Chapter 3
A Review of Empirical Studies on Dual Enrollment: Assessing Educational Outcomes

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3.1 Introduction

More than ever, high school students in the United States have ambitious educational goals. That is, most high school students expect to attend college regardless of their academic performance (Jackson & Kurlaender, 2014). In 1976, 50% of high school seniors planned to earn at least a bachelor's degree. In 2000, the percentage of high school seniors planning to earn at least a bachelor's degree increased to 78% (Reynolds, Stewart, Macdonald, & Sischo, 2006). Not surprisingly, the percentage of high school students that enrolled in college immediately after high school has also increased, from 9% in 1939–40 to 69% in 2015 (Clotfelter, Ehrenberg, Getz, & Siegfried, 1991; National Center for Education Statistics [NCES], 2017).

However, enrolling in and expecting to finish college does not necessarily mean one will graduate from college. In 2014, approximately 81% of first-time, full-time students who enrolled at four-year institutions returned the following fall, and this figure was even lower at 61% for those enrolled at two-year institutions (NCES, 2017). The persistence leak continues beyond the early college years, as only 59% of first-time, full-time students at four-year institutions graduated within 6 years of entry (NCES, 2017). Moreover, students are taking longer to attain their degree. Adelman (2004) estimates students took 4.34 calendar years to earn a bachelor's degree in 1972, 4.45 years in 1982, and 4.56 years in 1992.

The transition from high school to college therefore is not successful for many students. Although high schools often maintain a "college for all" ethos, many

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students leave high school with a vague notion of what college will be like (Jackson & Kurlaender, 2014). The expectations and norms students have learned and the skills they have cultivated throughout their primary and secondary education may not translate well to postsecondary education. For instance, college instructors tend to teach their material at a more rapid pace, emphasize content that demonstrates key thinking skills, and have different expectations for students than their high school counterparts (Conley, 2007).

It comes with little surprise then that many students enter college underprepared. Greene and Forster (2003) estimate that only 32% of high school students are college ready based on the following three criteria: high school graduation, basic reading skills, and coursework—which consists of English (4 years), math (3 years), natural science (2 years), social science (2 years), and foreign language (2 years). In 2012, 25% of students who took the ACT met the College Readiness Benchmarks across four areas: English, reading, math, and science (ACT, 2012). The ACT defines students as college ready when their scores on the ACT subject tests give them a 50% chance of earning a B or higher or a 75% change of earning a C or higher in corresponding first-year college courses such as English composition, social sciences, college algebra, and biology (ACT, 2012). Many students also recognize this lack of preparation. In a 2005 report, 39% of public high school graduates stated their high school education somewhat or did not prepare them to do the college work expected of them (Achieve, 2005). A way in which policymakers and educators have attempted to address students' lack of college preparation is through participation in dual enrollment programs in which high school students can enroll in college courses.

In this chapter, we review the empirical studies on dual enrollment, paying attention to research that centers on the student. By focusing on the student as the unit of analysis, our paper considers research in two general areas: patterns of participation in dual enrollment, and the relation between dual enrollment and educational outcomes. Our study differs from prior works that provide a comprehensive account of dual enrollment in that these papers either have focused on a general overview of the literature (D. Allen, 2010; Tobolowsky & Allen, 2016a; Young, Slate, Moore, & Barnes, 2014b) or have concentrated on a specific domain of dual enrollment policy (Borden, Taylor, Park, & Seiler, 2013; Education Commission of the States, 2001; Karp, Bailey, Hughes, & Fermin, 2004, 2005). Many dual enrollment reports focus on the state as the unit of analysis. These reports provide insight into the funding, implementation, and articulation of dual enrollment programs, but they give less attention to how students select into these programs or how dual enrollment affects their educational outcomes. Moreover, papers that provide a general overview of dual enrollment tend to focus on multiple units of analysis, such as the student, program, or state level. Because these papers use a broader brushstroke to summarize the literature on dual enrollment, they spend less time analyzing the condition of the empirical research.

We used *Google Scholar* and *EBSCO Host* to search for works on dual enrollment. Our search terms used a combination of the first search term (either dual* or concurrent*) and the second search term (either enrol* or credit*). Our initial search

led to 783 documents. We removed 182 documents that were either unpublished conference papers, master's theses, or unrelated to dual enrollment (e.g., dual markets and Medicaid). We further removed 31% of the remaining 601 documents because they were doctoral theses; approximately 68% of doctoral theses came after 2010, which indicates the burgeoning of the research topic. There were 292 documents related to dual enrollment that were not empirical studies. We do use some of these documents for our chapter, but they are secondary and used for contextual purposes. Therefore, the literature we reviewed for our chapter mainly derives from 122 empirical studies from journal articles or reports.

These 122 empirical studies include quantitative, qualitative, or mixed methods. Most empirical studies in our search were published as journal articles (66%), while the remaining were published as reports (34%). We were interested in the journal outlets in which these empirical studies appeared. To assist in our analysis, we used the SCImago Journal and Country Rank (SJR) score. We chose the SJR score over other popular approaches, such as the Journal Citation Reports (JCR), for two reasons. First, unlike JCR—where individuals or institutions need to pay a subscription to access its indices—SJR is free to use. Second, the SJR score weighs the citations that a journal receives based on the prestige of the journal from which the citation came and is based on Google's PageRank algorithm (Scimago Research Group, 2007). This means citations from prestigious journals that Journal A receives would have greater weight in calculating the score, whereas citations from less prestigious journals that Journal A receives are down-weighted (Butler, 2008).

We do not claim, nor do we encourage, readers to view the SJR as a measure of a journal's "quality." However, the SJR does correspond to prestigious journals in education and higher education, which also corresponds to well-known publishers. Indeed, 69% of empirical studies on dual enrollment cataloged in the SJR comes from just two publishers: SAGE Publications and Taylor & Francis. Approximately 48% of empirical studies cataloged in the SJR use either a multiple regression approach or quasi-experimental design, whereas just 24% of empirical studies not cataloged in the SJR use such statistical/methodological approaches. Surprisingly, 43% of empirical studies cataloged in the SJR use or include descriptive analysis, which is similar to the 47% of such studies not cataloged in the SJR. We find three times as many studies not cataloged in the SJR (29%) use either a qualitative or mixed methods approach than studies cataloged in the SJR (9.5%), suggesting that outlets for qualitative studies on dual enrollment are outside of SJR-cataloged journals.

In our analysis, we organize the literature around seven sections. The first section provides an overview of dual enrollment, which includes defining dual enrollment, state policies, program implementations, and overall enrollment trends. Although not the focus of our study, a brief overview of these components would benefit readers, especially those not familiar with dual enrollment. In the second section, we discuss demographic differences in participation patterns as well as explanations for participation. The third section reviews studies on the relation between dual enrollment and educational outcomes. The fourth section considers whether differences exist in the benefits of dual enrollment both within and across race and socioeconomic

status (SES). The fifth section reviews explanations of how and why dual enrollment affects educational outcomes. The sixth section highlights and compares dual enrollment to another accelerated program option, Advanced Placement (AP). In the last section, we provide a conclusion and directions for future research on dual enrollment.

3.2 Overview of Dual Enrollment

3.2.1 Terminology

Perhaps one of the most inconsistent aspects of dual enrollment is the terminology used to define and describe these programs. Borden et al. (2013) examine state dual enrollment policies and identify 97 different terms used across 50 states, although some of these terms are specific to a program or initiative. The three most common terms they find are "dual enrollment," "dual credit," and "concurrent enrollment." However, states, programs, and stakeholders do not necessarily define dual enrollment the same way.

Barnett and Stamm (2010) provide a straightforward definition where dual enrollment "refers to the opportunity for high school students to simultaneously enroll in both high school and college courses. Students who take college courses while in high school receive college credit but may or may not receive credit for college courses completed" (p. 2). This definition is similar to the definition offered by NCES in one of their first dual enrollment surveys. They note "dual enrollment, also known as 'dual credit,' 'concurrent enrollment,' and 'joint enrollment,' refers to student participation in college-level courses and the earning of college credits by high school students" (Kleiner & Lewis, 2005, p. 1). The common denominator between these definitions, and others, is that dual enrollment simply refers to high school students who are also enrolled in a college course.

As previously noted, some states, institutions, and organizations have adopted other terms such as dual credit and concurrent enrollment. For example, Illinois defines dual credit as "an instructional arrangement where an academically qualified high school student enrolls in a college-level course and, upon successful course completion, concurrently earns both college credit and high school credit" (Illinois Community College Board, 2015, ¶ 1). Thus, in addition to being dual enrolled, a student must earn both college and high school credit. The National Alliance of Concurrent Enrollment Partnerships (NACEP) (2018) that accredits dual enrollment programs uses the term "concurrent enrollment" and defines it more narrowly as courses taught in the high school and by college-approved high school faculty.

Despite not being universally accepted, we adopt the term dual enrollment throughout this chapter. This term is broad that intuitively represents the phenomenon of interest: students enrolled in both high school and college courses.

3.2.2 State Dual Enrollment Policies

Several studies have examined the role of state dual enrollment policies (Borden et al., 2013; Karp et al., 2004; Zinth, 2014b, 2015). This literature generally fits into three categories. The first category is best characterized as inventories of state dual enrollment policies (Borden et al., 2013; Bragg, Kim, & Barnett, 2006; Education Commission of the States, 2001; Karp et al., 2004; Michelau, 2001; Western Interstate Commission for Higher Education, 2006). Collectively, these studies have identified several features or characteristics of dual enrollment that help us to understand the role of state policy in regulating these programs. From these studies, we identify at least eight characteristics common in state policies: eligibility and admissions requirements; recruitment and outreach requirements; course type and course content regulations; expectations for faculty and instructor qualifications, and professional development; funding arrangements; tuition and fee provisions; course transferability; and quality and accountability. A comprehensive review of each characteristic is beyond the scope of this chapter; however, it is clear from these studies (and those reviewed below) that state dual enrollment policies are extensive and they regulate many aspects of dual enrollment practices.

The second category includes empirical studies of state polices. These studies illustrate how state dual enrollment policies are derived and how they influence local practice. Some studies analyze policies of several states (Horn, Reinert, Jang, & Zinth, 2016; Mokher & Mclendon, 2009). For example, Mokher and McLendon (2009) use a policy diffusion framework and event history analysis to investigate the factors that predict state adoption of dual enrollment policies over a 30-year period. They find states are more likely to adopt a dual enrollment policy if they have consolidated governing boards, unified Republican legislative control, large percentages of enrollments in two-year institutions, and prior adoption of innovative educational reforms (e.g., voucher legislation). Other studies examine policies of one state or a small number of states. Examining policies of two states, Pretlow and Patteson (2015) show dual enrollment policy in Virginia is best characterized as "centralized," whereby community colleges are the only providers of dual enrollment, and there are clear institutional contacts and service areas. Furthermore, there is cooperation among dual enrollment coordinators at different institutions. In contrast, dual enrollment policy in Ohio is characterized as "market" in which there are no defined dual enrollment service areas. This policy, in turn, leads to high schools partnering with several postsecondary institutions, thereby creating confusion, a culture of competition, and a culture not conducive to sharing best practices.

The third category is best characterized as policy analyses or commentaries based on existing literature and not from original data collection (Achieve, 2015; ACT, 2015; Austin-King, Lee, Little, & Nathan, 2012; Collins, Blanco, & Root, 2013; Hoffman, Vargas, & Santos, 2008; Hughes, Rodriguez, Edwards, & Belfield, 2012; Struhl, 2013; Zinth, 2014b). These analyses converge around several policy considerations. Zinth (2014b) offers 13 state policy components of dual enrollment that are organized around access, finance, course quality, and transferability of

credits. We also find governance, and accountability and transparency as important policy recommendations in the literature.

3.2.3 *Facilitating Dual Enrollment Program Success: Implementation Research*

A substantial number of papers provide basic information on the nature and characteristics of dual enrollment programs and how these programs are implemented. The literature suggests there is not a single, correct way of designing and implementing dual enrollment, because the geography and fiscal challenges differ across social contexts (Edwards, Hughes, & Weisberg, 2011). However, several commonalities have emerged in the literature as best practices to facilitate success. Beyond state policy, the literature shows at least five factors important for the success of dual enrollment programs: leadership, partnerships, funding and finance, structure, and stakeholder perceptions. The preponderance of literature in this section is based on either qualitative data analysis or survey research of program administrators, leaders, and faculty. Although there are many non-empirical accounts of factors that facilitate dual enrollment success, we focus on the empirical literature in this section.

