Chapter 6
Toward a Holistic Theoretical Model of Momentum for Community College Student Success

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Introduction

Over the past decade, the college completion agenda has been one of the key themes permeating the field of higher education research (Bowen, Chingos, & McPherson, 2009; Braxton, 2000; Kelly & Schneider, 2012). Scholars and policymakers wrestle with how to remove barriers and challenges facing college completion, particularly among underrepresented populations, such as low-income, first-generation, and racial/ethnic minority students (e.g., Arbona & Nora, 2007; Jehangir, 2010; Kezar, 2011; Mow & Nettles, 1990; Museus & Quaye, 2009; Nora, Cabrera, Hagedorn, & Pascarella, 1996; Perna & Jones, 2015; Rendón, Jalomo, & Nora, 2000; Strayhorn, 2010; Titus, 2006).

Within this research and policy context, it is hard to imagine a more critical postsecondary sector than the community college, which serves a disproportionately larger share of traditionally underrepresented students (Bailey & Alfonso, 2005; Bryant, 2001; Cohen, Brawer, & Kisker, 2014; Horn & Nevill, 2006; Terenzini & Pascarella, 1998). Because of their purported mission to democratize postsecondary education, community colleges are both lauded and scrutinized: While they provide access to students who otherwise would not be able to attend college, once students enroll, completion and upward transfer rates remain low (Bailey & Alfonso, 2005; Bragg, 2001, 2011; Goldrick-Rab, 2010; Hagedorn, 2010). In particular, success rates in remedial and gatekeeper courses are abysmal, making it extremely challenging

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for students to persist through the first year (Attewell, Lavin, Domina, & Levey, 2006; Bailey, 2009; Bailey & Cho, 2010; Bailey, Jeong, & Cho, 2010; Calcagno, Crosta, Bailey, & Jenkins, 2007; Grubb, 2001; Hagedorn, 2010; Hagedorn & DuBray, 2010). In this sense, even when access to a community college is within reach, there are enduring challenges for students to establish and maintain enough initial impetus in charting a path to longer-term college success (Attewell, Heil, & Reisel, 2012; Wang, 2015b).

In light of these realities, research on what matters to community college student success abounds, especially in the recent decade (e.g., Better, 2013; Boroch et al., 2007; Bunch & Kibler, 2015; Calcagno et al., 2007; Cho & Karp, 2013; Cox, 2009a; Crisp, 2010; Crisp & Nora, 2010; Dean & Dagostino, 2007; Edgecombe, 2011; Goldrick-Rab, 2010; Hagedorn, 2010; Jenkins, Speroni, Belfield, Jaggars, & Edgecombe, 2010; O'Gara, Karp, & Hughes, 2009; Visher, Schneider, Wathington, & Collado, 2010; Welsh, 2015; Wood & Williams, 2013; Zell, 2010). At the same time, despite its value, this body of empirical work has been unsystematic and lacking a unifying framework. Part of the reason for this lies in the complexity and diversity within the characteristics, goals, and educational paths of the students attending community colleges (Cohen et al., 2014; Hoachlander, Sikora, & Horn, 2003). In addition, the wide range of disciplinary backgrounds of scholars with sustained or new interest in the community college sector inherently results in vastly different and often diverging theoretical, methodological, and analytical approaches to empirical efforts in this area. As a result, research on community college student success yields mixed, and sometimes even conflicted, results that are not particularly conducive to the sustained accumulation of evidence that informs policy and practice.

In this chapter, I seek to reconcile this messy state of research by advancing a holistic theoretical model of community college student success that is anchored in *momentum*, a concept from classical mechanics that education scholars have borrowed and touched upon, explicitly or implicitly, in some of their research on community college students (e.g., Doyle, 2010; Leinbach & Jenkins, 2008; Wang, 2015b). Defined as the product of mass and velocity of a moving object within the context of classical mechanics, momentum is often adopted in colloquial English to refer to forward impetus. While, in the practice of prior education research, momentum has been inconsistently defined and largely empirically driven, I argue that the metaphorical connotations of this term hold great theoretical promise for articulating a compelling and holistic framework for community college student success. To demonstrate, I anchor the momentum concept in community college students' academic and enrollment behaviors, experiences within the classroom, and motivational attributes and beliefs. These facets intersect and intertwine as students navigate the curriculum, which reflects the unique nature of how community college students engage with their postsecondary educational experience, as compared with their four-year college counterparts whose engagement with college tends to span more evenly across the curricular and co-curricular domains. Thus, I use the community college classroom as the primary venue for discussing the interactive

fashion in which these facets collectively constitute and shape the momentum that influences students' later success.

Specifically, I aim to achieve two main objectives through this chapter. First, I offer a comprehensive review of the literature that explicitly or implicitly touches upon the momentum concept when studying community college students' educational outcomes, with this line of research often involving the specific notion of academic momentum and analysis of transcript data. Second, I advance a new holistic theoretical model of momentum for cultivating community college students' pathways to success. Ultimately, the new theoretical conceptualization of a momentum model will guide further empirical efforts and policy discussions around improving community college success.

Chapter Outline

This chapter will proceed as follows. First, I explicate the background and premises of momentum in the context of classical mechanics. This section both sets the theoretical foundation for momentum and highlights its relevance and appeal when adopted to inform research on community college students. Following this discussion, I delve into the more specific construct of academic momentum that has been used, sometimes interchangeably with momentum, in education research (e.g., Adelman, 1999, 2005, 2006; Attewell et al., 2012; Leinbach & Jenkins, 2008). I describe both conceptual perspectives and empirical studies in this vein, review their strengths and limitations, and assess their contributions to what we know about how to help community college students progress beyond the access point.

The chapter then advances a new holistic theoretical model of momentum for community college student success. This new model extends the existing momentum perspective by adding two new dimensions: the teaching and learning domain and the motivational domain. When articulating the teaching and learning domain of momentum, I review relevant literature on learning experiences and teaching practices within community college courses, and this part of the review and discussion centers on empirical evidence that illuminates promising learning experiences and teaching practices that help students gain knowledge and learning strategies in order to move forward academically. Similarly, when describing the motivational domain, this chapter provides a review of research on motivational attributes and beliefs among community college students that can serve as the psychological driver that helps build momentum.

Reconciling these areas of research, I argue that, by deeply situating students' momentum within their course-taking trajectories and their experiences within courses, and by framing the cultivation of positive academic attitudes and beliefs as a core part of building momentum, a fuller and richer meaning of momentum is accounted for and can be used to better inform policy and practice aimed at fostering community college student success. Accordingly, this chapter culminates in articulating a holistic new theoretical model of momentum for community college

student success, bringing together and unifying these aforementioned lines of work that are highly complementary to each other conceptually, but in practice have often been addressed in isolation. To delineate this new momentum model, I describe different domains of momentum along with their components, as well as factors and forces that act as counter-momentum friction that must be tackled in research and practice. In addition, I discuss in detail methodological approaches that researchers can adopt when using this new model to help extend our understanding of the topic within this broadened theoretical lens of momentum.

The Theoretical Appeal of Momentum

Before proceeding, it is necessary to further delineate the concept of momentum in the context of classical mechanics. In a perfectly frictionless space, a still object would remain still and a moving object would retain its speed and motion in the same direction until some external forces act upon it (i.e., inertia, Newton's first law of motion). According to Newton's second law of motion, when a force, either pushing or pulling, is applied to an object, the object will start accelerating and gaining momentum. As mass in motion (French, 1971), momentum includes magnitude and direction. In direct proportion to both mass and velocity of the object, momentum increases as either of these properties increases. Analogically, momentum can be applied to students' progress toward their education goals. A student's momentum is composed of and altered by a set of *individual* and *environmental* characteristics and factors, which can be considered as *internal* and *external* forces, respectively. As in classical mechanics, these forces collectively build the student's momentum toward a given educational outcome, or cause friction that reduces momentum. These characteristics and factors intersect to form a highly dynamic and interactive system of momentum that rests on the following premises: (1) momentum has multiple aspects (aligning with the mass, velocity, and direction of classical mechanics); (2) momentum is changeable and can be shaped by internal and external forces that exert mutual influence on each other; and (3) force is either positive parallel helping build momentum or negative/non-parallel deterring or redirecting momentum.

Often without an explicit conceptualization, several scholars have used the term "momentum" loosely to emphasize the importance of continuous, forward progress toward degree completion among community college students (Adelman, 1999, 2006; Goldrick-Rab, 2007; Tinto, 2013). When one thinks about a student's educational journey through the community college, the metaphorical appeal of "momentum" becomes obvious, as the notion captures the impetus the student needs to establish and maintain in order to progress toward a point of success—credential completion, transfer, workforce participation, or attaining other personal educational goals. Unlike many students starting at a four-year institution, a beginning community college student is more likely to arrive at college with some level of academic under-preparedness. Faced with a multitude of course options that can

take her/him in different directions, the community college student may lack metacognitive skills and academic motivation that help her/him stay on track with her/his educational intent (Bailey, Jaggers, & Jenkins, 2015). In addition, this process takes place in the face of many barriers that function as counter-momentum friction. These barriers can be academic, motivational, or institutional, all of which are analogous to the negative or non-parallel forces described earlier. Given these realities, for community college students, establishing and maintaining momentum—staying on the right educational path toward their educational goals with solid progress in that direction—is of paramount importance. In the final analysis, it is whether the student has enough momentum to overcome the friction so as to continue the forward progress that matters to goal attainment.

As such, momentum building is a particularly useful perspective that can valuably inform research on community college student success. Considering linear momentum in classical mechanics as a product of mass and velocity, a community college student's momentum as she/he navigates the college experience should accurately represent both the "quantity" (mass) of their academic efforts, experiences, and achievements and the "quality" of their progression (velocity)—progressing at a good pace and in the right direction. In the existing academic momentum research, there has been an almost exclusive emphasis on the progression through coursework and program requirements based on analysis of transcripts, whereas other important aspects of momentum are neglected, such as learning experiences and motivational attributes that can be facilitated within community colleges to foster momentum. As Hagedorn and other colleagues (e.g., Hagedorn & DuBray, 2010; Hagedorn & Kress, 2008; Karp, Hughes, & O'Gara, 2010) have established, the community college classroom is the prime venue through which we gain a real sense of students' educational experiences. I expand this idea by arguing that the experiences not only exist in the transcripts but also are constructed through the actual learning activities and teaching practices within the classroom. In addition, extensive research across a range of fields of study has determined that the psychological development of community college students, especially cultivating important motivational beliefs that contribute to learning and educational attainment, has the potential to transform the community college education. Yet, both the classroom teaching and learning dimension and the motivational dimension are largely absent from the academic momentum literature. Thus, I intend to fill in these missing pieces of the puzzle by including both dimensions as key domains of the new theoretical model of momentum for community college student success.

Academic Momentum at a Glance

The word "momentum" has often been referenced in the context of college students' course-taking patterns and academic progress. The first explicit use of the term in this specific context was by Clifford Adelman (1999) in his pioneering report on baccalaureate degree completion of the 1980 High School & Beyond

(HS&B/Sophomore) cohort. Drawing upon high school and college transcripts, test scores, and survey data, Adelman investigated what contributes to baccalaureate degree completion. Without an intentional attempt to define momentum, Adelman adopted this term to imply the forward impetus with which students' progress toward completing a bachelor's degree. Results from this report pinpoint academic resources measured by a composite of high school curriculum, test scores, class rank, and continuous enrollment to be key to baccalaureate completion. Adelman thus concluded that academic variables, which are fixable by institutions, carry more weight than social ones (i.e., demographic constructs, including socioeconomic status, race, and gender) in shaping college completion. In a subsequent report also dealing with baccalaureate completion among four-year beginning students, Adelman (2006) replicated his 1999 study and further elaborated the notion of momentum by explicitly adopting the term "academic momentum," and by analyzing and articulating, with much more clarity and purposiveness, academic momentum as the types of choices and behaviors in a student's academic history. Using the National Education Longitudinal Study of 1988 (NELS:88/2000) data and adopting logistic regression as the main statistical approach, Adelman charted students' academic history as featuring a series of decision points regarding course taking and academic progress, such as entering college directly from high school, credit load, summer enrollment in coursework, etc., that warrant time and effort eventually yielding the returns in the form of degree attainment.

