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ADDRESSING NON-FINANCIAL BARRIERS TO COLLEGE ACCESS AND SUCCESS: EVIDENCE AND POLICY IMPLICATIONS

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ABSTRACT

Non-financial barriers to college are an important possible explanation for socioeconomic, racial, gender, and other gaps in college access and success. A sizeable economic literature documents policy efforts to understand and address these barriers. We review this literature on non-financial interventions for improving college access and success ranging from discreet and narrowly defined interventions to comprehensive and multifaceted programs and systemic-level solutions.

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Addressing non-financial barriers to college access and success:Evidence and policy implications

1. Introduction

The United States has long ranked as the world's most educated nation, leading the charge for mass elementary education in the nineteenth century and mass secondary education in the early twentieth century (Goldin & Katz, 2008). But the transition to mass postsecondary education that began after World War II has stagnated in the twenty-first century. Between 1950 and 2000, the proportion of 25-34 year olds who had at least some exposure to college nearly quadrupled, from 16 to 57 percent, but improvements have slowed, and this figure has grown more modestly since then to 68 percent in 2020 (Baum et al., 2013, US Census, 2021).[1] This slowdown is particularly puzzling given that the wage premium for a bachelor's degree is near a historically high level (Goldin & Katz, 2008). Those with a bachelor's degree earn over $800,000 more in lifetime income, on average, than their counterparts with only high school diplomas, even after subtracting out loans taken on to finance higher education (Daly & Bengali, 2014). It is also concerning, given evidence of the social benefits of postsecondary attendance. For example, postsecondary education has been linked to higher levels of volunteering and voting (Dee, 2004), better birth outcomes and higher levels of school readiness in the next generation (Currie & Moretti, 2003), lower levels of criminal behavior (Lochner & Moretti, 2004), and higher levels of economic growth (Aghion et al., 2009).

Perhaps even more troubling than the overall slowdown in attainment growth, gaps in college attainment by family income have increased over time (Bailey & Dynarski, 2011; Belley & Lochner, 2007). Only 13 percent of students from the poorest families earn a bachelor's degree by age 24, compared to 64 percent of students from high-income families (Cahalan et al., 2021).

[1] Similar patterns can be seen by looking at immediate college enrollment rates of recent high school graduates, which rose from about 50 percent in the late 1970s to 67 percent in 1997 but has remained stagnant since then (NCES Digest of Education Statistics 2019, Table 302.20).

Financial barriers to college are an important possible explanation for these gaps, so much so that the evidence regarding financial aid for college is covered in a separate chapter of this handbook. But financial barriers are not the only source of concern. Young people—particularly those from lower-income, immigrant, and/or non-college educated families—may lack good information about the costs and benefits of enrollment, the process of preparing for, applying to, and selecting a college, and about how to navigate college once there. Informational failures are arguably increasingly important as program and financing options have multiplied over time.

Recent work in psychology and behavioral economics also suggests other possible sources of friction in students' college decision-making, particularly given their complex choice sets and given that the decision-makers are often young and inexperienced (Thaler & Mullainathan, 2008; Casey et al., 2011). All along the pathway from college consideration to matriculation and program completion, students face complicated choices and may lack sufficient support and structures to navigate burdensome or confusing processes and institutional bureaucracy.

These information constraints and behavioral realities motivate research and policy efforts to understand and mitigate barriers to college access and success beyond cost alone. In this chapter, we review the economic literature on non-financial policies and programs to improve college access and success (including those which may include financial aid, as long as it is not the primary component). These efforts range from discreet and narrowly defined interventions to comprehensive and multifaceted programs to promote college access and/or success. We emphasize research that identifies and characterizes causal relationships using experimental or quasi-experimental methods, though we also draw on descriptive evidence to provide context.

College access and college completion, of course, are not the same thing. Only about half of all degree-seeking, first-time college entrants complete any degree within six years.[2] And

[2] Authors' computations using NCES Quick Stats, BPS:2009 Survey data restricted by degree goals in first year.

among recent cohorts, those who do complete are taking longer to do so (Bound et al., 2010). Thus, conversations about college access and success should go hand-in-hand. Improving college access remains among the most promising strategies for raising college degree attainment overall, particularly if we conceptualize access not as getting students in the door of any college, but instead as getting them off to a good start at an institution that is well aligned with their interests and capabilities. Still, getting students through the door of a college does not guarantee success, and so a complete conversation should consider students' experiences before, during and after the transition into higher education.

To support this review, we conducted our primary literature search in March 2021, with updates in summer and fall 2021 for newly published papers. Our search focused on empirical studies that met three primary criteria. Specifically, the studies that we include in this review (1) examine an intervention or policy aimed at improving postsecondary access, retention / persistence, performance, and completion; (2) use methods that allow for causal inferences to be drawn; and (3) were published between 2000 and 2021. We began the search by selecting relevant papers in the journals and outlets publishing applied economics of education research.[3] We additionally included papers available through the National Bureau of Economic Research working paper series; articles published in general and education-specific policy journals and studies reviewed in the Regional Educational Laboratory Program and What Works Clearinghouse evaluation reports of postsecondary education interventions.[4] Finally, we explored bibliographic trails in all selected publications, including papers that cited or were cited in those identified

[3] This includes: *American Economic Journal: Applied Economics, American Economic Journal: Economic Policy, American Economic Journal: Macroeconomics, American Economic Journal: Microeconomics, American Economic Review, American Economic Review: Insights, Economics of Education Review, Journal of Economic Literature, Journal of Economic Perspectives, Journal of Human Resources, Journal of Labor Economics*, and *Quarterly Journal of Economics.*

[4] Education policy journals include: *Educational Evaluation and Policy Analysis, Education Finance and Policy,* and *Journal of Policy Analysis and Management.*

through the procedures described above.

The research identified for this review disproportionately focuses on the U.S. context, though we also discuss evidence from outside the U.S. where it is available. The concentration of evidence in the U.S. is likely driven by a confluence of several factors, including the sheer size of the postsecondary sector in the U.S. (with 26 million students enrolling each year, behind only India and China), the decentralized nature of higher education policy and delivery in the U.S., which generates useful variation both across and within states; the availability of robust longitudinal student datasets; and the fact that U.S.-based scholars and journals may disproportionately prioritize U.S.-based research questions. This concentration of research in the U.S. raises two important questions for our review. First, to what extent are college access and success particularly problematic in the U.S.? And if other countries face similar challenges, to what extent might findings from this research base be generalizable?

The challenges faced by U.S. stakeholders around college access and success may have some particularities but are hardly unique. The U.S. may have initially led the world in making the transition to mass postsecondary education, driven by rising demand for skilled workers and facilitated by rising rates of secondary completion (Goldin & Katz, 2008). Nevertheless, the "massification" of higher education is now a global phenomenon, with attendant tensions around cost-sharing, quality, and equity (Heller & Callender, 2013).

The U.S. does have an unusually complex landscape of postsecondary pathways, however, the foundations of which can be traced to its unusually decentralized genesis (Labaree, 2017). U.S. higher education today has both more entry points and opportunities for exploration and switching, as well as more opportunities for getting lost (Goldin & Katz, 2008; Scott-Clayton, 2011). This may explain why the U.S. ranks higher internationally on measures of gross postsecondary enrollment (10th) and "any degree" completion for recent cohorts (10th) than it does on bachelor's

degree completion (18th) or especially on-time bachelor's degree completion (20th).[5] Further, the financial risks of student debt and the relatively weak social safety net in the U.S. also make the stakes around college access and success particularly high for its students.

All research is necessarily local to a specific place, time, and group. As we review the literature, we will take care to highlight insights derived from non-US contexts and, more generally, insights about student behavior and program/policy mechanisms that may be of broad relevance across country contexts.

Reviews of the literature on college access and success conducted in the last two decades commonly articulate the challenges students face in several key domains, including financial constraints, informational / behavioral constraints, structural constraints, and academic constraints (Long & Riley, 2007; Holzer & Baum, 2017; Avery et al, 2019; Dawson et al, 2020). Of course, these constraints are not mutually exclusive, and for students residing in areas of concentrated disadvantage, these challenges may be particularly acute. Students of color may face additional, distinct barriers, including systemic discrimination and bias (Alon & Tienda 2007; Darity & Mason, 1998; Bertrand & Duflo, 2017). Building on these and other papers, we structure our review around five types of barriers that students face in the transition to college and evidence on efforts to combat those barriers. In Section 2, we consider policies and programs designed to address *academic under-preparation and misalignment* between secondary learning and postsecondary academic expectations. In Section 3, we discuss the complexity of the college-going process itself and efforts to improve students' *navigation of informational and behavioral impediments* that they face before and during college through information, nudge and advising interventions. In section 4, we consider the evidence on *comprehensive college access and success*

[5] Source for gross enrollment rates internationally (2015): https://ourworldindata.org/tertiary-education; source for international comparisons of degree attainment by age 25-34 (2019), and number of bachelor's degrees per 100 persons at the typical minimum age of graduation (2012): NCES Digest of Education Statistics

efforts designed to address student needs and challenges across multiple domains. In section 5, we consider *efforts to reform the systems and structures* that students must navigate to access college. And in section 6, we turn to consider the influence of *postsecondary system-level factors* on student outcomes. Finally, in section 7 we conclude by discussing implications for future policyand research.

2. Academic under-preparation and the misalignment between secondary school learning and postsecondary academic expectations

Many students enter college not academically ready. Among recent cohorts of entering high school students, an estimated one of every three to four students completes high school academically prepared for college as defined by successfully graduating from high school, engaging in a college-preparatory high school curriculum, and meeting a minimum threshold of skill in basic literacy (Chen et al., 2010; Greene & Forster, 2003).

Of course, academic preparation for college is a long process that starts well before the end of high school, and a comprehensive examination of human capital production from infancy onward is beyond the scope of this chapter. Nevertheless, there are academic challenges specific to the transition to college that are distinct from concerns about student achievement more broadly. In particular, high school graduation requirements have long been criticized as poorly aligned with requirements for college-level coursework, although students and families are unaware of the disconnect (Kirst & Venezia, 2004; Rosenbaum et al., 2006). Moreover, access to college-preparatory coursework and college counseling are not equally available at all high schools: low-income and minority students have both fewer opportunities to obtain the academic preparation required for college and less "college knowledge" regarding what is expected in the first place (see Goldrick-Rab, 2010; Gamoran, 2010; Kelly & Price, 2011). Here, we review the evidence on interventions to address the disconnect between K-12 and college academics, grouping them by

whether the intervention is primarily based in elementary / secondary schooling, in postsecondary schooling, or as a blending across these two levels.

2.1 K-12 curricular intensification

Intensifying secondary school curricula and imposing more demanding requirements for high school graduation, in theory, reduces barriers to receiving advanced training in school and thereby increases equity, students' skills, and preparation for postsecondary education. With these goals in mind, many states have increased curricular requirements for high school graduation, and numerous school districts have increased the rigor of their curricular offerings, via advanced training options including dual-credit, Advanced Placement (AP), and other college-preparatory coursework models. However, the mechanisms through which curricular intensification brings about improved achievement and better college outcomes are unclear. Proponents argue that widening access to college-preparatory curricula will lead to better outcomes via a direct human capital effect. However, students with higher-level cognitive skills, motivation, preparation, or achievement tend to self-select into more advanced courses. Further, schools with higher proportions of students prepared to engage with advanced content tend to select into offering advanced curricula as well.

Given these selection issues, an advanced curriculum open for all may not yield expected results for at least three reasons. First, advanced course-taking may improve college outcomes viaa signaling effect helping more capable students differentiate themselves among other college applicants. As more students enroll in advanced courses, their value may decrease. Second, advanced courses offered to lower-achieving students may set these students up for failure in secondary schooling and decrease college access. Third, instructional quality plays an important role in the success of curricular intensification and may be a challenge to ascertain. In sum, raising the curricular bar for students who are unprepared is not a conceptually clear intervention. The

available evidence reflects this ambiguity (Table 1 summarizes the details of these studies). Though early quasi-experimental studies generally found a positive link between more advanced K-12 coursework and college access and success (Attewell & Domina, 2008; Aughinbaugh, 2012), subsequent papers with more rigorous designs paint a more nuanced picture.

Curricular intensification efforts generally fall within one of three types: universal acceleration, targeted acceleration, and universal acceleration with targeted supplemental support. Universal acceleration efforts have been implemented at both the whole-district and whole-state levels. Across settings, the evidence on effects of universal acceleration efforts on college-going outcomes is mixed. In recent years, both the Chicago Public Schools (Allensworth et al., 2009) and the State of Michigan (Kim et al., 2019) mandated that all students enroll in a college-preparatory curriculum. In both cases, quasi-experimental evidence indicates that although these policies increased courses taken and passed, effects on college enrollment were modest to null overall. Further, both sites exhibited unintended consequences. In Chicago, college-going rates fell among lower-performing students, and in Michigan, although college enrollment improved for initially higher-achieving students, high school graduation rates declined modestly for lower-achieving students (Jacob et al., 2017).

In contrast to Michigan and Chicago's holistic curricular focus, intensification efforts also can focus on single subjects. For example, beginning in 2006, North Carolina required students to complete four (rather than three) high school mathematics courses to be eligible for admission into the University of North Carolina system's four-year colleges. This policy led to modest increases in math course-taking and enrollment at a UNC campus, however these enrollment increases were realized by students who fell in parts of the achievement distribution already well represented in the UNC system (Clotfelter et al., 2019). Across sites, the evidence is consistent with the conclusion that universal curricular intensification, on its own, may have limited effects on college

going and may discourage academic persistence among lower-achieving students. Indeed, an effort in Sweden to relax curricular requirements – specifically, decreasing mathematics requirements to allow students more curricular flexibility – modestly increased continuation to postsecondary education (Berggren & Jeppsson, 2021).

Targeted acceleration is one potential strategy for alleviating the negative consequences of advancing students into coursework for which they are not well prepared. The Wake County Public School System (Wake County, NC), for example, implemented a targeted intensification effort by which qualified (according to standardized test performance) middle school students were recommended for advanced mathematics culminating in Algebra I by 8th grade. The district's goal was to expand equitable access to college-preparatory mathematics while limiting potential negative consequences of universal acceleration. The policy increased college readiness as well as the share of students intending to continue to college (Dougherty et al., 2017).

Cohodes (2020) considers the long-run effects of another targeted intensification effort in which the Boston Public Schools identified high-achieving (according to standardized test performance) elementary students and provided them with an accelerated curriculum in designated classrooms taught by higher value-added teachers. As a result, selected students were more likely to take advanced courses, graduate from high school and enroll in college, with college-related gains mostly driven by Black students and Latino students. Cohodes (2020) interprets the findings as showing the importance of keeping high-achieving students on track for college early in their educational trajectory.

A second potential strategy for alleviating negative consequences of universal acceleration is advancing all students but providing targeted supplemental support, such as in Chicago Public Schools' practice of offering two periods of algebra daily (double-dosing) in ninth grade to students whose eighth-grade math test scores were below a given threshold. This double-dose

strategy led to improvements in ACT performance, high school graduation and college enrollment (Cortes et al., 2015). Taken together, the evidence on elementary and secondary curricular intensification suggests that universal intensification may lead to unintended negative consequences without additional curricular support for students who may struggle otherwise.

2.2 Dual enrollment and other high-school based interventions

Another approach to smoothing the academic transition from high school to college is to expose students to college-level work while they are in high school. Dual enrollment coursework allows students to take college-level courses and simultaneously earn high school and college credits at low or no cost. Dual enrollment courses are offered in all US states and in 82% of high schools (An & Taylor, 2019; Thomas et al., 2013). Potential advantages include exposure to college-level coursework, an increased likelihood of undergraduate degree attainment, and a reduction in informational and financial barriers to college. Further, some dual enrollment models encourage collaboration between the secondary and postsecondary sectors, can be aligned with local educational and labor market needs, and aim to expand higher education access to traditionally underrepresented students (Hemelt et al., 2020). Potential disadvantages include the difficulty of ensuring adequate course quality and discouragement effects particularly for students who have not been prepared adequately for rigorous coursework.

The oldest dual enrollment initiatives are the Advanced Placement (AP) and International Baccalaureate (IB) programs. The College Board's AP program, for example, was begun in the 1950s and has grown in popularity, with AP courses offered in 70 percent of US high schools in 2010, and more than one million exam takers in 2013 (CollegeBoard, 2014; Theokas & Saaris, 2013). Both the AP and IB programs offer rigorous courses in various subjects, are taught by high school teachers, and culminate in external standardized exams through which (depending upon the score received) students may earn college credit at some institutions. Non-experimental

evaluations of these programs have consistently found that participation is positively correlated with academic outcomes including college enrollment and performance (e.g., Chajewski et al., 2011; Saavedra, 2011; An, 2013). Experimental and quasi-experimental studies (summarized in Table 2) have considered the effects of programs like AP at two different margins: the margin of exam passing, conditional on taking exams, and the margin of course taking.

Underlying the integer scale on which AP scores are reported is a continuous scoring scale that goes unreported. Capitalizing on this underlying continuous score, researchers have investigated the impacts of just passing a given exam, conditional on taking it. Resulting papers have not explored impacts on college enrollment, as AP test takers generally transition to higher education at high rates. Local to the passing threshold, students who earn a college-credit bearing score are one to two percentage points (per exam) more likely to earn a bachelor's degree within four years, with more modest impacts on six-year degree attainment rates (Smith et al., 2017). Further, students with college credit earning scores in STEM-focused AP exams are more likely to take higher-level college courses in the same field with positive effects more pronounced for females (Gurantz, 2019). In sum, the college credit earning aspect of AP coursework may be an effective tool for boosting college completion and reducing college costs.

While these studies reflect the value of earning credit-bearing AP scores, another important margin for potential impact is between taking AP courses (and exams) versus not. A first set of studies to tackle this question comes from Jackson (2010, 2014) who investigated the effect of the Texas Advanced Placement Incentive Program (APIP) which provided monetary incentives to students (and their teachers) for passing scores on AP exams. Jackson (2010) finds that school-level participation in the program led to more AP test taking, higher scores on college entrance exams (SAT and ACT), and an increase in the share of students enrolling in college. In the longer run, students were also more likely to persist in college and earn higher wages (Jackson, 2014).

Notably, these studies did not disentangle the effects of financial incentives and the offering and taking of AP courses.[6]

Overcoming this limitation, Conger et al. (2020) experimentally test the effect of offering enrollment in AP Chemistry or Biology on college outcomes, finding no effect of AP science course-taking on college aspirations, applications, SAT/ACT scores, or enrollment in four-year colleges. Further, AP course takers in the study had a very low rate of passing the focal course's exam, and AP science course taking appeared to have a negative effect on selective college enrollment. The authors suggest that not passing the exam may have reduced students' aspirations to attend selective colleges. As with universal curricular intensification, these results are a cautionary tale regarding expanded AP course offerings without appropriate academic preparation and supports.

More studies of the effects of AP coursework are likely in the future, as many states have mandated public schools to offer at least some AP classes. Arce-Trigatti (2018) investigated the effect of such state-mandated AP coursework availability in Arkansas. To respond to the mandate, schools diverted resources from and reduced courses in career and technical-vocational education in favor of AP courses. In addition, enrollments declined and high school graduation rates increased at schools required to respond to the mandate, suggesting that the policy affected student sorting across schools. Future research should attend to both individual and general equilibrium effects of broad strokes policies such as a statewide AP mandate.

States have also explored other mechanisms for offering college-credit bearing coursework in high schools. Hemelt et al. (2020) experimentally evaluate the impact in Tennessee of a state-developed dual-credit algebra course and standardized end-of-course exam on college outcomes. Taking the course had no effect on college enrollment but did increase advanced math course

[6] To note, the incentive for students was between $100 and $500 for each score of 3 or better that they earned. Atthis level, it is unlikely that the incentives would have a direct effect on college enrollment.

taking in twelfth grade and induce some students to attend four-year rather than two-year colleges. Community colleges in Texas deliver dual credit courses in a variety of subjects in the state's public schools. Enrollment in these dual credit courses has led to modest but significant increases in college enrollment and completion, with degree-attainment increases primarily in certificate and associate degree programs. Nevertheless, lower-income and minority students benefit less, with barriers such as costs of tuition and/or textbooks (sometimes not covered by the school-college partnerships) hindering access to dual-credit coursework (Miller et al., (2018).

Perhaps the most intensive strategy to "bring the college curriculum into high schools" is to restructure the high school as an "early college." Established in 2002 and now including over 250 schools, the Early College High Schools (ECHS) Initiative promotes a secondary school model that blends high school and college and targets students typically underrepresented in higher education (Barnett et al., 2015). ECHSs offer extensive academic and affective supports, and students typically have the opportunity, at no or low cost, to earn an associate degree and/or credits towards a bachelor's degree (Sidiqqi & Mikolowsky, 2019). Despite the potential positive impacts, ECHSs have been criticized for truncating the high school experience.

Two research teams are engaged in experimental, lottery-based studies of oversubscribed ECHSs, with both efforts yielding impressive results on the positive effects of the ECHS opportunity. In a study of 10 sites across the US, a research team at AIR finds that two years after high school, the ECHS offer increased two-year college enrollment substantially, with no shifts from four-year institutions, pointing to ECHSs as expanding access to higher education rather than diverting students from four-year institutions (Berger et al., 2013; Garet et al., 2014; Haxton et al., 2016). Focusing on ECHSs in North Carolina, Edmunds et al. (2017, 2020) similarly find that the ECHS experience increased attainment of transferable college credits and college-enrollment in both the two- and four-year sectors. Both studies find positive effects on degree attainment, with

larger impacts for minority, low-income, and low-achieving students.

The internal validity of these studies is high, although their generalizability may be limited, as most ECHSs are not oversubscribed. Nevertheless, these studies illustrate that ECHSs can improve college access and degree attainment, supporting the theory of action that the programmatic model alleviates barriers particularly for socioeconomically disadvantaged students. The ECHS effects are larger than those of other dual credit programs, potentially due to their more comprehensive programmatic model. Further, the programmatic effects translate to a benefit-cost ratio of 4.6 (Atchison et al., 2020). Given the impressive results to date, we expect that both research teams will continue to track focal students into the labor market and adulthood.

2.3 Remedial coursework

While models of dual enrollment may be conceptualized as bringing college academics into high school, remediation extends high school coursework into college. Remedial coursework is perhaps the most widespread and costly intervention aimed at addressing perceived skill deficiencies among incoming college students. And although improved academic preparation in high school should contribute to reduced remedial course-taking, the need for postsecondary coursework that provides basic academic skills will likely remain, particularly for adults who return to college after years away from formal schooling. In the U.S., for example, nearly one in four beginning postsecondary students at two-year institutions and nearly one in five at four-year institutions are age 22 or above in their first year of enrollment.[7] Remedial or "developmental" courses provide basic instruction in reading, writing, and mathematics, but do not bear college credit. Most two-year colleges and many non-selective four-year colleges screen incoming students for possible remedial placement. Typically, placement is based upon whether students exceed a cutoff on a placement exam; those scoring below the cutoff may be required to take

[7] Authors' computations using NCES Quick Stats, BPS:2012/2017 Survey data.

remedial courses before taking college-level courses in the given subject.

Half of all undergraduates will take at least one remedial course; among those who take any, the average is 2.6 remedial courses (Scott-Clayton et al., 2014). Scott-Clayton et al. (2014) estimate that with over three million new students entering college each year, the numbers add up to a national cost of nearly $7 billion dollars annually. Relatively few students who enter remediation ever even attempt college-level coursework (Bailey, Jeong, & Cho, 2010). But because students entering remediation are disadvantaged to begin with, this fact alone is not informative about the causal effect of remediation.