Leadership Only a few studies explicitly identify the role of leadership as critical to dual enrollment success, which is somewhat surprising given the extensive literature on leadership in educational research. In a case study of Memphis City Schools, Barnett and Kim (2014) examine the implementation of dual enrollment across several high schools and colleges. Among other results, they find that support from district leaders (e.g., superintendents) is crucial to ensuring that dual enrollment is adequately prioritized and resourced. However, it is not just top leaders that are important for dual enrollment success but also the leadership of key champions, such as dual enrollment coordinators and faculty. In a recent qualitative study, Martinez, Valle, Cortez, Ponjuan, and Sáenz (2017) examine the role of school leadership in creating and maintaining dual enrollment for underrepresented students in South Texas. Their analysis identified four specific leadership approaches: visionary, progressive, strategic, and reflective. For example, leaders use progressive leadership approaches to allow students to develop a sense of purpose and value. This means transforming the school culture to a college-going culture, which includes early assessment for dual enrollment eligibility and hiring more bilingual teachers for core curriculum. Moreover, Piontek, Kannapel, Flory, and Stewart's (2016) qualitative study of dual enrollment administrators and faculty in Kentucky find a lack of staff to manage dual enrollment is a barrier to its success. They note dedicated management and staffing of dual enrollment programs as important factors to establishing relationships, facilitating communication, and problem solving around logistics.

Partnerships The factor most commonly cited as important to dual enrollment success is partnerships between secondary and postsecondary institutions. In their work on the implementation of Early College High Schools, the American Institutes for Research/SRI International (2007) identify four factors that facilitated effective partnerships: a shared understanding of goals and purposes, flexibility of policies and procedures from partners, a college liaison who is active and engaged, and a close proximity between the high school and college. Moreover, Barnett and Kim (2014) attribute the dual enrollment success at Memphis public schools, in part, to the effective partnerships and administrative structures that support dual enrollment. For instance, the district-level Director of High School Initiatives had strong relationships with high school and college partners, which are important to establish administrative structures such as common graduation requirements that dual enrollment can fulfill.

Dual Enrollment Financing and Funding Funding and finance are key factors that emerge in several studies of dual enrollment implementation. Even though many dual enrollment partnerships subsidize the price of dual enrollment courses to students, the costs remain a barrier for participation, particularly for middle- and low-income students (Piontek et al., 2016). In a survey of hundreds of Michigan high school and college administrators, Wozniak and Palmer (2013) report inadequate state funding for dual enrollment as the number one barrier to dual enrollment expansion. Similarly, Haag's (2015) analysis of dual enrollment in career and technical education (CTE) identifies lack of state funding as a significant barrier to success.

Structural Dimensions Important for Implementation Beyond the financial or funding structures of dual enrollment, there are other structural dimensions important for success. For instance, geographic proximity between high schools and colleges is important to the success of dual enrollment programs (Piontek et al., 2016; Wozniak & Bierlein Palmer, 2013). Closer proximity allows high school–college partnerships to offer a larger variety of program configurations and individual courses, and it allows students more opportunities to take the courses on college campuses. A second structural challenge is the lack of qualified high school instructors to teach dual enrollment courses (Piontek et al., 2016). This is particularly a problem in rural districts. A third structural challenge is the extent to which dual enrollment provides students with a college-like experience and/or integrates support services. In their study of dual enrollment in California, Edwards et al. (2011) find the authenticity of a dual enrollment experience is critical to the success and quality of the program. Dual enrollment courses tend to be more authentic if the courses are held on a college campus, taught by an instructor who uses pedagogy like regular college courses, and include a mix of college and high school students. However, Edwards et al. (2011) argue the course location is not the main criterion for course authenticity; students can have an authentic college experience independent of where the course is located or who teaches it. Moreover, support services such as orientation programs, access to the college library, tutoring, transportation,

and an academic success course are important for the success of dual enrolled students, especially for underrepresented students (Edwards et al., 2011; Piontek et al., 2016). For instance, the academic success course helps students learn note taking and study skills, orients them to the college-going process, and it provides additional resources such as college visits (Piontek et al., 2016).

Stakeholder Perceptions of Dual Enrollment A lack of stakeholder support for dual enrollment can also hinder the success of these programs. In Michigan, Wozniak and Palmer (2013) find high school superintendents and principals, as well as college dual enrollment administrators believe dual enrollment expansion is a priority, although college administrators tend to believe this more than high school leaders. Examining dual enrollment perceptions of high school principals, teachers, and counselors at a Midwest community college, Hanson, Prusha, and Iverson (2015) find counselors are less in favor of using dual enrollment as a means to provide students with academic benefits than are principals and teachers. This finding suggests high school counselors may be a likely source of resistance to dual enrollment expansion.

3.2.4 Trends in Overall Dual Enrollment Participation

Even with the variation in state policies and implementation of dual enrollment among and within states, a common trend found in the literature is dual enrollment participation has increased over the last couple of decades. At the national level, the best estimates come from two complementary surveys conducted by NCES. The total enrollment in dual enrollment courses (which may include duplicated counts of students) grew from 1.16 million in 2002–03 to 2.04 million in 2010–11, a growth of 76%. This period also witnessed an 11 percentage-point increase in public high schools offering dual enrollment courses (Thomas, Marken, Gray, & Lewis, 2013; Waits, Setzer, & Lewis, 2005). Currently, the collection of standardized federal data does not accurately measure dual enrollment, although the National Postsecondary Education Collaborative is exploring the potential to measure high school students taking college courses in the Integrated Postsecondary Education Data System (Taylor & An, 2017).

Despite the lack of adequate national enrollment estimates, many states count enrollments of high school students taking college courses; as a result, state data provide estimates of enrollment and changes in enrollment numbers over time. Due to differences in definitions, data collection mechanisms, and data collection time frames, it is difficult to compare states directly. That said, we highlight a few states to illustrate important trends and patterns in dual enrollment participation.

In Maryland, the number of high school students enrolled in college courses increased from 5,174 in 2011–12 to 6,480 in 2013–14. However, participation in dual enrollment was not evenly distributed and ranged from a low of 3% in some high school districts to a high of 28% in other districts (Henneberger, Shaw, Uretsky,

& Woolley, 2015). In Minnesota, Austin-King et al. (2012) report enrollment data separately for two programs: concurrent enrollment and postsecondary education opportunity (PSEO). In a two-year span, enrollment in the concurrent enrollment program increased 20%, from 17,581 in 2008–09 to 21,184 in 2010–11. However, PSEO decreased slightly by 4% during this same period. Students in Minnesota's concurrent enrollment program (but not PSEO) represented about 8% of all public school students. In Washington, dual enrolled students represented approximately 11% of all high school students. From 2010–11 to 2014–15, Washington State witnessed a 36% enrollment increase in Running Start and a 42% enrollment increase in College in the High School (Washington Student Achievement Council, 2016). Other states report similar upward trends in dual enrollment participation, and there are few signs of this trend changing anytime soon.

3.2.5 Early and Middle College High Schools

Early and Middle College High Schools (EMCHS) are a unique form of dual enrollment. We only comment on them briefly here because these models are evolving, and dual enrollment is only one component of their design. EMCHS are a high school reform movement that targets students who have been traditionally underserved by our education system. These programs furthermore provide extensive support services and small learning environments for students (Berger, Adelman, & Cole, 2010). In the broader context of credit-based transition programs between high school and college, EMCHS are what Bailey and Karp (2003) characterize as enhanced comprehensive programs that are intended to intersect with a significant amount of the high school experience and integrate support services, counseling and advising, mentoring, assistance with college applications, and other types of personal support.

The EMCHS movement was given significant attention at the turn of the century when several foundations invested to expand EMCHS around the country (Berger et al., 2010). It is difficult to estimate how widespread the EMCHS movement is because there are no systematic data collected on them. However, Jobs for the Future (2018) estimates that over 280 EMCHS are operating in 31 states and the District of Columbia, and EMCHS have collectively served more than 80,000 students. Several organizations involved in the EMCHS movement collaborated to develop and refine core principles or design features that guide the design of EMCHS (Berger et al., 2010), and these principles have evolved over time. According to Jobs for the Future (2018), which has been a key leader in the advancement of EMCHS, there are five primary design features of EMCHS: (1) instruction and curricula aligned to college-ready standards as well as perpetuating a college-going culture; (2) learning environments that promote personalization, and relationships between students and staff; (3) close physical proximity to nearby college campuses to allow high school students the opportunity to experience real college courses; (4) tuition-free credit that counts for both high school and college; and (5)

collaboration with strong college partners that also bears some responsibility for student success. These design features illustrate the comprehensive nature of EMCHS, for which earning college credit through dual enrollment is only one aspect of its design.

An extensive review of the literature and research on EMCHS is beyond the scope of this chapter, but it is important to note that new research is emerging on the influence of EMCHS on student outcomes (e.g., Berger, Turk-Bicakci, Garet, Knudson, & Hoshen, 2014; Edmunds et al., 2012; Haxton et al., 2016), how students experience EMCHS (e.g., Cravey, 2013; Hall, 2013; Ongaga, 2010), and the implementation of EMCHS (Bush, 2017; Kaniuka & Vickers, 2010; Leonard, 2013; Thompson & Ongaga, 2011). Although we may consider EMCHS as a subset of dual enrollment programs, they are unique from traditional dual enrollment programs and should therefore have their own assessment.

3.3 Participation in Dual Enrollment

The primary research agenda among studies that focus on students as the unit of analysis is the influence of dual enrollment on educational outcomes (we review this literature in the next section). A secondary, but still important, research agenda centers on students' participation in dual enrollment. Dual enrollment no longer remains in the fringes, and these programs have been implemented across the country. Forty-seven states (plus the District of Columbia) have a statewide policy of dual enrollment in place. For the remaining three states, dual enrollment is offered on an institutional basis (Education Commission of the States, 2018). Moreover, a notable proportion of high school students, especially high school seniors, participate in such programs. In Idaho, for instance, 13% of high school students participated in dual enrollment in 2014–15, a 4 percentage-point increase from 2011–12 (Holten & Pierson, 2016). The percentage of students who dual enrolled were also similar in Illinois (13%) and Virginia (16%) (Pretlow & Wathington, 2014; Taylor & Lichtenberger, 2013). These statistics provide conservative estimates, because they are based on the total number of high school students. However, dual enrollment participation is mainly for 11th and 12th graders. In Idaho, just 0.8% of 9th graders and 6% of 10th graders participated in dual enrollment in 2014–15. By contrast, 22% of 11th graders and 25% of 12th graders participated in dual enrollment during this time (Holten & Pierson, 2016). Dual enrollment participation in Kentucky is lower for 11th graders (9.4%) than previously shown for Idaho (22%), but participation is similar for 12th graders (24.6%) (Lochmiller, Sugimoto, Muller, Mosier, & Williamson, 2016).

3.3.1 Participation Disparities Across Groups

Aside from the overall participation rate, an important research and policy question concerns whether participation in dual enrollment differs among students and communities. When participation is equitable, we would expect student characteristics from those who participate in dual enrollment to mirror that of the student population. When participation is inequitable, we would expect systematic differences in student characteristics between dual enrollees and nonparticipants.

Studies show high-achieving students are overrepresented among dual enrollment participants. In Kentucky, 11th and 12th grade students with high ACT scores (19–36) had higher participation rates than students with low ACT scores (10–18). Similarly, 31% of students with an A grade point average participated in dual enrollment whereas only 14% of students with a C grade point average had done so (Lochmiller et al., 2016). These findings are not surprising given that dual enrollment programs were initially targeted for high-achieving students to take an academically challenging curriculum (Tobolowsky & Allen, 2016a).