Alongside these two reports, Adelman also authored a study of similar nature but exclusively dealing with community college students. Focusing on a traditional-age high school cohort, Adelman (2005) pointed out that those entering community colleges have less momentum from high school, compared with their counterparts entering four-year institutions. This is an alarming finding in that nearly all factors associated with community college students' associate degree attainment and upward transfer as Adelman identified are momentum variables. A major takeaway from this finding is the pivotal nature of establishing momentum among entering community college students earlier during their college career, if community colleges are indeed held in true regard as not only the safety net, but also a gateway to more advanced education and careers for historically underserved students. For example, this would mean that the early academic experiences students have exposure to, such as remedial and gatekeeper courses, would ideally serve as a venue to cultivate momentum, since many students entering community colleges do not have enough momentum coming from high school to translate into further momentum for college success. Needless to say, if students are trapped in pre-collegiate remedial courses, or cannot succeed in gatekeeper courses, they will not attain enough momentum to participate in subsequent college-level coursework that is required for future educational success (Adelman, 2005). In this sense, one could argue that developmental education adds friction, thus slowing down students' progress.

Taken as a whole, Adelman's early work lays down the empirical foundation for viewing a set of academic performance and milestone indicators as academic momentum, and sets the tone for the cornerstone nature of these indicators in a college student's longitudinal educational success. Since their publication, these

reports have set the genesis for a burgeoning line of research on college completion (e.g., Attewell et al., 2012; Leinbach & Jenkins, 2008). Much of this work concerns four-year degree attainment, but these reports' influence on empirical research on community college student success has been steady and potentially far-reaching into the future. In particular, while Adelman's work articulates a similar thesis regarding momentum for progress through college in general, the stark contrast between community college and four-year college students in regard to how much academic momentum they bring to college further amplifies not only the academic disadvantage among many community college entrants, but also the critical importance of studying, developing, and increasing momentum among them.

A Review of the Academic Momentum Literature

Adelman's momentum notion that evolved through these reports, notably the 1999 and 2006 pieces, have since found their traces in voluminous empirical studies and policy literature on community college student outcomes. For example, researchers have built upon the momentum lens to examine how community college students' course and program enrollment patterns, milestones, and pathways are related to their graduation (e.g., Calcagno et al., 2007; Jenkins & Cho, 2012), and transfer to a four-year institution (e.g., Doyle, 2009, 2010; Hagedorn, Moon, Cypers, Maxwell, & Lester, 2006; Roksa & Calcagno, 2010). While some of the studies that build upon or are informed by this work do not explicitly reference the term "momentum," likely due to its loose definitions in Adelman's reports, they clearly approach community college student success by examining their academic choices and behaviors denoted as momentum in Adelman's work.

Given the inherent involvement of these academic and course-taking behaviors as the underlying momentum indicators, this area of research often entails analysis of student transcripts to a varying degree of depth and statistical sophistication (e.g., Calcagno et al., 2007; Hagedorn & DuBray, 2010; Hagedorn et al., 2006; Kolenovic, Linderman, & Karp, 2013). As Hagedorn (2005) established, in studies on community college students, transcript analysis is particularly useful given the complex academic behaviors of these students. While studies based on transcript analysis do not all distinctively follow the momentum concept necessarily, it is not unfounded to say that transcript analysis is inherently tied to the idea of momentum due to its capacity to trace student progress across the curriculum, essentially revealing academic momentum.[1] Hagedorn and Kress (2008) offered a compelling argument on why transcript-based analysis is best suited for studying community college students' pathways to success. The authors are also among the first, after Adelman, to

[1] To be sure, the use of transcripts to test the relationship between enrollment behaviors and educational attainment for community college students can be traced back as early as Grubb (1989). Grubb pinpointed the importance of progress and the need to take sufficient numbers of credits to promote attainment, without explicitly articulating these as momentum.

explicitly tie transcript analysis to the examination of academic momentum among community college students. In essence, with or without a distinctive reference to "academic momentum," this body of research is rooted in Adelman's early work, and all focuses on students' academic behaviors and choices (essentially academic momentum) as factors of primary interest that can influence later student success.

Within this line of empirical inquiry, academic momentum, or academic behaviors and decisions, is conceptualized and measured through myriad ways. To summarize, three main approaches have been adopted: intensity-based, milestone-based, and pattern-based. It should be noted that academic ability and preparation prior to college, such as high school performance and academic resources, while also regarded as momentum by Adelman (1999, 2005), more strictly represent pre-collegiate measures of students' academic background. They obviously extend their influence on academic momentum during college, and can even be considered pre-college momentum, but technically are not part of the process of building college-level academic momentum. Therefore, these academic background variables do not fall under the main focus of this chapter's discussion of how college academic momentum is operationalized.

Intensity-Based Approach

With this approach, researchers are primarily concerned with academic momentum as indicated by the credit load students carry during a given academic term, often the first term or first year of college attendance (e.g., Attewell & Monaghan, 2016; Doyle, 2009, 2010). Several expressions have been adopted, such as academic intensity (Adelman, 1999, 2006; Doyle, 2009, 2010), enrollment intensity (Bahr, 2009, 2013b; McCormick, 1999), or attendance patterns, i.e., full-time versus part-time enrollment which also speaks to credit load (Crosta, 2014; Ewell & Boeke, 2007; Maxwell et al., 2003). The motivating rationale behind viewing intensity in course taking as momentum is that a higher credit load leads to greater odds of college completion or upward transfer for community college students (Adelman, 2006). Studies by Doyle (2009, 2010) are exemplary of the intensity-based approach. Using administrative data of first-time community college students in Tennessee from 1996 to 2004, Doyle (2009) applied propensity score matching techniques and examined how increased academic intensity, measured by credit hours during the first term of enrollment, affects transfer to four-year institutions. The study revealed that taking 12 or more credit hours during the first term is associated with an increase in transfer rates of between 11 % and 15 %. In a study published a year later, Doyle (2010) explored similar questions, adopting similar analytical techniques but using a nationally representative sample of baccalaureate-aspiring students beginning at community colleges, followed by the Beginning Postsecondary Students (BPS:96) longitudinal study. In this research, Doyle examined credit hours completed during the first year (as opposed to the first term), and arrived at a similar conclusion that

increasing academic intensity—the number of earned credit hours earlier in college—is likely to boost transfer rates.

Other studies dealing with academic intensity as reflected in credit hours reached similar findings (e.g., Adelman, 1999, 2006; Attewell & Monaghan, 2016). As the overall positive relationship between intensity and community college student success is by and large confirmed, there emerge recent empirical efforts that adopt a more fine-grained approach tackling the same question but aligning the intensity measurement closely with enrollment policy. Using a more recent sample of the BPS (BPS:04/09), including both four-year entrants and community college students, Attewell and Monaghan (2016) compared outcomes of "full-time" students with 12 credits versus 15 credits in the first semester. The authors found that, among community college students, after accounting for background characteristics, the probability of completing either a bachelor's or an associate degree for those taking 12 credits is 9 % less than their counterparts with 15 credits. While this finding may suggest that taking 15 credits during the first term indicates stronger academic momentum that yields better outcomes, Attewell and Monaghan cautioned that students who work more than 30 hours while attending college do not experience similar academic benefits by taking a higher credit load.

As a whole, research on academic momentum adopting an intensity-based approach has solidly concluded that there is a strong and positive relationship between the intensity of course taking and community college students' longer-term educational outcomes. At the same time, there is notable variation of this overall positive link among community college students based on employment status, with students working long hours benefitting the least from a heavy course load. Consequently, when contemplating course enrollment policies, there needs to be a balance between an optimal credit load and students' employment or financial burdens in order to help yield peak academic momentum through the intensity of course taking.

Milestone-Based Approach

Researchers focusing on academic momentum among community college students have also operationalized momentum using students' milestone progress and achievement through the community college curricula (also referred to as intermediate outcomes; Calcagno et al., 2007; Roksa & Calcagno, 2010). Often, this means that academic momentum is measured by the completion of foundational and gateway courses or finishing a certain percentage of program courses. Although milestone measures can also involve measuring a certain number of credits (McCormick, 1999), milestone-based approaches differ from intensity-based ones in that the latter typically impose a stringent time window, such as the first term or first year, when viewing credit accumulation.

One such example is Calcagno et al. (2007) who followed a cohort of first-time students beginning in Florida's 28 community colleges in the fall of the 1998–1999 academic year for 17 academic terms. Using a discrete-time hazard model and with a focus on potential differences between older students and traditional-age students, the authors examined how degree completion by the 17th term is influenced by the academic milestones students reached. The study's findings suggest that milestones such as earning 20 credits or completing 50 % of a program are significantly associated with the probability of completing a community college credential, and this relationship is stronger among traditional-age community college students.

In a study examining program completion among students enrolled at a community college that is part of the Achieving the Dream initiative, Jenkins and Cho (2012) followed student course-taking patterns for 5 years. Based on their descriptive analyses, the authors found that students who failed to enter a program early are much less likely to eventually declare a program and achieve a credential. In this study, entering a program as early as possible indicates strong early momentum that likely yields stronger educational outcomes.

Roksa and Calcagno (2010) operationalized milestones as passing college-level math and writing courses, meeting specific credit thresholds, and earning an associate degree in their study on upward transfer among first-time degree-seeking students beginning at Florida community colleges in 1998. Following these students through 2003 and using event history analysis, Roksa and Calcagno found that the successful completion of the noted milestones increases the probability of transfer among the students.

Similarly, Leinbach and Jenkins (2008) articulated a series of momentum points using milestone measures of course completion at various levels of a student's community college career. Using data spanning 5 years of a cohort of over 87,000 first-time students who entered Washington state's community and technical colleges in the 2001–2002 academic year, the authors conducted logistic regression analysis to identify milestones, or momentum points, defined as "measurable educational achievements that include both conventional terminal completions, such as earning a credential or transferring to a baccalaureate program, and intermediate outcomes, such as completing developmental education or adult basic skills requirements" (p.7). The authors maintained that achieving these "milestones" can produce "momentum" that leads to educational attainment.

A few other studies on community college students' academic progress and outcomes also integrated the milestone-based approach, such as examining completion status of developmental and gatekeeper courses in math and English at various levels (e.g., Bahr, 2008; Hagedorn, Chi, Cepeda, & McLain, 2007; Hagedorn, Cypers, & Lester, 2008; Hagedorn & DuBray, 2010; Hagedorn et al., 2006), or the specific timing of completing college-level math (e.g., Calcagno et al., 2007; Xu & Jaggars, 2010). With little exception, all milestone-based studies have arrived at the conclusion that accomplishing academic milestones in the form of declaring programs, passing gatekeeper and intermediate courses, etc., in a timely fashion greatly solidifies the momentum undergirding a strong path to educational attainment.