Of particular concern is the misassignment of students into remedial courses. Scott-Clayton et al. (2014) estimate that a quarter or more of students taking remedial screening tests are misassigned and that remedial misassignment is more common than misassignment to college-level courses. This has important implications for the costs that students incur for these non-credit bearing courses and for time to degree completion for those required to take them.

Among papers on remedial coursework (see Table 3 for details), several studies use regression discontinuity (RD) analysis to compare students just above and below remedial test score cutoffs and generally have found null to negative impacts of remediation. For example, Martorell et al. (2015) found that in the Texas community college context, students at the margin of remedial placement were no more or less likely to enroll. Martorell and McFarlin (2011) found that in Texas public two- and four-year colleges, students just below the test score threshold had significantly lower rates of persistence and college credit accumulation, with no impact on degree attainment or future labor market earnings. Studies in Florida and in a large urban community college system using analogous data and methods found similarly null to negative effects on academic outcomes (Calcagno & Long, 2008; Scott-Clayton & Rodriguez, 2015). Considering pathways into Science, Technology, Engineer and Mathematics (STEM) fields, Park & Ngo (2021)

showed that placement into remedial math courses deters students from pursuing further coursework in mathematics and in STEM fields more broadly. Martorell et al. (2015) suggest that students may lack information about the full costs and benefits of remediation. Scott-Clayton and Rodriquez (2015) conclude that remedial education primarily serves to divert students identified as lower performing from college-level academics.

A typical caveat in RD studies is that they identify average treatment effects local to students scoring near the cutoff—that is, the highest scoring remediated students and the lowest scoring non-remediated student—and thus one interpretation of the RD evidence may be that the existing remedial cutoffs are set too high. Evidence regarding impact heterogeneity by ability does in fact suggest that the negative effects of remediation may be largest for higher-ability or lower-academic-risk students (Martorell & McFarlin, 2011; Scott-Clayton & Rodriguez, 2015). Conversely, several RD studies examining very low-scoring students—who are at the margin between higher and lower levels of remediation—and certain student populations, such as English language learners, have found some positive effects of being assigned to more intensive remediation (Boatman & Long, 2018; Dadgar, 2012; Hodara, 2012; Hodara & Xu, 2018).

Two studies instrumented the probability of remediation by distance to college and seemingly arbitrary variation in placement test cutoff policies across public institutions within a given state. The first of these, by Bettinger and Long (2009), found some important positive impacts in a sample of ACT-takers in Ohio, including an increase in bachelor's degree completion within four years. However, in both English and math, remediated students completed significantly fewer total credits, while those remediated in math were more likely to drop out in their first year. The second study, by Clotfelter et al. (2015), found strong negative effects on the likelihood of ever passing a college-level course in the relevant subject, as well as on "college success," broadly defined to include degree or diploma completion, or completion of at least 10 transferable courses

within four years of entry among community college enrollees in North Carolina.

Two studies exploring remediation in Italian universities point to mixed results. De Paola and Scoppa (2014) use an RD design to study remedial course placement and find positive effects on credit attainment and persistence. In contrast, Duchini (2017) investigates the effect of remedial course placement with clear messaging on the requirement to repeat first-year courses in the case of remedial exam failure and finds null effects on academic outcomes.

Across studies, this overall negative (or at best mixed) set of findings is consistent with possible heterogeneity of effects across students with different characteristics and/or preparation. A related explanation is that the tests used to determine who should be remediated are poor predictors of who would do well in college-level courses. Scott-Clayton et al. (2014) predict, based on both test scores and detailed measures of high school course taking and grades, that approximately one-quarter of students remediated in math and one-third of students remediated in English could have earned a B or better in the relevant college-level course, had they been placed there directly.

Considering this body of evidence on remedial coursework in college, a number of large-scale system- and state-wide reforms since 2012 have given students more options for completing remediation quickly, and more ways to avoid it altogether. For example, in October 2017 California joined Texas, Florida, and Connecticut in passing legislation intended to reduce the number of college students assigned to a traditional remedial course sequence. These policy efforts have pushed in two directions to change the standard delivery of remedial coursework, including reducing remedial placement rates using more flexible placement algorithms, early awareness and, in some cases, pre-college remedial coursework; and delivering remedial course content more efficiently and/or effectively to limit the diversion of students from college-level coursework.

"Multiple measures" interventions aim to reduce remediation rates and improve the

accuracy of placements by using factors beyond test scores for remedial screening. In 2016, more than half of community colleges used multiple measures for remedial placement, more than doubling the numbers from 2011 (Rutschow & Mayer, 2018). Long Beach City College (LBCC) in California was one of the first to develop and pilot an alternative placement algorithm based on high school coursework and grades, which increased the proportion of students placing directly into college-level coursework by 21 percentage points in math and 56 percentage points in English, without significantly lowering the average performance of students in these courses (Hetts & Fuenmayor, 2013). A recent RCT at seven community colleges in New York finds similarly positive effects of alternative algorithms using high school transcript information: students placed using the alternative algorithm were much more likely to start in college level courses immediately, with higher rates of college-level course completion (Barnett, Kopko, Cullinan, & Belfield, 2020; Bergman, Kopko, & Rodriguez, 2021). Future analyses will need to explore whether early gains translate into higher rates of degree completion and/or post-college earnings.

An example of an early awareness intervention is the Early Assessment Program (EAP) in California, in which high school juniors take college placement exams and then have time to address academic gaps during the senior year of high school. Evidence capitalizing on changes over time in students' exposure to EAP indicates that this testing and feedback strategy reduced remediation rates in college without discouraging those who were underprepared from continuing (Howell et al., 2010). Other efforts not only assess students but also provide a stronger directive regarding high school course taking. As of 2012, 29 states offered transitional math and English courses to high school seniors who have not yet achieved standards of college readiness (Barnett et al., 2013). Causal evidence on such efforts come from Tennessee (Boatman & Bennett, 2020; Kane et al., 2021) and Florida (Mokher et al., 2018). In both states, placement into college-readiness courses in high school had no effect on college enrollment but increased placement into

and credit attainment in non-remedial courses. In Florida, this was particularly so for lower performing students while having no effect for those just below the cut off for selection into the college-readiness courses (Mokher et al., 2018), suggesting that the program may benefit from changes to the program assignment thresholds.

In contrast to the positive but modest results from these two studies, Lavy et al., (2021) consider much longer-run outcomes associated with remediation implemented in Israeli high schools. Following affected cohorts into their 30s, the authors find that in addition to short-run improvements in high school completion outcomes, students--particularly those from families with below-median income--realized increases in years of postsecondary education and annual earnings because of the remedial coursework.

Another example of an early awareness effort is remediation embedded in on-campus summer bridge programs before the typical start of college. Studies of such programs situated in community college (Barnett et al, 2012) and four-year college (Kurlaender et al., 2020) contexts, find some initial positive impacts that dissipate over time.

Corequisite course taking, in which students simultaneously take remedial and college-level courses, is another potential model. Evidence from community college systems in New York City and Tennessee point to corequisite remediation as beneficial for supporting students to pass college-level courses in the short run with some evidence of positive impacts on degree completion in the longer run (Logue et al., 2016, 2019; Kane et al., 2021). Based on evidence from Tennessee, Kane et al. (2021) conclude that co-requisite remediation might be effective because it removes the lag between remediation and college-level math.

Learning communities also have been employed for the delivery of remedial instruction. Learning communities' key features typically include the co-enrollment of a cohort of students into two or more courses with integrated and thematically aligned curricula and a structure that

fosters a stronger social network. Learning communities can also involve instructor collaboration and additional student supports (Weiss et al., 2015). Several experimental studies have explored the potential benefit of learning communities for improving student success with remedial coursework in community college context, generally finding some performance improvements in the remediated area but with null longer run outcomes (Weiss et al., 2010; Weiss et al., 2015; Weissman et al, 2011; Weisman et al., 2012).

Compared to approaches discussed above, comprehensive remedial programs appear to be promising. Such programs serve remedial students with linked courses together with enhanced supports such as increased faculty communication, counseling, and tutoring. These programs have generally led to short-run improvements, such as increased credit attainment, as well as positive effects on degree attainment, in cases where outcomes were tracked for a sufficient time (Sommo et al., 2012; Weiss et al., 2021; Rutschow et al., 2019). Among these programs, CUNY Start stands out for its unique design. For those needing remediation in math, reading and writing, CUNY Start has students defer full-time enrollment for one semester and provides instruction along with tutoring, advising, and a weekly seminar on college success skills. The program is intensive, asking nearly 30 hours per week of students but for a low cost $75 for the full semester. CUNY Start increased the proportion of college-ready students in all three subjects by 16 percentage points and increased credential attainment by 3.1 percentage point. To note is that the impact on degree attainment was driven by students transitioning from CUNY Start to CUNY ASAP (discussed below), meaning that they continued in a comprehensive and scaffolded college success program (Weiss et al., 2021). Of course, comprehensive models for remediation and student support require substantial planning, orchestration, and navigation of barriers, without which programs have less potential for success (Daugherty et al., 2018).

2.4 Conclusion

Policies and programmatic efforts discussed in this section aim to smooth the transition from secondary to postsecondary academic expectations and preparation. Broad-based curricular intensification at the secondary school level has been shown often to carry unintended consequences for those least academically prepared, with strategies such as targeted intensification and "double-dosing" as potential solutions to avoid or alleviate this concern. Similarly, research suggests that simply expanding access to college-credit bearing coursework, such as AP courses, in high school has limited benefit in expanding academic preparation for or access to college. In contrast, models that take a more comprehensive approach to introducing and preparing students for the expectations and academic of postsecondary education either while in secondary school (e.g., ECHS) or in the transition to college (e.g., CUNY Start) show considerably more promise.

Given continued concerns about this academic transition, particularly considering the effects that the Covid-19 pandemic has had on the secondary school experiences of recent cohorts of high school students, we expect that research will continue to be robust in this area in the years ahead and would expect more positive results for efforts that combine setting high expectations with providing sufficient support for meeting those expectations. Where solutions under study are more discreet, understanding the context in which they are implemented will be important for fully understanding their success. For example, in recent years, the Commonwealth of Massachusetts (MA) replaced use of the Accuplacer test with a multiple-measures approach to developmental course placement in college. Implemented in isolation, such a strategy may show limited effects. However, in the MA context, the shift in placement policy was accompanied by the development of mathematics course pathways and more robust co-requisite support. In this broader context, the revised course placement strategy may have better conditions for contributing to higher rates of student success in completing required developmental coursework.

3. Navigating complexity: Informational and behavioral interventions

Recognition of informational and procedural barriers to college access and success and their intersection with broader behavioral barriers has been a key development in the economics of education literature. Behavioral economics provides a framework for understanding departures from standard models of economic behavior, which do not account for facets of human behavior including limits to rationality and willpower (Thaler & Mullainathan, 2008). The field is especially relevant for studying students' college decisions, given the need to weigh costs in the present against benefits in the future (Lavecchia et al., 2016), and given that young adults are particularly present-focused, impulsive, and inexperienced in handling complex tasks (Casey, Jones, & Somerville, 2011; Castleman & Page, 2015; Steinberg, 2008; Steinberg et al., 2009).

To begin, students may fail to engage optimally in the process of identifying and applying to postsecondary institutions (Avery et al., 2014a). Even among college-aspiring students, a surprising share fails to complete an application to any college (Roderick et al., 2009), and among those who do apply to four-year institutions, many students fail to apply to an appropriate number and range of institutions, even though it would benefit them to do so (Smith, 2013). College selection and application decisions contribute to postsecondary "undermatch" where students matriculate to institutions that are not well-aligned to their academic and other credentials (Bowen, Chingos & McPherson, 2009; Dillon & Smith, 2013; Smith et al., 2013) even though attending a higher quality institution has substantial impacts on college completion (Goodman et al., 2015; Howell & Pender, 2015; Light & Strayer, 2000). Even among recent high school graduates who have been admitted to college, a surprisingly large share of students do not transition into postsecondary education during the summer after high school graduation (Castleman & Page, 2014a,b; Roderick et al, 2008; Stephan & Rosenbaum, 2013).

What barriers keep students from engaging optimally in the college selection and

application process? Some students may lack access to information; others may be overwhelmed by the process of parsing information on the volume of potential postsecondary options. Either circumstance may drive students to make important choices in a haphazard manner (Radford, 2013); based on simple rules of thumb (Pallais, 2015); or based on other factors that are not a good basis for decision making, such as the desire to avoid onerous applications or attend an institution with certain residential amenities (Smith et al., 2015; Thaler & Sunstein, 2008; Ross et al., 2013). For high-achieving, low-income students who are geographically isolated from other high-achieving peers, college application choice sets mirror those of peers who are socioeconomically rather than academically similar (Hoxby & Avery, 2013). Students cuing their college application choices from the decisions of preceding cohorts of students from their own high school also may relate to issues of social belonging and students' preferencing of aspects of their identity besides academic success (Walton & Cohen, 2007). Taken together, students can struggle with the sheer volume of options that they have and responsibilities they must balance and are more likely to make mistakes when their decision making is poorly informed (Milkman, et al., 2012; Ross et al., 2013).

Once in college, students must engage with their institutions both academically and administratively. As with gaining admission and transitioning to college initially, administrative requirements students face once enrolled can be substantial, and missteps with required processes can threaten their ability to continue. For example, students may lose access to financial aid by failing to (re)file the Free Application for Federal Student Aid (FAFSA) or may face monetary fines by missing administrative deadlines for enrolling in or dropping courses. Please see the other chapter in this Handbook devoted to financial aid for more information on financial aid processes. In sum, the complexity of the college-going process itself may hinder students from achieving greater rates of college access and success. Given the challenges that this context presents,

there is an opportunity to improve student postsecondary access and success by adding structure to students' college exploration and application processes, providing additional guidance and support, and facilitating decision making (Ross et al., 2013). In recognition, practitioners and researchers have implemented and evaluated several potential solutions. These efforts range in intensity from high- to low-touch initiatives and include solutions that are comprehensive (e.g., working with students through all steps in the college-going process) to those that are focused on providing information and/or support to address single barriers, such as applying for financial aid or taking the SAT. We organize our summary of related evidence along these dimensions.

3.1 In-person college-going guidance and support

When considering who can (or should) shepherd students through the college process, one obvious possibility is high school counselors. Indeed, Hurwitz and Howell (2014) provide evidence on the positive impact of counselors on college-going outcomes. However, current student-to-counselor ratios together with counselors' many other responsibilities translate to counselors having little time to provide high quality and personalized college-going support. In recent years, the average U.S. public school counselor has managed a caseload near double the American School Counseling Association recommended 250:1 (ASCA, 2012; Planty et al., 2009), and many counselors lack training and expertise in key college-going processes, such as applying for financial aid (Civic Enterprises, 2011). Thus, students may lack access to sufficient college-going guidance in the context of their own schools (Avery, 2010; Sullivan et al., 2019). When compared to their higher-income peers, lower-income students have less access to school-based college counseling (Clinedinst & Hawkins, 2009). It follows that providing additional college-going supports to lower-income students may increase equity in college search and application processes. At the same time, college counseling that is not coupled with sufficient academic and extracurricular preparation may have limited potential to improve college access, particularly at

highly selective institutions (Hossler et al., 1999; Lareau, 2000, 2011; Stephan & Rosenbaum, 2013).

A set of efforts have focused on reaching students from low-income background or who would be first in their family to attend college with the types of high-touch personalized supports more often enjoyed by students from higher-income backgrounds (Avery et al., 2014b). Programs such as College Possible, College Forward and Bottom Line deliver comprehensive advising and support services to students through the processes of college search, college exam taking and completing college and financial aid applications. The more robust and sustained relationship between students and their advisors in these programs allow them to establish trust, maintain engagement and spend more time in contact. In addition, because the programs are based on an in-person advising model, program counselors can draw upon knowledge of the local college context. Experimental evidence on College Possible and College Forward and quasi-experimental and experimental evidence on Bottom Line reveal that support from these organizations has led to increased enrollment in and persistence in four-year institutions (Avery, 2013; Barr & Castleman, 2017; Castleman & Goodman, 2018; Castleman et al., 2020). Although these programs are more costly, the authors of these studies argue that given the impacts observed, the costs are justified. Table 4 provides details of these and other studies reviewed in this subsection.

Bos et al. (2012) provide experimental evidence that similar advising provided by near-aged peers led to significant improvements in enrollment in four-year public institutions in California, and Carrell and Sacerdote (2013, 2017) found through a randomized controlled trial that late-stage college advising offered to students who were college-ready but behind in the application process significantly improved college enrollment for female high school graduates in New Hampshire. An MDRC led experimental study finds that the College MATCH program in Chicago, which provides college-going support to students through a combination of classroom

activities and support from a young adult or near-peer advisor, is successful in meeting its programmatic goal of improving the selectivity of the institutions to which college-intending students apply (Sherwin, 2012).

Other college counseling interventions follow a whole-school design in which supports are made available to all students. Across studies of such efforts, impacts tend to be larger among students who traditionally have been underrepresented in higher education along dimensions of race, ethnicity and/or socioeconomic status (SES) (Stephen & Rosenbaum, 2013; Cunha et al., 2018; Oreopoulos & Ford, 2019; Bettinger & Evans, 2019; Joshi & Barnes, 2021). This pattern suggests that such school-wide programs may serve as an important supplement in settings where student-to-school counselor ratios are particularly high. Given evidence that college-intending students sometimes do not complete key steps they are advised to take (Avery, 2010), building into these whole-school models structures for systematic engagement and task completion may bea design strategy for improving outcomes further.

While the efforts discussed thus far primarily are geographically limited, other federally-funded programs with broader reach also have sought to improve college advising both in and out of school. The United Kingdom's widening participation (WP) policy targets children throughout the country who live in areas with low prior rates of college going. Within these areas, local colleges and universities offer opportunities to bolster exposure to postsecondary education, such as summer schools, campus visits and meetings with current students. Rizzica (2020) finds that the WP policy leads to increases in college applications but not actual enrollment among students in treated areas. In the US context, a quasi-experimental study of Talent Search revealed positive impacts of the in-school counseling it provided on completion of college-going tasks, such as applying for financial aid, and direct-to-college enrollment (Constantine et al., 2006). A study of GEAR UP in Iowa found positive effects on college enrollment but no effects on persistence

(Bowman et al., 2018). In contrast, an experiment begun in the early 1990s found that Upward Bound had no effect on college enrollment rates or institutional selectivity overall. Nevertheless, the program did improve both college enrollment and completion among those who reported low expectations for completing a bachelor's degree at the time of study intake. Seftor et al. (2009) hypothesize that the null overall effects may relate to student self-selection into the program and that effects may be larger for programs that reach students with lower or less well formulated postsecondary expectations. Finally, the Quantum Opportunities Program evaluated by Schirm et al. (2003; 2006) and Rodriguez-Planas (2012; 2017) and providing comprehensive supportsto "at risk" youth over a period of five years beginning in the ninth grade had no effect on either high school completion or college access overall. One explanation for the disappointing findings is the program design was so comprehensive that it was difficult to implement with fidelity.

Another explanation for null effects of quite comprehensive programs is that they come with high opportunity costs. When programs demand substantial non-school time and attention, they may hinder students' productive engagement with their schoolwork. Ly et al. (2020) draw this conclusion based on their experimental evaluation of a tutoring program to provide academic support and help students formulate ambitious postsecondary plans in France. Whereas relatively high achieving participants benefited from the program in terms of high school performance and college access, lower-achieving students experienced declines. In short, the authors conclude that the costs and trade-offs associated with program participation differ for these two groups of students.

3.2 Technology-supported counseling for college access

Whereas some college-going efforts aim to "go deep", providing comprehensive support to students over time, others aim to "go wide", by employing technology-supported counseling to reach more students over a larger geographic area. Across such wide-reaching efforts, the general

approach is to provide students with outreach and reminders about key college-going processes via some combination of online resources, email, and text messaging. Where personalized advising was a component of support, it generally is provided via some combination of text, email, phone and video conferencing. In general, the evidence points to the limited effectiveness of broad-based, technology-supported counseling.

The technology-supported counseling programs on which we report do differ somewhat in their target audiences in terms of socio-demographics and academic performance (see Table 5 for details). Phillips and Reber (2019) focused on serving predominantly low-income, Hispanic, or African American students in California. Sullivan and colleagues (2019) targeted students who are high scoring on SAT / ACT and who are low to middle income. Gurantz, Pender, et al. (2020) focused on students in the top 10 percent of SAT takers who were also from low- or middle-income backgrounds. These programs typically sought to increase college enrollment, particularly in institutions with higher graduation rates. Despite programmatic and target population variations, findings were similar. In some cases, students felt more informed and supported through the college-going process (Phillips & Reber, 2019), but none of the studies found increases in overall college enrollment. There was some evidence that students enrolled in highly selective institutions (Sullivan et al, 2019) or institutions with a high graduation rate (Gurantz, Pender, et al, 2020) as a result of the outreach and support.

Recent work from Avery et al. (2021) sheds light on the ways in which technology may be fruitfully incorporated into college-going supports. The authors report on two experiments of text-based college guidance, one targeting a national sample and the other targeting a sample of students enrolled in selected public high schools in Texas. While outreach content was similar in both settings, the ostensible source of the communication and the customization of the outreach itself differed. Students in the national study received outreach from a virtual advisor on behalf of the

College Board. In the Texas study, outreach was framed as coming from students' own school counselors, messages were coordinated with other school-based college-going programming, and certain messages were customized using administrative data. Whereas the national study yielded null effects on college-going steps and modest negative effects on college enrollment, the Texas study yielded positive effects on key college-going tasks overall and on enrollment and early persistence for certain student subgroups. In sum, this work points to the relative benefit of incorporating technological supports into existing support structures, rather than as stand-alone interventions.

Other potential mechanisms may be driving the null effects observed across several of these studies. Phillips and Reber (2019) posit that their focal students may have needed more hands-on and intensive support. On the other hand, the interventions may have been poorly targeted, engaging students with a strong commitment to college-going and/or access to other college-going supports. This notion is supported by high control group rates on several college-going measures across the studies. Another possibility is that students may have been wary of receiving virtual support from a person or entity with which they had no prior relationship. Sullivan and colleagues (2019), for example, faced challenges with study recruitment. Finally, Phillips and Reber (2019) hypothesize that interventions such as these may yield better outcomes if they also targeted parents. Especially considering the ongoing COVID-19 pandemic, research should continue to explore the possibilities and limits of technology-supported counseling.

3.3 Counseling for college success

Guidance and coaching efforts targeting college access often focus narrowly on helping students to complete well-defined steps in the college search, application, selection and transition process. In contrast, guidance and coaching programs for those enrolled in college target a variety of academic and non-academic domains. Compared to the structured environment of secondary

schooling, students can struggle with the comparative flexibility, increased responsibility and academic demands, and new social context of postsecondary education. Several studies have investigated efforts to provide students with guidance on navigating and managing college life more successfully, and, in some cases, increasing access to basic needs. These efforts have included both in-person and technology-enabled modes of communication (see Table 6 for details). Six studies point to the effectiveness of proactive counseling provided either by an on-campus or virtual professional coach. In some cases, the counseling went far beyond academics to include topics such as managing personal commitments and finances, help-seeking, and career planning. Via their experimental study, Bettinger and Baker (2014) find that counseling services provided by Inside Track to students on four-year campuses increased college persistence (during and after the active intervention period) and degree completion. Also in the four-year context, Oreopoulos and Petronijevic (2018) find that academic performance was about one-third of a standard deviation higher among Canadian college students who received proactive coaching. Finally, Linkow et al. (2017, 2019) find that counseling services provided to community college students via Success Boston increased both FAFSA renewal and second-year persistence.