Aside from high-achieving students, White and high-SES students are traditionally most likely to participate in dual enrollment (Museus, Lutovsky, & Colbeck, 2007; Pierson, Hodara, & Luke, 2017). However, there is some evidence that efforts to expand dual enrollment beyond these traditional students have worked. In Virginia, for example, an amendment in 2005 to the state's dual enrollment policy served to increase college enrollment and attainment. These changes better informed high school students of dual enrollment opportunities and it lifted restrictions to allow participation for eligible 9th and 10th grade students. Pretlow and Wathington (2014) estimate in 2004, 1 year prior to the policy amendment, 7.5% of Black graduates participated in dual enrollment. In 2006, 1 year after the policy amendment, 9.1% of Black graduates participated in dual enrollment, translating to a 21% increase from 2004. This increase is greater than the 16% increase experienced by White graduates from 2004 to 2006. (This difference in participation between Black and White graduates is statistically significant at the 0.05 level, two-tailed). In their study of a community college in Texas, Young, Slate, Moore, and Barnes (2013) find dual enrollment participation for White students increased by 74% from 2005 to 2011, whereas it rose at a slower rate for Black students during this six-year span (39% increase). However, Hispanic students more than doubled their participation, from 6.7% in 2005 to 17.4% in 2011.

Similarly, between 2005–06 and 2010–11, low-income students in Minnesota increased their participation in PSEO (defined as dual enrollment courses taught by college professors on college campuses) by 11%, while middle- and high-income students decreased their participation by 9% (Austin-King et al., 2012). In their concurrent enrollment programs, defined as college courses offered at a student's high school, participation in Minnesota increased more for low-income students (40%) than for middle- and high-income students (17%) (Austin-King et al., 2012).

Despite these increases in participation rates, especially among racially minoritized and low-SES students, studies show racially minoritized and low-SES students

remain underrepresented in dual enrollment programs. In Virginia, White students accounted for 82% of students who dual enrolled even though they made up 66% of the graduating class in 2004. By contrast, Black students made up only 13% of dual enrolled participants in spite of making up 24% of the graduating class in 2004 (Pretlow & Wathington, 2014). A similar pattern exists in Maryland where White students comprised 69% of all dual enrolled students in 2013–14 but constituted only 49% of 12th grade students (Henneberger et al., 2015).

Similarly, middle- and high-SES students are more likely to participate in dual enrollment than their low-SES peers. In Idaho, Holten and Pierson (2016) estimate students on free/reduced-priced lunch would need to increase their dual enrollment participation by 10.9 percentage points to equal the participation rates of students not on free/reduced-priced lunch. Pierson, Hodara, and Luke (2017) came to a similar conclusion in that dual enrollment participation among students on free/reduced-priced lunch is 12.4 percentage points lower than their representation of the student population in Oregon.

Part of the explanation for the underrepresentation of racially minoritized and low-SES students in dual enrollment is due to the schools that students attend. National trends show that 91% of all public high schools in which the vast majority of the student population are White had at least one student participating in dual credit in 2010–11. By contrast, 75% of all public high schools in which less than half of the student population is White had at least one student participating in dual credit during this same period (Thomas et al., 2013). Some evidence suggests taking more rigorous courses increase students' high school graduation and enrollment to two-year colleges more so at high-poverty schools than at low-poverty schools (Long, Conger, & Iatarola, 2012). Despite the effects of rigorous courses favoring students at high-poverty schools, their participation rates in rigorous courses are lower at these schools than at low-poverty schools.

Differences in dual enrollment participation by sociodemographic factors are partly due to other influences that are associated with race and SES. Research on tracking and course-taking patterns in high school shows students (and their parents) have flexibility in the courses they choose. Instead of track placement being a one-time, global assignment, it now requires yearly, subject-specific decisions (Lucas, 2001). This flexibility in course-taking provides parents, especially those from the middle- and upper-class, with opportunities to curate their child's schooling experiences (Lareau & Weininger, 2008). Although studies show Black and Hispanic students have less access to rigorous courses (e.g., Oakes, Ormseth, Bell, & Camp, 1990), students' family background and prior academic achievement account for a large portion of this disparity (Lucas & Gamoran, 2002).

Interestingly, the quantitative studies we examined that consider differential participation rates by race and SES do not account for important covariates (e.g., academic achievement) that potentially confound the race and SES disparities in dual enrollment participation (an exception is Pierson et al., 2017). Instead, we turn to studies that estimate selection models to adjust for the relation between dual enrollment and various educational outcomes. These studies show Black and low-income students remain less likely to participate in dual enrollment than White and more

affluent students even after controlling for factors such as academic achievement (Giani, Alexander, & Reyes, 2014; Pierson et al., 2017; Struhl & Vargas, 2012). The results are less consistent across studies for Hispanic students.

3.3.2 Towards an Equity Agenda

These studies highlight that dual enrollment is not equally accessible to all students. Some scholars advocate for making dual enrollment more inclusive (Bailey, Hughes, & Karp, 2002; Hoffman et al., 2008; Struhl & Vargas, 2012); they reject the contention that nontraditional participants are academically unprepared for college-level work and argue that allowing these students to participate in dual enrollment would do more good than harm. As we will discuss later in this chapter in more detail, dual enrollment appears to benefit students regardless of race or SES backgrounds (Karp, Calcagno, Hughes, Jeong, & Bailey, 2007; Struhl & Vargas, 2012). Moreover, some institutions have developed dual enrollment programs for students at risk of education failure as a way to promote high school retention. In 2002–03, approximately 5% of institutions with dual enrollment programs offered programs for at-risk students (Kleiner & Lewis, 2005). In less than a decade, the percentage of institutions offering programs for at-risk students almost doubled to 9% in 2010–11 (Marken, Gray, & Lewis, 2013). These at-risk programs provide extra support services such as academic advising, tutoring, study skills workshops, counseling in college selection and application, and counseling in financial aid (Marken et al., 2013).

Several states have enacted legislation and increased funding for dual enrollment as a way to raise the exposure of college-level courses for high school students (Holten & Pierson, 2016). For instance, states such as Idaho and Washington have passed legislation that expands participation in dual enrollment with the goals of increasing academic preparation for students and reducing disparities in access to, and completion of, these programs (Holten & Pierson, 2016; Washington Student Achievement Council, 2016). In 2015, the U.S. Department of Education (2015) launched an experiment that allows the opportunity for qualified students to take dual enrollment classes using Federal Pell Grants.

3.3.3 Explanations for Dual Enrollment Participation

Most of the literature on students' participation in dual enrollment is descriptive in nature or based on anecdotal reports. While informative to know who is participating in dual enrollment, it is difficult to form interventions or policies with this type of research alone because we are still unsure why students participate (or not) in dual enrollment. We found 11 published articles and reports that provide an explanation for why students participate in dual enrollment. In general, these studies reveal four reasons for students' participation.

Financial Considerations For many students, economic motivation is an important reason to participate in dual enrollment. Participating in dual enrollment lessens the financial burdens placed on parents. Depending on the state and the funding model, the price of earning college credit through dual enrollment is sometimes free or heavily discounted for students, thus making it a more affordable option than earning college credit as a degree-seeking student. (For a summary of dual enrollment funding, see Zinth, 2015.) For instance, in their study of funding models in Illinois community colleges, Taylor, Fisher, and Bragg (2014) find students paying full tuition for dual enrollment courses are rare in Illinois community colleges, and most of these colleges (64%) do not charge tuition.

Although dual enrollment is a viable financial option for many students, having to pay tuition and course materials—even if they are heavily discounted—may still be enough to deter students from participating in dual enrollment. For instance, O'Connor and Justice (2008), and Mansell and Justice (2014) show many of the students in their study were unable to afford the costs of the dual enrollment course. This dynamic occurs in spite of knowing that participation in dual enrollment would save them money in the long run (Mansell & Justice, 2014). In addition, some students were able to take AP courses at no charge with only having to pay the exam fee should they decide to take the AP exam (Mansell & Justice, 2014; O'Connor & Justice, 2008).

Course selection and Availability The types of classes available through dual enrollment is a second factor for students when deciding to dual enroll. Some students use dual enrollment as an opportunity to sample college courses on a part-time basis (Johnson & Brophy, 2006). For others, they dual enroll because their high school does not offer the course (Huntley & Schuh, 2002–2003). Relatedly, some students in Huntley and Schuh's (2002–2003) study took dual enrollment courses because they took all rigorous courses available from their high school.

Challenges and Incentives A third reason for why students dual enroll is to be exposed to an environment that differs from their high school. Some students view high school as too easy or the courses being unrelated to their career goals (Dare & Nowicki, 2015; Huntley & Schuh, 2002–2003). This finding is consistent with the assertions made in the National Commission on the High School Senior Year (2001) report, as students often spend their senior year of high school relatively disengaged with academics (e.g., taking easy courses, skipping class, and being concerned more about extracurricular activities). High-achieving students especially may seek dual enrollment because they want to challenge themselves and develop their academic abilities (Dare & Nowicki, 2015). Typically, these dual enrollees may also take specific college courses that are more directly tied to their future aspirations than taking courses simply as electives (Huntley & Schuh, 2002–2003). At some schools, students receive extra GPA points in their dual enrollment courses (O'Connor & Justice, 2008). While students may or may not receive extra GPA points, most students receive college credit after successful completion of the dual enrollment course. Accumulating college credit prior to entering college is an important

incentive for students to enroll in dual enrollment (Dare & Nowicki, 2015; Mansell & Justice, 2014).

Some students, however, prefer to take AP courses over dual enrollment courses. Mansell and Justice (2014) find almost a quarter of students in their study believe that courses in AP are more challenging and rigorous than courses in dual enrollment. Some students also perceive AP courses as more prestigious and more widely accepted by four-year colleges and universities than dual enrollment courses (Mansell & Justice, 2014).

College Readiness The final explanation for participating in dual enrollment is to facilitate their transition to college and make their academic experiences in college more positive and enjoyable (Dare & Nowicki, 2015; Huntley & Schuh, 2002–2003; Mansell & Justice, 2014). Students taking dual enrollment often aspire to continue their formal schooling after high school graduation, and they therefore view dual enrollment as a way to prepare them for college (Dare & Nowicki, 2015; Huntley & Schuh, 2002–2003).

Most explanations for dual enrollment participation are developed for the typical student who participates in these programs. Few explanations consider why systematic differences exist in dual enrollment participation based on sociodemographic factors, such as race and SES. As one exception, An (2013b) uses literatures in academic tracking and educational stratification to guide his selection model into dual enrollment based on family background. It is important for future studies to continue to develop theoretical frameworks that explain for the uneven participation rates among students from diverse backgrounds.

3.4 Dual Enrollment and Educational Outcomes

An important set of questions in dual enrollment research pertains to the relation between dual enrollment and college outcomes such as matriculation, academic performance, persistence, and degree completion. However, researchers have addressed these questions using various quantitative approaches. In this section, we briefly discuss the different methods used in quantitative research that considers the effects of dual enrollment. For this section, we removed studies that focus solely on participation in dual enrollment. We also removed studies where the outcome is not college matriculation, academic performance, college persistence, and degree completion, which left us with 54 empirical studies (17 reports and 37 journal articles).

Perhaps the ideal approach to infer a causal estimate of dual enrollment is through randomized experiments. In this approach, the researcher assigns students to participate in dual enrollment or not based on a random generating device. By randomly denying access to students who would otherwise participate in dual enrollment, and vice versa, random assignment increases overlap across the covariate distributions between participants and nonparticipants (Heckman & Smith,

1995; Schafer & Kang, 2008). Although randomized experiments may be the best approach to infer a causal estimate of dual enrollment, it is extremely difficult to implement in real-world conditions. Given the potential advantages in college readiness and college-credit accumulation for dual enrollment participants, and concern about an outcry from parents, education leaders may hesitate to sponsor a study that denies access to students who seek participation. None of the studies we examined implemented random assignment to dual enrollment. Research on dual enrollment therefore relies on observational data to estimate the influence of these programs on college outcomes.

As shown earlier, student participation in dual enrollment does not occur by chance; there are a multitude of factors that affect selection into these programs. Opportunities to dual enroll are often restricted to high-achieving students and those who have already taken several rigorous and college preparatory courses. These same characteristics are positively associated with college success (Kim & Bragg, 2008). Without accounting for these baseline differences between dual enrollment participants and nonparticipants, the relation between dual enrollment and an educational outcome is a function of dual enrollment as well as systematic differences of the individuals who participate in dual enrollment. Fortunately, most quantitative studies of the relation between dual enrollment and college outcomes have moved away from naïve estimates (31.5%) where researchers simply examine the outcome difference between dual enrollment participants and nonparticipants; instead, they use analyses based either on regression-based models (46.3%) or quasi-experimental designs (22.2%), such as propensity score matching, difference-in-difference, and regression discontinuity.