Pattern-Based Approach

In this approach, academic momentum is viewed more expansively as a series of academic actions building upon each other, constantly evolving as students progress through coursework and programs. Different from the first two approaches, transcript-based analysis examining patterns of course or program progression does not always tie these patterns to student outcomes. This is a defendable approach, especially when the main goal of the research is to tease out the often chaotic and messy patterns in which community college students navigate their courses and programs.

There is a wide variety of ways in which course-taking or program enrollment patterns are examined, ranging from a straightforward approach of determining whether students follow a certain enrollment behavior, such as summer enrollment (Adelman, 2005; Attewell et al., 2012; Wang, 2015b) and enrollment in certain programs of study (Hagedorn et al., 2008; Jenkins & Cho, 2012), to a more complex, longitudinal treatment of sequences of actions as related to participation and performance in community college courses and programs (e.g., Bahr, 2010a, 2011; Crosta, 2014; Wang, 2015a).

In regard to enrollment patterns indicating academic momentum that are fairly straightforward to define, summer enrollment following the first year of college has gained notable empirical attention. For example, drawing upon transcript data from NELS:88/2000, Attewell et al. (2012) explored summer enrollment as one of the academic momentum indicators and found that enrolling in summer courses after the freshman year increases the probability of graduation. As another example, in Wang's (2015b) study on the effect of beginning at community colleges on baccalaureate attainment in science, technology, engineering, and mathematics (STEM) fields of study, summer enrollment in STEM courses was explored as a possible mediator between beginning at community colleges and STEM outcomes, and turned out to have no impact on STEM baccalaureate attainment. In Adelman's (2006) work, summer enrollment was also used as a measure of academic momentum. For instance, earning more than four credits during the summer term has a consistent positive effect on degree completion, especially for African American students.

Viewing course taking in an interlocking manner longitudinally, as early as Bach et al. (2000), researchers have attempted to trace complex attendance patterns followed by community college students over time. However, other than work by only a few scholars, this subarea of research does not enjoy as many sustained efforts, possibly due to the messy nature of coding transcript data longitudinally as well as the often difficult access to longitudinal and complete transcript data. Much of Peter Bahr's work concentrating on community college students' math remediation and progress into college-level math is exemplary for work that falls under this umbrella. Largely drawing upon administrative data from California's community college system, Bahr's work demonstrates how community college students transition into

and through college via course-taking and enrollment patterns, especially in terms of remedial education (e.g., Bahr, 2010a, 2011, 2012, 2013a).

For example, using data on first-time college students enrolled in the California community college system between fall 2001 and fall 2003 for at least five semesters (through the summer of 2009) longitudinally, Bahr (2012) examined the path between community college students' point of entry in remedial math and reading sequences, defined as the skill level of the first remedial course in either math or reading, and their eventual achievement of college-level competency. Bahr divided remedial sequences into specific steps that students must achieve in order to reach college-level competency, which were further broken down into "constituent behaviors" such as the attempt of a given step of the remedial sequence, the delay of this step if it was attempted, the pass/fail status of the course at this step, and the attempt of the next step in the remedial sequence. Each of these interim behaviors was included in a series of logistic regression models, as an outcome and then as a predictor of the next step. Through this series of detailed analyses, Bahr identified the junctures where student attrition occurs, that is, loss of momentum. Later, Bahr (2013b) described this study as an example for quantitative research that adopts a "deconstructive" approach to unpacking community college students' pathways.

Similar approaches were applied in a few other studies. For example, focusing on students placed into developmental education from eight community colleges, Fong, Melguizo, and Prather (2015) tracked student progression through developmental math sequences and investigated individual-, institutional-, and developmental math class-level factors associated with successful progression through the sequence (arithmetic, pre-algebra, elementary algebra, and intermediate algebra) using descriptive analysis and step-wise logistic regression models. Their findings reveal that most students exit the sequence not attempting or not passing their initial courses.

Drawing upon postsecondary transcript data through the BPS (BPS:04/09), Wang (2015a) examined how course-taking patterns are associated with upward transfer in STEM fields for beginning community college students. Using data mining techniques, Wang tied community college students' course-taking patterns to their different transfer outcomes. For example, the author found that the most salient course-taking pattern conducive to eventual transfer in STEM fields entails taking transferrable STEM courses during the first term, followed by taking math courses during the subsequent terms. Crosta (2014) investigated how enrollment patterns (measured as enrollment intensity and continuity) are related to community college students' credential completion and transfer to a four-year institution. Transcript data of a cohort of first-time, degree- or transfer-seeking students from five community colleges in a single state are used. Patterns of enrollment (reflected through intensity and continuity) are created for each student over 18 observed terms. A *k*-means clustering algorithm was used through an iterative process to group students based on enrollment patterns. As another example, drawing upon transcripts, demographic background characteristics, and credential award data of a cohort of first-time students enrolled in 105 California community colleges, Bahr (2010b) employed cluster analysis to develop a behavioral typology for first-time community

college students. Through this approach, six course-taking and enrollment patterns were identified. Extending this earlier work, Bahr (2011) focused on the same cohort of students, but tracked their behavior across all of the community colleges that students attended rather than concentrating solely on their first institution. The same analytical approach yielded similar research findings.

Due to the fairly small body of research adopting the pattern-based approach in contrast to the complexities in course-taking patterns as revealed by such analysis, it is hard to draw clear conclusions as to the most viable sequence and configuration of courses and programs that foster community college student success. Nonetheless, this set of studies have all demonstrated the potential utility of using pattern-based approaches to illuminate leaky spots in students' course pathways, as well as the optimal configuration and scaffolding of course and program offerings.

Up to this point, I have described three broad areas of empirical approaches dealing with academic momentum as indicated in course taking. I should note that these three approaches to operationalizing academic momentum are not necessarily adopted in isolation from one another in the reviewed studies. Indeed, in much of the empirical work in this vein, researchers have used a combination of these approaches to reflect the many ways in which academic momentum can be operationalized. For example, Bahr's (2012) work on remedial math and reading sequences places an emphasis on both the milestone nature of the remedial sequence as well as the patterns of course-taking along the sequence. Other examples include Hagedorn et al.'s (2008) study illustrating that both following a transfer-focused community college curriculum and passing transfer-level English and math are strong predictors for upward transfer. Similarly, focusing on degree completion, Calcagno et al. (2007) used longitudinal transcript data of first-time community college students in Florida and explored the influence of both enrollment pathways and milestone completion.

To sum up, the current literature on community college student success agrees on the importance of fostering academic momentum early in a student's educational trajectory (e.g., Attewell et al., 2012; Calcagno et al., 2007; Hagedorn & DuBray, 2010). Transcript analysis based on the three main approaches described earlier represents a particularly robust line of work contributing to this understanding, and helps reveal viable course-taking trajectories associated with student outcomes (e.g., Bahr, 2013b; Hagedorn & DuBray, 2010; Hagedorn & Kress, 2008; Wang, 2015a).

Conceptual Limitations of the Academic Momentum Literature

In their totality, the reviewed academic momentum studies and transcript analyses have illuminated the importance of examining the breadth and depth of course taking and program enrollment in better understanding community college students' academic pathways in connection with their later educational outcomes. Despite their collective value, there is a conspicuous lack of consistent conceptualization

and measurement of what counts as momentum and counter-momentum friction—the barriers and resistance that students encounter. Across various studies reviewed earlier, momentum measures are either not clearly defined or defined inconsistently. In Adelman's foundational work, momentum was loosely referred to as a wide range of high school and early college academic behaviors and achievements. Similar perspectives that adopt a very broadened view of momentum include Leinbach and Jenkins (2008) who defined what they referred to as "momentum points" (p. 2) as a series of educational achievement and attainment measures, such as completing adult basic skills requirement, a developmental education series, or a college-level math or English course, earning a certain amount of credits or a credential, and transferring into a baccalaureate program. Other researchers more narrowly defined momentum as earning credits quickly or attempting a high credit load (e.g., Attewell & Monaghan, 2016; Doyle, 2009, 2010; Kolenovic et al., 2013). For example, academic momentum was defined as credit load/enrollment intensity in students' first term/year (Attewell & Monaghan, 2016; Doyle, 2009, 2010).

These inconsistencies in the definitions and measurements of momentum are both attributed to, and indicative of, the absence of a clear and purposeful theorization of momentum. While the reviewed studies widely cited Adelman, often explicitly touching upon the notion of academic momentum, very infrequently did the authors attempt a theoretical treatment of momentum, such as a critical review, conceptualization or reconceptualization of this largely empirical concept. Generally, a systematic handling of theoretical arguments around academic momentum had been absent, and the loose reference of the concept was inherently driven by data. It was not until in recent years that a few scholars started to adopt a more systematic and critical view of academic momentum in an attempt to achieve stronger theorization of this notion that underlies voluminous studies on college student success over the past two decades. Notable examples of these new efforts to theoretically conceptualize academic momentum include work by Attewell and colleagues, Wang, and a few other scholars.

In their study "What Is Academic Momentum? And Does It Matter?" Attewell et al. (2012) adopted a critical view of Adelman's momentum framework. They raised concern around Adelman's momentum points, particularly their broad range, as well as causal circularity and endogeneity. Attewell et al. argued that it is crucial to distinguish between academic momentum, which they consider the cause of later student performance, and students' actual performance, which the authors contended is the effect resulting from momentum. Critiquing that Adelman's momentum proposition tends to conflate cause and effect, Attewell and colleagues adopted a much narrower definition of momentum that focuses on the following aspects that frame academic momentum as the cause for later achievement: whether there is delayed entry to college since high school graduation, part-time/full-time enrollment status during the first term, whether students attempted a high course load (18 credits or more) during the first term, and enrollment in summer courses at the end of the first year of college. Later, in a study on credit hours, Attewell and

Monaghan (2016) further reiterated this previously argued distinction between momentum as cause and academic achievement milestones resulting from momentum. In brief, the authors defined academic momentum as "the speed of progress towards a degree resulting from the rate of credit accumulation" (p. 3).

Also adopting the momentum framework but focusing on the STEM context, Wang's (2015b) study on community colleges as a pathway to a STEM baccalaureate degree represents a more situated and focused approach to theorizing momentum. Using the term "STEM momentum" to refer to the forward push in the early stages of students' academic trajectory within STEM fields of study, Wang reasoned that the definition of momentum needs to be domain specific to resolve the long-standing operational challenge in the definition and measurement of academic momentum. Situated within the STEM context, Wang's work represents an initial attempt to reconcile the diverging ways in which momentum has been conceptualized. Specifically, Wang outlined three premises underlying a sound operational definition of momentum in empirical work: a focused and parsimonious approach to the measurement of academic momentum, a reflection of the carry-over nature of momentum being a continuum, which takes into consideration the temporal relationship among multiple measures, and the need to account for both the quantity of student efforts and the quality of student progression.

The major contributions of recent work by Attewell and his colleagues as well as Wang lie in their more intentional efforts to theorize academic momentum for sharper and more focused policy implications. For example, by zeroing in on course load that directly corresponds to enrollment policy, Attewell and Monaghan's (2016) study reveals that, for students without excessive hours for paid work, full-time enrollment at 15 credits each academic term yields better long-term graduation rates than 12 credits. By the same token, Wang's (2015b) more specific delineation of STEM momentum in examining the efficacy of community colleges as part of the STEM baccalaureate pathway clearly highlights a community college "disadvantage" for similar students starting at these institutions as opposed to public four-year institutions in their long-term baccalaureate STEM attainment. On the other hand, Wang's study also illuminates the community college as a prime venue for cultivating STEM momentum.