Gordanier et al (2019) find that informing at-risk students of their status and referring them to peer advisors who helped make action plans and connect with other supports improved exam performance. Finally, two smaller-scale experimental studies found that connecting students with field-specific, upperclassmen mentors who provided emotional support, helped socialize into the profession, and served as role models, reduced anxiety and increased self-efficacy, persistence, and academic performance among female engineering students (Dennehy & Dasgupta, 2017) and nursing students (Kim et al., 2013). In the engineering-focused study, this was particularly so when female students were linked with female mentors.

In contrast to these positive effects, a multi-university experimental study of the

Monitoring Advising Analytics to Promote Success (MAAPS) program finds comparatively muted effects. The MAAPS program targeted low-income and first-generation collegegoers with proactive data-informed early-alert-based outreach from on-campus coaches to provide academic supports. Early results revealed null effects overall, with positive effects on outcomes such as credit attainment and student GPA on three campuses, suggesting that the program can be effective (Alamuddin et al., 2018). By the end of the study period, however, positive effects were observed on one campus only. Rossman et al. (2021) report that, on some campuses, the MAAPS advisor supports were redundant to departmental advising; the early alert systems did not operate as intended, placing burden on advisors to sort through data; students were not always responsive to advisor outreach; and staff attrition resulted in increased caseloads for advisors who remained, in turn hindering proactive and personalized outreach. These findings again point to the challenge of implementation fidelity in the case of complex program design.

3.4 Lighter touch outreach and targeted supports for college access

The efforts discussed above involve ongoing interactions between students and advisors, sometimes in person and over a long duration of time. Other efforts are less comprehensive, with some providing information but not support and others providing both but with a focus on specific tasks in the college-going process (see Table 7).

The Expanding College Opportunity-Comprehensive (ECO-C) Intervention, devised and experimentally tested by Hoxby and Turner (2013), targeted high-achieving, low-income high school students with information and other supports intended to improve the rates with which they applied and enrolled in selective institutions. For focal students, the authors argued, attending more selective colleges made both academic and financial sense, as low-income students at these institutions had higher graduation rates and lower out-of-pocket costs owing to generous institutional financial aid. Students received packets in the mail containing a semi-customized list

of colleges with details such as graduation rates, application deadlines, and net cost of attendance, and fee waivers with which students could apply to college. These packets led to improvements in the number of colleges to which students applied and were accepted as well as improvements in the graduation rates and financial resources of the institutions in which students enrolled. This foundational study motivated follow-up research seeking to replicate these promising results and to understand whether they might generalize more broadly.

Hyman (2020), for example, experimentally investigated the effect among high-achieving high school seniors in Michigan of receiving a letter from the Michigan Department of Education encouraging students to consider college and recommending the use of a website with college-going resources. Focusing on students in the top half of the PSAT and SAT distributions, Gurantz, Howell, et al. (2020) experimentally investigated the effect of the College Board providing students with college-focused informational brochures. In some treatment arms, students received additional supports such as text-based communication or college application fee waivers. Neither effort led to significant effects on college enrollment outcomes overall, although Hyman observeda positive enrollment effect of 1.4 percentage points among very high achieving, low-income students, similar to Hoxby and Turner's (2013) focal population.

Other efforts to provide guidance and support are less comprehensive, with some focusing more narrowly on specific tasks, such as FAFSA filing. Through a collaborative, experimental effort with H&R Block, Bettinger et al. (2012) find that coupling tax preparation with FAFSA completion together with providing information on likely levels of financial aid and tuition costs at nearby colleges led to substantial increases in rates of FAFSA submission as well as financial aid receipt, college attendance, and persistence. In a lighter-touch FAFSA-focused effort, Page, Castleman, & Meyer (2020) tested the effect of text-based outreach to students from their own high school counselors to remind them of the importance of applying for financial aid, notify them

of their status in the process, and offer follow up support. This outreach similarly led to improvements in FAFSA filing and college enrollment, but with effects of a smaller magnitude, compared to the H&R block study. Despite these positive impacts, this and other studies (Guzman-Alvarez & Page, 2021; Lee et al., 2021) point to additional barriers created by FAFSA verification,a process that requires selected students to verify certain details reported on their FAFSA. Students from low-income backgrounds who would be Pell eligible are disproportionately likely to be selected for verification (Wiederspan, 2019).

Other aspects of the financial aid system may also create challenges. Students may not realize the financial benefits for which they qualify, and even when presented with financial aid packages to consider, they may struggle to understand aid package components and make an informed choice regarding where to enroll and how much to borrow. Studies from Canada (Oreopoulos & Dunn, 2013), Chile (Dinkelman & Martínez, 2014), China (Loyalka et al., 2013), and Germany (Herber, 2018; Peter & Zambre, 2017) find that students are much more likely to prepare for and aspire to postsecondary education and apply for financial aid after receiving information about the costs and benefits of college and available scholarships. Barr and Turner (2018) find that well-designed letters sent to unemployment recipients about the benefits and costs of college-going and required steps to access available financial aid led to improvements in college enrollment, with larger effects for women, Black individuals, and those who had low earning potential. These efforts indicate that students and their families likely stand to benefit from improved access to college-related information focused on college financing.

Indeed, the past decade has seen a proliferation of tools, many developed by the federal government, intended to provide students and families with better information about important metrics related to college cost and quality. These include tools such as the White House College Scorecard, the FAFSA4Caster, net price calculators (NPCs), and the financial aid shopping sheet.

Levine (2014) provides evidence that many of these existing tools do not go far enough and advocates for the development of simpler, more user-friendly tools such as the My intuition estimator (which Levine initially developed for Wellesley College). Anthony and colleagues (2016; 2021) provide descriptive evidence that estimates provided by the federal template NPC can vary substantially from actual financial aid awards, potentially limiting its promise for putting meaningful information in the hands of students as they make decisions about the postsecondary institutions to which to apply. Rosinger (2017) finds that the financial aid shopping sheet, developed by the U.S. Department of Education and Consumer Financial Protection Bureau, had no impact on enrollment decisions but that it did decrease borrowing at certain four-year institutions, such as those with low graduation rates. In their study of the College Scorecard, Hurwitz and Smith (2018) find that while students' institutional preferences (as assessed by SAT score sending) were not affected by information on annual cost and graduation rates, they were responsive to information on graduates' earnings. This responsiveness, however, was driven by students attending well-resourced high schools. In the context of Italy, the publication of government-produced institutional rankings did influence institutional preferences among students, at least for high performing students and their preferences for highly ranked institutions (Biancardi & Bratti, 2019). Taken together, it may be too optimistic to expect that these tools, in isolation, will have a meaningful impact on students' college-going outcomes. In fact, it may be reasonable to expect that tools aiming to make information about college cost and quality more transparent will have more impact on the behavior of postsecondary institutions rather than the behavior of individual students and families (Loewenstein et al., 2014). This is an area of future research.

A set of recent studies sheds light on informational efforts seeking to increase the number of colleges to which students apply. Smith (2013) capitalizes on exogenous variation in adoption

rates of the Common Application, a tool which dramatically simplifies submitting applications to multiple colleges, to estimate the Common Application's impact on college application behavior. He pinpoints the intuitive result that the probability of college enrollment increases when students are prompted to apply to more institutions. Similarly, policy shifts related to the number of institutions to which students can send their ACT or SAT scores for free have had positive impacts on college access, quality and completion (Pallais, 2015; Hurwitz et al., 2017). Consistent with this set of results, Smith (2013) discusses two potential mechanisms through which increased college applications improve college matriculation and persistence. First, if students apply to more colleges, they increase their chances of being accepted to at least one school. Second, many dimensions of college "fit" may be uncertain at the time of college application. Students do not know how much financial aid they will receive from a given institution or where their friends will be attending school. Therefore, additional applications may increase students' probability of being accepted into colleges that turn out to be a good fit.

Indeed, Smith et al. (2013) identify that a key driver of institutional undermatch is students failing to apply to any institutions that are well-matched to their academic qualifications. Motivated by this fact and in line with the work of Hoxby and Turner (2013), efforts have also focused on shifting the specific portfolio of institutions to which students apply. Martinez et al (2018) find that by enhancing existing Upward Bound (discussed above) supports with personalized materials to support students' school search process together with text-based information about college applications and associated deadlines, they substantially increased the share of students applying to four or more colleges and to selective colleges, in particular.

Software-based solutions are also gaining popularity for supporting college search. Naviance is a software used currently in many US high schools. A signature feature of the Naviance tool are scattergrams -- visualizations that provide students with college-specific

information on the GPA, SAT/ACT scores and admissions outcomes of prior applicants from their own school, the idea being that this information will provide prospective applicants with relevant information about their prospects for acceptance at a specific institution. Whether a student can view a scattergram for a particular institution is dependent on there being enough applicants to that institution from prior cohorts. Mulhern (2021) finds that students' choices indeed are shaped by the scattergrams they can observe, with students more likely to apply to and attend institutions for which scattergrams are visible and to colleges where they are similar to previously admitted students. These effects are stronger for students who are Black, Hispanic, and/or from a low-income household and generally raise the concern that the tool is encouraging students to be conservative in their application behavior.

A key question in studies of information provision relates to what person or entity is providing the information. In many of the studies just discussed, outreach is provided by an entity with whom the student interacts during their high school career. Several studies explored how students are influenced by and act upon communication from postsecondary institutions, and how this outreach can shape both whether and where students enroll.

Smith et al. (2022) find that institutional outreach facilitated by the College Board's Student Search Service modestly increases student application to and enrollment in those institutions. The authors conclude that although information does influence behavior, to achieve larger effects, outreach may need to be better formulated and targeted. Two studies lend credence to this hypothesis. Miller and Skimmyhorn (2018) find that pooled effects of a variety of types of personalized outreach – including phone calls and recruitment visits – increased enlisted army members' likelihood of applying to and enrolling in the U.S. Military Academy at West Point. Given the uniqueness of West Point, the generalizability of this study may be limited, but efforts from the University of Michigan lend further support.

Dynarski et al. (2021) studied the effect of a well-targeted, multi-pronged outreach strategy implemented by the University of Michigan in which the university partnered with the state to first identify low-income students who were admissible to the University of Michigan. Among this group, treated students received personalized packets containing a letter from the university's president encouraging them to apply, together with a promise of a four-year, full-tuition scholarship conditional on acceptance. The packet also included information on application processes. Parents and school principals received supplemental communication. Notably, this was an informational rather than financial aid intervention, as the targeted students would have been eligible for the promised scholarship funds absent the outreach. Treatment students were 41 percentage points more likely to apply and 15 percentage points more likely to enroll at the University of Michigan. Several factors may have contributed to these sizable effects. First, the mailers provided unambiguous information about students' scholarship qualification. Second, outreach targeted students, parents, and school leaders. Third, the University of Michigan is a highly regarded state flagship university. Finally, universal SAT taking among public school students in Michigan allowed for precise targeting of students for outreach. Taken together, well designed and targeted outreach can lead to impressive effects when implemented in such ideal conditions. Future research should explore the bounds of similar strategies in different, and perhaps less ideal, conditions.

3.5 Nudges for college access and success

Simple reminders and well-framed encouragements or "nudges" have been shown to be effective in a variety of settings for improving follow-through with desirable actions (Armstrong et al, 2009; Dale & Strauss, 2009; Karlan et al, 2010; Thaler & Sunstein, 2008). Nudges aim to make small changes in the decision sets of individuals without limiting choice (Bhargava & Loewenstein, 2015; Thaler & Sunstein, 2008). In educational contexts, providing students with

nudges can help reduce inertia and students' tendency to procrastinate and can help them to make positive changes to their daily activities to contribute to more success (Lavecchia et al., 2016). Early studies of nudging have shown success of these strategies in a variety of educational settings (Bergman, 2015; Kraft & Rogers, 2015; York & Loeb, 2019).

A set of experimental studies have focused on supporting college-intending students with the summer transition to college (see Table 8 for details of these and other papers reviewed in this subsection). These studies have shown that proactive summer outreach and the offer of support delivered by counselors, near-aged peers, or by automated text message from a known advisor or organization serve to reduce summer attrition from the college-going pipeline (Castleman et al., 2012; Arnold et al., 2009, 2015; Castleman et al., 2015; Castleman et al., 2014; Castleman & Page, 2014a, 2015). Outreach efforts via artificially intelligent chatbot technology have also been tested by colleges and universities. For example, summer chatbot outreach to students who committed to attend Georgia State University (GSU) improved their completion of pre-enrollment requirements as well as enrollment (Page & Gehlbach, 2017). A study seeking to replicate these results in another context found that chatbot outreach increased take up of financial aid and enrollment among first-generation college goers for whom rates of summer attrition were high (Nurshatayeva et al., 2021).

Despite positive results across these studies, more recent efforts to replicate and scale text-based strategies to provide summer transition and other support suggest less promise (for recent reviews, see Page & Nurshatayeva, 2022; Escueta et al., 2020; Meyer & Rosinger, 2019; Lavecchia et al, 2016). For example, Linkow et al. (2021) found null effects of text outreach and the opportunity to communicate with an advisor over the summer on college enrollment and persistence outcomes, likely due to advisors being assigned too broad a caseload and a low experimental contrast given other supports received by students in the control condition. Bird et

al. (2021) found modest to null effects of a national-level nudge experiment to increase FAFSA filing, concluding that scaling such strategies may be more successful if done locally rather than in a centralized manner.

Nudge-based efforts to support college access typically focus on encouraging students to complete discrete steps in the college-going process. Some evidence points to the efficacy of such administratively focused nudges translating to the postsecondary context. For example, GSU expanded their use of text-based chatbot technology to support students once enrolled and found that targeted chatbot outreach increased the rates with which students handled "acute" (time-sensitive/serious) administrative tasks, FAFSA filing, and registration for the subsequent academic year (Page, Lee, & Gehlbach, 2020). Implemented in combination with a one-course tuition waiver, text-based outreach encouraging re-enrollment among community college students who were previously successful yielded a modest increase in enrollment. However, this outreach with no course waiver had null effects (Ortagus et al., 2020).

Research has also explored the potential efficacy of nudges to support students in their core academic work. These studies have used different channels of communication, including email, text, and in some cases calls or in-person meetings, and collectively point to a familiar pattern whereby effects that are promising based on small-scale studies are more muted or variable when tested at scale. For example, small-scale efforts – implemented in single courses or on single campuses – point to the short-run benefits of outreach efforts to help students better track their educational debt (Stoddard et al, 2017); provide students with assignment-specific feedback on course-performance and how their performance would affect their course grade (Smith et al., 2018); provide students with information about how much time their peers devote to their coursework (O'Connell & Lang, 2018); and help students to establish and follow through on task-based (rather than performance-based) goals (Clark et al, 2020). A field experiment at one German

university found that a commitment device in the form of a non-binding agreement to stay on track for graduation had positive effects on academic performance (Himmler et al., 2019).

Carrell and Kurlaender (2020) investigate the effect of targeted faculty feedback in the form of emails from the course professor about students' progress, what to do to succeed, and instructor availability. A one-course pilot experiment yielded large and positive effects on course grades. When scaled across several classes, the intervention improved several outcomes, including course grades and positive perceptions of one's course faculty member, particularly for underrepresented students. In addition, these same students were more likely to persist in college and graduate at higher rates.

Oreopoulos & Petronijevic (2019) conducted a set of experiments to test various nudge interventions in Canadian institutions. Focal interventions included those targeting goal setting, mindset building, advice on how to succeed academically, and provision of coaching via text or in-person. The authors carefully designed these interventions to replicate promising studies that suggested that low-touch psychological and nudge interventions increase achievement (e.g., Goyer et al., 2017; Morisano et al., 2010; Walton et al., 2015; Yeager et al., 2014; Yeager et al., 2016). Although some of these interventions had some positive effects on students' mental health and study time, they had no effect on measures of achievement. In the context of the growing body of nudge literature, the authors conclude that such low-touch, nudge-type interventions may be most suitable for encouraging completion of discrete, one-time actions, but that more intensive interventions may be needed to affect habit formation and achievement. Even if nudge-type efforts are beneficial for promoting completion of required administrative tasks, questions remain about how to enact them well in the decentralized context of a college campus and whether the efficacy of such efforts will wane over time as students become overwhelmed by or desensitized to this type of communication.

3.6 Conclusion

The positive impacts associated with intensive, in-person college-going guidance indicate that students' college-going outcomes indeed can be shaped and improved by robust support. However, such programs can be costly to implement and not all students and communities have ready access to such programs. Further, participation may come with high opportunities costs among students who stand to benefit the most, especially if they require a commitment of time from students beyond the regular school day. Efforts to rely on technology to overcome the place-based nature of robust college-going supports, on their own, have not proven promising when implemented at broad scale. Lighter touch technological support may work best if incorporated thoughtfully into existing support structures and drawing on the relationships that exist between students and school staff. On its own and disconnected from existing relationships, students may place less trust in such communication. In addition, light-touch supports may simply not provide students with the detailed and nuanced guidance needed to make progress through the college-going process and to make informed choices about whether and where to attend.

Indeed, the null effects observed for programs such as V-SOURCE and College Point advising may be because these programs are too light touch or because they are disconnected from other sources of college-going advice, such as school counselors. An additional, important consideration is how the research process itself may influence study findings, particularly in terms of generalizability. In the case of these same two studies, another potential explanation for null effects is that those students who opted into the study already had strong intentions to continue to college and access to other supports on which they could rely.

Indeed, future work should think carefully about continuing to increase equitable access to college-going guidance as well as equitable use of broadly available tools designed to increase the transparency of college-going processes and college pricing. Such tools, like net price calculators

and the College Scorecard may serve to exacerbate differences in college-going outcomes, particularly if students from better resourced backgrounds are more likely to make use of them.

Rather than simply making college search tools broadly available, investigations like the University of Michigan HAIL study illustrate that outreach and communication can have large effects on students' college application and enrollment behavior when it is targeted based on data, detailed, and sent from a reputable institution. Given the impressive findings from the HAIL study,a key area for research is whether this type of communication strategy can replicate in less ideal conditions.

4. Comprehensive supports for college access and success

The barriers to college access discussed above—financial, informational, behavioral, and academic—are not mutually exclusive. Particularly for low-income, minority, and first-generation college students—often concentrated in under-resourced schools—these barriers can interact, and successful transition to and through college requires navigating all or at least some combination of them. Indeed, from this rich and growing literature on barriers to college access and success and their prospective solutions, a dominant theme that emerges is the overall complexity that students must navigate. Given this complexity, policy solutions that focus on just one type of barrier may lead to short-run improvements but may be insufficient for supporting students through to degree attainment or may be more effective when bundled with a comprehensive set of supports.

As noted, this chapter does not include coverage of the vast literature on college financial aid. Nevertheless, here we do consider comprehensive programs that include financial aid as a component (the summary of studies reviewed in this section is in Table 9). Such orchestration of supports is sensible. Consider additional grants funds that allow students to enroll in college. These may not be well invested if students use them to attend institutions that do not maximize their chances of success. Similarly, the potential benefits to helping students select and apply to well-

matched colleges may not be fully realized if they face actual or perceived financial barriers that keep them from attending. In short, improving student outcomes may require alleviating challenges in multiple domains simultaneously (for previous reviews, see Domina, 2009; Swail & Perna, 2002; Page & Scott-Clayton, 2016).

Some programs focus on providing students from low-income backgrounds with advising and academic supports beginning in middle or high school with the goals of keeping them on-track for high school graduation and supporting their transition to postsecondary education. Both the FLIGHT (Facilitating Long-term Improvements in Graduation and Higher Education for Tomorrow) program in Florida and the Pathways to Education program in Canada provide such supports with the possibility of earning scholarship aid through program engagement. FLIGHT support additionally continues into the first several semesters of college. Both programs led to increases in college enrollment (Philp, 2015; Lavecchia et al, 2020). Further, through tracking longer-run outcomes, Lavecchia and colleagues (2020) find that the Pathways program led to increases in earnings and employment and reductions in welfare receipt.

A variety of efforts aim to support students once on campus, some by providing students with a combination of peer or faculty advising and supplemental academic supports together with financial incentives to motivate program participation or to reward academic performance. Two studies set on a four-year university campus (Angrist et al, 2009; 2014) provide evidence that while financial incentives or advising may be insufficient when offered in isolation, when combined they can lead to modest improvements in academic performance. In one of these two studies, the combined supports were effective only for women, with null effects observed for men. In contrast, De Paola et al. (2012) find that in the context of an Italian university, competitive financial incentives improve course performance for initially high-performing students, with null effects for initially low-performing students.

In the two-year context, a set of studies have evaluated variants of the Opening Doors program which, in its basic form, offers students intensive counseling together with stipends to encourage participation. In one study, participants received intensive counseling focused on ensuring academic progress and overcoming other barriers over two semesters. This support led to short-run improvements in credit attainment and course registration that dissipated over time (Scrivener & Weiss, 2009). Follow-on studies investigated program variants focused on certain student populations, including those on academic probation (Scrivener et al, 2009) and those with children (Barrow et al, 2014). Findings across these studies point both to the relative benefit of more intensive, multifaceted supports, including mandatory college success courses and supplemental instruction, as well as the challenge of implementing more involved program models with fidelity (for earlier reports see also Richburg-Hayes et al., 2009; Brock & Richburg-Hayes, 2006; Scrivener & Coghlan, 2011). In the Texas community college context, Evans et al. (2020) find that the offer of social-worker provided coaching and referral services coupled with emergency financial aid throughout college led to increases in persistence and degree attainment, particularly among women. This study also found that the emergency financial assistance alone yielded null results, suggesting that money alone cannot address barriers to college success for students from low-income backgrounds.

Whereas these studies investigated the effects of targeted financial incentives, other efforts aim to mitigate financial barriers to college entirely within the context of comprehensive program models. Perhaps the most widely known and extensively researched program combining financial and non-financial support for disadvantaged college students is the Accelerated Study in Associate Programs (ASAP), first implemented at City University of New York. ASAP is designed as a three-year program to provide community college students with structural, financial, and academic support to increase their persistence and degree attainment. The program not only waives tuition

and fees, but also requires full-time enrollment and provides free transportation, intensive advising, career services, special seminars, among other supports. Evidence on ASAP is impressive. After three years, students randomly assigned to the program were nearly twice as likely to have earned an associate degree compared to the control group (40 percent versus 22 percent) (Scrivener et al., 2015), and after six years, this effect was still 10 percentage points (Weiss et al., 2019; Scrivener et al., 2015). But the program is not low cost: at least in its initial implementation, ASAP represented a 60 percent increase in per-student expenditure. Importantly, however, it cost less per graduate than business-as-usual (Levin & Garcia, 2013). A social cost-benefit analysis easily justifies spending the resources needed to expand the number of students served, if those resources exist. On the other hand, if resources are held fixed, the results suggest the system would produce more graduates by serving fewer students with ASAP-like intensity.[8] The success of ASAP does not mean that simply providing more services yields better results. Instead, the way the multitude of supports are integrated matters. Evidence also points to the replicability of the ASAP model, with experimental implementation in other contexts leading to similarly large impacts on degree attainment (Sommo et al., 2018; Miller et al., 2020). Further, programs that are akin to ASAP, such as One Million Degrees in Chicago (Bertrand et al, 2019) and the Adelante Scholarship program at Pima Community College in Arizona (Patel & Valenzuela, 2013), also show promise.