There has been a surge of dual enrollment research within a relatively brief period—almost 61% of the empirical studies that we evaluated were published after 2010. The way we organize this literature is as follows. First, we discuss findings of studies that consider dual enrollment as a dichotomous indicator (i.e., participate in dual enrollment or not). Second, we discuss studies that conceive of dual enrollment in a different manner, focusing on the dosage and characteristics of dual enrollment courses. Dual enrollment dosage represents the number of dual credits earned and characteristics of dual enrollment courses include course location (e.g., on campus, online, or at a high school), course subject, or course type (e.g., vocational/professional or academic). Third, we highlight research that looks at interaction effects of dual enrollment; that is, the interplay of dual enrollment with student characteristics in predicting outcomes. Finally, we discuss how dual enrollment might help mitigate outcome gaps by SES.

3.4.1 Dual Enrollment as a Dichotomous Indicator

A common way that researchers have studied the relation between dual enrollment and college outcomes is to conceptualize dual enrollment as a dichotomous indicator. Part of the reason for this conceptualization is due to data limitations. Moreover,

methodological limitations (e.g., sensitivity analysis) at the time of analysis require a dichotomous indicator of dual enrollment (An, 2013a, 2013b; Blankenberger, Lichtenberger, & Witt, 2017; Grubb, Scott, & Good, 2017; Taylor, 2015). However, there is a substantive reason for using a dichotomous approach. It addresses an important first-order research question: does dual enrollment influence college outcomes? It is important to address this fundamental question before other types of research questions.

Early empirical works on dual enrollment addressed this question by comparing the outcomes between those who dual enrolled and those who did not using simple descriptive or inferential analysis (Perkings & Windham, 2002; Spurling & Gabriner, 2002), where the benefits of dual enrollment may be attributed more to the students who participated in the program than to the program itself. An important follow-up question therefore is the following: does the relation between dual enrollment and educational outcomes remain after accounting for baseline differences between those who participated in dual enrollment and those who did not? As we previously discussed, most recent quantitative studies of dual enrollment attempt to account for these differences.

Dual Enrollment and High School Graduation Only a few studies have examined the relation between dual enrollment and high school graduation; this paucity of research is likely due to data constraints. Most studies use data where students are already in college, thereby making it unfeasible to examine this outcome. The few studies that have examined this relation generally show positive results. For instance, in a study of high school students in Utah, Haskell (2016) estimates the probability of students graduating from high school increases by 25% for those who participated in dual enrollment. Karp et al. (2007) also find dual enrollment increases the probability of graduating from high school, albeit a smaller effect (4.3% increase).

However, examining Washington's dual enrollment program (Running Start), Cowan and Goldhaber (2015) show the opposite pattern. Participants are 2.3 percentage points less likely to earn a high school degree and 1.1 percentage points more likely to drop out of high school than similar nonparticipants. They postulate two possible explanations for this seemingly counterintuitive finding. First, some Running Start students may plan to enroll in a two-year college without completing high school. Indeed, 15% of Running Start students who did not graduate high school on time remain enrolled in the same college in which they participated Running Start a year after their expected high school graduation. Second, a disproportionate share of low-achieving students may take advantage of Running Start, given its relatively inclusive requirements for eligibility, but this participation may result in a higher rate of high school dropouts. Running Start students in the bottom academic quintile are 4.6 percentage points more likely to drop out than similar nonparticipants.

Dual Enrollment and College Matriculation as a Degree-Seeking Student Compared to high school completion, more research exists on the relation between dual enrollment and college matriculation as a degree-seeking student. The majority of studies

show positive results, but some studies do show negative results. On the one hand, studies find dual enrollment increases a student's likelihood to attend college. In Illinois, Taylor (2015) estimates the odds of enrolling in any college for dual enrollees, on average, is 7.4 times as large as the odds of enrolling in any college for nondual enrollees. Lichtenberger, Witt, Blankenberger, and Franklin (2014) likewise find a seemingly large advantage in Illinois where, compared to nonparticipation, dual enrollment participation raises the odds of students enrolling at a two-year college by 8 times and for enrollment at a four-year institution by 6.7 times. Cowan and Goldhaber (2015) report that, in contrast to their negative finding for high school completion, Running Start students are more likely to attend college or have earned a degree shortly after high school graduation.

On the other hand, studies show dual enrollment may not increase—or at the least, universally increase—college matriculation rates. In Kentucky, for instance, students who took academic courses in dual enrollment matriculated at higher rates than the general student population, but those who took technical and occupational courses in dual enrollment matriculated at lower rates, leading to an overall null finding (Kentucky Council on Postsecondary Education, 2006). While Running Start students may be more likely to attend any college, they seem to be less likely than nonparticipants to attend a four-year university full-time shortly after high school graduation (Cowan & Goldhaber, 2015). However, Running Start may have altered the pathway for students rather than merely adjusting their overall educational expectations. Many students who graduated from public universities in Washington had transferred from two-year colleges (approximately 40%), which suggests that a notable proportion of Running Start students will also transfer to four-year colleges (Cowan & Goldhaber, 2015).

Dual Enrollment and Academic Performance The weight of evidence shows students who participated in dual enrollment generally do better in college than nonparticipants. This finding is robust to different student samples and different statistical models, and it remains even after accounting for baseline differences between those who participated in dual enrollment and those who do not. Allen and Dadgar (2012) estimate taking one or more classes from College Now, a dual enrollment program in New York, increases students' GPA in the first semester by 0.16. The analyses controlled for a rich set of students' demographic and academic characteristics. The positive finding holds even after Allen and Dadgar (2012) accounted for further unobserved differences among program participants and nonparticipants by taking advantage of idiosyncratic variation in program participation. In a national sample, An (2013b) examined the relation between dual enrollment participation and first-year GPA and finds a similar result; even after adjusting for baseline differences, students who participated in dual enrollment experience a 0.11 GPA (or a 0.13 effect size) advantage over similar students who did not participate in dual enrollment. This effect size of dual enrollment on first-year GPA is similar to the effect size of other important factors related to academic performance, such as SES, gender (Allen, Robbins, Casillas, & Oh, 2008), and race (Turley & Wodtke, 2010; Wolniak & Engberg, 2010).

Dual Enrollment and College Persistence College persistence is an understudied area of dual enrollment research. In our search of the literature, we found only a handful of studies that focus on college persistence, and these studies find that dual enrollment tends to increase first-year persistence for students both at two-year and four-year institutions. In Florida, the probability of persisting to the second semester in college is 4.5 percentage points higher for students who dual enrolled than those who did not (Karp et al., 2007). Similarly, Struhl and Vargas (2012) estimate the odds of persisting to the second year at either two-year or four-year institutions are 1.79 times as large as the odds for students who did not complete dual enrollment.

Dual Enrollment and Degree Completion Perhaps more important than academic performance for policy makers is whether dual enrollment increases a student's likelihood to earn a college degree. Similar to college persistence, few studies have focused on the relation between dual enrollment and degree completion (Blankenberger, Lichtenberger, & Witt, 2017; Cowan & Goldhaber, 2015). However, this research is becoming more common as statewide databases are linking students' academic records in high school to their postsecondary outcomes.

The nascent literature generally shows dual enrollment increases the likelihood that a student attains a college degree. In Texas, the odds of completing a degree at a four-year college within 6 years for students who completed at least one dual enrollment course is 1.77 times as large as the odds for similar students who did not participate in dual enrollment (Struhl & Vargas, 2012). Using state data from Illinois, Blankenberger, Lichtenberger, and Witt (2017) estimate dual enrollment increases the probability of attaining any postsecondary credential by 7 percentage points and increases the probability of attaining a bachelor's degree by 8 percentage points. In a national study, An (2013a) finds similar results where the probability of students who dual enrolled attaining any postsecondary degree is 8 percentage points higher than for nonparticipants, and the probability of students who dual enrolled attaining a bachelor's degree is 7 percentage points higher than for nonparticipants. Importantly, these results are resilient to large unobserved confounding variables. An (2013a) conducted a sensitivity analysis where he simulated an unobserved covariate, *U*, and calibrated this covariate to influence both dual enrollment and degree attainment in a way similar to three observed confounders: parental education, academic achievement, and academic rigor in coursework. For both outcomes, *U* would need to be stronger in its influence on dual enrollment and degree attainment than parental education, academic achievement, or coursework to mitigate the relation between dual enrollment and degree attainment.

Dual Enrollment and Time to Completion To our surprise, an understudied research question is whether dual enrollment reduces a student's time to degree. A common benefit advocates put forth for dual enrollment is these programs reduce the time to a college degree mainly through the accumulation of college credits prior to entering college (ACT, 2015; Bailey & Karp, 2003; Hoffman et al., 2008). However, few empirical studies test this assertion.

The few empirical studies we found suggest dual enrollment reduces a student's time to degree. Haskell (2016) estimates the number of days students earn an associate's degree and bachelor's degree are, respectively, 262 days and 167 days sooner for dual enrollment participants than for nonparticipants; however, Haskell's measure of dual enrollment includes credits earned through Advanced Placement. Similarly, Radunzel, Noble, and Wheeler (2014) find students who participated in dual enrollment typically earn a bachelor's degree in 57 months, whereas those who did not participate in dual enrollment typically earn a bachelor's degree in 72 months—a difference of 15 months. The results from Radunzel et al.'s study may reflect the sizable proportion of dual enrollment students who brought in more than 12 credits in their sample of four institutions in Texas. An (2009) provides a more conservative estimate where students earn a bachelor's degree 4.1 months sooner for dual enrollment participants than for nonparticipants. These results are promising, but more research is needed that explores this relation.

Studies that consider dual enrollment as a dichotomy have led to important insights about how these programs affect students' educational outcomes as well as to policy changes. However, some researchers have extended the question of whether dual enrollment matters based on course location, intensity, or course type. These questions focus on three lines of inquiry that are discussed below.

3.4.2 Location of Dual Enrollment Course

Nationally, the majority of dual enrollment courses are taught at the high school. In 2002–03, 74% of the total enrollment in dual credit courses occurred at a high school campus, 23% occurred at a postsecondary campus, and 4% occurred through distance education (these values do not equal 100% due to rounding) (Waits et al., 2005). By 2010–11, the overall share of total enrollment in dual credit courses went up for courses taught at high schools—which includes career centers run by the public-school system (77%)—and through distance education (6%). This means that the share of total enrollment in dual credit courses taught at postsecondary campuses went down to 18% (Thomas et al., 2013). Among dual enrollment courses attempted at postsecondary schools, most are offered at two-year colleges; however, some evidence suggests a rise of dual enrollment courses being attempted at four-year colleges. In Kentucky, for example, 3.9 times as many dual enrollment courses were taken at two-year institutions than at four-year institutions in 2009–10. In just 3 years, only 1.7 times as many dual enrollment courses were taken at two-year institutions than at four-year institutions (Lochmiller et al., 2016).

Despite the various locations in which students can take dual enrollment courses, surprisingly little research considers whether the location of the dual enrollment course affects outcomes. The arguments that center on course location pertains to the instructional quality and college experiences of students who participate in dual enrollment through means other than at college campuses. Critics of dual enrollment courses taught on high school campuses argue these courses do not maintain

the same level of academic rigor had the course been taught on college campuses (Allen, 2010). High schools have norms and rules that are unique to their environment and are distinct from the norms and rules at college (Zimmermann, 2012). Students benefit most when they perceive the course as authentic and have available academic and other support services, both of which occur more on college campuses (Hughes et al., 2012). Therefore, students who participate in dual enrollment on high school campuses may not receive the full benefits from these courses as if they had taken the course on college campuses.

There are additional challenges for students when taking online courses than taking courses through face-to-face instruction. For instance, students who traditionally take courses through face-to-face instruction are more likely to struggle with the online course than students who have experience taking such courses (O'Brien, Hartshorne, Beattie, & Jordan, 2011). Distance education students may also prefer face-to-face instruction, since it is easier to get questions answered within a traditional class environment (Houdeshell & Chudde, 2007).