Notwithstanding their value, these studies represent only preliminary progress toward a more systematic approach to theory building around momentum, a promising concept for promoting community college student success. Indeed, a pragmatic approach centering on how to empirically define academic momentum is still at the core of these recent attempts to conceptualize momentum. Most glaring is the absence of a fully developed theoretical model delineating momentum and the mechanisms through which it affects community college students' eventual educational attainment and success. In other words, the conceptual basis underlying research examining or informed by academic momentum remains seriously underdeveloped.

Methodological Limitations of the Academic Momentum Literature

Shifting from the conceptual to the methodological, I now offer several critiques of the research design and approaches associated with inquiry into academic momentum. First of all, most studies take advantage of, but solely rely on, transcript data at the national, state, or institutional level. This tradition consistently follows Adelman's work and makes good use of the rich and reliable student transcript data as opposed to self-reported data. There are both strengths and weaknesses to using such data. On the one hand, transcripts capture students' enrollment behaviors and academic performance in a valid and reliable way. Albeit loose definitions of academic momentum, all three approaches to operationalizing momentum (i.e., intensity, milestone, and pattern), described previously, are best traced within students' transcripts as compared with other means such as self-reports. On the other hand, with the exception of a few studies drawing upon national longitudinal studies that contain both transcript and survey data (e.g., Adelman, 1999, 2005, 2006; Attewell et al., 2012; Wang, 2015a), transcript data at the state and institutional level, as part of the routine collection of administrative data, are only linked to a very limited number of student demographic variables. In this sense, in studies utilizing statewide and institutional administrative data, the research design may inherently suffer from the omission of potentially important factors that are related to student outcomes above and beyond the relationship between momentum and outcomes.

In terms of analytical approaches, researchers have applied descriptive approaches to classify students (e.g., Bach et al., 2000; Hagedorn et al., 2008; Maxwell et al., 2003) or courses (e.g., Hagedorn & DuBray, 2010; Hagedorn & Lester, 2006) in an attempt to reflect the complexity of academic momentum as illustrated through student movement through coursework. Again, these approaches are appealing for their ease of use and interpretation. In addition, correlational and traditional regression types of analyses have dominated empirical work in this area. These approaches are well suited for exploring how academic momentum (and its various forms) is connected to later progression and attainment, and can often produce findings that are straightforward and easy to present and interpret for a practitioner audience. Their advantages aside, these analytical approaches, by nature, are weak in generating causal inferences. Thus, studies drawing on these approaches present less compelling policy implications compared with those adopting methods that are stronger in drawing causal conclusions (e.g., Attewell et al., 2012; Attewell & Monaghan, 2016; Doyle, 2009, 2010; Wang, 2015b). Acknowledging that randomized controlled trials, which are best at identifying causal relationships, are highly implausible in this research context, the use of quasi-experimental approaches to strengthening the causal inference will help better identify specific momentum measures' influence on student success for clearer policy implications. This is particularly important given that, by now, an empirical "saturation" is almost reached with the long line of correlational research on academic momentum. That is, we can almost expect a positive correlation between academic momentum measures and

student outcomes, given momentum's strong theoretical plausibility and the repeatedly confirmed patterns of relationships as revealed in the correlational studies. What we do not have yet is a detailed, nuanced, and situated understanding of *how* a specific measure of academic momentum may causally result in better student outcomes—the kinds of empirical findings that hold more compelling implications for policy interventions.

Another area of analytical approaches for further consideration is how to make the most of the wealth of transcript data. Much of this line of work adopts more conventional statistical techniques (i.e., descriptive and regression-based) to disentangle community college students' course and program pathways. While this may represent an intuitive and appropriate approach, often times, it can be clumsy and impose too many statistical assumptions that may not hold given their parametric and hypothesis-testing nature. In response to this limitation, in recent years, there has been an increase in the use of analytical approaches not conventionally applied in higher education research, especially for studies that fall under pattern-based approaches to transcript analysis (notably data mining techniques). For example, Wang (2015a) employed data mining methods such as frequent pattern/association rule, decision list algorithm, and decision tree algorithm to identify course-taking patterns among students following different transfer pathways. Crosta (2014) used the *k*-means clustering algorithm to make sense of enrollment patterns among community college students. Cluster analysis has also been adopted (e.g., Bahr, 2010b, 2011) to develop behavioral typologies based on enrollment patterns. These approaches, under the broad umbrella of data mining, add to the analytical repertoire for research designs that aim at teasing out highly complex and noisy course enrollment behaviors of community college students.

Looking forward, there are several other limitations that must be addressed in future research on academic momentum. One of these is that heterogeneities among the diverse body of community college students have not been examined with enough purposefulness and thoroughness in existing work. With a few exceptions (e.g. Calcagno et al., 2007; Hagedorn & Dubray, 2010; Hagedorn & Lester, 2006; Wang, 2015b), most studies did not explicitly build into their design to address potential subgroup differences when exploring the relationship between momentum and student success. For example, very few studies have explored in depth how students from different socio-demographic backgrounds or students of varying prior academic abilities may follow different academic trajectories, gain/retain momentum differently, and accordingly, experience disparate success rates. While these student characteristics are often introduced as control variables, assuming their connection to the outcome variable, by and large they have not been extensively examined as potential moderators that shape the relationship between momentum and success in potentially divergent ways. What is more problematic is that the demographic variables that do get included in these studies are often those demographics (e.g., gender, race, and family income) that are "standard" for conducting research on traditional four-year college students. While of great importance, these demographics alone do not mirror the vast diversity among community college students, many of them being a single parent, having dependent children, and/or being much

older than their four-year college counterparts. In addition, studies on counter-momentum friction are also needed, and the aforementioned analytical approaches and considerations can also be applied to the measures of friction with the purpose of reducing or removing them from students' education pathways.

Setting the Stage for a New Holistic Theoretical Model of Momentum

The literature review in the previous section shows that, although the notion of "momentum" is not always explicitly referenced in the body of literature on community college student success drawing upon Adelman's work, this stream of research unequivocally demonstrates the utility of adopting a momentum-building perspective in explaining community college student outcomes. While the analyses employed in prior scholarship primarily rely on transcripts, the academic momentum researchers rightfully underscore the importance of viewing momentum building as providing holistic support that centers on the whole range of students' academic experiences, as well as their roles and responsibilities (Attewell et al., 2012; Doyle, 2009; Wang, 2015b). On the other hand, narrowing the view of momentum to course-taking intensity, patterns, and milestones alone, as has been practiced in previous empirical research, misses other critically important elements of student experiences, pathways, and success that collectively underlie the true meaning of momentum for community college students. In other words, momentum as a concept holds unbridled potential for generating a more robust and unifying theoretical model for community college student success, but this potential is yet to be realized. In particular, two main dimensions have been absent from the discourse on cultivating momentum among community college students: classroom learning and teaching, as well as psychological development of students' motivational attributes and beliefs. In the following, I explain why these elements should also be considered key domains of momentum in the community college context, based on a succinct review of the existing small body of research within each of these two areas that focuses on community college student success.

Classroom Learning and Teaching

The existing research examining student progression through courses and programs, as reviewed previously, has clearly indicated that the course and program completion rates are low at community colleges (e.g., Bailey & Alfonso, 2005; Bragg, 2001, 2011; Cohen et al., 2014; Hagedorn, 2010), and failure to pass earlier courses significantly and negatively influences students' later progress, often resulting in dropping out (e.g., Attewell & Monaghan, 2016; Doyle, 2009, 2010; Kolenovic et al., 2013). Yet, beyond this knowledge, there have been only limited theoretical and

empirical efforts that delve deeply into the community college classroom setting. Given the large number of academically underprepared students arriving at community colleges and the staggeringly low rates of progress and completion in coursework (e.g., Bailey & Cho, 2010; Bailey et al., 2010; Hagedorn, 2010), teaching practices and learning experiences within the community college classroom warrant careful research, revisiting, and reform.

The scholarship on teaching and learning at community colleges is small, but at the same time informative and growing. Across existing studies, there has been a rather consistent finding indicating that the pedagogical approaches adopted within the community college classroom remain largely lecture-based and decontextualized, with students often being passive recipients of knowledge instead of active participants. As an example, drawing upon observation data collected from 257 classrooms and interviews with instructors and administrators at 32 colleges from 11 states, Grubb and Associates (1999) revealed that, in these community college classrooms, the transmission of knowledge is prioritized through the primary reliance on lecturing. Similarly, based on in-depth interviews and classroom observations of 14 instructors at a large suburban community college in the Midwest, Mesa, Celis, and Lande (2014) found that, among various teaching approaches in community college classrooms which the authors categorized as "traditional," "meaning-making," and "student-support," the "traditional" approach emerged to be the most dominant one.

A further review of empirical research on teaching and learning at community colleges uncovers only a small body of work, and a considerable part of this line of inquiry concentrates on remedial classrooms, particularly in math. This is not surprising given both the gatekeeping role of math in students' college career and outcomes, as well as the dire passing rates in developmental math courses and programs (Cox, 2015). A limited number of studies dealing with developmental math classrooms that employed classroom observations have arrived at a similar conclusion that commonly adopted practices revolve around "drill-and-skill" (e.g., Grubb, 2010; Grubb et al., 2011; Grubb & Gabriner, 2013). This typical decontextualized approach to teaching developmental math features an excessive amount of instructional time devoted to routine questions (Mesa, Celis, Suh, Lande, & Whittemore, 2011), an isolation of math subjects from others (Levin & Calcagno, 2008; Perin, 2011), and a heavy reliance on a review-and-lecture mode (Grubb, 2010)—instructional approaches that are all "remedial" in nature instead of cultivating learning opportunities that actively engage students to make meaning of what they learn (Cox, 2015). Focusing on teaching practices within developmental math courses across two urban community colleges in the northeast, Cox (2015) conducted classroom observations and instructor interviews to further unravel the interplay between instructional practices and opportunities for learning. She argued that the "default" model of developmental math education has to be disrupted from the organizational level, and that there is a great need for further understanding the relationship between the enacted curriculum and the resulting student math proficiencies.

The prevalence of this decontextualized approach to teaching developmental math and other courses at community colleges inhibits students from appreciating

the utility of the subject matter in real-world situations (Levin & Calcagno, 2008) and may well be part of the main cause for the high dropout and low completion rates in remedial courses (Grubb et al., 1999). This is also true for other courses at community colleges where teaching and learning around the subject matter are detached from students' real-life experiences (Grubb et al., 1999; Richardson, Fisk, & Okun, 1983).