Other comprehensive support programs in the community college setting have an explicit focus on career pathways and aim to encourage postsecondary occupational training in in-demand areas based on the local labor market. Like ASAP, they provide supports to encourage academic success including basic and vocational skills instruction, academic and transportation support, and financial aid. Given the occupational emphasis, program participants also receive support in the

[8] To see this, assume a fixed budget $10,000, a cost of $100 per student for the baseline service and $160 for the intervention, and a graduation rate of 22 percent for the control group and 40 percent for the treated group. Serving 100 students with the cheaper baseline intensity produces 22 graduates, while serving 63 students with the more expensive program produces 25 graduates.

form of job readiness and placement services. Across a variety of studies in different contexts, career pathway programs have shown success. For example, experimental evidence on the Valley Initiative for Development and Advancement program in Texas and the Integrated Basic Education and Skills Training program in Washington state indicates that both programs led to improvements in credential attainment (Martinson et al., 2018; Rolston et al., 2017, 2021). Based on an experimental study, the Accelerating Connections to Employment program led to significant and sizable increases in certificate attainment, employment, and earnings in all but one of nine study sites (Modicamore et al, 2018).

The last two decades have also seen comprehensive support efforts underway on four-year campuses, with research evidence coming from several public state flagship institutions. The Longhorn Opportunity Scholars (LOS) program at University of Texas at Austin, for example, was started in response to the state ban on affirmative action. The program begins with outreach and recruitment efforts, seeking to enroll high-achieving students from low-income backgrounds. Once in college, scholars receive generous institutional scholarships and a suite of academic and social supports to shape students' undergraduate experiences. Andrews et al. (2020) find that the program increased enrollment in and graduation from UT Austin by 2.2 and 1.5 percentage points, respectively. Andrews et al. (2020) hypothesize that the positive effects of programs such as these are driven by a combination of three mechanisms acting in concert: attending a higher quality college, receiving financial aid, and receiving academic and other support services in college.

Of course, the success of such programs may still be context dependent. Andrews et al. (2020) also evaluated a similar effort implemented by Texas A&M University (TAMU). In contrast to LOS, the TAMU program had no effect on enrollment at the university. The authors speculate that this lack of effect may be related to TAMU's rural location and less diverse student body. Both factors may have made TAMU undesirable for students targeted by the program's

outreach. In alignment with the UT Austin results, a similarly comprehensive program at University of North Carolina, Chapel Hill (The Carolina Covenant) supported low-income enrollees to earn higher GPAs and stay on-track with credit accumulation benchmarks, whereas an earlier version providing financial aid only had no such effects (Clotfelter et al., 2018). At the University of New Mexico, four semesters of performance-based financial aid and advising decreased time-to-degree and loan borrowing, particularly among students with low academic preparation and low family income (Erwin et al., 2021).

Many comprehensive support models are campus-specific programs. In contrast, the Dell Scholars program provides financial and non-financial support to support bachelor's degree attainment among selected low-income students. Dell Scholars receive scholarship funds which can be used flexibly to cover expenses, such as tuition and fees as well as test preparation and fees, study abroad and internship stipends. They also receive counseling assistance to support their navigation of academic, cultural, and other challenges (e.g., overcoming stress, managing debt, organizing childcare) that may hinder their postsecondary success. Selection as a Dell Scholar (which occurs in the spring of students' high school senior year) had no effect on college enrollment. Nevertheless, the program increased later college persistence and bachelor's degree attainment within four or six years (Page et al., 2019).

4.1 Conclusion

The evidence on robust, multifaceted supports to improve college access and success outcomes points to the benefit of looking well beyond financial aid in providing students with support across the multiple domains that may cause challenges with college persistence through to degree completion. Although these programs may be more expensive on a per student basis, cost-effectiveness analysis reveals that programs like ASAP are less costly on a per-graduate basis (Levin & Garcia, 2013). Understanding the long-run benefits of such comprehensive efforts may

be critical for their sustained operation.

Further, such efforts may be particularly important as students and educational systems, alike, work to recover from the damage done by the Covid-19 pandemic. Community college systems, for example, have seen record declines in enrollments during the pandemic, likely a combination of the toll Covid-19 has taken on the populations that attend community colleges and labor market conditions that are favorable to workers. The challenges brought by the pandemic may increase the benefits associated with multifaceted supports like those provided through ASAP.

5. Structural barriers to college access

For the most part, the research discussed up to this point takes the structures of college going and colleges themselves as given. However, research and policy have also called into question these systems, asking whether and how changes to them may lead to improvements in student outcomes. In this section, we consider the pitfalls and potential remedies of three structural domains of college access and success: college entrance exams; affirmative action and the structures that hinder or promote equitable access to higher education along racial and ethnic dimensions; and systems of credit transfer across postsecondary institutions. Although topically disparate, work in all three domains represent examples of efforts to change the structures of higher education rather than just smooth students' navigation of existing systems.

5.1 College entrance exams

The SAT was first introduced in 1926 as an adaption from a US Army IQ test. In its early years, the SAT was used to broaden the socioeconomic diversity of applicants to institutions such as Harvard, identifying students with high academic promise from beyond the secondary schools from which such institutions typically admitted students. The decades that followed included the era of mass higher education expansion in the US, as the GI Bill increased the number of college goers substantially. In this context, the ACT was also introduced (in 1959) and college entrance

exams were widely adopted, as colleges needed a consistent mechanism to screen large numbers of applicants.

Modern critics argue that despite initially being introduced as tools to expand socioeconomic diversity, today strong scores on the SAT or ACT are likely markers of privilege, as wealthier students can more readily sit for the exams, hire tutors, buy additional training, and retake tests on route to achieving those scores. Indeed, SAT taking is correlated with student socioeconomic status (SES) (Avery & Kane, 2004), and retaking college entrance exams is associated with improved performance in both US and non-US contexts (Goodman et al., 2020; Frisancho et al., 2016).

Despite these critiques, performance on these exams is predictive of college performance (Bettinger et al., 2013). Further, most colleges, especially selective colleges, consider scores on these tests in making admissions decisions, although the Covid-19 pandemic dramatically disrupted standard practices. Pandemic-related disruptions aside, drivers such as the U.S. News and World Report institutional rankings give institutions additional cause for paying attention to test scores, as student performance on these exams is a factor in calculating institutional rank (Alon & Tienda, 2007). In some non-US contexts, such as China, college entrance exams are a necessary and even more central factor in college access. In other contexts, for example in Belgium, college entrance exams play a less important role and students may begin almost any higher education program with progress and completion dependent on their initial performance in college. Although allowing for broad access, such ex-post selection tends to have high costs both directly for the system itself and indirectly in the form of foregone earnings for those who begin college (Declerq & Verboven, 2018).

Given the importance of these exams in college admissions, researchers have considered how policies and procedures related to their availability, implementation, and use have influenced

college-going outcomes. Exploiting variation in SAT testing site openings and closures, Bulman (2015) finds that the availability of SAT taking opportunities increases test taking and four-year college enrollment. Angrist and Lavy (2009) show that offering cash incentives to encourage exam taking and passing leads to improved test performance and subsequent college enrollment among girls in Israel. Here, we consider two contrasting strategies for mitigating inequities identified in college-entrance exam structures: expanding access through universal college entrance exam procedures and allowing students discretion in whether to report scores as part of their college applications.

5.1.1 Universal college entrance exam administration

One solution to the problem of differential access to college entrance exams is to make them universal, typically by offering them in school during the regular school day. Several localities have implemented universal, school-day testing that substantially mitigates many of the barriers to timely SAT or ACT taking.[9] Some states selected SAT or ACT as their 11th grade accountability assessment required under No Child Left Behind.[10] Studies that capitalize on the exogenous shock of these policies being introduced in certain geographies and at certain points in time show that, as would be expected, they have a sizeable impact on rates of test taking (Goodman, 2016; Hurwitz, Smith et al., 2015; Hyman, 2017; Klasik, 2013). However, the effect of universal testing on college enrollment may be muted by the capacity constraints at local colleges which cannot necessarily supply more seats proportionately to an increase in eligible SAT- or ACT-takers who apply (Bound & Turner, 2007; Goodman, 2016; Hyman, 2017; see Table 10 for details). Based on evidence from Colorado, Illinois, Maine and Michigan, mandatory college

[9] States implementing school-day ACT policies include: Arkansas, Colorado, Illinois, Kentucky, Louisiana, Michigan, Montana, North Carolina, Tennessee, Utah and Wyoming (http://www.act.org/stateservices/) and states implementing school-day SAT policies are Delaware, Idaho and Maine, as well as certain districts and schools in Florida, Indiana, Maryland, New Jersey and Texas (http://professionals.collegeboard.com/higher-ed/recruitment/sat-test/school-day).

[10] No Child Left Behind is a name commonly used for the 2001 amendments of the 1965 Federal Elementary and Secondary Education Act

entrance exam policies generally have modest to no effect on college enrollment overall but lead to increased enrollment at four-year colleges, particularly among students who had a lower probability of taking an exam in absence of a universal testing policy (Klasik, 2013; Hurwitz et al., 2015; Goodman, 2016; Hyman, 2017). These studies find that universal testing policies are (or have the potential to be) cost effective, depending on how states implement them.

Several mechanisms may be at play in the impacts discussed here. SAT/ACT test taking itself is an important milestone in the college-going process (Klasik, 2012), and sitting for an exam in the spring of junior year may serve as encouragement for students to begin their college search and application process at that time (Holzman et al., 2019). The school-day policies and the introduction of local test centers both increase awareness of and reduce travel and other hassle costs associated with test taking itself (Cook & Turner, 2019). Further, these policies underscore an implicit recommendation that students should be taking college entrance exams. In addition, the exam process may provide students with information about their college potential, via feedback in the form of their test scores as well as recruitment materials sent to test takers by colleges and scholarship providers and may help to overcome students' perceptions that taking these assessments is incongruent with their own identity (Hurwitz et al., 2015). Recall that the HAIL and Expanding College Opportunity studies both relied on SAT and/or ACT test scores to identify students for outreach. Collectively, the evidence points to mandatory exam policies working through alleviating barriers to exam taking as well as providing information about students' abilities. Yet, such benefits are realized primarily by those who were already college intending.

5.1.2 Eliminating college entrance exams as an application requirement

A different response to the barriers and inequities created by entrance exams has been for institutions either to suspend their use entirely (as recently enacted by the University of California system) or to implement test-optional policies, allowing applicants discretion in whether to report

scores from these assessments. Test-optional policies began in the early 2000s, primarily with liberal arts institutions, and have continued to grow in popularity, with institutions aiming to increase socioeconomic and racial diversity among their students (Bennett, 2021).

Test-optional policies could affect college-going outcomes via at least four potential channels (Bennett, 2021). First, students may add to their institutional choice set one or more schools that adopt a test-optional policy. Second, test-optional policies remove SAT / ACT taking as a step in the college-application gauntlet (Klasik, 2012). Third, more students may see themselves as college-qualified without the SAT / ACT metric. And finally, students may view test-optional colleges as better aligned with their ideals, as test-optional policies may serve to signal that institutions value applicants' unique contributions. Critics, however, question the motivation for institutions to go test-optional, arguing that these policies may lead to increases in institutional selectivity and ranking status, driven by an increase in applicants without a corresponding change in the average test scores used in rankings, as lower-scoring applicants may withhold their scores (Ehrenberg, 2002). A key challenge to investigating the effects of test-optional policies is that such policies often are not implemented in isolation. Of course, other policies implemented in concert provides more contextual information about institutional intentions. For example, the University of Chicago introduced other efforts simultaneous to going test optional to increase diversity. These efforts included providing full scholarships for applicants from disadvantaged backgrounds and increasing recruitment activities in both rural and urban areas (Jump, 2020).

Still, evidence suggests that test-optional policies may not help colleges achieve goals of increased diversity but may, in fact, boost the indicators used in college rankings. First, Belasco et al. (2015) find that at several US liberal arts colleges, test-optional policies increased applications, had no effect on the share of students who were from low-income or minority backgrounds, and

had a positive effect on average SAT scores among enrolled students. Examining a broader set of four-year institutions, Saboe and Terrizzi (2019) similarly find that test-optional policy adoption had no effect on diversity. In contrast to Belasco et al. (2015), they find no effects on average SAT scores and a temporary positive effect on the number of applications. Finally, in a study examining 100 private institutions that implemented test-optional policies between 2005 and 2015, Bennett (2021) estimates that test-optional policies among these institutions increased the share of students who were Pell grant recipients or ethnic / racial minorities each by one percentage point, with no effects on application volume and no evidence of heterogeneity by institutional selectivity.

Taken together, test-optional policies thus far have had a limited effect on the characteristics of students served by the institutions implementing them. Of course, the Covid-19 pandemic has expanded at least temporary use of test-optional policies by necessity, as students have been unable to sit for exams. The effects of eliminating college entrance exams from admissions processes entirely may differ, and future research should explore how both policy- and pandemic-related disruptions to standardized testing practices may affect the distribution of students across institutions going forward. A move away from college entrance exams may also lead colleges and universities to put even more weight on students' high school rank and GPA in making college admissions decisions. A concern related to this point, however, is that grading practices in US public schools indicate steady trends of grade inflation, particularly in schools that serve more affluent students (Gershenson, 2018; Hurwitz & Lee, 2018).

5.1.3 Conclusion

The college entrance exam landscape is shifting rapidly with changes hastened by the disruptions to standardized testing brought by the Covid-19 pandemic. Looking forward, research should attend to continued efforts to expand access to testing through school-day testing policies

as well as the effects of recent changes to the tests themselves. Very recently, for example, the College Board announced a shift to computer-based administration of the SAT that will allow fora decrease in the duration of the exam using computer-adaptive testing. Such a move to computer-based administration may introduce an additional opportunity for inequities, however, if students, families, and school systems vary in access to adequate technology to support preparation for computer-based testing and schools additionally vary in adequate hardware and internet access for supporting test administration.

At the same time, the pandemic has also pushed institutions more rapidly toward making admissions decisions in a test-optional context or without standardized test scores at all. Whether colleges will revert to pre-Covid practices as the pandemic subsides is an open question, and although it has made some allowances for the challenges of the pandemic, the US News ranking of institutions – a recognized driver of institutional decision making – is continuing to rely on student SAT / ACT performance as a factor in their ratings of colleges and universities. For example, for 2022, the US News announced a modest change to their methodology with respect to college entrance exams. Specifically, if less than 50 percent (down from 75 percent) of an institution's entering class of 2020 submitted test scores, the institution's SAT/ACT percentile distribution value would be deflated by 15 percent prior to use in rankings calculations. Such a policy creates a strong incentive for ratings-sensitive institutions to work to admit more of their incoming cohorts from among applicants who report standardized test scores.

Today, college entrance exams are perhaps one of the most critiqued aspects of competitive college admissions, especially considering the recent scandals related to testing. However, newer analytic methods that facilitate analysis of large bodies of text-based data point out that the quality of other application components, such as admissions essays, also vary by socioeconomic status

(Alvero et al., 2021). We expect that continued development and use of such methods will allow for close examination of other factors considered in college admissions. Finally, a move away from standardized testing in college admissions will change the incentives for how families prepare for and engage in competitive college admissions. Given increased pressure that this may put on grade inflation and the relative importance of other factors considered in college admissions, the opportunity for increases in equitable college admissions with the deemphasis of the SAT or ACT may be severely reduced.

5.2 Equitable access to higher education by race / ethnicity

In addition to the barriers to college access discussed up to this point, racially/ethnically minoritized groups face additional, distinct, structural barriers—including highly segregated schools and neighborhoods (Rothstein, 2015) and discrimination and bias in both labor market and educational settings(Darity & Mason, 1998; Bertrand & Duflo, 2017; Darity, Hamilton, & Stewart, 2015; Starck, Riddle, Sinclair, & Warikoo, 2020) that also manifest in disparities in college access and success (Alon & Tienda, 2007; Posselt, Jaquette, Bielby, & Bastedo, 2012) . While we do not cover the full depth of research on affirmative action in college admissions, we highlight key findings from this literature (for detailed review, see Arcidiacono & Lovenheim, 2016; Hinrichs, 2012, 2014; Holzer & Neumark, 2006).

Recent evidence on enacted affirmative action policies come from outside the US, and particularly from Israel, India, and Brazil (see Table 11 for details). Alon and Malamud (2014) examine the impact of a color-blind affirmative action policy implemented by four Israeli universities and targeting students from disadvantaged backgrounds. Students meeting policy criteria were more likely to be admitted and to enroll. Once in college, these students performed similarly to their same-campus peers. Evidence from Brazil focuses on mandates establishing

quotas for racial and/or income minorities and for students attending public secondary schools. These policies did increase enrollments among those targeted by the policies, although the policies also motivated strategic responding by college applicants. For example, students claimed different characteristics targeted by the quotas, including racial classification, strategically (Aygun & Bó, 2021; Francis &Tannuri-Pianto, 2012; Vieira & Arends-Kuenning, 2019). Finally, evidence from India explores affirmative action policies for students from lower-caste groups. These policies successfully work to increase enrollment and persistence among lower-caste applicants, however, they also serve to exclude other disadvantaged but non-targeted groups, such as women. In addition, these policies have been tied to societal costs in the form of income losses, given higher labor market returns for upper-caste students attending the focal higher education programs (Bertrand et al., 2010; Frisancho & Krishna, 2016; Khanna, 2020).

In the US context, early studies document sharp declines in minority enrollment at selective public institutions after the enactment of affirmative action bans (Tienda et al., 2003; Kain et al., 2005). Several recent studies have identified the effects of affirmative action by comparing changes in minority student enrollment (or other outcomes) within states that implemented affirmative action bans (California, Texas, Washington, and Florida) to changes in states that did not. Hinrichs (2012, 2014) concludes that such bans have little effect on minority enrollments or bachelor's degree completions overall but substantially reduce the likelihood that minorities enroll in or complete a bachelor's degree at a selective four-year institution. Other studies with similar findings include Backes (2012), Long (2004), and Dickson (2006). In short, such bans tend to affect where students enroll and complete degrees, rather than whether they do so at all (an important caveat is that there are many more studies of the application/enrollment margins than the completion margin).

A complication in many studies of affirmative action bans is that states and institutions

often developed new policies intended to counter the effects of the affirmative action bans, so studies that rely on difference-in-difference designs, in particular, will capture the combined effect of eliminating affirmative action and of implementing new programs in response, rather than the isolated effect of instituting a ban. Top X% plans, which typically guarantee admission to in-state public institutions to students who rank in the top X% of their high school class, are the most notable example of an alternative policy.[11] Texas was the first state to implement its Top 10% plan as a race-neutral alternative to affirmative action after the Hopwood vs. U of Texas Law School (1996) decision banning race-conscious admission policies. Several states have since enacted similar plans (Antonovics & Backes, 2013; Arcidiacono et al., 2014; Arcidiacono & Koedel, 2014; Arcidiacono & Lovenheim, 2016; Hill, 2017).

If high schools were fully segregated by race, a top 10% policy would ensure admission for 10% of students within each racial group. But as Hinrichs (2012) notes, the reality is that high schools are not completely segregated, and "fewer than x% of minorities are in the top x% of their high school class" (p. 715). Although the Texas Top 10% plan increased enrollment of rank-eligible Hispanic students and students from districts serving high shares of minority and low-income students (Niu & Tienda, 2010), this broader pattern of racial segregation may explain why such alternatives do not completely undo the effects of affirmative action bans for minorities. Cortes (2010) examines how the switch from affirmative action to the top 10% policy in Texas affected the post-enrollment outcomes of minority students differentially by high school class rank. She finds that persistence and graduation were flat or declining for minority students below the top decile, while the same outcomes were increasing for minority students in the top 10% (as well as for non-minority students throughout the distribution). Daugherty et al. (2014) find that students

[11] In 2009, UT-Austin was allowed to limit the proportion of students admitted under the Top 10% plan to 75 percent of the incoming class, meaning that students who just barely make the top 10% still may not meet the effective cutoff for UT-Austin. Florida and California also have so-called "percent plans" but they only guarantee admission to some public four-year institution, not to the institution of the student's choice as in Texas (Cortes, 2010).

who just barely qualified were much more likely to attend a state flagship institution but at the expense of private college enrollments, such that there were no effects on enrollment or measures of institutional quality in general.

More recently, Black et al. (2020) studied the effect of the Texas plan on enrollment, graduation, and earnings of students who were "pulled in" and "pushed out" from flagships by the policy. High-achieving students who gained access to flagships ("pulled-in students") had higher enrollment in public, four-year colleges, higher graduation from any four-year college, and exhibited suggestive earnings gains. Students below 10% in "feeder" high schools ("pushed out students" who tended to lose access to flagships) attended less selective colleges, but the policy had no effect on their enrollment, graduation, or earnings. Taken together, the policy increased efficiency by allocating spots in flagship institutions for those who benefited from them more.

Nevertheless, such policies can have important limitations. One critique of both affirmative action and top X% plans—and a possible explanation for limited effects on enrollment—is that they may be of limited use to students facing additional barriers like the ones we discuss elsewhere. For example, Cortes and Klasik (2020) find that the Texas plan had a limited influence on enrollment in state flagships for students attending high schools with no prior history of sending students to those institutions. Rather, schools that served as feeders to the state flagship institutions remained largely the same before and after the policy was enacted. This observation motivated the development of the Longhorn Opportunity Scholarship program discussed above.

5.2.1 Conclusion

Legally permissible uses of race in competitive college admissions have been the focus of several Supreme Court cases including *Regents of the University of California v. Bakke* (1978); *Grutter v. Bollinger* (2003); *Gratz v. Bollinger* (2003); and *Fisher v. University of Texas* (2013, 2016). The most recent of these decisions reaffirmed the earlier decision of *Grutter v. Bollinger*

(2003) that the use of race was allowable under the circumstance that it be considered as one factor among many in the process of holistic review of candidates, so long as it operated narrowly to serve a compelling interest of the state by providing students with the educational benefits attendant in learning among a diverse student body. With the recent shift in the Supreme Court toward a conservative majority, the Court has agreed to hear challenges to the constitutionality of this form of race-conscience admissions based on cases brought against Harvard University and the University of North Carolina. Although race-conscious admissions processes used today are supported by established legal precedent, the upcoming Supreme Court case has the potential to change the landscape considerably.

6. Postsecondary system-level factors

Finally, we consider the challenge of college success from an institutional perspective. While many of the programs and policies that we have discussed thus far support both access and completion, it is also possible for these two goals to come into conflict, particularly in the context of limited resources. When institutional resources are constrained, higher education systems may face a tradeoff: serve more students with lower quality or fewer students with higher quality academic opportunities and other services (Barr, 2010). At the extreme, if resources are spread too thin, an institution could increase its number of graduates by decreasing the number of students admitted.

Unfortunately, in the US, resources for higher education have not expanded as fast as enrollments. In fact, at the state level, expenditures are falling in real terms. In the face of competing priorities, the share of state budgets devoted to higher education fell from 8 percent in 1980 to 4 percent in 2010 (Mettler, 2014). On a per-student basis, state funding has fallen 30 percent since its peak in 1987-88, from about $10,000 to $7,000 per student (Baum & Ma, 2014). Thus, the tension between quantity served and quality of service is not a hypothetical one. These

patterns help to explain why improving college access is not, on its own, sufficient to eliminate socioeconomic gaps in educational attainment and improve rates of intergenerational mobility: the "marginal" students induced into college by virtue of programs focused exclusively on college access disproportionately enter the public institutions at which resource constraints are most acute (Chetty et al., 2017). Given current trends in per-student funding, the tension between promoting access and maintaining quality is likely to increase in the coming years. In this section, we consider the research on the role of institutional resources in promoting student success. We also consider the evidence on other institution- and system-level factors, such as the make-up of the teaching faculty and how well aligned the faculty is to the identities and learning needs of students enrolled. We then highlight on the literature related to mode of instructional delivery and the effects of online learning. This topic is highly relevant currently, as the world continues to wade through the Covid-19 pandemic. Finally, we touch on cross-level orchestration in the form of transfer pathways from two- to four-year institutions.