Despite the alleged advantages of taking dual enrollment courses on college campuses than through other locations, there are reasons to provide dual enrollment at locales other than on college campuses. Many of these arguments focus on issues of equity and opportunity. For some programs, there is a tension between maintaining the quality and integrity of the program versus promoting accessibility of the program (Allen, 2010). A benefit of offering dual enrollment courses on a high school campus, and for that matter online, is the convenience for students because they do not have to travel to the college campus. Finding reliable transportation to the college campus may hinder some students' opportunities to participate in dual enrollment. Aside from transportation, some parents do not want their child to travel to an unfamiliar college campus (Hughes et al., 2012). Dual enrollment courses taught online are particularly beneficial for schools in rural areas, because they tend to have fewer course offerings than their counterparts in suburban or urban schools (Holian, Alberg, Strahl, Burgette, & Cramer, 2014).

The empirical research shows mixed results on the relation between the location of the dual enrollment course and educational outcomes. On the one hand, some evidence shows dual enrollment on college campuses yields the best results. Burns and Lewis (2000) find participants saw benefits from taking dual enrollment at their high school, but the benefits are even greater when taking dual enrollment at the college campus. Some students felt more comfortable in their high school because of the familiarity of the environment; however, it was not until they were exposed to the college environment that they became less intimidated with college courses (Burns & Lewis, 2000). They also felt their concentration levels increase when they took dual enrollment courses on the college campus. Students who took dual enrollment courses on college campuses tend to have higher educational aspirations than those who took dual enrollment courses on high school campuses (Smith, 2007). Some evidence suggests course completion rates are highest when courses are through face-to-face instruction on college campuses and lowest when courses are through face-to-face instruction on high school campuses (Lochmiller et al., 2016). Students who dual enrolled in classes on technical college campuses are more likely

to persist in college than students who dual enrolled in classes on high school campuses (D'Amico, Morgan, Robertson, & Rivers, 2013).

On the other hand, some studies show the benefits of dual enrollment are the same or even greater when students take these courses in locations other than on college campuses. For instance, Dixon and Slate (2014) find no difference in grades earned between dual enrollees on high school campuses and dual enrollees on college campuses for three of the six courses they evaluated. For the remaining three courses, moreover, dual enrollees on high school campuses earned higher grades than those on college campuses. Taylor and Yan (2018) examine differences in college enrollment and retention based on dual enrollment location, NACEP accreditation status, and instructor type. They find no difference in college enrollment or retention between students who participated in courses located on a high school campus that were NACEP accredited and students who participated in similar courses that were not NACEP accredited. However, students taught by a college instructor or taught on a college campus were slightly less likely to enroll in college than students who participated in courses that were not NACEP accredited. Phelps and Chan (2016) find taking introductory technical college courses on high school campuses by college-certified instructors in CTE tend to benefit high school students more in their 3-year college graduation and early labor market outcomes than taking similar courses on college campuses.

Dual enrollment courses through online delivery occurs less frequently than delivery through other means, but this type of delivery is trending upward (as discussed earlier). Research on the effectiveness of dual enrollment through online delivery is scarce, and the research that does exist shows mixed results. Students who participated in dual enrollment through televised classes felt it was not equivalent to face-to-face instruction, felt less prepared for college, and were generally less satisfied with the education they received (Judd, Woolstenhulme, Woolstenhulme, & Lafferty, 2009). However, Arnold, Knight, and Flora (2017) find evidence that suggests little difference in grades between dual enrollment courses delivered online and dual enrollment courses delivered face-to-face on high school campuses. They speculate students today are more familiar with these type of technologies, both personally and within an educational setting, and know the norms and expectations for online courses. They may therefore feel less disconnected from this type of course delivery than in the past.

In summary, it is difficult to assess whether the location of where the dual enrollment course takes place alters the influence of these programs on educational outcomes. Despite some strong assertions of lower quality programs based on course location, most studies on this topic use purposive sampling designs. It is difficult to know therefore whether the experiences of students in the sample accurately represent the population of students at their respective schools. As dual enrollment courses on high school campuses and through online delivery become more popular, research on this topic needs to follow in step.

3.4.3 *Dual Enrollment Intensity or Dosage*

The second line of research considers differences in dual enrollment participation based on intensity or dosage. Studies that acknowledge dosage effects of dual enrollment implicitly (or explicitly) are concerned that treating dual enrollment as a dichotomy may mask valuable information about the gradated influence of dual enrollment. In other words, traditional research approaches to dual enrollment assume the benefit of dual enrollment is the same regardless of the number of dual enrollment courses students completed. Most studies that consider dosage effects either consider the number of courses/credits taken or consider a threshold (e.g., 20 credits).

Research shows the number of dual enrollment courses or credits students take influences a host of college outcomes (e.g., access, persistence, and completion) above and beyond simply having taken dual enrollment (Delicath, 1999; Giani et al., 2014). However, Giani et al. (2014) show that conceptualizing dual enrollment as a dichotomous indicator remains significant in most analyses even *after* they include a second indicator that captures the total number of dual enrollment courses completed. Their study suggests that considering the dosage effects of dual enrollment does not undermine the contributions made in past studies that use a dichotomous indicator of dual enrollment.

Other studies test for nonlinearities in the dosage effects. In other words, is there a point in which the returns to dual enrollment drop off or disappear as students take additional dual enrollment courses? This question has important implications for stakeholders because it provides some guidance in how much to invest in dual enrollment for students to be successful, and not overinvest such that students see little returns to dual enrollment.

The evidence suggests a moderate dosage of dual enrollment—one or two courses—might yield the strongest results. Karp et al. (2007) show highly intensive participation in dual enrollment—such as five or more courses—tends to have little additional influence on short-term outcomes, such as high school graduation, college enrollment, first-year GPA, and persistence to the second year. An (2013a) initially finds attaining a bachelor's degree was the same for students who earned three college credits (approximately one course) through dual enrollment and those who did not participate in such programs. However, part of the explanation for the null finding is that the comparison group included students who participated in AP. When these students were removed from analysis, the probability of attaining a bachelor's degree is 9% points higher for students who earned three college credits through dual enrollment than students who participated in traditional high school courses.

3.4.4 Dual Enrollment Course Type

A third line of research that extends our understanding of the relation between dual enrollment and educational outcomes explores the differential impact by course subject. For instance, while dual enrollment in all core academic subjects generally improves students' college enrollment and degree completion, dual enrollment in math seems to exert the largest influence on grades and baccalaureate attainment (Arnold et al., 2017; Giani et al., 2014). Each additional dual enrollment course in math raises the odds of attaining a bachelor's degree within 6 years by 1.60–1.89 (Giani et al., 2014). Taking dual enrollment in math may also increase students' interest to pursue additional math coursework or math-related majors in college (Cevallos, Cevallos, & Webster, 2016). Further evidence suggests that dual enrollment in math may benefit students who are at the margins in participation. Speroni (2011b) finds students on the margins of dual enrollment participation in college algebra experience large gains in their likelihood in college enrollment and degree completion.

Researchers also examine how students who dual enroll in a specific subject fare when taking a subsequent course of the same subject area as compared to college students who took a similar course as the dual enroll course, but as a matriculated degree-seeking college student. For instance, Radunzel, Noble, and Wheeler (2014) find the likelihood of earning a B or higher are the same for students who took a prior course in the same subject area through dual enrollment as it is for students who took the prior course in college for 19 of 21 course pairs. Crouse and Allen (2014) compare the academic performance of traditional college students with those who took college courses through dual enrollment. Controlling for gender, family income, college exam scores, and high school GPA, students who participated in dual enrollment perform better in the subsequent course for 18 of the 49 course types than traditional degree students in community colleges. Moreover, the null finding for 31 of the course types suggest courses through dual enrollment were as good as courses taken at community colleges.

Course Distinctions Based on Academic or Career and Technical Focus The majority of students who dual enroll take courses with an academic focus rather than courses with a CTE focus. Nationally, approximately 70% of all dual enrollment courses have an academic focus. Still, almost half of all high schools have students taking dual enrollment courses with a CTE or vocational focus (Thomas et al., 2013). Compared to dual enrollment courses with an academic focus, dual enrollment courses with a CTE or vocational focus are less likely to occur on a college campus (20% academic vs. 12% CTE) or through distance education (7% academic vs. 3% CTE) (Thomas et al., 2013).

Tech Prep programs are earlier iterations of CTE programs. The Carl D. Perkins Vocational and Technical Education Act provides federal funds to increase the number of technology-skilled workers (Bishop-Clark et al., 2010). The idea behind these programs is to offer students a rigorous curriculum with practical, hands-on

experiences (Kim, 2014). Typically, Tech Prep begins during students' last 2 years of high school and continues into their first 2 years of college (Bailey et al., 2002). Evidence shows students who participated in Tech Prep programs are more likely to finish high school and enter two-year colleges. However, these programs may reduce students' chances of entering four-year colleges immediately after high school completion (Cellini, 2006).

However, federal funds for Tech Prep were cut in 2011 (Washington Student Achievement Council, 2016). Given the end of federal funding for Tech Prep, but the continual need for a more educated workforce, there has been a shift away from the traditional Tech Prep model and towards dual enrollment as a means to provide CTE students with academic and technical experiences (Karp et al., 2007; Zinth, 2014a). In Washington State, for example, student enrollments in all dual enrollment programs increased from 2010–11 to 2014–15, with the exception of Tech Prep (Washington Student Achievement Council, 2016).

A potential concern for CTE students is whether they are pigeonholed toward a vocational or career-oriented path. At least for CTE dual enrollment, this does not seem to be case. The evidence generally shows, compared to participating in dual enrollment, CTE dual enrollment does not hinder the probability of students graduating from high school or attending college (Karp et al., 2007; Rodríguez, Hughes, & Belfield, 2012). The effects of CTE dual enrollment tend to be stronger once students enter college, and some evidence shows that the effects increase over time. Participating in CTE dual enrollment increases the likelihood of enrolling in a four-year institution by 8.6 percentage points, and it also increases college GPA by 0.26 points (Karp et al., 2007). Rodríguez, Hughes, and Belfield (2012) find CTE dual enrollees accumulate 1.2 (2009 graduating class) and 1.3 (2010 graduating class) more credits after one semester than other students from their district. The advantage in credit accumulation for CTE dual enrollees increases after 1 year of college, resulting in students earning 1.7 (2009 graduating class) and 3.0 (2010 graduating class) more credits than other students from their district. After 2 years in college, the advantage in credit accumulation increases to 4.6 credits in favor of CTE dual enrollees.

3.5 Does Dual Enrollment Benefit a Wide Audience of Students?

As previously discussed, dual enrollment participation has expanded so that participation is no longer exclusive to a certain segment of the school population (high-achieving, White, and high-SES students), but dual enrollment participation is far from equitable. Despite the push towards expansion in participation, only a handful of studies exist that consider whether underrepresented students benefit from dual enrollment. Without testing the effects of dual enrollment within each social group, we assume all students equally benefit from these programs.

The evidence suggests dual enrollment participation tends to benefit students regardless of race and SES. For instance, Taylor (2015) estimates racially minoritized students who participated in dual enrollment are 26% more likely to enroll in college and 14% more likely to attain a college degree than similar students who did not participate in dual enrollment. Furthermore, based on sensitivity analysis, these results are relatively robust to hidden bias. One possible exception is dual enrollment may only have a marginal influence for Asian students (Leonard-Foots & Lumadue, 2014). Similarly, studies tend to show dual enrollment positively influences academic performance for both male and female students (Leonard-Foots & Lumadue, 2014; Young, Slate, Moore, & Barnes, 2014a). Finally, An (2013a) estimates the probability of first-generation students attaining a bachelor's degree is 8 percentage points higher if they participated in dual enrollment. Moreover, first-generation students who dual enrolled tend to have a first-year GPA that is 0.09 points higher than comparable first-generation students who did not dual enroll (An, 2013b).

Our review of the literature shows dual enrollment appears to benefit most students who participate regardless of race, class, or gender. An issue with these studies, however, is they are largely atheoretical. As a notable exception, Lile, Ottusch, Jones, and Richards (2018) reason that, compared to affluent students, low-income and first-generation students have not had access to the financial resources, cultural capital, and social capital necessary for college success. Low-income students in their study did not have family members and role models who knew the norms, expectations, and unwritten rules of a college campus. Dual enrollment programs potentially offer low-income and first-generation students with the knowledge and skills that will help them succeed in college. Overall, however, more conceptual work is needed regarding whether racially minoritized and low-income students would benefit (or not) from current dual enrollment practices.