Contextualization is viewed as a potentially powerful solution to this complicated problem (Ambrose, Davis, & Ziegler, 2013; Baker, Hope, & Karandjeff, 2009; Berns & Erickson, 2001; Boroch et al., 2007; Perin, 2011; Simpson, Hynd, Nist, & Burrell, 1997). Both Mesa et al. (2014) and Wang, Sun, and Wickersham (in press) suggested that the community college math classroom, remedial or other, should feature the interaction between and across students, instructors, and content within the subject matter. Both studies also pinpoint the challenge of balancing a rigorous facilitation of sophisticated math learning and a welcoming, supportive, accessible approach to assisting underrepresented students. This resonates with Grubb and Cox's (2005) forceful argument that student-centeredness and support within the classroom are key to the success of community college students, particularly among those who are academically underprepared. In light of these findings, it follows that rigorous instruction and meaningful learning experiences within the classroom may foster momentum so that community college students are not only comfortable in the learning context, but also experience true mastery of a complex subject matter.[2]

As a whole, we know enough to conclude that a main part of the reason why the majority of community college students are not achieving sufficient momentum to progress forward academically rests with what happens within the community college classroom. Limited exposure to teaching and learning approaches that allow students to engage in sense-making and constructing knowledge as active learners,

[2] I should note that, in addition to teaching and learning within the classroom, there has also been limited research on a range of curricular and co-curricular offerings intended to support student learning, such as supplemental instruction, learning communities, and student success courses (Butler & Christofili, 2014; Crisp & Taggart, 2013; Dawson, Meer, Skalicky, & Cowley, 2014; Goomas, 2014; Laanan, Jackson, & Stebleton, 2013; Lorch, 2014; Malnarich, 2005). In general, these studies show a positive relationship between participation in these support programs and student outcomes. For example, Dawnson et al. (2014) and Goomas (2014) illustrated that participation in supplemental instruction and academic support programs is associated with lower failure and withdrawal rates, higher course completion, retention, and graduation rates, as well as stronger academic skills and relationships with peers. Similarly, participation in learning communities is positively related to learning gains (Laanan et al., 2013), attainment of goals (Lorch, 2014; Malnarich, 2005), and improved self-motivation (Bulter & Christofili, 2014). Overall, studies on these structured student success programs and offerings are rather scattered, especially considering the wide range of differences across each program, and how each is implemented and studied. As Crisp and Taggart (2013) maintained, much more systematic research better at drawing causal inferences is warranted to understand how and why these support programs potentially influence community college students' short-term and long-term outcomes. Also, as most of community college students are not able to participate in these support programs due to employment and family obligations, these programs' potential for building momentum is relatively limited, compared with what could result from innovations that occur within the classroom context.

coupled with academic underpreparedness and a general lack of academic motivation, often result in the loss of momentum, as students become disillusioned, bored, or feel they cannot progress forward academically. These types of classroom experiences only serve as friction and resistance to student momentum. A true process of building momentum, therefore, should allow community college students to not only pursue promising course and program pathways, but also have enriching and meaningful learning experiences within those courses and programs in order to succeed in them. Simply put, momentum does not exclusively imply going through the motion of taking the "right" sequence of courses; it also taps into the actual learning and teaching that occur inside of the classroom—a key venue where roadblocks to gaining momentum may be removed. Students placed into the appropriately structured sequence must have rigorous learning experiences that allow them to gain momentum to move toward their larger educational goals, by not only taking but also succeeding in the courses and programs. After all, more often than not, succeeding in the courses and programs is fundamental to fostering further momentum for students.

Motivational Attributes and Beliefs

In addition to what goes on within the classroom, another key element missing in the existing literature on momentum is what happens within students themselves: their previously held and evolving aspirations, attitudes, beliefs, habits of mind, and the resulting behaviors as they engage with their community college experience. The motivational perspective is critical as it is closely tied together with momentum through coursework as well as learning and teaching within the classroom. Grubb and Gabriner (2013) noted that community college students often report low academic motivation, which research has shown to be a major barrier to course completion (Aragon & Johnson, 2008). Similarly, Bailey et al. (2015), when emphasizing the importance of offering students guided pathways, equally highlighted the critical value of cultivating academic motivation. In terms of longer-term educational outcomes, Nippert's (2000) study on community college students' degree attainment confirmed that, in addition to academic experiences, motivational factors matter for degree attainment. Studies by Wang (e.g., 2009, 2012, 2013a, 2013b) also consistently highlighted the strong predictive value of motivational beliefs and attributes in understanding community college student success.

These and other studies convincingly support the need to add the motivational perspective to conceptualizing momentum for community college student success. In light of the fluidity of community college students' educational aspirations, the various and diverging educational pathways that can be overwhelming at times, and the many barriers students face within and beyond the classroom, continued commitment to educational aspirations and sustained efforts are critical on the part of students as agentic individuals. Specifically, academic motivation related to one's aspirations, agency, growth mindset, and perseverance (Farrington et al., 2012)

represents pivotal attributes that contribute to and build momentum. Advisors can help guide students toward the right sequence of courses, and instructors can facilitate meaningful learning experiences; yet without students' strong motivation that helps them focus and persevere in the face of barriers, it is next to impossible for them to maintain the initial surge of momentum given the environmental factors that cause counter-momentum friction.

Expanding the momentum-building framework to include motivational factors bears great implications for cultivating community college student success. Here, by emphasizing motivational factors, I do not imply that they are only intrinsic to the students. As alluded by Dean and Dagostino (2007) and argued by Wang et al. (in press), community college faculty and administrators must adopt a dynamic and interactive lens toward psychological factors underlying student motivation. Instead of viewing them as innate and unchangeable that only some students have while others do not, the community college environment can be transformed into a motivating and empowering setting that helps build and strengthen the kinds of motivational beliefs among students that allow them to achieve educational and life goals meaningful to them. Existing research has reinforced the importance of non-cognitive skills such as academic habits, cultural know-how, balancing multiple demands, and help-seeking in contributing to community college students' academic success (e.g., Karp & Bork, 2014). Further empirical endeavors are greatly warranted for a better understanding of what motivational factors matter the most. Building upon this knowledge, these beliefs can be tapped into and cultivated through advising and classroom practices.

Advancing a Holistic Model of Momentum for Community College Student Success

In this section, I present a new, holistic theoretical model—Momentum for Community College Student Success, hereafter referred to as the momentum model, based on my review and critiques of existing research on academic momentum as well as research on classroom teaching and learning and the psychological development of community college students. This theoretical model extends beyond Adelman's academic momentum notion and the often-disjointed literature dealing with the learning, development, and success of community college students. Going back to the classical definition of momentum, the momentum model mirrors both the "mass" and "quality of progression—progress in the right direction" (i.e., the motion and velocity resulting from applying a directional force). Metaphorically, just like motion and velocity in physics indicate both how fast and in which direction an object moves, this Newtonian momentum in the community college context means both how fast a student is progressing through the "right" course and program pathways as well as what is happening within the classroom and students themselves. Before I present the momentum model in full detail, it is necessary to

offer a brief discussion on the definition of community college student success that serves as the overarching end goal that the momentum model is intended to serve.

A Word on the Definition of Community College Student Success

College success is a multifaceted and complex construct. Granted, completion of credentials, often used to measure student success, is of vital importance and represents a key policy concern for federal and state governments, as well as institutions and many individual students. However, defining success for community college students is an even more complicated task (Mullin, 2012), where credential completion or transfer rates alone cannot be adopted as a single yardstick, given the wide range of community college offerings and student goals for attending. By articulating the momentum model, I do not intend to reduce a sophisticated task of defining community college student success to a measurable model. Rather, the momentum model represents a new way of thinking in terms of how to enable and empower community college students to achieve their educational goals, acknowledging that success for community college students is particularly fluid and there exist many ways of defining it, by institutions, programs, instructors, and students themselves.

For this precise reason, the momentum model, as delineated later, also entails an aspirational component that emphasizes clarification of students' educational goals and finding viable paths aligned with those goals. In summary, the end purpose of the momentum model inherently reflects the fluid and complex nature of community college student success, with the understanding that to arrive at one single definition of community college student success is not the primary task of the proposed theoretical model. Regardless of the definition of success, which should be situated within specific empirical studies dealing with community college students with their specific educational intent, momentum is an appropriately broad lens that applies across different ways of defining success. In other words, the central argument is that, in order for students to succeed in their educational pursuits through a community college education, a more holistic view of their educational experience must be taken through building momentum, as described in this new momentum model.

The new momentum model is developed in response to the following three unique realities of community colleges and their students that are different from their four-year counterparts. First, community colleges typically offer a wide, diverse, and sometimes overwhelming range of curricula (Cohen et al., 2014; Perin, 1998; Schuyler, 1999), which provide many choices but more often blur the "right" paths for students to navigate in order to move toward achieving success given their educational intent. Second, on average, beginning community college students are not as college ready as their four-year college counterparts; thus, the learning and

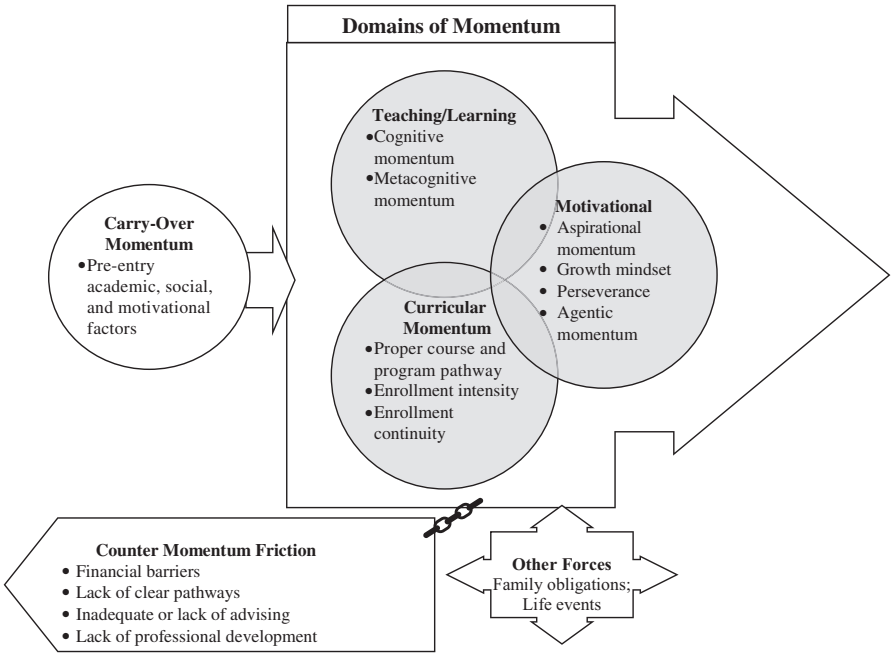

Fig. 6.1 A theoretical model of momentum for community college student success

teaching that happen within the classroom, especially in remedial and gatekeeper courses, are critically important for them to master basic skills and learning strategies that allow them to progress into and through college-level work successfully. Third, in light of the complex academic and life challenges facing community college students (Cohen et al., 2014), there needs to be a considerable amount of commitment that students put into their own academic work, which calls for the kinds of mindsets and beliefs that motivate students and keep them on track to success.

Given these realities, in whole, the new momentum model is predicated in the argument that, to assist students in pursuing fruitful educational experiences and outcomes, community colleges must cultivate an environment that fosters momentum. This entails well-sequenced and scaffolded courses across the curricula, teaching practices within these courses that promote active learning and metacognitive skills to master the subject matter, and motivational attitudes and beliefs of students that help them maintain direction. This new momentum model for community college student success differs from most of the existing theoretical frameworks in its dynamic nature and intentional focus on the classroom that is front and center of community college students' engagement with their education.

Figure 6.1 is a visual representation of the momentum model. There are three main domains of momentum: curricular, teaching and learning, and motivational. Within each domain, there exist subareas indicating specific types of momentum. In what follows, I delineate the momentum model in greater detail.

Curricular Domain of Momentum

This domain of momentum refers to the forward motion students maintain through course-taking patterns and efforts along either a formal program of study (such as a certificate or an associate degree program), or a sequence and configuration of coursework leading to a tangible educational goal (such as getting on the transfer path, non-credit education, or taking a few courses for self-enhancement). Curricular momentum is largely rooted in Adelman's notion of academic momentum and the empirical work reviewed earlier in this chapter that falls under the umbrella of academic momentum. I chose to name this type of momentum curricular momentum, as opposed to academic momentum, to avoid the misassumption that other domains of momentum to be described below do not include or have implications for building momentum within academic contexts and for academic reasons. In this sense, I strive to achieve a narrowing of the original academic momentum notion to reflect its primary focus on students' progress and efforts pertaining to course taking across the curriculum, one key dimension of the "academic" side of a community college education, but not all of it. Given these considerations, the curricular momentum domain is only briefly described below, as it is conceptually aligned with the academic momentum literature, which has been extensively reviewed earlier in this chapter.