6.1. Institutional resources/quality

Institutional quality and per-student expenditure on instruction and academic supports (e.g., tutoring, advising and mentoring) play important roles in creating an environment conducive to student success. Indeed, Hoxby and Turner (2013) show that the most competitive institutions are those with the highest levels of per student core instructional expenditures, on average. Further, descriptive evidence suggests that while both student and institutional characteristics are related to college success, institutional characteristics are more important and that decreased resources per student and enrollment shifts towards public colleges with less funding explain most of the decline in the degree attainment rates (Bound et al., 2010, 2012; Webber & Ehrenberg, 2010). Causal evidence also points to the impact of institutional resources on college success (see also Table 12). For example, Deming and Walters (2017) examined the effect of public subsidies on

postsecondary degree completion at US public colleges between 1990 and 2013. Instrumenting tuition with legislative tuition caps and freezes and instrumenting public spending with variation in state appropriations induced by state budget shocks, they find that a 10% increase in spending increases enrollment and degree completion. In contrast, they found no effect of price variation on access and degree completion. In sum, increasing public subsidies to institutions may be more effective in raising postsecondary attainment than tuition cuts, as institutions tend to put appropriations toward core academic investments. Notably, given the identifying variation, these findings pertain primarily to non-selective public institutions.

Three additional papers point to the importance of institutional resources. Bound and Turner (2007) instrument for the availability of higher education resources with the size of college-age cohorts within states and estimate the effect of public funding on undergraduate degree attainment. Large cohorts of students tend to have lower college completion rates due to receiving lower public subsidies per student, with a 10% increase in the size of college-age cohorts decreasing college completion rates by 4%. The effect was driven by the inability of colleges to absorb heightened demand (and not by declines in school quality or lack of academic preparation). Similarly, in an examination of a state-based merit scholarship, Cohodes and Goodman (2014) show that because the scholarship offer shifted students' enrollment away from better-resourced private colleges towards public institutions, it led to the unintended consequence of reducing degree completion among recipients. Finally, recent consolidation in the Georgia University System led to improvements in student retention and degree attainment. Russell (2019) hypothesizes that these effects were achieved through increased spending on academic support generated through economies of scale in student services provision.

While for-profit colleges in theory could expand access by relaxing supply-side constraints in the public sector, in practice research has found these institutions largely crowd-out enrollment

in the public sector rather than increasing enrollments overall (Cellini, Darolia, & Turner, 2020). And while higher and lower quality institutions exist in all sectors, the concentration of poor student outcomes in the for-profit sector has attracted policy and research attention (Cellini & Koedel, 2017). An early study by Deming, Goldin, & Katz (2012) using propensity-score matching concluded that the disparities in completion rates and labor market outcomes between for-profits and other sectors could not be explained by differences in student composition and other institution-level characteristics. Scott-Clayton (2018) reaches the same conclusion with respect to high rates of student loan default among for-profit enrollees. Cellini & Chaudhary (2014) used an individual fixed-effects approach with data from the NLSY and found that for-profit associate degree completers experienced small positive earnings effects, but lower than comparable completers from public institutions, and not sufficient to outweigh the substantially higher tuition costs. Evidence from two resume audit studies is consistent with employers considering for-profit credentials to be of questionable value, with one study finding that fictitious graduates from for-profits received significantly fewer callbacks (Deming et al., 2016), and another finding a negative but statistically insignificant difference relative to community college graduates (Darolia et al., 2015). Perhaps the most decisive available evidence comes from a recent study using rich administrative earnings data from the IRS, examining earnings before and after enrollment for those attending for-profit colleges versus matched enrollees at public institutions, confirms that "the majority of [for-profit] schools appear to have negligible average earnings effects" (p. 367), with particularly poor outcomes at online and chain for-profit institutions (Cellini & Turner, 2019).

6.2. Match of characteristics between students and faculty

An extensive literature points to effects of teacher characteristics and their match with student characteristics on student outcomes in K-12 schooling in the US and abroad (e.g., Gershenson et al., 2018; Lindsay & Hart, 2017; Muralidharan & Sheth, 2016). Similarly, the match

of demographic characteristics between students and their college instructors may be an important factor in improving college success, particular among students from sociodemographic groups that are underrepresented in the postsecondary context. Instructors who are the same race and and/or gender as their students may serve as role models for or respond differently to gender- or race-matched students thus minimizing student experiences of discrimination and bias. They may also be able to better relate to students' experiences, thus heightening certain students' sense of belonging on campus and in the classroom.

Most papers find positive effects of same-gender instructors on achievement and related outcomes (also see Table 13). For example, in the context of four-year liberal arts colleges, female faculty generally increase female students' interest in male-dominated fields, whereas male faculty increase male student interest in female dominated fields (Bettinger & Long, 2005; Griffith, 2014; Solanki & Xu, 2018). Studies in the unique context of the US Air Force Academy point to similar findings. Carrell et al. (2010) find that instructor gender has no effect on male student outcomes, but for female students, being taught by a female instructor in introductory, required STEM courses increases the probability of taking subsequent math and science courses and graduating with a STEM degree. These effects were most pronounced for females with strong math skills. Mansour et al. (2018) corroborate these findings and extend them to show impacts on the likelihood of choosing a STEM occupation and completing a master's program in STEM for female students with strong math skills. Similarly, an experimental study at a Lebanese university finds that women are more likely to enroll and graduate with a STEM degree if assigned to an advisor who is a woman rather than a man (Canaan & Mouganie, 2021).

Research has also explored the match between instructor and student race / ethnicity. As with studies of gender, findings point to the benefit of increasing faculty diversity along racial and ethnic lines. Fairlie et al. (2014) classify individuals who are Black, Hispanic or Native American

/ Pacific Islander as underrepresented minorities (URMs) and investigate the effect of URM students being taught by URM faculty in the community college context. For these students, being taught by a URM faculty member increases course passing and performance and decreases course withdrawal. Similar effects have been observed from studies that consider same-race and same-gender instructors in the context of public, four-year institutions (Price, 2010), graduate school (Birdsall et al, 2020), and military academies (Kofoed & McGovney, 2019). From this literature, it follows that same-gender (Griffith and Main, 2021) or same-race/ethnicity (Lusher et al., 2018) teaching assistants would also yield positive effects.

The role-model mechanism appears to be salient in explaining such effects by race or gender. To test this mechanism, Porter and Serra (2020) conducted an experimental study focused on female students in economics in the context of a large, private university. The intervention involved exposure to women who had majored in economics at the same university and who talked with students about their experience as economics majors, their career choices, current jobs, and how majoring in economics helped them in their careers. This exposure led to a near doubling in the rate with which female students chose to major in economics.

As Fairlie and colleagues (2014) note, this work, taken together, points to the promise of policies that foster growth in the ranks of women and minority faculty members. A note of caution, however, is that if done at differential rates across academic departments, such efforts could heterogeneously affect student selection into certain areas of study. Therefore, more research on how faculty composition influences student sorting is warranted.

At least one study highlights the possibility that instructor gender and race / ethnicity effects may be context dependent. Hoffman and Oreopoulos (2009) explored this question within first-year, large enrollment undergraduate courses at the University of Toronto, finding that a same-sex instructor improved average grades by 1-5 percent of a standard deviation and reduced

the probability of course dropout by 1.2 percentage points. However, these estimates were driven by male students performing worse in courses taught by female instructors. The authors concluded that same-sex instructors may matter less in large enrollment classes where instructors and students do not necessarily interact closely and in classes where both genders are well represented and therefore where the potential for stereotype threat may be limited.

6.3. Adjunct instructors

Another dimension of faculty composition relates to whether students are taught by tenure-line faculty or by adjunct instructors (see Figlio & Schapiro, 2021, for further discussion, and Table 14). Descriptive evidence at the aggregate level indicates that higher shares of faculty who are adjuncts is associated with lower graduation rates (Ehrenberg & Zhang, 2005; Jacoby, 2006). However, thiscorrelation could be driven by other omitted factors. Examining this question using student-level data suggests heterogeneity in the effects of adjunct instructors at two- and four-year institutions.

In the four-year context, evidence suggests that adjunct instructors are just as or somewhat more effective than tenure-line faculty (Bettinger & Long, 2010; Figlio et al., 2015; Xu & Solanki, 2020). Bettinger et al. (2016) similarly find that in the four-year setting, having a graduate student instructor for an introductory course increases students' likelihood of continuing in the same discipline. Within the two-year context, several studies observe a consistent pattern whereby students who take a given course with an adjunct instructor earn higher grades in that course, on average, but are less likely to take or perform well in subsequent courses in the same discipline (Ran & Xu, 2019; Xu, 2019; Ran & Sanders, 2020; Xu & Ran, 2021) and may be more likely to drop out altogether (Ran & Xu, 2019). Ran & Xu (2019) find that these effects are more pronounced for adjunct instructors on temporary contracts.

Several mechanisms may explain these patterns. Ran and Sanders (2020) note that

temporary instructors may face inferior working conditions like teaching evening classes and may lack institutional knowledge about academic and non-academic services. Further, contract uncertainty can lead certain instructors – particularly temporary or pre-tenure female instructors – to experience pressure to award higher grades (Griffith & Sovero, 2021). Indeed, Chen et al., (2021) find that part-time instructors award more generous grades compared to their full-time colleagues and compared to themselves when they convert to full-time status.

6.4. Online vs face-to-face instruction

Online instruction has been a feature of the higher education landscape for some time, with its broad adoption – at least temporarily – hastened by Covid-19. Even outside of the pandemic context, online instruction is an enticing option given its potential to scale inexpensively, to overcome geographic barriers, and to dramatically expand access to higher education. A key question for understanding the potential promise of online higher education is whether it is as or more effective than in-person instruction. The evidence to date leaves some ambiguity (McPherson & Bacow, 2015; Xu & Xu, 2020; see also Table 15). A review of quasi-experimental studies found that online learning (and particularly blended learning) improved students' performance (Means et al., 2009), although blended models also increased instructional time. At one Mexican university, Xu and colleagues (2020) investigate effects of blended learning where half of instructional time in an English language class was replaced with an interactive online learning environment. In this context, the blended approach significantly improved course performance and completion. In another study, Bowen et al. (2014) experimentally compared student performance in a statistics course offered either in an in-person or blended format at several four-year campuses and found no differences in course outcomes. Nevertheless, these results may not generalize to all contexts (Jaggars & Bailey, 2010). Indeed, the preponderance of recent evidence points to the detrimental effects of online compared to in-person coursetaking.

Several studies consider the effects of singular courses taught online versus in-person. Evidence in the four-year college context comes from four studies that compare online versus in-person learning in introductory economics courses. These studies consistently find that those assigned to online instruction exhibited poorer course performance, with detrimental effects particularly pronounced for males and those who were initially lower performing (Bosshardt & Chiang, 2018; Figlio, Rush & Yin, 2013; Alpert et al., 2016; Kofoed, 2021). Interestingly, these findings mirror those from studies of laptop computer use in the classroom. Patterson and Patterson (2017), for example, find that laptop use negatively affects students' course performance, particularly for males and lower-performing students. Additional survey data collected by Kofoed (2021) points to potential drivers of these negative effects, namely that students assigned to online instruction had difficulty concentrating in class and did not feel sufficiently connected to their instructors and peers.

One study considers the effect of degree programs that are fully online rather than in person. Admittedly, selection issues may be harder to overcome in such comparisons. Using a matching strategy with a rich set of covariates, Cellini and Grueso (2021) find that students attending on-campus bachelor's degree programs in Colombia significantly outperform their counterparts in exclusively online versions of these same programs, based on student performance on compulsory course exit exams.

These findings are corroborated by a set of quasi-experimental studies set in the community college or for-profit college setting which collectively find that online (rather than in-person) instruction is associated with lower course performance, lower course-level and college persistence, decreased continuation in the field of study and an increased need for course retaking (Xu & Jaggars, 2013; Bettinger et al., 2017; Hart et al., 2018; Altindag et al., 2021). Finally, Kozakowski (2019) investigates remedial instruction delivered via an "emporium" model of online

instruction whereby students come to a campus computer lab to learn online with on-site course instructors who assist them. Even this model that included some in-person engagement with an instructor led to reduced course pass rates, retention, and degree attainment in comparison to traditional in-person instruction.

At the margin of course taking either in-person or online, the evidence points consistently to in-person learning yielding better outcomes. A different but also important margin is that between learning online versus not accessing higher education at all. Early evidence on the effect of online education to expand access to higher education comes from Goodman et al. (2019) in their study of Georgia Tech's online computer science master's program. Capitalizing on a threshold in admissions decisions, they show that program acceptance substantially increases enrollment in master's level training. Given the proliferation in online programs at both the undergraduate and graduate levels, a key question is the extent to which such programs are expanding access by meeting previously unmet demand or are serving as a lower-quality substitute for the in-person programs that students might otherwise pursue.

6.5 Systems for transfer across institutional sectors

Almost 80% of students entering community colleges intend to transfer to a four-year college (Horn & Skomsvold, 2011; Jenkins & Fink, 2016). However, actual transfer rates are far lower, and community college degree completion rates also tend to be low. Therefore, students may benefit from increased guidance as well as better articulated pathways to accomplish the transfer from two- to four-year institutions (Oreopoulos, 2021). Many states have developed systems to improve articulation between and facilitate the transfer from two-year to four-year institutions. Evidence on these programs comes from two states: Ohio and California. Ohio's transfer program is a statewide agreement between community colleges and four-year colleges that allows students who complete a specified set of courses (a transfer module) at one institution to

transfer all module course credits to a receiving institution. In 2010, the California community colleges and state universities jointly established a set of degrees and articulated the transfer process in certain disciplines. Both efforts are associated with increased rates of transfer from two- to four-year institutions (Baker, 2016; Boatman & Soliz, 2018; see Table 16 for more details). Boatman and Soliz (2018) additionally observe that completing a transfer module is associated with higher rates of associate degree attainment and increased credit attainment. Thus far, however, only a small number of students take up this option, leading the authors to question whether the transfer module effort is a sufficient policy instrument for improving transfer from two- to four-year institutions. Both studies represent early looks at these structural changes. Thus, they suggest promise and motivate continued investigation into longer-run outcomes and efforts to encourage take up of these better articulated opportunities for cross-sector transfer.

6.6 Conclusion

An ever-increasing share of jobs in the US economy require some postsecondary education and training behind high school (Carnevale, Smith & Strohl, 2013). Given this, an important question is whether colleges and universities will have the resources and structures needed to meet the demands of an increasingly diverse student body and provide the skills needed to succeed in today's labor market. A concerning pattern discussed above is that public appropriations directly to institutions of higher education have declined over time on a per student basis, with a greater share of the cost burden of higher education and the associated risk passed on to individual students and their families (as discuss in the chapter on financial aid). Increasingly (and fueled by political rhetoric from certain corners), students and families are questioning whether college is "worth it" (Tough, 2021). If per student expenditures continue to decline, particularly at public institutions, an additional concern relates to the quality of the educational experience at these institutions and about the expanding inequality of the student experience across different sectors of the higher

education system.

Research discussed in this section suggests that students stand to benefit when they can learn from high-quality faculty members on long-term contracts with some evidence additionally that students also benefit when their faculty members mirror their own demographics, such as race, ethnicity, and gender. Given the mismatch between students and faculty on such dimensions, efforts to change the demographic distribution of university faculty will take concerted effort to influence the pipeline and process of entering the university faculty profession.

Research in this section also points to a concern about the negative effects of online (vs. in-person) learning on educational persistence and degree attainment. At the time of our writing, college students and educational systems were still very much contending with the disruptions associated with the pandemic, with more learning than usual occurring online rather than in-person. It may take some time to understand the long-run consequences of this disruption, not only for college access (vs. not) but also for the quality of learning for those currently enrolled.

7. Discussion: Future Directions for Research

As this review of the literature suggests, college access and success has been a generative domain for economics of education research over the past 20 years. In general, a broad focus on college access preceded a focus on college success, and as a result, the research on college success is somewhat less robust but is expanding rapidly. This may also relate to the comparative complexity of college access and success. Whereas accessing college is a multifaceted process involving many decisions and required actions, the attendant actions and steps are generally well defined and occur over a limited timeframe. In contrast, once enrolled, persisting in college through to credential or degree attainment is typically a multi-year endeavor, involving sustained attention to academic, administrative, financial, and related requirements in the context of a decentralized and complicated organizational structure typical of colleges and universities. For

many, the experience of college also intersects with a first foray into adulthood. As a result, the "recipe" for success in postsecondary education is much less clear than for initial postsecondary access.

Given this, research should continue to track and document how students induced to enroll in college by various college-access interventions continue to perform and persist in college. Further, research can work to identify key factors, supports and structures that facilitate students to be successful in college. With these better articulated, college access and success can be thought of as going hand-in-hand, with access focused on students enrolling in institutions that are well equipped to support their success. Existing evidence discussed earlier in this chapter points to the college-search process still being quite haphazard for many students.

In addition to the college-going process itself, research should continue to consider the impacts of policies and programs for preparing students to meet the academic demands of postsecondary education. Setting high academic expectations for students also requires providing sufficient supports for all to be able to succeed. As discussed early in this chapter, broad scaling of programs like AP course and test-taking necessitates that students are ready to take advantage of these opportunities and that supports are sufficient for all students involved to succeed. Without such supports, evidence suggests that unintended consequences – such as less-well prepared students becoming discouraged – may be a result. As state policy pushes toward expansion of programs like AP, research should investigate factors that facilitate the broadest access and success of students engaged as well as the implications for educational opportunities broadly and especially for students who do not take up AP (or related) coursework.

Among the structures and programs aimed at improving students' experiences to and through college, those that provide a more holistic approach to acclimating students to the college environment and college academic expectations show more promise than simply increasing

academic expectations in high school, for example. The structural and comprehensive educational reports of Early College High Schools and the CUNY ASAP have shown the most promise for transformative impacts. Research related to these and other programs should continue on several fronts. First, we should continue to track outcomes of these efforts over time to understand the extent to which promising short-run outcomes translate to impacts on labor market and other life outcomes. Precisely because the research that we consider here has been published in the last 20 years, there is still much room to understand how the returns to these programs evolve over participants' lifetimes. If we observe that lifetime returns to more expensive investment list ASAP are large, then public investment in them is better justified.

Second, with these and other efforts, research should seek to investigate the extent to which results replicate and generalize in different and potentially less-ideal contexts. Here again, the ECHS model is a useful example. The ECHS research that shows such promise is based on studying early colleges that are oversubscribed – one signal of the strength of these particular programs. Looking ahead, a key question pertains to the generalizability of the ECHS model and whether other college access and academic transition models, such as College Forward, Bottom Line, and CUNY Start, can replicate in other settings.

Another area of future research relates to the data-driven targeting of academic and non-academic supports that is becoming increasingly common on college campuses. For example, Georgia State University employs predictive analytics to identify and triage support and outreach to students who may be showing signs of challenge. Such approaches have the potential to help resource-constrained institutions better target attention where it is most needed. Nevertheless, use of data for targeting and tracking of students in this way is a relatively young field, and so many questions remain in terms of how to do this best, what factors and behaviors college should track and what the bounds are in terms of ethical use of student data for tracking and targeting.

With the call for replication above, researchers should also attend to how the research process itself may affect the study results. This is particularly so in the context of experimental trials where students often have more insight into their own involvement in a study. In such contexts and particularly when intervention impacts are null (as in the case of the College Point and V-SOURCE studies discussed previously), research should carefully investigate whether these null impacts may be the result of factors such as low levels of intervention take up and engagement; weak experimental contrast and redundancy of supports; and poor targeting of the intervention (either by reaching students who would do well regardless or by providing insufficient support to help students overcome the challenges they face). With very large-scale efforts delivered outside of the educational systems of which students are a part, interventions may fail because students lack trust in the source of support being offered. The support that they are receiving through a given intervention may also conflict with guidance they are receiving from their own educational context. Such dissonance may weaken the potential for any particular support to have a positive effect for students. In short, research should consider how any potential educational intervention interacts, compliments or conflicts with the educational experience students have in their own local context. A related point about the research enterprise in the economics of education is that a goal of research is often to isolate and estimate the causal effect of a narrowly defined mechanism. However, as we have seen, some of the most promising research evaluates the impact of programs that are complex and multifaceted efforts and where particular mechanisms are less-well identified. That is, understanding causal mechanisms of discrete tweaks may be at odds with the types of integrated and multifaceted supports from which students stand to benefit the most.

The HAIL study, in which the randomly assigned intervention included communication to students, parents and school leaders is a useful example here. Bundling multiple channels of communication makes it challenging to disentangle which aspect drives the impact, but a priori, a

multi-faceted communication strategy may have provided the best chance possible of reaching students with the relevant intervention. In short, there may be a tension between designing interventions to maximize student success, versus the scientific goal of precisely isolating specific causal pathways.

Finally, outside of the control of students, families and even educational systems in some cases, the college-going landscape is and likely will continue to see substantial changes in the years ahead. First, in light of the Covid-19 pandemic as well as more generally, colleges and universities are struggling with the question of whether or how to continue to use college entrance exams in their admissions processes. Led by recent decisions by the University of California system to remove these exams from consideration, other systems of higher education may follow suit or at least switch to test optional reporting. Research should document carefully the extent to which such changes allow for more equitable access to the highest rungs in the US system of higher education. At the same time, organizations like the College Board are making changes to tests, shortening them and moving to computer-based administration. Research such seek to document impacts of this move on equitable access to testing.

Also with a focus on equity, the educational policy community will be watching carefully as the Supreme Court considers anew the allowable use of race in college admissions in promoting the educational benefits of learning among a diverse student body. If the now conservative court reverses course on the long-standing precedent established in *Grutter v. Bollinger*, we will be documenting the systemic repercussions for many years to come.

In the United States especially, higher education is enormously complex and varied. In the 2018-19 academic year, for example, the US "system" of higher education included over 6,000 institutions that vary along dimensions including institutional control, sector and credentials awarded. Given this complexity, two students who both access college can enter enormously

different contexts, have different college experiences, and realize different returns to those college experiences. Given this variation and the potential for this system to either exacerbate or help to correct persistent and growing income inequality (Alon, 2009; Chetty et al., 2017), research in the economics of education should attend not only to whether students access higher education but also (and as importantly) where they enroll, whether they persist through to degree attainment, and how well their institution positions them for subsequent success in the labor market and other dimensions of private and civic life.

Works Cited

Aghion, P., Boustan, L., Hoxby, C., & Vandenbussche, J. (2009). *The causal impact of education on economic growth: Evidence from U.S.* Unpublished paper. Retrieved from: http://www.weareeducation.org/Harvard_Causal_Impact_Of_Education.pdf.

Alamuddin, R., Rossman, D., & Kurzweil, M. (2018). *Monitoring advising analytics to promote success (MAAPS): Evaluation findings from the first year of implementation*. Ithaka S + R.

Allensworth, E., Nomi, T., Montgomery, N., & Lee, V. E. (2009). College preparatory curriculum for all: Academic consequences of requiring algebra and English I for ninth graders in Chicago. *Educational Evaluation and Policy Analysis*, *31*(4), 367-391.

Alon, S. (2009). The evolution of class inequality in higher education: Competition, exclusion, and adaptation. *American Sociological Review, 74*(5), 731-755.

Alon, S., & Malamud, O. (2014). The impact of Israel's class-based affirmative action policy on admission and academic outcomes. *Economics of Education Review*, *40*, 123-139.

Alon, S., & Tienda, M. (2007). Diversity, opportunity, and the shifting meritocracy in higher education. *American Sociological Review*, *72*(4), 487-511.

Alpert, W. T., Couch, K. A., & Harmon, O. R. (2016). A randomized assessment of online learning. *American Economic Review*, *106*(5), 378-382.