3.5.1 Differential Effects of Dual Enrollment

So far, we have discussed whether students who traditionally do not participate in dual enrollment would benefit from such programs. Researchers have further considered whether the influence of dual enrollment benefits some groups more than others. It may not be enough to show simply that most students benefit from dual enrollment; it is also important to know whether the benefits of these programs differ across social groups. If the benefits do differ, then certain students may continue to have advantages over other students. Studies that examine whether the relation between dual enrollment and college outcomes differ by social groups or achievement levels find mixed results.

On the one hand, some evidence suggests dual enrollment benefit those who are least likely to participate more than others, which is known as the negative selection hypothesis (Brand & Xie, 2010). Regarding academic achievement, Cowan and Goldhaber (2015) find lower-performing students gained the most from dual

enrollment participation. The college enrollment rates for dual enrollment students in the bottom three quintiles of the achievement distribution are 6 percentage points higher than nonparticipants. Although dual enrollment students in the top two quintiles of the achievement distribution witnessed positive benefits from participation, the observed advantage in college enrollment was smaller. In Florida, the influence of dual enrollment on college enrollment and GPA is higher for students at the bottom quartile of academic achievement—as measured by high school GPA—than those at the top quartile of academic achievement (Karp et al., 2007). Studies also find dual enrollment may benefit low-SES students more than their high-SES counterparts (Blankenberger, Lichtenberger, Witt, & Franklin, 2017; Karp et al., 2007). Finally, evidence shows the benefits of dual enrollment—in terms of college enrollment, college GPA, and college persistence to the second term—are stronger for male students than for female students (Karp et al., 2007).

Other studies show dual enrollment benefits social groups equally. In Kentucky, for instance, students with high ACT scores did not experience greater gains from their dual enrollment participation than students with lower ACT scores (Kentucky Council on Postsecondary Education, 2006). Equality tests in An's (2013a) study reveal little evidence that the estimates across levels of parental education are different from one another. Unlike the findings from Karp et al.'s (2007) study, Ganzert (2012) find no significant difference in the dual enrollment effect between males and females.

To complicate matters further, some evidence suggests dual enrollment benefits White and high-income students more than racially minoritized and low-income students. Although underrepresented students did not benefit from dual enrollment as much as others, this does not mean that they did not benefit from these programs at all. However, these findings are counter to Rawls's (1999) theory of justice in that policies need to benefit at least equally those who are disadvantaged in society. In Texas, while dual enrollment participation increased college access for Black students, the influence was smaller than the increase experienced by White students. Struhl and Vargas (2012) estimate White students who completed dual enrollment have odds of enrolling in college that are 2.2 times the odds of similar White students who did not complete dual enrollment. For Black students, dual enrollment raised the odds of enrolling by 1.6 times that of non-completers. Similarly, Taylor (2015) shows the probability of enrolling in college and completing college in Illinois is lower for underrepresented students. Low-income students who dual enrolled completed any college degree or certificate at higher rates than similar low-income students who did not dual enrollment, but their advantage is a full 6 percentage points lower than the dual enrollment effect for the whole sample.

It is unclear why some studies show certain social groups benefiting from dual enrollment more than others, while other studies show these same social groups benefit equally as—or even less than—other groups. The studies do differ in their population, covariates, and regression techniques. Future research that addresses these apparent discrepant findings would help readers make sense of these findings. Regardless of these results from subgroup populations, advocates for increasing

participation in dual enrollment conjecture that these increases would help reduce inequality gaps among varying social groups.

3.5.2 Using Dual Enrollment to Address Gaps in College Outcomes

A final piece to the equity agenda is whether increasing dual enrollment participation reduces gaps in college outcomes across social subgroups. The reasoning is as follows. Underrepresented students benefit from participation in dual enrollment programs. However, low-SES and racially minoritized students are less likely to participate in dual enrollment than high-SES and White students. At the same time, gaps in college outcomes exist by SES and race where low-SES and racially minoritized students tend to have lower college GPAs and are less likely to attain a college degree than high-SES and White students. It stands to reason that expanding dual enrollment participation would help mitigate some of these outcome gaps. Indeed, researchers and educators have advocated for the expansion of dual enrollment as a way to reduce inequalities in college outcomes ("Dual enrollment in Texas," 2010; Hoffman et al., 2008; Karp, 2015; Lerner & Brand, 2006).

One question that remains largely unaddressed is how much should we expect dual enrollment to close these outcome gaps? Work by An (2013a, 2013b) sheds some light to this question. Decomposing the gap in degree attainment by parental education, equalizing dual enrollment participation would do little to reduce this gap. Less than 4% of parental-education gaps in first-year GPA is due to differences in dual enrollment participation.

The culprits for the outcome gap between high- and low-SES students mainly lie in differences in academic achievement and coursework of students from different family backgrounds. These two factors account for almost half of the gap in B.A. attainment between first-generation students and students with a college-educated parent (An, 2013a). These results demonstrate the difficulty in reducing outcome gaps between high- and low-SES students. Students enter dual enrollment with distinctive characteristics. But dual enrollment does not equalize these distinctive characteristics, and students therefore may leave these programs with most of the differences intact. The research suggests that equal participation of dual enrollment would not be enough and instead policies would need to target low-income schools to reduce these gaps further (An, 2013b).

As previously discussed, a key benefit of dual enrollment is it increases students' levels of college readiness. However, the majority of dual enrollment studies do not directly measure college readiness and instead make the assumption that they do so, thereby keeping the mechanisms unknown. This makes sense because knowing how dual enrollment raises college readiness is secondary to the primary question of whether dual enrollment benefits students' college outcomes. Our examination of the literature seems to show some stability in the findings to the primary question.

Although we advocate for continued research on whether dual enrollment affects college outcomes, we also encourage researchers to focus their attention on *how* dual enrollment influences these outcomes. In the upcoming sections, we pay closer attention to the link between dual enrollment and college readiness.

3.6 Explanations of How and Why Dual Enrollment Affects Educational Outcomes

3.6.1 Developmental Courses or Remediation

An important motivation behind the popularity of dual enrollment is it tackles two concerns: students enter college poorly prepared, and they graduate at relatively low rates (Bound, Lovenheim, & Turner, 2010; Hoffman et al., 2008). One way to measure college readiness, or the lack thereof, is by the number of remedial or developmental courses students take. These are courses that colleges and universities provide for students when they do not meet the college's standards for reading, writing, or math (Attewell, Lavin, Domina, & Levey, 2006). Students requiring developmental education usually pay tuition and fees for these courses, but oftentimes they do not receive degree-applicable credit upon successful completion of the course (Melguizo, Bos, Ngo, Mills, & Prather, 2016). A report by Complete College America (2012) shows 52% of students entering a two-year college enrolled in a developmental course, and 20% of those entering a four-year college enrolled in a developmental course.

National reports show students who take developmental courses are far less successful in college than those who do not take these courses (Adelman, 2006; Complete College America, 2012). We caution readers that these results do not necessarily imply developmental courses led to poor college outcomes. Students who take developmental courses tend to have weaker academic skills and lower academic motivation (among other things) than those who do not take these courses. From these reports, it is difficult to untangle the effect of developmental education on college outcomes from the characteristics that led students to take a developmental course in the first place (Attewell et al., 2006; Jackson & Kurlaender, 2014). Studies that use more sophisticated approaches further suggest a negative effect of developmental education on college outcomes. Based on a meta-analysis of 11 reports (21 independent samples) on developmental education that used a regression discontinuity design, Valentine, Konstantopoulos, and Goldrick-Rab (2017) find that students in developmental courses earned fewer college credits, were less likely to pass the course in which they needed the remediation, and were less likely to earn a certificate or degree than students not in developmental courses.

Some state policy makers have argued participation in dual enrollment would reduce students requiring remediation (Grubb et al., 2017). Despite its advocacy, there are few studies that examine the relation between dual enrollment and

developmental education. Kim and Bragg (2008) find that dual enrollees are less likely to take a developmental course than nonparticipants. In their study of a single community college, Grubb, Scott, and Good (2017) estimate the probability of taking a developmental course is 9 percentage points lower for students who participated in dual enrollment than those who did not. Based on sensitivity analysis, they find their results are somewhat vulnerable to a hidden bias. However, they do not benchmark their findings to an important but observed covariate, making it difficult to assess the strength of the hidden bias. Using national data, An (2013b) finds similar, albeit smaller, estimates where dual enrollees experience a 6 percentage points reduction in their probability to take a developmental course compared to non-dual enrollees. Moreover, he estimates the unobserved confounder would need to be as strong as calculus course-taking to undermine the result, although his analysis includes students who attend both two-year and four-year colleges.

3.6.2 Academic Momentum

In two seminal reports, Adelman (1999, 2006) states the pace of college credit accumulation is an important marker for attaining a college degree. A set of individual and environmental factors compose and alter this academic momentum. Attewell, Heil, and Reisel (2012) put forth three explanations for why academic momentum could influence college completion. First, students who take many college courses have greater opportunities to interact with other students and their professors, which augments their integration into the life of being a college student, than students who take occasional courses or attend part time. Second, students' experiences of competence and accomplishment early in their college careers enhance their self-efficacy and academic self-concept. The third explanation relates to life issues—such as adequate financial aid, family responsibilities, and work—that prevent a student from studying full time or taking a full course load.

Researchers such as Adelman (2006) argue that expanding dual enrollment programs may serve as an important precollege form of momentum. As intended, students who successfully complete dual enrollment courses enter college with college credit. Although estimates vary, students earn between 8 and 12 credit hours on average through dual enrollment (Lochmiller et al., 2016; Pretlow & Wathington, 2014; Radunzel et al., 2014). This "boost" in college credit translates to an advantage for dual enrolled students, because it is difficult for those who did not participate in dual enrollment to make up the difference in credit accumulation. For instance, Karp et al. (2007) estimate dual enrolled students earned 15.1 more college credits than nonparticipants within 3 years after high school graduation. Another study shows 71% of dual enrolled students attained at least 96 total credit hours by the end of year 4, whereas only 55% of nonparticipants had done so (Radunzel et al., 2014).

It makes intuitive sense to argue that dual enrollment provides students with the opportunity to accumulate college credits and build momentum as they enter

college, which in turn, increases their chances to complete a degree completion. As we just illustrated, there is a positive association between dual enrollment and college credit accumulation. However, few studies directly test whether academic momentum accounts for the relation between dual enrollment and college outcomes. An exception is Wang, Chan, Phelps, and Washbon's (2015) study using data from the Wisconsin Technical College System to examine the extent to which academic momentum mediates the influence of dual enrollment on college retention or completion. Operationalizing academic momentum as the total attempted credits during the first year, delayed entry, summer enrollment, and first-term GPA, they find all four indicators of academic momentum significantly increase students' probability to remain in college or earn their degree by the fourth term, although summer enrollment exerts the strongest influence among the four indicators. Moreover, Wang et al. (2015) find academic momentum completely mediates the relation between dual enrollment and student retention or completion. Wang et al.'s (2015) study provides invaluable insight into an important mechanism of dual enrollment. However, it is a single study based on research from two-year technical colleges. Future research that replicates Wang et al.'s (2015) work as well as studies that expand the population of dual enrollment students would help solidify (or modify) their conclusions.

Finally, evidence suggests more engagement in dual enrollment is not always better. Students who accumulated many college credits through dual enrollment may encounter some difficulties while in college (Tobolowsky & Allen, 2016b). These students believe they are not as integrated in their college environment as their peers, and they also feel that they have a small window to decide on their career path. Some students were also uncomfortable being the youngest in their upper-division courses. Despite these drawbacks, students who accumulated many college credits through dual enrollment nevertheless spoke positively about their head start.

3.6.3 Academic Motivation

Students tend to be less motivated in their academic work during their high school years, especially during their senior year, than other times in their academic careers—such as in elementary school or in college (Martin, 2009; National Commission on the High School Senior Year, 2001; Otis, Grouzet, & Pelletier, 2005). This disengagement from academic work during the senior year is known as "senioritis" or a senior slump, and it is due in part to the lack of incentives for seniors to work hard (National Commission on the High School Senior Year, 2001). College-bound students finish most of their college applications in the first semester of their senior year, which means their college resume is largely accomplished by their junior year (National Commission on the High School Senior Year, 2001). As a result, there is little incentive for some college-bound students to work hard after submitting their college applications (Kirst, 2001).

