make academics a priority (Deil-Amen 2011). While lateral co-enrollment should open up more opportunities to help students remain in college, it may not boost persistence and completion when work or family responsibilities compete with studies.

One question underlying this study is whether co-enrollment accelerates baccalaureate completion. Our results clearly show that it depends on the type of co-enrollment: Lateral co-enrollment does not particularly contribute to timely completion or college persistence, whereas vertical co-enrollment has the potential to serve as a booster to both, especially among baccalaureate-aspiring students beginning at community colleges. As discussed earlier, it is possible that by vertically co-enrolling at a 4-year institution, baccalaureate-aspiring community college students get a stronger head start in their movement into the 4-year environment compared to their counterparts who do not engage in vertical co-enrollment, thus enjoying a much greater likelihood to speed up their baccalaureate completion. Among those students beginning at 4-year institutions, although vertical co-enrollment still benefits timely completion, its positive role appears to be larger in regard to facilitating 6-year completion as well as 6-year persistence, instead of 4-year completion. It seems to suggest that, compared to their 4-year college counterparts, beginning community college students not only use vertical co-enrollment for possibly different reasons, as mentioned earlier, but they probably also possess different levels of motivational beliefs surrounding baccalaureate completion. By the sheer fact of choosing to co-enroll at a 4-year institution, it stands to reason that vertically co-enrolled community college students demonstrate a clearer and more focused intent on baccalaureate completion. To some degree, this may explain the differential extent to which vertical co-enrollment seems to accelerate completion among beginning 4-year and beginning community college students.

Complexities of Enrollment Patterns in Postsecondary Education

While this study is able to elucidate more nuanced forms of co-enrollment, it also reinforces the complexities of enrollment patterns in postsecondary education. Considering the

various enrollment patterns discussed in the literature and those explored in this study, it is important to reflect on the potentially intertwined nature of these attendance patterns. Bahr's (2012) work on lateral transfer between community colleges informs our research and how we further examined types of co-enrollment in relation to whether students eventually transferred, when they did, and whether the transfer was horizontal, reverse, or vertical. The patterns revealed by this study support Bahr's (2012) emphasis on the great intricacy associated with postsecondary enrollment. As delineated earlier, co-enrollment is not necessarily used in isolation, and may intersect with other attendance patterns such as transfer, highlighting the increasingly sophisticated student movement and trajectories through postsecondary education today. In particular, these intricate enrollment patterns create even more challenges in understanding the influence of each in shaping students' postsecondary pathways and success. As students follow more intertwined educational trajectories, the benefits and drawbacks might not be as straightforward, especially when several enrollment patterns converge with one another.

## Implications for Policy and Future Research

### Policy Implications of the Study

The findings from this study point to several implications worth noting for educational policy and practice. First, the fact that there is a significant and positive relationship between vertical co-enrollment and progress to baccalaureate completion among beginning 4-year college students speaks to the increasingly vital role of community colleges in postsecondary education. As the cost of a baccalaureate education continues to rise, an increasing number of students from low-income and middle class families depend heavily on institutions to provide more affordable courses as a means to lessen the financial burden of attaining a baccalaureate degree (Townsend 2001). As a result, policymakers and practitioners need to encourage alternative pathways for students to obtain the necessary and high quality coursework for a bachelor's degree. Not only should 4-year institutions and their advising staff inform students who are interested in co-enrolling at community colleges about such options, but they also need to foster cooperative relationships with community colleges to promote upward transfer. That way, although 4-year institutions may lose course enrollments due to students co-enrolling at other institutions, they can gain those course enrollments back from baccalaureate-aspiring community college students from partnering colleges and assist them with their baccalaureate pursuits. These baccalaureate-aspiring community college students may generate additional future course enrollments and student credit hours, should they engage in upward transfer to the 4-year institutions.

Likewise, results suggest that community colleges may find it useful to consider co-enrollment programs with 4-year institutions. Given that many community college students do not follow traditional enrollment patterns (Nathan Marti 2008), it is critical to ensure that feasible options exist for these students to traverse intricate pathways to achieve their educational plans. Collaborative co-enrollment programs may help overcome potential challenges community college students face at any point during the transfer process, ease the transition to a 4-year college, and keep students on track to baccalaureate completion. For existing co-enrollment programs, it is pivotal that both 2- and 4-year institutional leaders carefully evaluate the efficacy of these options to ensure that they are viable and easy for students to navigate.