Following well-scaffolded and aligned course sequences is at the heart of the curricular domain of momentum. Historically, community colleges have primarily adopted a "cafeteria-style self-service" approach to education (Bailey et al., 2015, p. 3), where students are expected to navigate the often overwhelming choices with little direction, leading to potential confusion, loss of momentum, and dropping out. Therefore, a core element of curricular momentum is students' well-advised and informed forward progress on a well-structured path of courses that leads to successful fulfillment of educational goals (e.g., Bailey et al., 2015; Hagedorn et al., 2006; Wang, 2015a).

Enrollment intensity is another indicator of curricular momentum. Intensity can be indicated either numerically by the number of credits students carry, or more discretely by classifying credit number into enrollment intensity status such as full-time and part-time. In general, enrolling in a high number of credits, or with full-time status, has been suggested to be associated with better educational outcomes (Adelman, 2006; Attewell et al., 2012; Attewell & Monaghan, 2016; Calcagno et al., 2007; Crosta, 2014; Doyle, 2009, 2010; Ewell & Boeke, 2007). Thus, having curricular momentum also means being able to maintain the intensity of one's enrollment.

Enrollment continuity, as another curricular momentum indicator, refers to continuous enrollment until the intended educational goal is achieved. Community college students' enrollment behaviors often feature high rates of disruption and discontinuity (Bahr, 2011; Crosta, 2014), which all significantly add to the risk of non-completion (Bahr, 2013b). Research on summer enrollment revealing its general

positive relationship to student outcomes also speaks to the value of enrollment continuity. Accordingly, enrolling in an uninterrupted manner is a major component of, and mechanism sustaining, curricular momentum.

Teaching and Learning Domain of Momentum

As discussed earlier, the community college classroom represents a most immediate and relevant venue for cultivating momentum, especially in the domain of teaching and learning. This domain contains two key subareas: **cognitive momentum** and **metacognitive momentum**. I use the word "cognitive" to describe the aspect of a community college student's education that involves the thinking, understanding, and learning of the subject matter. Hence, cognitive momentum is viewed as students' cumulative progress toward the learning and mastery of the subject matter at hand. The word "metacognitive" refers to the processes of identifying, monitoring, and planning strategies that are optimal for learning (Flavell, 1979; Zimmerman, 2001). Metacognitive strategies are goal-oriented efforts such as planning, problem-solving, and self-regulation to influence students' learning (Pintrich, 2000). Accordingly, metacognitive momentum means community college students' ability to apply strategies to regulate, adjust, adapt, and assess one's own learning processes.

Both cognitive and metacognitive momentum represent the types of momentum community college students critically need to establish and maintain academic progress. Many community college beginners do not necessarily possess carry-over momentum from high school in the form of adequate academic preparation (Adelman, 1999, 2005). Thus, their first exposure to teaching and learning at a community college may come through developmental or gatekeeper courses, which represent a major opportunity for the development of cognitive momentum through rigorous, student-centered approaches to teaching. In addition to fostering cognitive momentum, the community college classroom should shift from a knowledge transition approach to a space where students also learn how to learn (Bailey et al., 2015), thus strengthening students' metacognitive momentum. While cognitive momentum speaks more directly to the accumulation of knowledge and metacognitive momentum more to strategies applied to learning processes, these two types of momentum are not completely distinct from each other and are mutually reinforcing. Viewed holistically, cognitive and metacognitive momentum is best embodied in an active learner and best cultivated through a set of instructional practices placing students at the front and center of classroom teaching and learning, under the broader umbrella term of active learning. Most community college classrooms are still dominated by the traditional, lecture-based model of teaching. Active learning strategies, when adopted appropriately, can foster student engagement with the college academic environment (Perrotta & Bohan, 2013), thus adding to students' cognitive and metacognitive momentum.

Motivational Domain of Momentum

Finally, the new momentum model includes a key motivational domain. This domain speaks to the development of aspirations, mindsets, perseverance, and agency that allow community college students to stay on track of their educational journey despite setbacks and counter-momentum friction. The following specific types of momentum constitute the motivational domain of the momentum model.

Aspirational Momentum Aspirational momentum refers to students' clear definition of and sustained commitment to their educational goals. In light of the positive relationship between educational expectations and student effort (Domina, Conley, & Farkas, 2011; Wang, 2013a), maintaining early momentum in the form of aspirational persistence has a far-reaching influence on community college students' longer-term success (Bers & Smith, 1991; Driscoll, 2007; Hawley & Harris, 2005). At the same time, aspirational momentum also entails a purposeful reexamination and refinement of previously held goals. Community college students' educational intents do shift and evolve over time, especially considering that many students arrive at community colleges without a clear intent, or with a vague intent that makes it challenging to select and participate in appropriate course-taking pathways (Bahr, 2011; Voorhees & Zhou, 2000). Therefore, as students experience college over a more extended period of time and are exposed to the college environment, their aspirations and associated choices may become clearer. Thus, efforts assisting with aspirational momentum should be part of the ongoing process of developing momentum.

Growth Mindset Growth mindset as a form of momentum means students' belief that their academic performance is malleable through hard work, repeated practice, and application of useful strategies, and is thus changeable. Growth mindset is among a family of academic mindsets—"beliefs, attitudes, or ways of perceiving oneself in relation to learning and intellectual work that support academic performance" (Farrington et al., 2012, p. 28)—that have been studied in relation to college student success. Of these mindsets, sometimes loosely referred to as "noncognitive" skills[3] (Borghans, Duckworth, Heckman, & Weel, 2008), the growth mindset

[3] In recent years, the term "noncognitive skills" has been liberally applied to refer to students' personal qualities and attributes beyond cognitive ability that are beneficial to student learning and success. However, it has received valid critiques for its inaccurate implication that there are aspects of individuals' psychological functioning devoid of cognition (e.g., Duckworth & Yeager, 2015). Also, in recent work conceptualizing "noncognitive" skills, sometimes metacognitive skills are labeled as a subcategory of "noncognitive" skills (e.g., Farrington et al., 2012). This is also problematic as metacognition, by definition, is cognition of cognition (Hacker, 1998, p. 3). In addition, metacognitive strategies and skills, going by their classic definitions in the literature, distinctively pertain to students' cognitive and learning processes (Veenman, Hout-Wolters, & Afflerbach, 2006) instead of personal attributes and beliefs that are often described as "noncognitive" in the recent literature. For these reasons, in this chapter, I do not formally adopt the term "noncognitive" skills when describing various forms of motivational momentum. Furthermore, I intentionally keep metacognition distinct from the motivational domain.

(Paunesku et al., 2015; Yeager & Dweck, 2012; Yeager & Walton, 2011) is particularly relevant as a form of motivational momentum for community college students. Academic success is not only determined by existing knowledge and prior abilities, but also attitudes, habits of mind, and values (Astin et al., 1992), which should portray learning as a growing process. Often in the discussion on the characteristics associated with incoming community college students, the discourse is solely around their academic deficiencies. While it is undeniable that academic underpreparedness is widespread among community college students, focusing exclusively on underpreparedness only adds to the deficit view of these students (Laanan & Jain, 2017) and perpetuates a sense of hopelessness and defeat among students. In this sense, cultivating a growth mindset among community college students helps avoid the deficit approach and illuminates the development and growth as prominent features underlying students' educational experiences at community colleges.

Perseverance Another highly relevant element of this domain of momentum is academic perseverance,[4] also referred to as "grit" (e.g., Duckworth, Peterson, Matthews, & Kelly, 2007; Duckworth & Quinn, 2009), which is a student's ability to remain focused and engaged despite barriers and constraints (Farrington et al., 2012). Perseverance or grit is especially relevant for community college students who often face a multitude of divergent pathways as well as academic and other challenges (Napoli & Wortman, 1998; Zell, 2010). For students balancing work, family, and college, gaining and maintaining momentum is a particular challenge (Kolenovic et al., 2013) and perseverance will prove a critical type of momentum to help student stay on track.

Agentic Momentum Agentic momentum refers to community college students' drive to seek information, knowledge, help, and resources by their own action. Considering the fact that many community college students are older adults who already arrive at college with a strong sense of autonomy (Bailey, Leinbach, & Jenkins, 2006; Hawley & Harris, 2005; Levin & Kater, 2012), it is important to tap into this particular quality to build momentum. The community college student body consists of more adult learners who adopt an agentic approach to learning by co-creating learning in the classroom, constructing their own knowledge, and monitoring their own progress (Montero-Hernandez & Cerven, 2012). Research has shown that self-advocacy and proactivity can be cultivated into the community college student's role and identity that help develop a sense of competence and accomplishment (Schuetz, 2008) and prompt them to succeed (Karp & Bork, 2014).

[4] Perseverance is not to be confused with resilience. Perseverance and resilience have some overlapping in concept and meaning. Perseverance covers a broader meaning than resilience. Perseverance puts more emphasis in a strong will to hang on (Colquitt & Simmering, 1998; Kanfer & Ackerman, 1989). Resilience describes the ability to recover/restore its normal state (Howard & Johnson, 2000; Luthar, Cicchetti, & Becker, 2000; Masten & Powell, 2003; Smith et al., 2008). Given these distinctions, perseverance aligns well with the momentum framework.

It is important to reiterate that the motivational domain and its various types of momentum are not something that is entirely and inherently innate, and further, they form a highly interactive system feeding into one another. To illustrate, Mesa (2012) shows that community college instructors have yet to appeal to the strong motivational beliefs students bring into the classroom, which should be considered momentum that can be further built upon. Also, Karp and Bork's (2014) research further emphasizes the importance of the motivational dimension of momentum that eases community college students' transition into and through community colleges, especially highlighting the value of defining and clarifying students' agentic role in the process. Thus, the community college classroom presents prime conditions to cultivate motivational momentum by strengthening the connections among students and instructors and fostering students' individual agency and autonomy (Bailey et al., 2015).

Counter-Momentum Friction

Just as with linear momentum as defined in classical mechanics, motion and velocity involve the direction in which an object moves, and in this process, there can exist forces that counter motion and velocity to deter or redirect momentum. Accordingly, it is critical to be mindful of the many individual, structural, and institutional barriers facing community college students. Hence, momentum building also implies reducing "friction" that counteracts momentum, by paying purposeful attention to removing the academic and financial challenges community college students often negotiate that prevent them from engaging in activities that help build momentum, such as taking a high course load. Thus, in addition to articulating what constitutes momentum, the model also includes the kinds of factors and barriers to community college student success that serve as counter-momentum friction. To be precise, these friction factors are not what constitute momentum, but external forces that would reduce momentum, thus not being at the core of the momentum model.

Financial Barriers Financial barriers are one of the major counteracting forces that cause counter-momentum friction. The vast majority of community college students face substantial financial burden (Cohen et al., 2014; Geckeler, Beach, Pih, & Yan, 2008). Concerns about financing their current and future education, as well as the lack of financial resources, deter high-achieving community college students from finishing a credential or transferring to a four-year institution (Geckeler et al., 2008). This student population is also sensitive to both the type and timing of financial aid (DesJardins, Ahlburg, & McCall, 2002). To combat counter-momentum financial friction, financial aid in the form of scholarships provided earlier during college has shown to have a more positive effect than other types of aid in order to promote momentum (Mundel, 2008). The recent policy discussion and efforts associated with free tuition at community colleges represent a big stride toward reducing the financial friction that gets in the way of the forward momentum of community

college students. Also associated with financial barriers are the many obligations that community college students face, such as the need for transportation and childcare, which may prevent students from gaining momentum (Doyle, 2010), particularly in the curricular domain.