Research on dual enrollment is consistent with educators' concern that many college-bound students are disengaged with schoolwork during their senior year of high school. Some dual enrolled students were unhappy with their experiences at their high school, and they find college to be a better environment for them (Huntley & Schuh, 2002–2003; Lile et al., 2018). These students generally agree high school is boring because their classmates are immature, the pace of the classes are slow, and the classes are not relevant to their career goals (Huntley & Schuh, 2002–2003; Smith et al., 2007). Students felt a new sense of autonomy and adulthood when they dual enrolled on a college campus (Lile et al., 2018). Moreover, they were excited to take on the academic challenges of college courses, although they needed to become acclimated with the pace of the course instruction and the time scarcity to complete their assignments (Johnson & Brophy, 2006; Smith et al., 2007). Students who participated in dual enrollment tend to remain more academically motivated than non-accelerators even when they attend college as a degree-seeking student (An, 2015).

3.6.4 Input–Environment–Outcomes Model

Astin's input–environment–outcomes (I–E–O) model is a prominent conceptual framework in higher education that considers both institution and individual characteristics on student development. Inputs refer to characteristics and qualities students bring to the college campus. Environments refer to the experiences students have while in college. Finally, outcomes are the developmental endpoints that occur in students as a result from their experiences with the environment (Astin & antonio, 2012). A fundamental purpose of the I–E–O model is to allow higher education researchers to examine a less biased estimate of the effects of environments on an outcome after the researcher accounts for differences in characteristics students bring to college (Astin & antonio, 2012). Kim and Bragg (2008) use the I–E–O model for their study and frame dual enrollment as a college environment. Dual enrolled students therefore have prior exposure to curricula, teaching practices, interactions with instructors and peers, the physical surroundings that occupy the program, and other environment factors that occur in college.

However, students who dual enrolled in Kim and Bragg's (2008) study did so at a community college. It therefore makes sense to conceptualize dual enrollment courses as an environment. It becomes more difficult to use the I–E–O model if students participate in dual enrollment on high school campuses. One may argue dual enrollment on high school campuses can be either an input or an environment. It is an input because students who dual enroll at their high school do not set foot onto a college campus. Therefore, they do not physically experience the college environment. It is an environment because the college instruction comes to the high school. Students are exposed to the college curriculum and pedagogy, as well as the norms and expectations from college instructors. Kim and colleagues (Kim, 2014; Kim & Bragg, 2008) are the only published works of which we are aware that use

the I–E–O model in dual enrollment research. However, a cursory review of recent doctoral theses on dual enrollment shows that 12 studies have used Astin's student development model to guide their study. Moreover, 28 doctoral theses have also used Tinto's integration model to explain for the effects of dual enrollment on college outcomes.[1] If doctoral theses are any indication of potential future publications, then future research needs to clarify exactly how dual enrollment fits into these higher education frameworks.

3.6.5 Role and Socialization Theory

Role and socialization theory have gained traction in dual enrollment research as an explanation of how dual enrollment prepares students for college beyond academic preparation. According to role theory, individuals inhabit roles or positions within a social structure. These roles reflect patterns of behaviors and attitudes that provide actors a strategy to deal with recurrent sets of situations (Turner, 1990). Individuals collect information on the roles of others, such as faculty and peers, with whom they interact. They use this information to predict the expectations others hold for them (Lile et al., 2018). These role-based identities become integrated into individuals' self-concepts, which helps shape their future actions and interactions with others (Karp, 2007).

Roles are not static, and they may change over time (Turner, 1990). As social structures change for individuals—such as a transition out of high school—individuals too need to adjust their cultural repertoires and how they behave and understand the world. This process is not immediate and oftentimes there is a trial period in what individuals know about the new role and its behaviors is nonconforming with normative expectations (Karp, 2007). Dual enrollment programs may act as a socializing organization in which students are disabused of their inaccurate perceptions of a college student they developed during the process of anticipatory socialization—an individual's initial attempt to take on the values, attitudes, and behaviors of those they aspire to be (Ebaugh, 1988; Karp, 2012; Mortimer & Simmons, 1978).

Dual enrollment provides students with a transitional period where they begin to learn the normative rules and behaviors of being a college student (Karp, 2012). Indeed, some students indicate they expect a taste of what college life is like through their dual enrollment courses (Harnish & Lynch, 2005). This role rehearsal in dual enrollment allows students to be more comfortable once they enter their new college environment (Karp, 2012). Individuals who can correctly anticipate the expectations for their upcoming role are less likely to experience role shock and strain (V. L. Allen & Van de Vliert, 1984). Dual enrollment furthermore allows students to develop skills and coping strategies—such as critical thinking and help seeking—that are important for college success (Kanny, 2015; Karp, 2012).

[1] These numbers are not mutually exclusive. Some doctoral theses use both frameworks to guide their studies.

For instance, drawing from a sample of 26 students from CUNY's College Now program, Karp (2012) demonstrates how students who participated in the program began to shift their role of student. At the start of the semester, students incorrectly anticipated the expectations of a college student. Given the rigidity of course schedules in high school, some students had misinformation about college students having a lot of free time and doing little work. As the semester was ending, students had a clearer sense of the college student role, at least in respect to coursework. For instance, learning strategies students honed while in high school sometimes were incompatible with strategies required for college courses. Despite spending less class time in college, students are expected to dedicate more of their time out of class to their coursework than in high school. Students discover they must take responsibility for their own learning, and they develop their study skills and behaviors in accordance with this responsibility. Importantly, students who perceived their dual enrollment courses as authentic—such as providing content and pedagogical structures similar to that offered on a college campus—experienced the most role change than those who did not see a difference between their dual enrollment courses and other high school courses (Karp, 2012).

Students also report they get an opportunity to learn the hidden curriculum—implicit skills and practices not formally taught in the classroom but important for academic success. In a qualitative study of low-income Latina/o students who dual enrolled, Kanny (2015) reports these students learn how important it is to interact regularly with faculty. Some students were initially hesitant to seek help from the college instructor if they have questions about the assignment, because they were afraid to engage with this type of interaction. This finding is consistent with Calarco's (2011) argument that help-seeking behaviors differ between middle and working class students in elementary school. Working-class children tend to sit quietly and try to work through an assignment even if they do not understand it. By contrast, middle-class children are more inclined to seek help from their teachers at the outset. Although irritated at times by the constant help seeking, teachers—a middle-class profession—condone this type of behavior because it adheres to cultural expectations of the classroom. Dual enrolled students in Kanny's (2015) study also express to be more mature and independent, because there is less handholding in their college courses and they need to initiate conversations with strangers.

3.6.6 Academic Engagement

Academic engagement refers to the amount of effort students put into their studies and their participation in activities that are related to schooling (Kuh, Kinzie, Buckley, Bridges, & Hayek, 2007). Students are not passive recipients, but rather active actors in shaping their college experiences. Important factors that affect students' academic performance—whether they are cognitive or noncognitive—are manifested through their academic behaviors (Nagaoka et al., 2013). Students may engage in academic activities and behaviors either through reactive or proactive

stimulus. By reactive, we mean students respond to requests from others (e.g., class requirements). By proactive, we mean students take the initiative to engage and interact in non-required classroom activities (Grabowski & Sessa, 2014). Academic engagement includes such behaviors as task-management skills, study habits, class attendance, participation in class discussions, peer and faculty interactions, and completion of projects and assignments (Hu & Wolniak, 2013; Kuh et al., 2007; Nagaoka et al., 2013).

Institutions also play a pivotal role in setting the conditions in which students can develop and exhibit academic behaviors (Kuh et al., 2007; Nagaoka et al., 2013). The National Survey of Student Engagement identifies five clusters or benchmarks of effective educational practices: academic challenge, active and collaborative learning, student–faculty interactions, enriching educational experiences, and a supportive campus environment (Hu & McCormick, 2012). Saenz et al. (2011) also emphasize student services, such as academic advising, tutoring, and skill labs, as important for academic engagement.

Student engagement requires both the contextual space for students to be exposed to engagement activities and the active role of students to seek out those activities. Higher education studies of student engagement rightfully focus on the college itself as the arena in which engagement occurs. However, the extent students are reactive to the social context and how proactive they are to engagement opportunities is due in part to prior exposure in high school. The premise of dual enrollment is that students who participated in these programs receive exposure to experiences, norms, and expectations that prepare them for the expectations of college.

Dual enrolled students learn that teachers and instructors treat them differently in their college courses than in their high school courses. Students who dual enroll become acclimated to student–instructor interactions at the college level (Kanny, 2015). When comparing between high school teachers and college professors, dual enrollees note their high school teachers tend to show greater concern for their overall well-being—which they expected—than their college professors, with concerns centering more on specific learning areas (Huntley & Schuh, 2002–2003). However, students said it is usually their responsibility to seek the help of the college professor, whereas high school teachers are more likely to initiate conversation if the student needs help (Kanny, 2015).

Students further note that college courses are more difficult and demanding than high school classes (Huntley & Schuh, 2002–2003; Tobolowsky & Allen, 2016b). It was not only the content of the college courses that made them more difficult, but also the expectations in college courses were less forgiving than the expectations in high school courses (Huntley & Schuh, 2002–2003). Students learn that engagement with the course materials and active participation in the course is an important part of being a college student (Lile et al., 2018). There is greater self-induced accountability in college than in high school, and college professors are less likely to monitor whether students are keeping up with the material than high school teachers (Bailey et al., 2002; Huntley & Schuh, 2002–2003; Kanny, 2015). Despite some dual enrolled students being surprised by the expectations, content, and grading in college courses, these students did not necessarily disengage from the course.

Instead, they saw the course as a new challenge and began to understand what was needed for college success (Cevallos et al., 2016; Kanny, 2015).

These changes in course expectations are also reflected in changes in students' academic behaviors. Research shows dual enrollees tend to have better study habits and higher levels of academic motivation than nonparticipants (An, 2015; Bishop-Clark et al., 2010; Lile et al., 2018; Smith, 2007). These new skills required in college pushed students to reflect upon their own skills and abilities and newfound responsibilities as college students (Lile et al., 2018).

There is disagreement in the literature about how dual enrolled students interact with their college peers. Lile et al. (2018) report the social interactions and peer groups of high school students dramatically changed when they took classes on a community college campus than on a high school campus. Some dual enrolled students express greater acceptance and comfort when they attend courses on college campuses. They no longer feel they need to impress their peers, worry about repercussions from their friends, and can just be themselves. Others instead felt alone and lost when attending a course on college campuses (Huntley & Schuh, 2002–2003). For some students who dual enrolled on college campuses, they did not feel connected or have things in common with their college classmates due, in part, to differences in age between dual enrollees and college students (Huntley & Schuh, 2002–2003). Dual enrollees with negative experiences with others feel their college peers and professors are judging them, and they note feelings of a chilly classroom environment (Kanny, 2015).

Research shows students who participate in dual enrollment exhibit changes in their academic behavior and expectations that better prepare them for college. It makes sense students will use what they learned and experienced in dual enrollment once they attend college as degree-seeking students. However, researchers often do not test this assumption, because most studies stop their analysis while students are still participating in dual enrollment or shortly after they complete the course. There are few studies that consider whether dual enrollees continue to engage in academic behaviors while they are in college (see An, 2015; An & Taylor, 2015). For instance, An (2015) finds dual enrollees tend to have higher levels of academic motivation and engagement than non-accelerators. However, academic motivation and engagement mediate a modest portion, at most 22%, of the relation between dual enrollment and academic performance.

3.7 Examining Outcome Differences Between Dual Enrollment and Advanced Placement

At many high schools, students have several options to take college or college-level courses. Arguably, the AP program is the best-known alternative to dual enrollment. In 2010–11, approximately 70% of all public high schools offered courses in AP or the International Baccalaureate (Thomas et al., 2013). While both AP and dual

enrollment are intended to accelerate a student's postsecondary learning and experiences, they operate in different ways. Discussing in depth the similarities and differences between dual enrollment and AP is beyond the scope of this chapter. (For sources that compare these two programs, see Dutkowsky, Evensky, & Edmonds, 2009; Klopfenstein & Lively, 2012.) We do point out two key distinctions between these two programs: the curriculum and college credit accumulation. Students who take AP courses learn a standardized, college-level curriculum based on a survey from college professors who teach first-year college courses (Klopfenstein & Lively, 2012; Speroni, 2011a). The content of an AP course therefore represents a stylized first-year course based on the recommendations from a group of college professors. AP students receive college credits through taking an optional examination and meeting or exceeding a predetermined threshold (usually a score of 3) set by the college or university to which they matriculate (Dutkowsky, Evensky, & Edmonds, 2006). By contrast, students in dual enrollment take a course with an authentic college syllabus, and in most cases, they receive college credit upon the successful completion of the course (Speroni, 2011a).