Next, results from this study inform institutions of the significant role of advising between 2- and 4-year institutions, especially with respect to vertical co-enrollment. It is vital that advisers communicate with students who co-enroll in order to help them navigate this complex attendance pattern and direct them toward courses that will transfer appropriately between institutions and contribute to their overall degree program. Proper advising can help students avoid the accumulation of credits that do not transfer and facilitate more efficient time-to-degree. Also, it is not the sole responsibility of one adviser at one institution to work with a vertically co-enrolled student. Both institutions should have advisers guiding the student in order to build collaborative relationships between institutions and honor any articulation policies that exist. That way, students may be more inclined to consider co-enrollment opportunities because advisers at both institutions can provide them with the necessary support and information to streamline the process.

In addition, it is critical to highlight the significance of articulation agreements, which act to preserve credits during the transfer process (Roksa and Keith 2008). This is especially pertinent to our findings since there appears to be an intersection between co-enrollment and transfer. As enrollment patterns continue to grow and diversify, institutions must work together to ensure that students can move seamlessly between postsecondary institutions. While articulation policies exist in many states, institutions have also taken initiatives to work with one another to improve the movement of students and credits (Anderson et al. 2006). Without strong and effective articulation policies, students who co-enroll will still face challenges of losing credits and repeating coursework. In light of our findings, focusing efforts on agreements between 2- and 4-year institutions may be particularly beneficial for students' eventual degree attainment as there exist more course and degree progression opportunities when co-enrolled students attend institutions of different levels instead of the same. Articulation agreements must be improved to keep up with the complex and ever changing educational pathways of students, particularly considering the ways in which colleges are used that may not be anticipated by institutions and policymakers (Palmer and Pugh 1993).

Implications for Future Research

While this study was able to differentiate between different types of co-enrollment, it would be helpful for future research to explore the role of online education in facilitating or increasing this type of enrollment pattern. As online courses are on the rise and massive open online courses (MOOCs) are gaining popularity, more students may consider enrolling in these courses alongside their traditional classes offered on campus. Future studies exploring various formats of co-enrollment and whether the courses are offered in a classroom or online may offer additional information on the course-taking patterns of students who co-enroll.

Other than online classes, any other course-taking patterns related to co-enrollment warrant further study. Are the majority of students co-enrolling in general education type courses, or do some target specialized or upper-level coursework? Do students utilize co-enrollment as a means to explore other major areas of study and do they eventually change their degree program as a result? Transcript data at individual institutions could prove to be especially useful in analyzing specific course-taking patterns of students who co-enroll in connection to the unanswered questions discussed above. Furthermore, qualitative work to follow up these results would offer additional insight into motivational and other underlying factors prompting students' decision to co-enroll.

Lastly, complex attendance patterns continue to deserve additional empirical research in order to accurately depict how students negotiate increasingly intricate pathways in postsecondary education. It is likely that many students do not use particular attendance patterns in isolation. Although we took the first step in disentangling co-enrollment, examined its relationship with persistence and time-to-degree, all the while paying careful attention to the role of transfer in the context of this study, further exploration is needed to determine how postsecondary enrollment patterns intersect with and build upon one another to shape the college trajectory.

## Conclusion

The student population entering postsecondary education continues to grow and diversify. As a result, their attendance patterns and educational pathways are transforming and becoming more complex (Goldrick-Rab 2006). Co-enrollment is gradually becoming a focus of recent research on enrollment patterns (Crisp in press; Lam 2007; McCormick 2003; Peter and Forrest Cataldi 2005; Wang and McCready 2013). Contributing to the small, evolving body of research in this vein, this study delved into a more nuanced definition of co-enrollment by differentiating between lateral and vertical co-enrollment and assessing their potentially differential relationships with persistence and time-to-degree among two distinct student populations: beginning 4-year institution students and baccalaureate-aspiring beginning community college students. The study shows that across both student groups, there was a positive association between vertical co-enrollment and all three success outcomes relative to departure, while lateral co-enrollment was not significantly related to an increase or decrease in the likelihood to persist and attain a bachelor's degree. These findings contribute to the larger discussion of diverging educational pathways, student outcomes, and baccalaureate degree attainment. The study's results also inform the development of policies and programs integrating various types of co-enrollment to improve persistence, assist students with time-to-degree, and encourage better articulation and cooperative relationships between 2- and 4-year institutions.

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