Lack of Clear Pathways Aligned with Student Intent A key barrier to the academic progress of community college students is a lack of clearly integrated and articulated course or program pathways. Many academically underprepared students are trapped in remedial sequences. In addition, college-ready students are often faced with an overwhelming set of choices, often leading them to pick the courses that may not contribute to a cohesive whole toward their intended outcomes (Bailey et al., 2015). The idea of guided pathways offers a promising approach, but a significant and persistent challenge is how to accurately measure the highly diverse and fluid educational goals among community college students in order to chart a viable trajectory for students to make forward progress toward those goals. The alignment between student goals and clear pathways still remains a critical piece of the puzzle needing resolution to pave the way for building momentum. In light of the momentum model, bridging students' aspirational momentum with other types of momentum, such as curricular and metacognitive, helps remove this potential misalignment problem and translate aspirations into actionable and viable educational plans.

Inadequate or Lack of Advising Closely coupled with the lack of clear pathways is the issue of insufficient, or absence of, advising, particularly in the area of course and program selection (Packard & Jeffers, 2013). Many community colleges are severely under-resourced, with an untenable student-to-advisor ratio as high as in the hundreds or even thousands (Cohen et al., 2014; Packard & Jeffers, 2013). Inadequate academic advising negatively affects community college students' outcomes (Hagedorn et al., 2006; Packard, Gagnon, & Senas, 2012), and poor or no advising may lead to students taking the "wrong" courses or courses that they do not need or will not transfer (Packard & Jeffers, 2013). Given these realities and factors, inadequate or lack of advising is a major counter-momentum friction.

Lack of Professional Development for Community College Educators Much of the momentum model centers on classroom practices that can be facilitated by community college instructors. Also important to the momentum-building process are advisors and counselors serving community college students. In particular, fostering cognitive and metacognitive momentum is largely contingent on adopting active learning and teaching approaches that require rigorous professional development among community college faculty to disrupt commonly practiced yet inadequate approaches to teaching. However, as Bailey et al. (2015) suggested, much as community college students often struggle with self-direction, time management, and academic motivation, faculty are not often able to view the development of these skills and attributes within the scope of their instruction. As a result, the decontextualization of course instruction isolated from students' motivational

beliefs and future aspirations often leads to a "demotivating" (p. 14) environment for learning. To make things more complicated, community colleges are often under-resourced, thus not featuring a strong culture for professional development opportunities among faculty and advisors in order to adopt evidence-based teaching and advising approaches that may represent the best venue to foster student momentum. The lack of robust professional development, coupled with the need to maintain low cost and open access with a heavy reliance on part-time faculty, represents a major barrier that may counteract momentum, especially in the teaching and learning domain.

Carry-Over Momentum Prior to Community College Entry

Viewing momentum as a continuum, I also include in the model carry-over momentum prior to community college entry. While this is not one of the main domains of momentum at the community college level, pre-entry momentum contributes in large to later momentum of students while attending community colleges. For example, pre-entry momentum can be obtained through dual enrollment[5] experiences that may motivate two-year college attendees to achieve greater academic momentum (Wang, Chan, Phelps, & Washbon, 2015). Students may bring carry-over momentum from high school, life, and work experiences. Carry-over momentum reflects students' prior experiences and backgrounds in the academic, social, and motivational contexts, and provides a foundation that can be further developed. In a sense, these background factors, as well as beliefs and attitudes students hold, including aspirations and mindsets, are also assets (Laanan & Jain, 2017) that instructors, advisors, and institutions can tap into in the momentum-building process.

Other Forces

Many community college attendees have significant responsibilities in life. Compared with their four-year counterparts, students entering community colleges tend to be older, have dependent children, serve as the major care provider for their families, along with assuming many other roles and responsibilities (Bryant, 2001; Cohen et al., 2014). This complex set of life circumstances, responsibilities, and events may either pull or push students on their academic trajectory, as some of them may serve as motivating factors that fuel momentum (e.g., working hard toward finishing a degree to obtain a job in order to support one's family and community; Cohen et al., 2014; Voorhees & Zhou, 2000), while others counteract momentum (e.g., working too many hours to sustain a momentum-garnering

[5] Dual enrollment programs are designed to allow high school students to enroll in high school and programs offering college courses concurrently (Andrew, 2004; Bragg, Kim, & Barnett, 2006).

credit load; Calcagno et al., 2007; Cohen et al., 2014). Accordingly, a careful consideration of these other forces is in order when constructing momentum-building activities for community college students.

Major Assumptions and Considerations Underlying the Momentum Model

After describing the new momentum model, I now turn to a discussion of three important suppositions underlying the momentum model: (1) the centrality of the classroom, (2) the intersectionality of the momentum model, and (3) the malleability of momentum. To sum up, the new momentum model centers on what educators can do to help students build momentum, rather than the question of how much momentum students require for success. In this sense, a momentum "point" measurement cannot give a holistic view of the malleability of momentum as a continuum.

The Centrality of the Classroom in the Process of Building Momentum With the understanding that community college students navigate different spaces in their academic and social encounters with their community college experience, the momentum model highlights the centrality of the classroom when considering all potential venues for cultivating momentum. In the existing college retention models developed with traditional four-year college students in mind, the academic integration aspect of Tinto's (1975) model, for example, has gained some empirical ground for community college students (Deil-Amen, 2011; Halpin, 1990; Pascarella & Chapman, 1983). The centrality of classroom experience also extends into the academic life of students who transfer out of community colleges and into the four-year venue. For example, Lester, Leonard, and Mathias (2013) revealed that transfer students contextualize their college engagement within academic work. In sum, prior scholarship has established the centrality of the community college classroom as the main venue for engaging student learning and facilitating progress, as community colleges are organized around classroom teaching (Lundberg, 2014). Accordingly, the community college classroom and curriculum represent the most immediate vehicle for building momentum in a holistic, concentrated, and purposeful manner and should be prioritized in related discussions, especially since this potential is still by and large unrealized, as indicated in the literature. Development of positive motivational beliefs and metacognitive skills will particularly benefit academically underprepared students in order to persist through multitudes of obstacles, academic or otherwise. Given their limited time on campus, the classroom becomes the educational space community college students spend most of their time navigating (Hagedorn & Kress, 2008) and holds vital potential for building a safe and positive learning environment. At the same time, I do not suggest that venues other than the community college classroom do not merit exploration. While historically, little emphasis has been placed on student organizations or faculty-student interaction

outside of the classroom, these out-of-classroom domains may be missed opportunities where community colleges could expand efforts to increase student momentum and learning.

Intersectionality of the Momentum Model Similar to their counterparts in classical mechanics, the domains of momentum and their various forms are neither mutually exclusive nor static. They represent a dynamic, collective process in which one form of momentum builds upon, extends, and amplifies another. For example, cognitive and metacognitive momentum that students gain through actively engaging in learning activities within the classroom can strengthen students' commitment to goals (Crisp, 2010; Wang, Sun, Lee, & Wagner, 2015), thus adding to students' aspirational momentum in the motivational domain. In addition, as Wang et al. (in press) illustrated in their research on contextualization within remedial math courses, instructional practices centering on meaning making and active engagement of students can transform the classroom setting into a motivational environment, thus cultivating both cognitive momentum and the types of momentum in the motivational domain, such as growth mindset. In fact, the interconnected nature of various types of momentum has also received support from academic momentum researchers as they articulated a theory of change explaining why academic momentum through coursework may foster success. For example, Attewell et al. (2012) posited that momentum works through better integration of students, increased academic self-concept, and the "crowding-out" of other obligations of students that could counter momentum through heavy course loads, thus suggesting that curricular momentum in the form of enrollment intensity can help build momentum in the teaching and learning domain as well as the motivational domain. Martin, Wilson, Liem, and Ginns (2013) further illustrated that momentum's potential to push students forward toward progress can also be explained from the perspective of learning as a generative process through which students make meaning through a connection between new and prior knowledge and experiences, further demonstrating that one form of momentum extends from and contributes to other forms of momentum.

Malleability of Momentum A major limitation with the existing academic momentum framework is its heavy emphasis on individual students' decisions and choices. As such, momentum in prior literature is viewed as almost exclusively stemming from students' own decisions, choices, and efforts because "there is a limit to what [we] institutions can realistically do unless students respond to highly targeted advice and prodding" (Adelman, 2006, p. xxiv). However, as Grubb et al. (1999) argued, "Even if some decisions to drop-out depend on financial and familial factors beyond the control of the college, improvement in teaching would at least do everything a college can do to help students realize their goals" (p. 355). By advancing a more holistic and dynamic momentum model, I further extend Adelman's later acknowledgement that these student decisions and behaviors happen in conjunction with the structures and opportunities provided by institutions. Momentum, true to its original definition as in classical mechanics, is thus malleable and can be collectively built by students and the community colleges they attend (Grimes & David,

1999). As an example, the development of momentum in the teaching and learning domain is made viable through concerted efforts involving both instructors and students in contextualized and integrated instruction, as these approaches have gained a strong empirical base as rigorous ways to strengthen community college students' learning of the subject matter (Perin, 2011; Perin & Charron, 2006)—thus developing cognitive momentum. These approaches also help cultivate student self-efficacy in the subject matter (Wang et al., in press)—therefore adding to various elements to the motivational domain of momentum as well, such as aspirational momentum and growth mindset.

I should note that by being malleable, community college students also play an active role in developing their own momentum. This is why agentic momentum plays such an essential role, both as a form of motivational momentum, and as a generative force that empowers community college students to assume a proactive approach in developing other forms of momentum. To strengthen agentic momentum, it is pivotal to help clarify the value and utility in coursework, as research has shown that a failure to recognize them is one of the major barriers leading to counterproductive behaviors such as failing to complete assignments and courses (Cox, 2009a, 2009b; Grubb, 2006). Community college students tend to have a strong orientation toward the utility of what they learn. As such, clarifying utility, expectations, and more importantly, how learning is connected to students' future goals, will help build agentic and other types of momentum.

Future Research Directions for Using the Momentum Model

In this section, I offer several major directions for future research building upon the momentum model. As a comprehensive and holistic model, it is not always feasible to tackle all of the elements contained in the model in a single chapter. Therefore, I organize my recommendations for future research based on the specific domains of momentum, followed by a set of common directions that apply across all three domains of momentum. However, as I discuss in greater detail later, it is important to keep in mind that, to fully understand how momentum works and is cultivated, a sustained research program addressing all the elements of the momentum model is worth pursuing through longitudinal, mixed methods research designs.

Curricular Domain

Among all three domains of momentum, this area has received the most sustained empirical attention and efforts. As such, empirical evidence abounds, pointing to the positive influence of this type of momentum, especially with regard to enrollment intensity and continuity. What is less clear is momentum built through following well-sequenced and scaffolded course and program pathways or a clear unequivocal

identification of the pathways. As discussed previously, transcript analysis has been in existence for several decades and more, proving particularly informative when considering the often chaotic patterns followed by community college students. However, empirical evidence is still limited and falls short of fully revealing clear course and program pathways. This is partly due to the fact that analysis of course taking in the current literature is primarily approached through traditional statistical analysis that fails to account for the complexity and richness of transcript data.