Alvero, A. J., Giebel, S., Gebre-Medhin, B., Antonio, A. L., Stevens, M. L., & Domingue, B. W. (2021). Essay content is strongly related to household income and SAT scores: Evidence from 60,000 undergraduate applications. *Stanford Center for Education Policy Analysis Working Paper*, (21-03).

Altindag, D. T., Filiz, E. S., & Tekin, E. (2021). *Is online education working?* National Bureau of Economic Research.

American School Counselor Association. (2012). *ASCA national model: A framework for school counseling programs*. American School Counselor Association.

An, B. P. (2013). The impact of dual enrollment on college degree attainment do low-SES students benefit? *Educational Evaluation and Policy Analysis,* 35, 57-75.

An, B. P., & Taylor, J. L. (2019). A review of empirical studies on dual enrollment: Assessing educational outcomes. In M. B. Paulson & L. W. Perna (Eds.), *Higher education: Handbook of theory and research* (pp. 99-151). Springer.

Andrews, R. J., Imberman, S. A., & Lovenheim, M. F. (2020). Recruiting and supporting low-income, high-achieving students at flagship universities. *Economics of Education Review*, 74, 101923.

Angrist, J., Lang, D., & Oreopoulos, P. (2009). Incentives and services for college achievement: Evidence from a randomized trial. *American Economic Journal: Applied Economics, 1*(1), 136-163.

Angrist, J., & Lavy, V. (2009). The effects of high stakes high school achievement awards: Evidence from a randomized trial. *American Economic Review, 99*(4), 1384-1414.

Angrist, J., Oreopoulos, P., & Williams, T. (2014). When opportunity knocks, who answers? New evidence on college achievement awards. *The Journal of Human Resources*, *49*(3), 572-610.

Anthony, A. M., & Page, L. C. (2021). How big is the ballpark? Assessing variation in grant aid awards within net price calculator student profiles. *Education Finance and Policy, 16*(4), 716-726.

Anthony, A. M., Page, L. C., & Seldin, A. (2016). In the right ballpark? Assessing the accuracy of net price calculators. *Journal of Student Financial Aid, 46*(2), 25-50.

Antonovics, K., & Backes, B. (2013). Were minority students discouraged from applying to

University of California campuses after the affirmative action ban? *Education Finance and Policy, 8*(2), 208-250.

Arce-Trigatti, P. (2018). The impact of state-mandated Advanced Placement programs on student outcomes. *Economics of Education Review, 63*, 180-193.

Arcidiacono, P., Aucejo, E., Coate, P., & Hotz, V. J. (2014). Affirmative action and university fit: Evidence from Proposition 209. *IZA Journal of Labor Economics, 3*(1), 1-29.

Arcidiacono, P., & Koedel, C. (2014). Race and college success: Evidence from Missouri. *American Economic Journal: Applied Economics*, *6*(3), 20-57.

Arcidiacono, P., & Lovenheim, M. (2016). Affirmative action and the quality-fit tradeoff. *Journal of Economic Literature*, *54*(1), 3-51.

Armstrong, A. W., Watson, A. J., Makredes, M., Frangos, J. E., Kimball, A. B., & Kvedar, J. C. (2009). Text-message reminders to improve sunscreen use. *Arch Dermatology*, 145(11), 1230-1236.

Arnold, K. C., Castleman, B. L., Chewning, A. & Page, L. C. (2015) Advisor and student experiences of summer support for college-intending, low-income high school graduates. *Journal of College Access, 1*(1), 6 - 28.

Arnold, K.D., Fleming, S., De Anda, M., Castleman, B., & Wartman, K.L. (2009). The summer flood: The invisible gap among low-income students. *Thought & Action, 25*, 23-34.

Atchison, D., Zeiser, K. L., Mohammed, S., Knight, D. S., & Levin, J. (2020). The costs and benefits of early college high schools. *Education Finance and Policy*, 16(4), 659-689.

Attewell, P., & Domina, T. (2008). Raising the bar: Curricular intensity and academic performance. *Educational Evaluation and Policy Analysis*, *30*(1), 51-71.

Aughinbaugh, A. (2012). The effects of high school math curriculum on college attendance: Evidence from the NLSY97. *Economics of Education Review*, *31*(6), 861-870.

Avery, C. N. (2010). *The effects of college counseling on high-achieving, low-income students*. National Bureau of Economic Research.

Avery, C. N. (2013). *Evaluation of the College Possible program: Results from a randomized controlled trial*. National Bureau of Economic Research.

Avery, C., Castleman, B. L., Hurwitz, M., Long, B. T., & Page, L. C. (2021). Digital messaging to improve college enrollment and success. *Economics of Education Review*, *84*, 102170.

Avery, C. N., Howell, J. S. & Page, L. C. (2014a). *A review of the role of college applications in students' postsecondary outcomes*. College Board Research Brief.

Avery, C. N., Howell, J. S. & Page, L. C. (2014b). *A review of the role of counseling, coaching, and mentoring on students' postsecondary outcomes.* College Board Research Brief.

Avery, C. N., Howell, J., Pender, M., & Sacerdote, B. (2019). Policies and Payoffs to Addressing America's College Graduation Deficit. *Brookings Papers on Economic Activity*, *2019*(2), 93-172.

Avery, C. N., & Kane, T. J. (2004). Student perceptions of college opportunities: The Boston COACH Program. In C. M. Hoxby (Ed.), *College choices: The economics of where to go, when to go, and how to pay for it* (pp. 355–394). Chicago, IL: University of Chicago Press.

Aygun, O., & Bó, I. (2021). College admission with multidimensional privileges: The Brazilian affirmative action case. *AEJ-Microeconomics*, 13(3), 1-28.

Backes, B. (2012). Do affirmative action bans lower minority college enrollment and attainment? Evidence from statewide bans. *Journal of Human Resources*, *47*(2), 435-455.

Bailey, M., & Dynarski, S. (2011). "Inequality in postsecondary education." In G.J. Duncan and R.J. Murnane (eds.), *Whither Opportunity? Rising Inequality, Schools, and Children's Life Chance*s (pp 117-132). New York: Russell Sage.

Bailey, T., Jeong, D.W., & Cho, S.W. (2010). Referral, enrollment, and completion in

developmental education sequences in community colleges. *Economics of Education Review*, 29, 255–270.
Baker, R. (2016). The effects of structured transfer pathways in community colleges. *Educational Evaluation and Policy Analysis, 38*(4), 626-646.
Barnett, E. A., Bork, R. H., Mayer, A. K., Pretlow, J., Wathington, H. D., & Weiss, M. J. (2012). Bridging the gap: An impact study of eight developmental summer bridge programs in Texas. *National Center for Postsecondary Research*.
Barnett, E. A., Fay, M. P., Bork, R. H., & Weiss, M. J. (2013). *Reshaping the college transition: States that offer early college readiness assessments and transition curricula*. New York, NY: Community College Research Center.
Barnett, E. A., Kopko, E., Cullinan, D., & Belfield, C. R. (2020). *Who Should Take College-Level Courses? Impact Findings from an Evaluation of a Multiple Measures Assessment Strategy*. Center for the Analysis of Postsecondary Readiness.
Barnett, E., Maclutsky, E. and Wagonlander, C. (2015), Emerging early college models for traditionally underserved students. *New Directions for Community Colleges*, 2015: 39–49.
Barr, N. (2010). *Paying for higher education: What policies, in what order?* London, England: London School of Economics.
Barr, A., & Castleman, B. (2017). *The bottom line on college counseling*. Bottom Line.
Barr, A., & Turner, S. (2018). A letter and encouragement: Does information increase postsecondary enrollment of UI recipients? *American Economic Journal: Economic Policy*, 10(3), 42-68.
Barrow, L., Richburg-Hayes, L., Rouse, C. E., & Brock, T. (2014). Paying for performance: The education impacts of a community college scholarship program for low-income adults. *Journal of Labor Economics*, 32(3), 563-599.
Baum, S. R., & Ma, J. (2014). *Trends in College Pricing, 2014*. New York: NY: The College Board.
Baum, S. R., Elliott, D. C. & Ma, J. (2014). *Trends in student aid, 2014*. New York: NY: The College Board.
Baum, S., Ma, J., & Payea, K. (2013). *Education pays 2013: The benefits of higher education for individuals and society*. New York: The College Board.
Becker, G.S. (1964). *Human capital: A theoretical and empirical analysis, with special reference to education.* Chicago: University of Chicago Press.
Belasco, A. S., Rosinger, K. O., & Hearn, J. C. (2015). The test-optional movement at America's selective liberal arts colleges: A boon for equity or something else? *Educational Evaluation and Policy Analysis*, *37*(2), 206-223.
Belley, P., & Lochner, L. (2007). *The changing role of family income and ability in determining educational achievement*. National Bureau of Economic Research.
Bennett, C. T. (2021). Untested admissions: Examining changes in application behaviors and student demographics under test-optional policies. *American Educational Research Journal*, 00028312211003526.
Berger, A., Turk-Bicakci, L., Garet, M., Song, M., Knudson, J., Haxton, C., . . . Stephan, J. (2013). *Early college, early success: Early College High School initiative impact study*. Washington, DC: American Institutes for Research.
Berggren, A., & Jeppsson, L. (2021). The impact of upper secondary school flexibility on sorting and educational outcomes. *Economics of Education Review*, 81, 102080.
Bergman, P. (2015). Parent-child information frictions and human capital investment: Evidence from a field experiment. *Journal of Political Economy, 129*(1), 286-322.
Bergman, P., Kopko, E., & Rodriguez, J. E. (2021). *Using predictive analytics to track students:*

Evidence from a seven-college experiment. National Bureau of Economic Research.
Bertrand, M., & Duflo, E. (2017). Field experiments on discrimination. *Handbook of economic field experiments*, *1*, 309-393.
Bertrand, M., Hallberg, K., Hofmeister, K., Morgan, B., & Shirey, E. (2019). *Increasing academic progress among low-income community college students: Early evidence from a randomized controlled trial*. University of Chicago Poverty Lab.
Bertrand, M., Hanna, R., & Mullainathan, S. (2010). Affirmative action in education: Evidence from engineering college admissions in India. *Journal of Public Economics*, *94*(1-2), 16-29.
Bettinger, E. P., & Baker, R. B. (2014). The effects of student coaching: An evaluation of a randomized experiment in student advising. *Educational Evaluation and Policy Analysis*, *36*(1), 3-19.
Bettinger, E. P., & Evans, B. J. (2019). College guidance for all: A randomized experiment in pre-college advising. *Journal of Policy Analysis and Management, 38*(3), 579-599.
Bettinger, E. P., Evans, B. J., & Pope, D. G. (2013). Improving college performance and retention the easy way: Unpacking the ACT exam. *American Economic Journal: Economic Policy*, *5*(2), 26-52.
Bettinger, E. P., Fox, L., Loeb, S., & Taylor, E. S. (2017). Virtual classrooms: How online college courses affect student success. *American Economic Review*, *107*(9), 2855-2875.
Bettinger, E., & Long, B. T. (2005). Do faculty serve as role models? The impact of instructor gender on female students. *The American Economic Review*, *95*(2), 152-157.
Bettinger, E. P., & Long, B. T. (2009). Addressing the Needs of Underprepared Students in Higher Education Does College Remediation Work? *Journal of Human Resources*, *44*(3), 736-771.
Bettinger, E. P., & Long, B. T. (2010). Does cheaper mean better? The impact of using adjunct instructors on student outcomes. *The Review of Economics and Statistics*, *92*(3), 598-613.
Bettinger, E., Long, B.T., Oreopoulos, P., & Sanbonmatsu, L. (2012). The role of application assistance and information in college decisions: Results from the H&R Block FAFSA experiment. *Quarterly Journal of Economics*, *127*(3): 1205-1242.
Bettinger, E. P., Long, B. T., & Taylor, E. S. (2016). When inputs are outputs: The case of graduate student instructors. *Economics of Education Review*, *52*, 63-76.
Bhargava, S., & Loewenstein, G. (2015). Behavioral economics and public policy 102: Beyond nudging. *American Economic Review*, *105*(5), 396-401.
Biancardi, D., & Bratti, M. (2019). The effect of introducing a Research Evaluation Exercise on student enrolment: Evidence from Italy. *Economics of Education Review*, *69*, 73-93.
Bird, K. A., Castleman, B. L., Denning, J. T., Goodman, J., Lamberton, C., & Rosinger, K. O. (2021). Nudging at scale: Experimental evidence from FAFSA completion campaigns. *Journal of Economic Behavior & Organization*, *183*, 105-128.
Birdsall, C., Gershenson, S., & Zuniga, R. (2020). The effects of demographic mismatch in an elite professional school setting. *Education Finance and Policy*, *15*(3), 457-486.
Black, S. E., Denning, J. T., & Rothstein, J. (2020). *Winners and losers? The effect of gaining and losing access to selective colleges on education and labor market outcomes*. National Bureau of Economic Research.
Boatman, A., & Bennett, C. T. (2020). A switch in time: The academic effects of shifting math remediation from college to high school. *Education Finance and Policy*, 16(3), 464-492.
Boatman, A., & Long, B. T. (2018). Does remediation work for all students? How the effects of postsecondary remedial and developmental courses vary by level of academic preparation. *Educational Evaluation and Policy Analysis*, 40(1), 29-58.

Boatman, A., & Soliz, A. (2018). Statewide transfer policies and community college student success. *Education Finance and Policy, 13*(4), 449-483.

Bos, J., Berman, J, Kane T, and F. Tseng (2012). *The impacts of SOURCE: A program to support college enrollment through near-peer low-cost student advising.* Working paper.

Bosshardt, W., & Chiang, E. P. (2018). Evaluating the effect of online principles courses on long-term outcomes. *International Review of Economics Education, 28*, 1-10.

Bound, J., Lovenheim, M. F., & Turner, S. (2010). Why have college completion rates declined? An analysis of changing student preparation and collegiate resources. *American Economic Journal: Applied Economics*, 2(3), 129-57.

Bound, J., Lovenheim, M. F., & Turner, S. (2012). Increasing time to baccalaureate degree in the United States. *Education Finance and Policy*, *7*(4), 375-424.

Bound, J. & Turner, S. (2002). Going to war and going to college: Did World War II and the G.I. Bill increase educational attainment for returning veterans? *Journal of Labor Economics* 20 (4): 784–815.

Bound, J., & Turner, S. (2007). Cohort crowding: How resources affect collegiate attainment. *Journal of Public Economics*, *91*(5-6), 877-899.

Bowen, W. G., Chingos, M. M., Lack, K. A., & Nygren, T. I. (2014). Interactive learning online at public universities: Evidence from a six-campus randomized trial. *Journal of Policy Analysis and Management*, *33*(1), 94-111.

Bowen, W. G., Chingos, M. M., & McPherson, M. S. (2009). *Crossing the finish line: Completing college at America's public universities*. Princeton University Press.

Bowman, N. A., Kim, S., Ingleby, L., Ford, D. C., & Sibaouih, C. (2018). Improving college access at low-income high schools? The impact of GEAR UP Iowa on postsecondary enrollment and persistence. *Educational Evaluation and Policy Analysis*, *40*(3), 399-419.

Brock, T., & Richburg-Hayes, L. (2006). *Paying for persistence: Early results of a Louisiana scholarship program for low-income parents attending community college*. MDRC.

Bulman, G. (2015). The effect of access to college assessments on enrollment and attainment. *American Economic Journal: Applied Economics, 7*(4), 1-36.

Cahalan, M. W., Addison, M., Brunt, N., Patel, P. R., Perna, L. W. (2021). Indicators of higher education equity in the United States: 2021 historical trend report. Washington, DC: The Pell Institute for the Study of Opportunity in Higher Education, Council for Opportunity in Education (COE), and Alliance for Higher Education and Democracy of the University of Pennsylvania (PennAHEAD).

Calcagno, J. C., & Long, B. T. (2008). *The impact of postsecondary remediation using a regression discontinuity approach: Addressing endogenous sorting and noncompliance.* National Bureau of Economic Research.

Canaan, S., & Mouganie, P. (2021). The Impact of Advisor Gender on Female Students' STEM Enrollment and Persistence. *Journal of Human Resources*, 0320-10796R2.

Carnevale, A. P., Smith, N., & Strohl, J. (2013). *Recovery: Job growth and education requirements through 2020.* Georgetown University Center on Education and the Workforce.

Carrell, S. E., & Kurlaender, M. (2020). *My professor cares: Experimental evidence on the role of faculty engagement*. National Bureau of Economic Research.

Carrell, S. E., Page, M. E., & West, J. E. (2010). Sex and science: How professor gender perpetuates the gender gap. *The Quarterly Journal of Economics*, *125*(3), 1101-1144.

Carrell, S. E., & Sacerdote, B. (2013). *Late interventions matter too: The case of college coaching New Hampshire*. National Bureau of Economic Research.

Carrell, S. E., & Sacerdote, B. (2017). Why do college-going interventions work? *American Economic Journal: Applied Economics*, 9(3), 124-151.

Casey, B. J., Jones, R. M., & Somerville, L. H. (2011). Braking and accelerating of the adolescent brain. *Journal of Research on Adolescence*, *21*(1), 21-33.

Castleman, B. L. & Goodman, J. (2018). Intensive college counseling and the enrollment and persistence of low-income students. *Education Finance and Policy*, *13*(1), 19-41.

Castleman, B. L. & Page, L. C. (2014a). *Summer melt: Supporting low-income students through the transition to college.* Cambridge, MA: Harvard Education Press.

Castleman, B. L. & Page, L. C. (2014b). A trickle or a torrent? Understanding the extent of summer "melt" among college-intending high school graduates. *Social Science Quarterly*, 95(1), 202 – 220.

Castleman, B. L. & Page, L. C. (2015). Summer nudging: Can personalized text messages and peer mentor outreach increase college going among low-income high school graduates? *Journal of Economic Behavior and Organization, 115*, 144 – 160.

Castleman, B. L., Arnold, K.D., & Wartman, K.L. (2012). Stemming the tide of summer melt: An experimental study of the effects of post-high school summer intervention on low-income students' college enrollment. *Journal of Research on Educational Effectiveness, 5*(1), 1-17.

Castleman, B. L., Deutschlander, D., & Lohner, G. (2020). *Pushing college advising forward: Experimental evidence on intensive advising and college success*. Annenberg Institute.

Castleman, B. L., & Goodman, J. (2018). Intensive college counseling and the enrollment and persistence of low-income students. *Education Finance and Policy*, *13*(1), 19-41.

Castleman, B. L., Owen, L. & Page, L. C. (2015) Stay late or start early? Experimental evidence on the benefits of college matriculation support from high schools versus colleges. *Economics of Education Review, 47*, 168-179.

Castleman, B. L., Page, L. C. & Schooley, K. (2014). The forgotten summer: Mitigating summer attrition among college-intending, low-income high school graduates. *Journal of Policy Analysis and Management, 33*(2), 320 – 344.

Cellini, S. R., & Chaudhary, L. (2014). The labor market returns to a for-profit college education. *Economics of Education Review, 43*, 125-140.

Cellini, S. R., Darolia, R., & Turner, L. J. (2020). Where do students go when for-profit colleges lose federal aid? *American Economic Journal: Economic Policy, 12*(2), 46-83.

Cellini, S. R., & Grueso, H. (2021). Student Learning in Online College Programs. *AERA Open*, *7*, 23328584211008105.

Cellini, S. R., & Koedel, C. (2017). The Case for Limiting Federal Student Aid to for-Profit Colleges. *Journal of Policy Analysis and Management*, *36*(4), 934-942.

Cellini, S. R., & Turner, N. (2019). Gainfully employed? Assessing the employment and earnings of for-profit college students using administrative data. *Journal of Human Resources*, *54*(2), 342-370.

Chajewski, M., Mattern, K. D. and Shaw, E. J. (2011). Examining the role of Advanced Placement® exam participation in 4-year college enrollment. *Educational Measurement: Issues and Practice*, 30: 16–27.

Chen, K., Hansen, Z., & Lowe, S. (2021). Why do we inflate grades? The effect of adjunct faculty employment on instructor grading standards. *Journal of Human Resources*, *56*(3), 878-921.

Chen, X., Wu, J., & Tasoff, S. (2010). *Postsecondary expectations and plans for the high school senior class of 2003-04.* Issue Tables. NCES 2010-170rev. National Center for Education Statistics.

Chetty, R., Friedman, J. N., Saez, E., Turner, N., & Yagan, D. (2017). *Mobility report cards: The role of colleges in intergenerational mobility* (No. w23618). national bureau of economic

research.
Civic Enterprises. (2011). School counselors literature and landscape review. The College Board.
Clark, D., Gill, D., Prowse, V., & Rush, M. (2020). Using goals to motivate college students: Theory and evidence from field experiments. *Review of Economics and Statistics, 102*(4), 648-663.
Clinedinst, M. E. & Hawkins, D.A. (2009). 2009 State of College Admission. National Association for College Admission Counseling.
Clotfelter, C. T., Hemelt, S. W., & Ladd, H. F. (2018). Multifaceted aid for low-income students and college outcomes: Evidence from North Carolina. *Economic Inquiry, 56*(1), 278-303.
Clotfelter, C. T., Hemelt, S. W., & Ladd, H. F. (2019). Raising the bar for college admission: North Carolina's increase in minimum math course requirements. *Education Finance and Policy, 14*(3), 492-521.
Clotfelter, C. T., Ladd, H. F., Muschkin, C., & Vigdor, J. L. (2015). Developmental Education in North Carolina Community Colleges. *Educational Evaluation and Policy Analysis* 37 (3), 354–375.
Cohodes, S. R. (2020). The long-run impacts of specialized programming for high-achieving students. *American Economic Journal: Economic Policy*, 12 (1): 127-66.
Cohodes, S. R., & Goodman, J. S. (2014). Merit aid, college quality, and college completion: Massachusetts' Adams scholarship as an in-kind subsidy. *American Economic Journal: Applied Economics, 6*(4), 251-285.
CollegeBoard (2014). *AP report to the nation*. College Board.
Conger, D., Long, M. C., & McGhee Jr, R. (2020). *Advanced placement and initial college enrollment: Evidence from an experiment.* Annenberg Institute, Brown University.
Constantine, J. M., N.S. Seftor, E. Martin, T. Silva, & D. Myers (2006). *Study of the effect of the Talent Search Program on secondary and postsecondary outcomes in Florida, Indiana and Texas. Final report from Phase II of the National Evaluation.* U.S. Department of Education.
Cook, E. E., & Turner, S. (2019). Missed Exams and Lost Opportunities: Who Could Gain From Expanded College Admission Testing? *AERA Open*, *5*(2), 2332858419855030.
Cortes, K. E. (2010). Do bans on affirmative action hurt minority students? Evidence from the Texas Top 10% Plan. *Economics of Education Review, 29*(6), 1110-1124.
Cortes, K. E., Goodman, J. S., & Nomi, T. (2015). Intensive math instruction and educational attainment: Long-run impacts of double-dose algebra. *The Journal of Human Resources, 50*(1), 108-158.
Cortes, K. E., & Klasik, D. (2020). *Uniform admissions, unequal access: Did the Top 10% Plan increase access to selective flagship institutions?* National Bureau of Economic Research.
Cunha, J. M., Miller, T., & Weisburst, E. (2018). Information and college decisions: Evidence from the Texas GO Center project. *Educational Evaluation and Policy Analysis, 40*(1), 151-170.
Currie, J., & Moretti, E. (2003). Mother's education and the intergenerational transmission of human capital: Evidence from college openings. *The Quarterly Journal of Economics*, 118(4), 1495-1532.
Dadgar, M. (2012). *Essays on the economics of community college students' academic and labor market success*. Columbia University (Doctoral dissertation).
Dale, A., & Strauss, A. (2009). Don't forget to vote: Text message reminders as mobilization tools. *American Journal of Political Science*, 53(4), 787-804.
Daly, M. C., & Bengali, L. (2014). Is it still worth going to college? *FRBSF Economic Letter*, 13, 1-5.