Instead of seeing dual enrollment and AP as competitors, it may be better to view these programs as complementary to one another (Klopfenstein & Lively, 2012). Implementing expected value analysis, Dutkowsky, Evensky, and Edmonds (2009) recommend that the type of accelerated programs high schools offer should be based on the school's clientele. Districts whose students often matriculate to postsecondary institutions with high tuitions (e.g., private and public out-of-state colleges) and those whose AP exam performance is near the average should favor dual enrollment programs. Districts whose students are likely to perform well on AP exams or enroll in relatively inexpensive colleges should favor AP programs.

Nevertheless, some educators and researchers disagree over whether both programs are equally effective in college preparation (Dutkowsky et al., 2009; Speroni, 2011a). A difficulty occurs when comparing between dual enrollment and AP in that students who participate in dual enrollment are markedly different, on average, to those who participate in AP. Dual enrollment students are more likely to reside in rural areas and tend to be from lower-income families than AP students (Klopfenstein & Lively, 2012). However, states such as Florida have a higher proportion of Black and Hispanic students in AP programs than in dual enrollment programs, reflecting concerted efforts from AP programs to reach more underrepresented students (Speroni, 2011a). Other research reports students who received college credit through examinations (such as through AP exams) are more likely to be White or Asian than students who received college credit through dual enrollment (An & Taylor, 2015). Dual enrolled students also tend to have lower academic preparation entering college than their AP counterparts (An & Taylor, 2015; Klopfenstein & Lively, 2012; Speroni, 2011a).

Few studies compare students who participated in AP and dual enrollment on college outcomes, while at the same time, controlling for important baseline differences between AP and dual enrolled students. Research that yields the most positive results in favor of AP over dual enrollment come from reports commissioned by the College Board. For instance, Wyatt, Patterson, and Giacomo (2015) show AP

students who scored at least a 3 on an AP exam have better college outcomes than students who dual enrolled either at a two-year or four-year institution. It is not clear why Wyatt, Patterson, and Giacomo (2015) decide to compare AP students based on their performance on the AP exam to dual enrolled students based on the location of the dual enrollment course.

Other reports from the College Board compare the performance of dual enrolled students to the performance of AP students. To measure performance, these reports use final grades in dual enrollment and scores on the AP exam (Godfrey, Matos-Elefonte, Ewing, & Patel, 2014; Kaliski & Godfrey, 2014). Students with high AP exam scores tend to have higher college GPAs than dual enrolled students who earned a course grade of B or higher. However, dual enrolled students who earned a course grade of B or higher tend to earn more college credits and attain a college degree at a faster pace than students with AP exam scores (Godfrey et al., 2014).

Interestingly, the authors in all three College Board reports designate students who participated in AP but did not take the AP exam as non-AP students. A large proportion of AP students does not take the AP exam. While the College Board does not collect this data, studies estimate the percentage of students enrolled in AP classes who took the corresponding AP exam range from as low as 55% to as high as 70% (Warne, 2017). Future research should examine whether taking an AP course but not the exam provides value-added benefits to a student's college readiness. Even if students do not take the AP exam, their course learning does not disappear. Furthermore, what does it mean for AP to lead to college readiness if a significant percentage of the AP population neither takes the AP exam nor performs well if they do take it? Slightly over half of the students who took the AP exam in English (56%) and the AP exam in math/computer science (52%) scored a 3 or higher. For science, the percentage of students who scored a 3 or higher on the AP science exam is even lower at approximately 38% (Godfrey et al., 2014).

Other studies find less pronounced differences in the effects between dual enrollment and AP than the findings from the College Board once researchers adjust for observable differences between AP and dual enrolled students. Studies initially show AP students are more college ready and more likely to attain a degree than dual enrolled students. However, these results reflect baseline differences in student characteristics between AP students and dual enrolled students (An, 2013a; An & Taylor, 2015; Speroni, 2011a). Similar to Godfrey et al. (2014), Klopfenstein (2010) finds students who participated in dual enrollment earned their bachelor's degree at a significantly faster rate than similar students who participated in AP. As an exception, Speroni (2011a) finds students who participated in dual enrollment are less likely to enroll in a four-year institution than similar students who participated in AP. However, this advantage in college destinations for AP students over dual enrolled students does not translate into bachelor's degree attainment, where dual enrolled students are as likely to attain a bachelor's degree as AP students. Overall, these findings show dual enrollment is not inferior to AP as measured and judged by bachelor's degree attainment (Klopfenstein & Lively, 2012), and dual enrollment may be an important option for those interested in building academic momentum as they enter college. To be fair, these studies do not focus on academic performance,

where the advantages of AP over dual enrollment may reside. We need more studies from independent researchers that examine college outcomes beyond degree attainment.

3.8 Conclusion and Future Directions

This chapter has explored empirical research on dual enrollment participation as well as the relation between dual enrollment and educational outcomes. In this concluding section, we first summarize the results from our analysis of the relation between dual enrollment and educational outcomes and identify gaps that remain in research. Next, we summarize the theories used to understand dual enrollment and offer suggestions for new theories that are needed to understand dual enrollment. We then comment on the methods used to measure the influence of dual enrollment and offer directions for future research. We conclude with a discussion of the need to understand dual enrollment practices and policies better, and how policies influence dual enrollment outcomes.

3.8.1 Understanding Educational Outcomes

Our analysis of research on the relation between dual enrollment and educational outcomes leads us to five primary observations. First, the weight of existing evidence on the effects of dual enrollment generally points to the same conclusion: on average, dual enrollment participation leads to positive and desirable educational outcomes, and this is particularly true for studies that use more sophisticated statistical analyses. With few exceptions, these results are consistent across multiple studies, contexts, and outcomes. Second, the literature suggests dual enrollment has effects not only on proximal outcomes (e.g., high school graduation and college matriculation), but also on distal outcomes (e.g., college completion) as well. This finding is critical and suggests that the effects of dual enrollment do not fade once students enter college; it is also consistent with the What Works Clearinghouse's (2017) assessment of three studies that met their evidence standards. Third, research on the effects of dual enrollment has focused on some outcomes at the expense of others. For example, college performance is overrepresented in the literature, whereas high school academic outcomes are underrepresented. Similarly, only a handful of studies have examined distal outcomes of college completion and time to degree. A fourth observation is there are some discrepancies in findings on two educational outcomes: college readiness and college matriculation. At least a couple studies found either null or negative effects of dual enrollment for these outcomes.

A final observation relates to equity and the distribution of benefits of dual enrollment. As previously noted, existing research suggests dual enrollment benefits students regardless of race and SES. However, the research that examines differential

effects by social groups is less conclusive. Some studies find larger gains for lower-achieving students (Cowan & Goldhaber, 2015; Karp, 2007) and for lower-SES students (Blankenberger, Lichtenberger, Witt, and Franklin 2017b; Karp et al., 2007), whereas other studies show no difference in gains across academic and social differences (An, 2013a, 2013b; Ganzert, 2012; Kentucky Council on Postsecondary Education, 2006), and still others find larger gains for more advantaged students (Struhl & Vargas, 2012; Taylor, 2015). Given these inconsistent results, researchers need to develop further this line of inquiry so that we have greater understanding of how dual enrollment influences social groups differently.

3.8.2 Using Theoretical and Conceptual Frameworks

Dual enrollment literature draws from relatively diverse theoretical perspectives, although there is more theoretical space that requires exploration. To summarize, we found that existing literature tends to focus on the following theoretical and conceptual frameworks: momentum (e.g., Wang), college readiness (e.g., Conley), motivation theory, evaluation (e.g, Astin's I–E–O model), role and socialization theory, and engagement.

Despite the use of many frameworks in the literature, dual enrollment research would benefit from an even wider set of theoretical and conceptual lenses. For example, given the research on dual enrollment and equity, researchers should consider using critical theories to assess how and if racial and social class inequities are perpetuated through dual enrollment. Researchers might also expand sociological theories—such as social and cultural capital—to understand how dual enrollment facilitates critical transition knowledge and skills, particularly for students who are the first in their family to attend college. These theoretical frameworks are valuable for understanding how students participate in dual enrollment as well as how dual enrollment affects educational outcomes. Researchers could also develop and expand other psychological theoretical frameworks that include self-efficacy, growth or fixed mindset, identity, or sense of belonging. These frameworks would help us to understand how dual enrollment might aid or hinder students' psychological development as they transition from high school.

3.8.3 Methodological Considerations

Research on the influence of dual enrollment on educational outcomes predominantly uses a variety of descriptive, inferential, and quasi-experiential designs. We found no studies that used experimental design to examine the impact of dual enrollment on educational outcomes.[2] Accounting for student selection to dual enrollment

[2] Berger, Turk-Bicakci, Garet, and Hoshen (2014) and Edmunds et al. (2017) are somewhat exceptions as they conducted a randomized controlled trial to examine early college high schools.

is important, because students do not find themselves in dual enrollment courses by chance. Many states have policies that determine which students are eligible and which are not eligible for dual enrollment. If studies do not address for factors that influence selection into dual enrollment, it could be that observed (or unobserved) differences in educational outcomes are due to differences in student characteristics or their decisions to participation in dual enrollment.

We found several peer-reviewed and policy reports that used simple descriptive statistics (e.g., t-tests and ANOVA) or used regression-based approaches but controlled for a small set of factors that might influence both selection into dual enrollment and the outcome. A smaller set of studies used regression-based approaches that controlled for a fuller array of factors or used quasi-experimental designs. Conducting randomized controlled trials to examine the influence of dual enrollment on educational outcomes is difficult, because dual enrollment programs are deeply embedded within high schools and colleges. That is, dual enrollment programs are already standard practice in many educational settings. Perhaps the best opportunity for leveraging experimental design in dual enrollment research is to test new ways of delivering dual enrollment, new types of dual enrollment policies, or test existing strategies by using random assignment. For example, researchers could work with an existing program to assign randomly students to different instructional modalities (e.g., online, face-to-face, or hybrid) and examine differences in learning and other educational outcomes among these modalities. Or researchers might be interested if dual enrollment paired with college transition support services (e.g., FAFSA workshops, college knowledge workshops, and academic tutoring) might have a better effect on students' college transition. Furthermore, researchers might target their intervention where it is most needed: among first-generation, low-income, or racially minoritized students. These types of studies allow us not just to say whether dual enrollment is effective, but rather allow us to identify how it is effective and/or what new policies and programs we can develop and implement to increase its impact.

3.8.4 Understanding Dual Enrollment Practices and Policies

Analyzing the influence of different dual enrollment practices and policies leads to our final observation. There are several papers on "best practices" in dual enrollment, but few studies empirically test for the differential effects of dual enrollment on educational outcomes by policies and practices. For instance, many states and institutions have adopted new standards for dual enrollment, including standards established by the NACEP. Despite the proliferation of these standards and accredited programs, virtually no research assesses the relation between such programs and educational outcomes. Some dual enrollment programs and policies provide students with financial assistance, directed and structured support services, and

college transition support services. Yet, we know little about how these integrated services and assistance influence educational outcomes.

Moreover, a nascent research agenda considers differences in educational outcomes by dual enrollment course location, course modality, and course type (e.g., Burns & Lewis, 2000; D'Amico et al., 2013; Dixon & Slate, 2014; Giani et al., 2014; Judd et al., 2009; Karp, 2007; Lochmiller et al., 2016; Phelps & Chan, 2016; Rodríguez et al., 2012). Collectively, these studies have shown mixed evidence, but many of them do not use methods that control for baseline differences of students that might influence educational outcomes. More rigorous research is needed on the influence of dual enrollment policies, programs, and implementation. Assuming students are equally eligible for dual enrollment, schools should allow opportunities for random assignment to different learning environments to examine whether certain policies and practices (e.g., courses taught on a high school campus) are as effective as other policies and practices.

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