Moving into the future, more sophisticated and robust approaches to transcript-based analysis hold enduring promise for disentangling specific trajectories contributive to community college student outcomes, especially situated within concrete institutional contexts or a domain-specific subject area (e.g., biology in STEM fields of study). Given the large volume of transcript data, it is clear that exclusively relying on descriptive approaches would not be sufficient to truly mirror the complex and nuanced ways in which students gain or lose momentum as they navigate college through coursework in a longitudinal and highly interactive fashion. Corresponding with the rise of policy interest in big data and the potential adoption of machine learning analytics in exploring education data, in the past few years, there has been a small but growing body of work on academic momentum and transcript analysis that employs data mining techniques to reveal complex course-taking patterns (e.g., Bahr, 2010b, 2011; Crosta, 2014; Wang, 2015a). Future research endeavors can further benefit from these analytical approaches utilizing institutional or state administrative data. In these efforts, it is particularly valuable to compare how the identified course-taking patterns and sequences align or do not align with published and recommended course sequences and transfer agreements. This approach offers insight into any potential gaps between students' actual practices and the intended course sequences as well as program or transfer pathways, illuminating specific problem areas for targeted interventions.

In addition, more research is needed to not only elucidate commonly practiced course and program sequences and pathways, but more importantly, outcomes associated with them. Certain data mining techniques, such as association rule mining and decision tree, as exemplified by Wang (2015a), not only offer a typology of course-taking patterns, but also tie patterns to student transfer outcomes. These approaches represent promising directions for future research. Furthermore, quasi-experimental approaches and machine learning techniques may work in concert with each other to both tease out clear patterns based on complex transcript data and offer stronger causal inferences, thus shedding light on policy implications associated with course and program sequences.

Teaching and Learning Domain

Overall, much more research is needed that focuses on what happens inside of the community college classroom. The momentum model highlights the centrality of the classroom in fostering momentum, an argument well-grounded within both prior literature and the realities of a community college student's engagement with

her/his experience. Yet, scholarship on teaching and learning within community colleges is quite disjointed and spans a range of disciplines, with only limited research in the higher education research literature. While evidence-based, high-impact teaching approaches such as active learning, contextualized and integrated instruction are known to many, limited research (e.g., Baker et al., 2009; Hamilton, 2013; Mazzeo, Rab, & Alssid, 2003; Wachen et al., 2012; Wang et al., in press) exists that truly delves into the extent to which these approaches are adopted and their actual impacts on student outcomes. A critically important missing link in our knowledge base is the potential barriers and opportunities in faculty adoption of these practices and students' reception of and participation in practices aimed at fostering cognitive and metacognitive momentum. Research tackling these dynamics will prove especially beneficial as we think about how to strengthen faculty professional development to better cultivate student involvement, especially in light of the earlier discussion of a major counter-momentum friction point in the lack of professional development opportunities.

In addition, existing research in this area has heavily relied on data collection tools that are not always truly reflective of what is going on within the classroom. Sole reliance on surveys and interviews, while helpful in their own right, do not speak directly to the actual practices and dynamics within the classroom. Future empirical work should further leverage classroom observations as a way of collecting data in conjunction with other tools to reconstruct an authentic and complex picture of learning experiences and teaching practices that happen within the community college classroom that shape and develop momentum.

Motivational Domain

There has been solid empirical support for the correlation between college students' motivational attributes and educational outcomes. But within the general college student population, community college students have only received limited attention. As such, it is imperative that more research is devoted to understanding specific motivational factors that may prove especially pertinent for this student population. Other than the inherent need to grow the research in this area, future research endeavors should strengthen their application of relevant psychological theories. The theories undergirding the motivational constructs that have been utilized in community college research are often well developed in the field of psychology, especially social psychology; yet, the constructs adopted in existing research on community college students are sometimes used in a piecemeal fashion without a complete theoretical background. A more purposeful and systemic adoption or adaptation of these theories will strengthen the rigor of studies in this area. Furthermore, it is crucial for future research to identify the sources shaping the development of attributes and beliefs that keep students motivated, such as those core types of momentum depicted in the motivational domain. These sources are

often well theorized depending on the particular construct under study, but need to be situated within the community college student success context to lend insights into the concrete conditions and settings underlying its development.

Common Considerations

Interdisciplinary Approaches to Defining and Measuring Momentum As a theoretical model, the momentum model is meant to offer a new lens of thinking about community college student success, instead of delineating a full-blown measurement model with an exhaustive and fine-grained depiction of all constructs contained in the model. As a matter of fact, a fully developed theory requires continued refinement through robust collection and analysis of original data that is beyond the scope of this chapter. In this sense, the momentum model put forth herein, by nature, calls for future endeavors to further clarify, define, measure, and fine tune the domains and constructs of momentum. With that established, it is important to take full advantage of interdisciplinary approaches to studying momentum, grounded within the realities of community colleges, their students, and what success means. Many of the elements in the momentum model have their theoretical roots and backing within disciplines of social psychology, learning sciences, as well as higher education research as a field in its own right. Given the multi-thronged, multifaceted nature of the barriers, challenges, and opportunities facing community colleges and their students across and within the curriculum, future research drawing upon the momentum model will certainly benefit from utilizing scholarship across disciplines to truly reflect and address the complexities of the issue of community college student success.

Getting to the Bottom of "What Works" Aside from issues of measurement, pragmatically, it is important for researchers to better understand the sources of momentum and the mechanisms underlying the development of momentum. To that end, both research aimed at identifying potentially viable momentum interventions and studies on the efficacy of existing interventions are of value. In the first regard, qualitative inquiry, as opposed to statistical analysis that is correlational in nature, embodies abundant untapped potential to pinpoint the types of supports and services that reap the most benefits in terms of building momentum. By delving deep into students' experiences and voices through qualitative research in search of a rich and nuanced understanding of how momentum is shaped and what shapes it, clear light can be shed on specific policy and practice. In regard to existing interventions, rigorous research better at drawing causal inferences is needed to gauge efficacy. For example, prior research has indicated that community college success courses may help holistically develop momentum. There has been a growing body of evidence suggesting that these types of courses may cultivate curricular momentum as both developmental and college-ready students who have taken them have earned more college-level credits and persist into the second year (Cho & Karp, 2013).

Student success courses may also help build aspirational momentum by providing knowledge about college itself and helping students make connections with instructors, advisors, and peers (O'Gara et al., 2009). Success courses are also linked to other domains of momentum by means of improving metacognitive skills and motivational attributes (e.g., Rutschow, Cullinan, & Welbeck, 2012). Yet to date, the evaluation of success courses or similar interventions is mostly correlational, lending limited insight into their effectiveness, particularly in terms of why they may or may not develop momentum.

In general, future quantitative research on momentum should move further in the direction of drawing causal inferences. An exemplary approach in this direction can be gleaned from the research on the City University of New York's (CUNY) Accelerated Study in Associate Programs (ASAP), an intervention aimed at increasing graduation rates by offering students a holistic range of support services. Experimental and quasi-experimental studies on this intervention have produced evidence indicating that this intervention seems to encourage momentum through proactive and comprehensive support, leading to improved graduation rates. In addition to creating a model of quantitative evaluation that is better at revealing what works to foster momentum, future studies, again, should better and more fully utilize qualitative approaches to reveal the specific points and pieces in the intervention that encourage momentum and positive outcomes. For example, a qualitative component assessing ASAP could involve interviews with students to understand the specific support elements within the holistic bundle that helps them the most. This approach would strengthen policy implications of such interventions by highlighting mechanisms worth the most investments.

Attending to Heterogeneities Among Community College Students While I argue that a momentum-building perspective will benefit all community college students, it is also critically important to not assume that all community college students possess, develop, and respond to interventions to build momentum the same way. To be sure, there exists a multitude of diversity within the community college student population based on their gender, racial/ethnic, cultural, socioeconomic, academic, and other backgrounds, and these differences may certainly influence the sources and underlying forces related to their momentum. Using racial/ethnic background as an example, for students of color, educational aspirations for oneself are often inseparable from a sense of responsibility to one's community (Yosso, 2005). Among Latino students, aspirations and academic attitudes may outweigh other factors such as age and English proficiency in predicting their academic success (Hagedorn et al., 2007), and the students' sense of purpose and commitment to others reinforce their academic intent to persist (Zell, 2010). Given these findings, an integration of academic and personal goals may constitute a particularly promising way to strengthen the aspirational momentum of Latino/a students. Also, students of color at community colleges often face unique challenges (Fiebig, Braid, Ross, Tom, & Prinzo, 2010) that may be particularly counterproductive to building momentum. By the same token, there might be unique opportunities as well as challenges regarding how to best engage students in building momentum. The best route

to teasing out these differences is to purposefully address them in empirical work, such as using multi-group approaches or adding interaction terms in quantitative analyses, and focusing qualitative inquiries to delve into the lived experiences of a particular subgroup of students.

Utilizing Longitudinal, Mixed Methods Research Designs To better account for the holistic, intersectional, and continuous nature of momentum as delineated in this chapter, rigorously designed longitudinal, mixed methods research encompasses enormous promise for future inquiries based on the momentum model. In regard to research conceptualization, it will prove fruitful to both reflect the interconnectedness of various domains of momentum and identify ways that shape different forms of momentum, in both unique and interlocking fashions. Longitudinal designs will add much rigor to momentum research as it will allow inquiry that captures the evolving and fluid nature of momentum and what factors and barriers turn out to be salient along the momentum-building process. For quantitative studies, modeling techniques such as structural equation modeling, path analysis, growth curve modeling, etc. that accommodate repeated measures of momentum and depict the temporal order of change have great utility toward that end. Qualitative approaches are vital in order to fully understand the complex process through which certain patterns of momentum or momentum building (e.g., how to develop momentum within the motivational domain) can be richly understood. Ideally, a longitudinal, mixed methods approach that combines the strengths of both quantitative and qualitative inquiry is best positioned to produce nuanced, sophisticated, and contextualized findings that illuminate a brighter picture of how momentum is developed among community college students to foster their success.

Conclusion

As a national priority, understanding community college student success represents an area of opportunity for education research. While the notion of academic momentum has been instrumental in shedding light on students' course-taking behaviors and patterns in connection with their educational attainment, it is theoretically underdeveloped and has been only applied to a single dimension of students' progress through coursework and program requirements. Thus, its potential is yet to be realized to chart a clearer research agenda for community college student success.

In this chapter, I seek to extend the theoretical and methodological conceptualization of the academic momentum literature, based on which I develop the new model of momentum for community college student success. Rooted in the concept of momentum from Newton's classical mechanics, the proposed momentum model connects several highly important, highly complementary, yet understudied and often disconnected lines of inquiries. It thus fills significant gaps in the community college student success literature through advancing a compelling theory of the impact of momentum on success. By viewing the community college education as

a process of building momentum that can be found in students' curricular behaviors and pathways, teaching and learning within the classroom, and students' psychological development, community colleges can become the avenue for overcoming the multifaceted barriers often facing their students.

Hagedorn and DuBray (2010) maintained that, in order to truly live up to their mission, community colleges must provide holistic and appropriate support structures to help their many historically underserved students combat the multiple financial and academic barriers that they face. The momentum model serves exactly that. Adopting a holistic approach to cultivating momentum that prioritizes the active role of both community colleges and students in the process, the momentum model calls for a comprehensive plan appealing to multiple attributes, behaviors, and ways of thinking to build momentum that encourages community college students to engage in rigorous educational experiences and develop momentum-generating mindsets in order to maintain a strong and steady path toward success. As the higher education landscape enters the twenty-first century, the discourse around community colleges should move away from the process of cooling out (Conway, 2010) and the deficits in the community college student population, and instead toward a new model shedding a positive light on the process of building momentum to directing, supporting, and empowering community college students to proactively pursue a viable educational path and build momentum from within and without to achieve their own success.

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