Darity Jr, W. A., Hamilton, D., & Stewart, J. B. (2015). A tour de force in understanding intergroup inequality: An introduction to stratification economics. *The Review of Black Political Economy*, *42*(1-2), 1-6.

Darity, W. A., & Mason, P. L. (1998). Evidence on discrimination in employment: Codes of color, codes of gender. *Journal of Economic Perspectives*, *12*(2), 63-90.

Darolia, R., Koedel, C., Martorell, P., Wilson, K., & Perez-Arce, F. (2015). Do employers prefer workers who attend for-profit colleges? Evidence from a field experiment. *Journal of Policy Analysis and Management*, *34*(4), 881-903.

Daugherty, L., Gomez, C. J., Carew, D. G., Mendoza-Graf, A., & Miller, T. (2018). *Designing and implementing corequisite models of developmental education* (Vol. 12). Rand Corporation.

Daugherty, L., Martorell, P. & McFarlin, I. (2014). The Texas Ten Percent Plan's Impact on College Enrollment. Education Next vol. 14 no. 3 (Summer 2014), pp. 63-69.

Dawson, R. F., Kearney, M. S., & Sullivan, J. X. (2020). *Comprehensive approaches to increasing student completion in higher education: A survey of the landscape*. National Bureau of Economic Research.

Declercq, K., & Verboven, F. (2018). Enrollment and degree completion in higher education without admission standards. *Economics of Education Review*, *66*, 223-244.

Dee, T. S. (2004). Are there civic returns to education? *Journal of Public Economics*, *88*(9), 1697-1720.

Deming, D. J., Goldin, C., & Katz, L. F. (2012). The for-profit postsecondary school sector: Nimble critters or agile predators? *Journal of Economic Perspectives*, *26*(1), 139-64.

Deming, D. J., & Walters, C. R. (2017). *The impact of price caps and spending cuts on US postsecondary attainment*. National Bureau of Economic Research.

Deming, D. J., Yuchtman, N., Abulafi, A., Goldin, C., & Katz, L. F. (2016). The value of postsecondary credentials in the labor market: An experimental study. *American Economic Review*, *106*(3), 778-806.

Dennehy, T. C., & Dasgupta, N. (2017). Female peer mentors early in college increase women's positive academic experiences and retention in engineering. *Proceedings of the National Academy of Sciences*, 114(23), 5964-5969.

De Paola, M., & Scoppa, V. (2014). The effectiveness of remedial courses in Italy: A fuzzy regression discontinuity design. *Journal of Population Economics*, *27*(2), 365-386.

De Paola, M., Scoppa, V., & Nisticò, R. (2012). Monetary incentives and student achievement ina depressed labor market: Results from a randomized experiment. *Journal of Human Capital*, *6*(1), 56-85.

Dickson, L. M. (2006). Does ending affirmative action in college admissions lower the percent of minority students applying to college? *Economics of Education Review*, *25*(1), 109-119.

Dillon, E. W., & Smith, J. A. (2013). *The determinants of mismatch between students and colleges*. National Bureau of Economic Research.

Dinkelman, T., & Martínez A, C. (2014). Investing in schooling in Chile: The role of information about financial aid for higher education. *Review of Economics and Statistics*, *96*(2), 244-257.

Domina, T. (2009). What works in college outreach: Assessing targeted and schoolwide interventions for disadvantaged students. *Educational Evaluation and Policy Analysis*, *31*(2), 127-152.

Dougherty, S. M., Goodman, J. S., Hill, D. V., Litke, E. G., & Page, L. C. (2017). Objective course placement and college readiness: Evidence from targeted middle school math acceleration. *Economics of Education Review*, *58*, 141-161.

Duchini, E. (2017). Is college remedial education a worthy investment? New evidence from a sharp regression discontinuity design. *Economics of Education Review*, *60*, 36-53.

Dynarski, S., Libassi, C. J., Michelmore, K., & Owen, S. (2021). Closing the gap: The effect of reducing complexity and uncertainty in college pricing on the choices of low-income students. *American Economic Review*, 111(6), 1721-56.

Edmunds, J. A., Unlu, F., Furey, J., Glennie, E., & Arshavsky, N. (2020). What happens when you combine high school and college? The impact of the early college model on postsecondary performance and completion. *Educational Evaluation and Policy Analysis*, *42*(2), 257-278.

Edmunds, J. A., Unlu, F., Glennie, E., Bernstein, L., Fesler, L., Furey, J., & Arshavsky, N. (2017). Smoothing the transition to postsecondary education: The impact of the early college model. *Journal of Research on Educational Effectiveness*, *10*(2), 297-325.

Ehrenberg, R. G. (2002). Reaching for the brass ring: The US News & World Report rankings and competition. *The Review of Higher Education*, *26*(2), 145-162.

Ehrenberg, R. G., & Zhang, L. (2005). Do tenured and tenure-track faculty matter? *The Journal of Human Resources*, *40*(3), 647-659.

Erwin, C., Binder, M., Miller, C., & Krause, K. (2021). Performance-based aid, enhanced advising, and the income gap in college graduation: Evidence from a randomized controlled trial. *Educational Evaluation and Policy Analysis*, *43*(1), 134-153.

Escueta, M., Nickow, A. J., Oreopoulos, P., & Quan, V. (2020). Upgrading education with technology: Insights from experimental research. *Journal of Economic Literature*, *58*(4), 897-996.

Evans, W. N., Kearney, M. S., Perry, B., & Sullivan, J. X. (2020). Increasing community college completion rates among low-income students: Evidence from a randomized controlled trial evaluation of a case-management intervention. *Journal of Policy Analysis and Management*, *39*(4), 930-965.

Fairlie, R. W., Hoffmann, F., & Oreopoulos, P. (2014). A community college instructor like me: Race and ethnicity interactions in the classroom. *American Economic Review*, *104*(8), 2567-2591.

Figlio, D., Rush, M., & Yin, L. (2013). Is it live or is it internet? Experimental estimates of the effects of online instruction on student learning. *Journal of Labor Economics*, *31*(4), 763-784.

Figlio, D., & Schapiro, M. (2021). Staffing the higher education classroom. *Journal of Economic Perspectives*, *35*(1), 143-162.

Figlio, D. N., Schapiro, M. O., & Soter, K. B. (2015). Are tenure track professors better teachers? *Review of Economics and Statistics*, *97*(4), 715-724.

Francis, A. M., & Tannuri-Pianto, M. (2012). Using Brazil's racial continuum to examine the short-term effects of affirmative action in higher education. *Journal of Human Resources*, *47*(3), 754-784.

Frisancho, V., & Krishna, K. (2016). Affirmative action in higher education in India: targeting, catch up, and mismatch. *Higher Education*, *71*(5), 611-649.

Frisancho, V., Krishna, K., Lychagin, S., & Yavas, C. (2016). Better luck next time: Learning through retaking. *Journal of Economic Behavior & Organization*, *125*, 120-135.

Gamoran, A. (2010). Tracking and inequality. New directions for research and practice. In M. W. Apple, S. J. Ball, & L. A. Gandin (Eds.), *The Routledge international handbook of the sociology of education*. Routledge.

Garet, M., Knudson, J., & Hoshen, G. (2014). *Early college, continued success: Early college high school initiative impact study*. Washington, DC: American Institutes for Research.

Gershenson, S. (2018). *Grade Inflation in High Schools (2005-2016).* Thomas B. Fordham Institute.

Gershenson, S., Hart, C.M., Hyman, J., Lindsay, C. and Papageorge, N.W., 2018. *The long-run impacts of same-race teachers*. National Bureau of Economic Research.

Goldin, C., & Katz, L. F. (2008). *The race between education and technology*. Cambridge, MA: The Belknap Press of Harvard University Press.

Goldrick-Rab, S. (2010). Challenges and opportunities for improving community college student success. *Review of Educational Research*, *80*(3), 437-469.

Goodman, J., Gurantz, O., & Smith, J. (2020). Take two! SAT retaking and college enrollment gaps. *American Economic Journal: Economic Policy*, *12*(2), 115-158.

Goodman, J., Hurwitz, M., & Smith, J. (2015). *College access, initial college choice and degree completion*. National Bureau of Economic Research.

Goodman, S. (2016). Learning from the test: raising selective college enrollment by providing information. *Review of Economics and Statistics*, *98*(4), 671-684.

Gordanier, J., Hauk, W., & Sankaran, C. (2019). Early intervention in college classes and improved student outcomes. *Economics of Education Review*, *72*, 23-29.

Goodman, J., Melkers, J., & Pallais, A. (2019). Can online delivery increase access to education? *Journal of Labor Economics*, *37*(1), 1-34.

Goyer, J. P., Garcia, J., Purdie-Vaughns, V., Binning, K. R., Cook, J. E., Reeves, S. L., . . . Cohen, G. L. (2017). Self-affirmation facilitates minority middle schoolers' progress along college trajectories. *Proceedings of the National Academy of Sciences*, *114*(29), 7594-7599.

Greene, J. P., & Forster, G. (2003). *Public high school graduation and college readiness rates in the United States*. Education Working Paper No. 3. Center for Civic Innovation.

Griffith, A. L. (2014). Faculty gender in the college classroom: Does it matter for achievement and major choice? *Southern Economic Journal*, *81*(1), 211-231.

Griffith, A. L., & Main, J. B. (2021). The role of the teaching assistant: Female role models in the classroom. *Economics of Education Review*, 85, 102179.

Griffith, A. L., & Sovero, V. (2021). Under pressure: How faculty gender and contract uncertainty impact students' grades. *Economics of Education Review*, *83*, 102126.

Gurantz, O. (2019). How college credit in high school impacts postsecondary course-taking: The role of AP exams. *Education Finance and Policy*, 16(2), 1-43.

Gurantz, O., Howell, J., Hurwitz, M., Larson, C., Pender, M., & White, B. (2020). A national-level informational experiment to promote enrollment in selective colleges. *Journal of Policy Analysis and Management*, 40(2), 453-479.

Gurantz, O., Pender, M., Mabel, Z., Larson, C., & Bettinger, E. (2020). Virtual advising for high-achieving high school students. *Economics of Education Review*, 75, 101974.

Guzman-Alvarez, A., & Page, L. C. (2021). Disproportionate burden: Estimating the cost of FAFSA verification for public colleges and universities. *Educational Evaluation and Policy Analysis*, *43*(3), 545-551.

Hart, C. M., Friedmann, E., & Hill, M. (2018). Online course-taking and student outcomes in California community colleges. *Education Finance and Policy*, *13*(1), 42-71.

Haxton, C., Song, M., Zeiser, K., Berger, A., Turk-Bicakci, L., Garet, M. S., . . . Hoshen, G. (2016). Longitudinal findings from the Early College High School initiative impact study. *Educational Evaluation and Policy Analysis*, *38*(2), 410-430.

Heller, D. E., & Callender, C. (2013). *Student financing of higher education: A comparative perspective*. Routledge.

Hemelt, S. W., Schwartz, N. L., & Dynarski, S. M. (2020). Dual-credit courses and the road to college: Experimental evidence from Tennessee. *Journal of Policy Analysis and*

Management, *39*(3), 686-719.
Herber, S. P. (2018). The role of information in the application for highly selective scholarships: Evidence from a randomized field experiment. *Economics of Education Review*, *62*, 287-301.
Hetts, J. J., & Fuenmayor, A. (2013). *Promising pathways to success: Using evidence to dramatically increase student achievement.* Long Beach, CA: Long Beach City College.
Hill, A. J. (2017). State affirmative action bans and STEM degree completions. *Economics of Education Review*, *57*, 31-40.
Himmler, O., Jäckle, R., & Weinschenk, P. (2019). Soft commitments, reminders, and academic performance. *American Economic Journal: Applied Economics*, *11*(2), 114-42.
Hinrichs, P. (2012). The effects of affirmative action bans on college enrollment, educational attainment, and the demographic composition of universities. *Review of Economics and Statistics*, *94*(3), 712-722.
Hinrichs, P. (2014). Affirmative action bans and college graduation rates. *Economics of Education Review*, *42*, 43-52.
Hodara, M. (2012). *Language Minority Students at Community College: How Do Developmental Education and English as a Second Language Affect Their Educational Outcomes?* Columbia University (Doctoral dissertation).
Hodara, M., & Xu, D. (2018). Are two subjects better than one? The effects of developmental English courses on language minority and native English-speaking students' community college outcomes. *Economics of Education Review*, *66*, 1-13.
Hoffmann, F., & Oreopoulos, P. (2009). A professor like me the influence of instructor gender on college achievement. *Journal of Human Resources*, *44*(2), 479-494.
Holzer, H. J., & Baum, S. (2017). *Making college work: Pathways to success for disadvantaged students*. Brookings Institution Press.
Holzer, H. J., & Neumark, D. (2006). Affirmative action: What do we know? *Journal of Policy Analysis and Management*, 25(2), 463-490.
Holzman, B., Klasik, D., & Baker, R. (2019). Gaps in the college application gauntlet. *Research in Higher Education*, 61(7), 795-822.
Horn, L. J., & Skomsvold, P. (2011). *Community college student outcomes: 1994-2009.* Washington, DC: National Center for Education Statistics.
Hossler, D., Schmit, J., & Vesper, N. (1999). *Going to college: How social, economic, and educational factors influence the decisions students make*. Johns Hopkins University Press.
Howell, J. S., Kurlaender, M., & Grodsky, E. (2010). Postsecondary preparation and remediation: Examining the effect of the Early Assessment Program at California State University. *Journal of Policy Analysis and Management*, *29*(4), 726-748.
Howell, J.S. & Pender, M. (2015). The costs and benefits of enrolling in an academically matched college. *Economics of Education Review*, 51, 152-168.
Hoxby, C., & Avery, C. (2013). The missing "one-offs": The hidden supply of high-achieving, low-income students. *Brookings Papers on Economic Activity*, *2013*(1), 1-65.
Hoxby, C., & Turner, S. (2013). Expanding college opportunities for high-achieving, low income students. *Stanford Institute for Economic Policy Research Discussion Paper*, (12-014).
Hurwitz, M., & Howell, J. (2014). Estimating causal impacts of school counselors with regression discontinuity designs. *Journal of Counseling & Development*, *92*(3), 316-327.
Hurwitz, M., & Lee, J. (2018). Grade inflation and the role of standardized testing. In: Buckley, J., Letukas, L., & Wildavsky, B. (Eds.), *Measuring success: Testing, grades, and the future of college admissions*, pp. 64-93, Johns Hopkins University Press.

Hurwitz, M., Mbekeani, P. P., Nipson, M. M. & Page, L. C. (2017). Surprising ripple effects: How changing the SAT score-sending policy for low-income students impacts college access and success. *Educational Evaluation and Policy Analysis*, *39*(1), 77-103.

Hurwitz, M., & Smith, J. (2018). Student responsiveness to earnings data in the College Scorecard. *Economic Inquiry*, *56*(2), 1220-1243.

Hurwitz, M., Smith, J., Niu, S., & Howell, J. (2015). The Maine question: How is 4-year college enrollment affected by mandatory college entrance exams? *Educational Evaluation and Policy Analysis*, *37*(1), 138-159.

Hyman, J. (2017). ACT for all: The effect of mandatory college entrance exams on postsecondary attainment and choice. *Education Finance and Policy*, *12*(3), 281-311.

Hyman, J. (2020). Can light-touch college-going interventions make a difference? Evidence from a statewide experiment in Michigan. *Journal of Policy Analysis and Management*, *39*(1), 159-190.

Jackson, C. K. (2010). A little now for a lot later: A look at a Texas Advanced Placement incentive program. *Journal of Human Resources*, 45(3), 591-639.

Jackson, C. K. (2014). Do college-preparatory programs improve long-term outcomes? *Economic Inquiry*, *52*(1), 72-99.

Jacob, B., Dynarski, S., Frank, K., & Schneider, B. (2017). Are expectations alone enough? Estimating the effect of a mandatory college-prep curriculum in Michigan. *Educational Evaluation and Policy Analysis*, *39*(2), 333-360.

Jacoby, D. (2006). Effects of part-time faculty employment on community college graduation rates. *The Journal of Higher Education*, *77*(6), 1081-1103.

Jaggars, S., & Bailey, T. R. (2010). *Effectiveness of fully online courses for college students: Response to a Department of Education meta-analysis.* Community College Research Center, Teachers College, Columbia University.

Jenkins, P. D., & Fink, J. (2016). *Tracking transfer: New measures of institutional and state effectiveness in helping community college students attain bachelor's degrees*. Community College Research Center, Teachers College, Columbia University.

Joshi, S., & Barnes, S. (2021). Impact of a low-cost postsecondary enrollment intervention: Evidence from Louisiana. *Education Finance and Policy*, 16(3), 493-515.

Jump, J. (2020). *Ethical college admissions: Chicago declares test optional a success.* Inside Higher Ed.

Kain, J. F., O'Brien, D. M., & Jargowsky, P. A. (2005). *Hopwood and the top 10 percent law: How they have affected the college enrollment decisions of Texas high school graduates.*Texas School Project, University of Texas at Dallas.

Kane, T. J., Boatman, A., Kozakowski, W., Bennett, C., Hitch, R., & Weisenfeld, D. (2021). Is college remediation a barrier or a boost? Evidence from the Tennessee SAILS program. *Journal of Policy Analysis and Management*, 40(3), 883-913.

Karlan, D., McConnell, M., Mullainathan, S., & Zinman, J. (2010). *Getting to the top of mind: How reminders increase saving*. National Bureau of Economic Research.

Kelly, S., & Price, H. (2011). The correlates of tracking policy: Opportunity hoarding, status competition, or a technical-functional explanation? *American Educational Research Journal*, *48*(3), 560-585.

Khanna, G. (2020). Does affirmative action incentivize schooling? evidence from India. *Review of Economics and Statistics*, *102*(2), 219-233.

Kim, S. C., Oliveri, D., Riingen, M., Taylor, B., & Rankin, L. (2013). Randomized controlled trial of graduate-to-undergraduate student mentoring program. Journal of Professional Nursing, 29(6), e43-e49.

Kim, S., Wallsworth, G., Xu, R., Schneider, B., Frank, K., Jacob, B., & Dynarski, S. (2019). The impact of the Michigan Merit Curriculum on high school math course-taking. *Educational Evaluation and Policy Analysis*, *41*(2), 164-188.

Kirst, M., & Venezia, A. (2004). *From high school to college: Improving opportunities for success*. San Francisco: Jossey-Bass.

Klasik, D. (2012). The college application gauntlet: A systematic analysis of the steps to four-year college enrollment. *Research in Higher Education*, 53, 506-549.

Klasik, D. (2013). The ACT of enrollment: The college enrollment effects of state-required college entrance exam testing. *Educational Researcher*, *42*(3), 151-160.

Kofoed, M. S., Gebhart, L., Gilmore, D., & Moschitto, R. (2021). *Zooming to Class? Experimental Evidence on College Students&Apos; Online Learning During Covid-19.* IZA Discussion Paper(14356).

Kofoed, M. S., & McGovney, E. (2019). The effect of same-gender or same-race role models on occupation choice evidence from randomly assigned mentors at west point. *Journal of Human Resources*, *54*(2), 430-467.

Kozakowski, W. (2019). Moving the classroom to the computer lab: Can online learning with in-person support improve outcomes in community colleges? *Economics of Education Review*, *70*, 159-172.

Kraft, M. A., & Rogers, T. (2015). The underutilized potential of teacher-to-parent communication: Evidence from a field experiment. *Economics of Education Review*, *47*, 49-63.

Kurlaender, M., Lusher, L., & Case, M. (2020). Is early start a better start? Evaluating California State University's Early Start remediation policy. *Journal of Policy Analysis and Management*, *39*(2), 348-375.

Labaree, D. (2017). *A perfect mess: The unlikely ascendancy of American Higher Education*. Univeristy of Chicago Press.

Lareau, A. (2000). *Home advantage: Social class and parental intervention in elementary education*. Rowman & Littlefield Publishers.

Lareau, A. (2011). *Unequal childhoods: Class, race, and family life*. University of California Press.

Lavecchia, A. M., Liu, H. & Oreopoulos, P. (2016). Behavioral economics of education: Progress and possibilities. In Hanushek, E. A., Machin, S. J., & Woessmann, L. (Eds.). *Handbook of the Economics of Education* (Vol. 5, pp. 1-74). Elsevier.

Lavecchia, A. M., Oreopoulos, P., & Brown, R. S. (2020). Long-run effects from comprehensive student support: Evidence from Pathways to Education. *American Economic Review: Insights*, *2*(2), 209-224.

Lavy, V., Kott, A., & Rachkovski, G. (2021). Does remedial education at late childhood pay off after all? Long-run consequences for university schooling, labor market outcomes and inter-generational mobility. *Journal of Labor Economics*, 40(1), 239-282.

Lee, J. C., Dell, M., González Canché, M. S., Monday, A., & Klafehn, A. (2021). The hidden costs of corroboration: Estimating the effects of financial aid verification on college enrollment. *Educational Evaluation and Policy Analysis*, *43*(2), 233-252.

Levin, H. M., & Garcia, E. (2013). Benefit-cost analysis of Accelerated Study in Associate Programs (ASAP) of the City University of New York (CUNY). Center for the Benefit-Cost Studies in Education. Teachers College, Columbia University.

Levine, P. B. (2014). *Transparency in college costs.* Brookings Institution, Economic Studies Working Paper.

Light, A., & Strayer, W. (2000). Determinants of college completion: School quality or student

ability? *Journal of Human Resources*, 35(2), 299-332.
Lindsay, C. A., & Hart, C. M. (2017). Exposure to same-race teachers and student disciplinary outcomes for Black students in North Carolina. *Educational Evaluation and Policy Analysis*, 39(3), 485-510.
Linkow, T., Bumgarner, E., Didriksen, H., Lack, K., Nichols, A., Dastrup, E., . . . Gamse, B. (2019). *The story of scaling up: Interim report on the impact of Success Boston's coaching for completion.* Abt Associates.
Linkow, T., Gamse, B., Unlu, F., Bumgarner, E., Didriksen, H., Furey, J., . . . Nichols, A. (2017). *The power of coaching: Highlights from the interim report on the impact of Success Boston's transition coaching on college success.* Abt Associates.
Linkow, T., Miller, H., Parsad, A., Price, C., & Martinez, A. (2021). *Study of college transition messaging in GEAR UP: Impacts on enrolling and staying in college*. U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance.
Lochner, L., & Moretti, E. (2004). The effect of education on crime: Evidence from prison inmates, arrests, and self-reports. *American Economic Review*,*94*(1), 155-189.
Loewenstein, G., Sunstein, C. R., & Golman, R. (2014). Disclosure: Psychology changes everything. *Economics, 6, 391-419.*
Logue, A. W., Douglas, D., & Watanabe-Rose, M. (2019). Corequisite mathematics remediation: Results over time and in different contexts. *Educational Evaluation and Policy Analysis, 41*(3), 294-315.
Logue, A. W., Watanabe-Rose, M., & Douglas, D. (2016). Should students assessed as needing remedial mathematics take college-level quantitative courses instead? A randomized controlled trial. *Educational Evaluation and Policy Analysis*, *38*(3), 578-598.
Long, B. T. (2004). Does the format of an aid program matter? The effect of in-kind tuition subsidies." *Review of Economics and Statistics,* vol. 86, no. 3, pp. 767-782.
Long, B. T., & Riley, E. (2007). Financial aid: A broken bridge to college access? *Harvard Educational Review, 77*(1), 39-63.
Loyalka, P., Song, Y., Wei, J., Zhong, W., & Rozelle, S. (2013). Information, college decisions and financial aid: Evidence from a cluster-randomized controlled trial in China. *Economics of Education Review, 36,* 26-40.
Lusher, L., Campbell, D., & Carrell, S. (2018). TAs like me: Racial interactions between graduate teaching assistants and undergraduates. *Journal of Public Economics, 159,* 203-224.
Ly, S. T., Maurin, E., & Riegert, A. (2020). A pleasure that hurts: the ambiguous effects of elite tutoring on underprivileged high school students. *Journal of Labor Economics*, *38*(2), 501-533.
Mansour, H., Rees, D. I., Rintala, B. M., & Wozny, N. N. (2018). The effects of professor gender on the postgraduation outcomes of female students. *ILR Review*, 0019793921994832.
Martinez, A., Linkow, T., Miller, H., & Parsad, A. (2018). *Study of enhanced college advising in Upward Bound: Impacts on steps toward college (NCEE 2019-4002)*. National Center for Education Evaluation, Institute of Education Sciences, U.S. Department of Education.
Martinson, K., Cho, S.-W., Gardiner, K., & Glosser, A. (2018). *Washington state's Integrated Basic Education and Skills Training (I-BEST) program in three colleges: Implementation and early impact report. Pathways for advancing careers and education (OPRE Report No. 2018-87).* Office of Planning, Research, and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services.
Martorell, P., & McFarlin, I. J. (2011). Help or hindrance? The effects of college remediation on academic and labor market outcomes. *The Review of Economics and Statistics*, 93(2), 436–

454.
Martorell, P., McFarlin Jr, I., & Xue, Y. (2015). Does failing a placement exam discourage underprepared students from going to college? *Education Finance and Policy*, *10*(1), 46-80.
McPherson, M. S., & Bacow, L. S. (2015). Online higher education: Beyond the hype cycle. *Journal of Economic Perspectives*, *29*(4), 135-154.
Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2009). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies*. U.S. Department of Education, Center for Technology in Learning.
Mettler, S. (2014). *How U.S. higher education promotes inequality—and what can be done to broaden access and graduation.* Cambridge, MA: Harvard University, Scholars Strategy Network.
Meyer, K., & Rosinger, K. O. (2019). Applying behavioral insights to improve postsecondary education outcomes: A review of Obama administration efforts and next steps under the Trump administration. *Journal of Policy Analysis and Management*, *38*(2), 481-499.
Milkman, K.L., Beshears, J., Choi, J.J., Laibson, D, & Madrian, B.C. (2012). *Following through on good intentions: The power of planning prompts.* National Bureau of Economic Research.
Miller, B. J., & Skimmyhorn, W. L. (2018). I want you! Expanding college access through targeted recruiting efforts. *Education Finance and Policy*, *13*(3), 395-418.
Miller, C., Headlam, C., Manno, M., & Cullinan, D. (2020). *Increasing community college graduation rates with a proven model: Three-year results from the Accelerated Study in Associate Programs (ASAP) Ohio demonstration*. MDRC.
Miller, T., Kosiewicz, H., Tanenbaum, C., Atchison, D., Knight, D., Ratway, B., . . . Gebremariam, H. (2018). *Dual-credit education programs in Texas: Phase II*. American Institutes for Research.
Modicamore, D., Lamb, Y., Taylor, J., Takyi-Laryea, A., Karageorge, K., & Ferroggiaro, E. (2018). *Accelerating Connections to Employment: Final evaluation report*. ICF International.
Mokher, C. G., Leeds, D. M., & Harris, J. C. (2018). Adding it up: How the Florida College and Career Readiness initiative impacted developmental education. *Educational Evaluation and Policy Analysis*, *40*(2), 219-242.
Morisano, D., Hirsh, J. B., Peterson, J. B., Pihl, R. O., & Shore, B. M. (2010). Setting, elaborating, and reflecting on personal goals improves academic performance. *Journal of Applied Psychology*, *95*(2), 255.
Mulhern, C. (2021). Changing college choices with personalized admissions information at scale: Evidence on Naviance. *Journal of Labor Economics*, *39*(1), 219-262.
Muralidharan, K., & Sheth, K. (2016). Bridging education gender gaps in developing countries: The role of female teachers. *Journal of Human Resources*, 51(2), 269-297.
Niu, S. X., & Tienda, M. (2010). The impact of the Texas top ten percent law on college enrollment: A regression discontinuity approach. *Journal of Policy Analysis and Management*, *29*(1), 84-110.
Nurshatayeva, A., Page, L. C., White, C. C., & Gehlbach, H. (2021). Are artificially intelligent conversational chatbots uniformly effective in reducing summer melt? Evidence from a randomized controlled trial. *Research in Higher Education*, *62*(3), 392-402.
O'Connell, S. D., & Lang, G. (2018). Can personalized nudges improve learning in hybrid classes? Experimental evidence from an introductory undergraduate course. *Journal of Research on Technology in Education*, *50*(2), 105-119.

Oreopoulos, P. (2021). What limits college success? A review and further analysis of Holzer and Baum's M*aking College Work*. *Journal of Economic Literature, 59*(2), 546-573.
Oreopoulos, P., & Dunn, R. (2013). Information and college access: Evidence from a randomized field experiment. *The Scandinavian Journal of Economics*, *115*(1), 3-26.
Oreopoulos, P., & Ford, R. (2019). Keeping college options open: A field experiment to help all high school seniors through the college application process. *Journal of Policy Analysis and Management*, *38*(2), 426-454.
Oreopoulos, P., & Petronijevic, U. (2018). Student coaching: How far can technology go? *Journal of Human Resources*, *53*(2), 299-329.
Oreopoulos, P., & Petronijevic, U. (2019). *The remarkable unresponsiveness of college students to nudging and what we can learn from it*. National Bureau of Economic Research.
Ortagus, J. C., Tanner, M., & McFarlin, I. (2020). Can re-enrollment campaigns help dropouts return to college? Evidence from Florida Community Colleges. *Educational Evaluation and Policy Analysis*, *43*(1), 154-171.
Page, L. C., Castleman, B. L., & Meyer, K. (2020). Customized nudging to improve FAFSA completion and income verification. *Educational Evaluation and Policy Analysis*, 42(1), 3-21.
Page, L. C., & Gehlbach, H. (2017). How an artificially intelligent virtual assistant helps students navigate the road to college. *AERA Open*, *3*(4), 1-12.
Page, L. C., Kehoe, S. S., Castleman, B. L., & Sahadewo, G. A. (2019). More than dollars for scholars: The impact of the Dell scholars program on college access, persistence, and degree attainment. *Journal of Human Resources*, *54*(3), 683-725.
Page, L. C., Lee, J., & Gehlbach, H. (2020). *The conditions under which college students are responsive to nudging*. Annenberg Institute.
Page, L. C., & Nurshatayeva, A. (2022). Behavioral economics of higher education: Theory, evidence, and implications for policy and practice. In N. A. Bowman (Ed.), *How college students succeed: Making meaning across disciplinary perspectives* (pp. 75-115). Stylus.
Page, L. C., & Scott-Clayton, J. (2016). Improving college access in the United States: Barriers and policy responses. *Economics of Education Review*, *51*, 4-22.
Pallais, A. (2015). Small Differences that Matter: Mistakes in Applying to College. *Journal of Labor Economics*. 33(2):493-520.
Park, E. S., & Ngo, F. (2021). The effect of developmental math on STEM participation in community college: Variation by race, gender, achievement, and aspiration. *Educational Evaluation and Policy Analysis*, *43*(1), 108-133.
Patel, R., & Valenzuela, I. (2013). *Moving forward: Early findings from the performance-based scholarship demonstration in Arizona. The performance-based scholarship demonstration.* MDRC.
Patterson, R. W., & Patterson, R. M. (2017). Computers and productivity: Evidence from laptop use in the college classroom. *Economics of Education Review*, *57*, 66-79.
Peter, F. H., & Zambre, V. (2017). Intended college enrollment and educational inequality: Do students lack information? *Economics of Education Review*, *60*, 125-141.
Phillips, M., & Reber, S. J. (2019). *Does virtual advising increase college enrollment? Evidence from a random assignment college access field experiment*. National Bureau of Economic Research.
Philp, J. D. (2015). *FLIGHT final evaluation report: Facilitating long-term improvements in graduation and higher education for tomorrow*. The Evaluation Group.
Planty, M., Hussar, W., Snyder, T., Kena, G., Kewal Ramani, A., Kemp, J., Bianco, K., Dinkes, R. (2009). *The condition of education 2009 (NCES 2009-081).* National Center for

Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC.

Porter, C., & Serra, D. (2020). Gender differences in the choice of major: The importance of female role models. *American Economic Journal: Applied Economics*, *12*(3), 226-254.

Posselt, J. R., Jaquette, O., Bielby, R., & Bastedo, M. N. (2012). Access without equity: Longitudinal analyses of institutional stratification by race and ethnicity, 1972–2004. *American Educational Research Journal*, 49(6), 1074-1111.

Price, J. (2010). The effect of instructor race and gender on student persistence in STEM fields. *Economics of Education Review*, *29*(6), 901-910.

Radford, A. W. (2013). *Top student, top school? How social class shapes where valedictorians go to college*. University of Chicago Press.

Ran, F. X., & Sanders, J. (2020). Instruction quality or working condition? The effects of part-time faculty on student academic outcomes in community college introductory courses. *AERA Open*, *6*(1), 2332858420901495.

Ran, F. X., & Xu, D. (2019). Does contractual form matter? The impact of different types of non-tenure-track faculty on college students' academic outcomes. *Journal of Human Resources*, *54*(4), 1081-1120.

Richburg-Hayes, L., Brock, T., LeBlanc, A., Paxson, C. H., Rouse, C. E., & Barrow, L. (2009). *Rewarding persistence: Effects of a performance-based scholarship program for low-income parents*. MDRC.

Rizzica, L. (2020). Raising aspirations and higher education: Evidence from the United Kingdom's widening participation policy. *Journal of Labor Economics*, *38*(1), 183-214.

Roderick, M., Nagaoka, J., Coca, V., & Moeller, E. (2008). *From High School to the Future: Potholes on the Road to College.* Consortium on Chicago School Research.

Roderick, M., Nagaoka, J., Coca, V. & Moeller, E. (2009). *From high school to the future: Making hard work pay off.* Chicago: Consortium on Chicago School Research.

Rodriguez-Planas, N. (2012). Longer-term impacts of mentoring, educational services, and learning incentives: Evidence from a randomized trial in the United States. *American Economic Journal: Applied Economics*, *4*(4), 121-139.

Rodríguez-Planas, N. (2017). School, drugs, mentoring, and peers: Evidence from a randomized trial in the US. *Journal of Economic Behavior & Organization*, *139*, 166-181.

Rolston, H., Copson, E., Buron, L., & Dastrup, S. (2021). *Valley Initiative for Development and Advancement: Three year impact report.* OPRE Report 2021-96. Washington, DC: Office of Planning, Research, and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services.

Rolston, H., Copson, E., Gardiner, K., & Constance, N. (2017). *Valley Initiative for Development and Advancement: Implementation and Early Impact Report*. OPRE Report #2017-83, Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services.

Rosenbaum, J., Deil-Amen, R., & Person, A. (2006). *After admission: From college access to college success.* New York: Russell Sage.

Rosinger, K. O. (2017). Federal policy efforts to simplify college-going: An intervention in community college enrollment and borrowing. *The ANNALS of the American Academy of Political and Social Science*, *671*(1), 114-131.

Ross, R., White, S., Wright, J., & Knapp, L. (2013). *Using behavioral economics for postsecondary success*. Ideas42.

Rossman, D., Alamuddin, R., Kurzweil, M., Karon, J. (2021). *MAAPS advising experiment evaluation findings after four years.* Ithaka S + R.

Rothstein, R. (2015). The Racial Achievement Gap, Segregated Schools, and Segregated Neighborhoods: A Constitutional Insult. *Race and Social Problems* 7(1): 21-30.

Russell, L. (2019). Better outcomes without increased costs? Effects of Georgia's university system consolidations. *Economics of Education Review, 68*, 122-135.

Rutschow, E. Z., & Mayer, A. K. (2018). *Early Findings from a National Survey of Developmental Education Practices. Research Brief.* Center for the Analysis of Postsecondary Readiness.

Rutschow, E. Z., Sepanik, S., Deitch, V., Raufman, J., Dukes, D. C., & Moussa, A. (2019). *Gaining ground: Findings from the Dana Center Mathematics Pathways impact study*. Community College Research Center at Teachers College, Columbia University, and MDRC.

Saavedra, A.R. (2011). *The academic impact of enrollment in International Baccalaureate Diploma Programs: A case study of Chicago Public Schools*. RAND.

Saboe, M., & Terrizzi, S. (2019). SAT optional policies: Do they influence graduate quality, selectivity or diversity? *Economics Letters, 174*, 13-17.

Schirm, A., Rodriguez-Planas, N., Maxfield, M., & Tuttle, C. (2003). *The Quantum Opportunity program demonstration: Short-term impacts*. Mathematica Policy Research.

Schirm, A., Stuart, E., & McKey, A. (2006). *The Quantum Opportunity program demonstration: Final impacts*. Mathematica Policy Research.

Scott-Clayton, J. (2011). On money and motivation: A quasi-experimental analysis of financial incentives for college achievement. *Journal of Human Resources 46* (3): 614–46.

Scott-Clayton, J. (2018). *The looming student loan crisis is worse than we thought.* Brookings.

Scott-Clayton, J., Crosta, P. M., & Belfield, C. R. (2014). Improving the targeting of treatment: Evidence from college remediation. *Educational Evaluation and Policy Analysis, 36*(3), 371-393.

Scott-Clayton, J. & Rodriguez, O. (2015). Development, discouragement, or diversion? New evidence on the effects of college remediation policy. *Education Finance and Policy,* 10 (1): 4-45.

Scrivener, S., & Coghlan, E. (2011). *Opening doors to student success: A synthesis of findings from an evaluation at six community colleges*. MDRC.

Scrivener, S., Sommo, C., & Collado, H. (2009). *Getting back on track: Effects of a community college program for probationary students*. MDRC.

Scrivener, S., & Weiss, M. J. (2009). *More guidance, better results? Three-year effects of an enhanced student services program at two community colleges. MDRC.*

Scrivener, S., Weiss, M. J., Ratledge, A., Rudd, T., Sommo, C. & Fresques, H. (2015). *Doubling graduation rates: Thee-year effects of CUNY's Accelerated Study in Associate Programs (ASAP) for Developmental Education Students.* MDRC.

Seftor, N. S., Mamun, A., & Schirm, A. (2009). *The impacts of regular Upward Bound on postsecondary outcomes seven to nine years after scheduled high school graduation: Final report*. US Department of Education.

Sherwin, J. (2012). *Make me a match: Helping low-income and first-generation students make good college choices. Policy Brief.* MDRC.

Sidiqqi, J., & Mikolowsky, J. (2019). *Attainment for all postsecondary pathways: The Early College High School model*. Hunt Institute.

Smith, B. O., White, D. R., Kuzyk, P. C., & Tierney, J. E. (2018). Improved grade outcomes with an e-mailed "grade nudge". *The Journal of Economic Education, 49*(1), 1-7.

Smith, J. (2013). The effect of college applications on enrollment. *The BE Journal of Economic Analysis & Policy, 14*(1), 151-188.

Smith, J., Howell, J., & Hurwitz, M. (2022). The impact of college outreach on high schoolers' college choices: Results from over 1,000 natural experiments. *Education Finance and*

Policy, 17(1), 105-128.
Smith, J., Hurwitz, M., & Avery, C. (2017). Giving college credit where it is due: Advanced Placement exam scores and college outcomes. *Journal of Labor Economics, 35*(1), 67-147.
Smith, J., Hurwitz, M., & Howell, J. (2015). Screening mechanisms and student responses in the college market. *Economics of Education Review*, *44*, 17-28.
Smith, J., Pender, M., & Howell, J. (2013). The full extent of student-college academic undermatch. *Economics of Education Review, 32*, 247-261.
Solanki, S. M., & Xu, D. (2018). Looking beyond academic performance: The influence of instructor gender on student motivation in STEM fields. *American Educational Research Journal*, *55*(4), 801-835.
Sommo, C., Cullinan, D., Manno, M., Blake, S., & Alonzo, E. (2018). *Doubling graduation rates in a new state: Two-year findings from the ASAP Ohio demonstration*. MDRC.
Sommo, C., Mayer, A. K., Rudd, T., & Cullinan, D. (2012). *Commencement day: Six-year effects of a freshman learning community program at Kingsborough Community College*. MDRC.
Starck, J. G., Riddle, T., Sinclair, S., & Warikoo, N. (2020). Teachers are people too: Examining the racial bias of teachers compared to other American adults. *Educational Researcher*, *49*(4), 273-284.
Steinberg, L. (2008). A social neuroscience perspective on adolescent risk-taking. *Development Review 28: 78-106.*
Steinberg, L., Cauffman, E., Woolard, J., Graham, S., & Banich, M. (2009). Are adolescents less mature than adults? Minors' access to abortion, the juvenile death penalty, and the alleged APA "Flip-Flop." *American Psychologist 64:* 583-594.
Stephan, J. L., & Rosenbaum, J. E. (2013). Can high schools reduce college enrollment gaps with a new counseling model? *Educational Evaluation and Policy Analysis*, *35*(2), 200-219.
Stoddard, C., Urban, C., & Schmeiser, M. (2017). Can targeted information affect academic performance and borrowing behavior for college students? Evidence from administrative data. *Economics of Education Review, 56*, 95-109.
Sullivan, Z., Castleman, B. L., & Bettinger, E. (2019). *College advising at a national scale: Experimental evidence from the CollegePoint initiative*. Annenberg Institute, Brown University.
Swail, W. S., & Perna, L. W. (2002). Pre-college outreach programs. In W. G. Tierney & L. S. Hagedorn (Eds.), *Increasing access to college: Extending possibilities for all students* (Vol. 37, pp. 15-34). State University of New York Press.
Thaler, R. H. & Mullainathan, S. (2008). "Behavioral Economics." *The Concise Encyclopedia of Economics.* Library of Economics and Liberty.
Thaler, R. H., & Sunstein, C. R. (2008). *Nudge: Improving decisions about health, wealth, and happiness.* Yale University Press.
Theokas, C., & Saaris, R. (2013). *Finding America's missing AP and IB students*. The Education Trust.
Thomas, N., Marken, S., Gray, L., & Lewis, L. (2013). *Dual credit and exam-based courses in US public high schools: 2010-11*. US Department of Education, National Center for Education Statistics.
Tienda, M., Leicht, K. T., Sullivan, T., Maltese, M., & Lloyd, K. (2003). *Closing the gap? Admissions and enrollments at the Texas public flagships before and after affirmative action*. Office of Population Research, Princeton University.
Tough, P. (2021). *The Inequality Machine: How universities are creating a more unequal world-and what to do about it*. Random House.
U.S. Census. (2021). Educational attainment tables 2020. Available at www.census.gov.

Vieira, R. S., & Arends-Kuenning, M. (2019). Affirmative action in Brazilian universities: Effects on the enrollment of targeted groups. *Economics of Education Review*, *73*, 101931.

Walton, G.M., & Cohen, G.L. (2007). A question of belonging: Race, social fit, and achievement. *Journal of Personality and Social Psychology 92*(1): 82-96.

Walton, G. M., Logel, C., Peach, J. M., Spencer, S. J., & Zanna, M. P. (2015). Two brief interventions to mitigate a "chilly climate" transform women's experience, relationships, and achievement in engineering. *Journal of Educational Psychology*, *107*(2), 468.

Webber, D. A., & Ehrenberg, R. G. (2010). Do expenditures other than instructional expenditures affect graduation and persistence rates in American higher education? *Economics of Education Review*, 29(6), 947-958.

Weiss, M. J., Ratledge, A., Sommo, C., & Gupta, H. (2019). Supporting community college students from start to degree completion: Long-term evidence from a randomized trial of CUNY's ASAP. *American Economic Journal: Applied Economics*, *11*(3), 253-297.

Weiss, M. J., Scrivener, S., Slaughter, A., & Cohen, B. (2021). An on-ramp to student success: A randomized controlled trial evaluation of a developmental education reform at the City University of New York. *Educational Evaluation and Policy Analysis*, 43(4), 555-586.

Weiss, M. J., Visher, M. G., & Wathington, H. (2010). Learning communities for students in developmental reading: An impact study at Hillsborough Community College. *National Center for Postsecondary Research*.

Weiss, M. J., Visher, M. G., Weissman, E., & Wathington, H. (2015). The impact of learning communities for students in developmental education: A synthesis of findings from randomized trials at six community colleges. *Educational Evaluation and Policy Analysis*, *37*(4), 520-541.

Weissman, E., Butcher, K. F., Schneider, E., Teres, J., Collado, H., & Greenberg, D. H. (2011). *Learning communities for students in developmental math: Impact studies at Queensborough and Houston Community Colleges*. National Center for Postsecondary Research.

Weissman, E., Cullinan, D., Cerna, O., Safran, S., & Richman, P. (2012). *Learning communities for students in developmental English: Impact studies at Merced College and the Community College of Baltimore County*. National Center for Postsecondary Research.

Wiederspan, M. (2019). *Impact of verification on Iowa FAFSA filers*. Iowa College Aid.

Xu, D. (2019). Academic performance in community colleges: The influences of part-time and full-time instructors. *American Educational Research Journal*, *56*(2), 368-406.

Xu, D., Glick, D., Rodriguez, F., Cung, B., Li, Q., & Warschauer, M. (2020). Does blended instruction enhance English language learning in developing countries? Evidence from Mexico. *British Journal of Educational Technology*, *51*(1), 211-227.

Xu, D., & Jaggars, S. S. (2013). The impact of online learning on students' course outcomes: Evidence from a large community and technical college system. *Economics of Education Review*, *37*, 46-57.

Xu, D., & Ran, F. X. (2021). The impacts of different types of college instructors on students' academic and labor market outcomes. *Journal of Policy Analysis and Management*, *40*(1), 225-257.

Xu, D., & Solanki, S. (2020). Tenure-track appointment for teaching-oriented faculty? The impact of teaching and research faculty on student outcomes. *Educational Evaluation and Policy Analysis*, *42*(1), 66-86.

Xu, D., & Xu, Y. (2020). The ambivalence about distance learning in higher education: Challenges, opportunities, and policy implications. In *Higher Education: Handbook of*

Theory and Research (Vol. 35, pp. 351-400). Springer.

Yeager, D. S., Henderson, M. D., Paunesku, D., Walton, G. M., D'Mello, S., Spitzer, B. J., & Duckworth, A. L. (2014). Boring but important: a self-transcendent purpose for learning fosters academic self-regulation. *Journal of personality and social psychology*, *107*(4), 559.

Yeager, D. S., Walton, G. M., Brady, S. T., Akcinar, E. N., Paunesku, D., Keane, L., . . . Urstein, R. (2016). Teaching a lay theory before college narrows achievement gaps at scale. *Proceedings of the National Academy of Sciences*, *113*(24), E3341-E3348.

York, B. N., & Loeb, S. (2019). *One step at a time: the effects of an early literacy text messaging program for parents of preschoolers.* *Journal of Human Resources*, *54*(3), 537-566.

Table 1. K-12 curricular intensification

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Allensworth et al. (2009)	Mandatory college-prep courses	Chicago Public Schools	ITS, DiD	College enrollment↔
Attewell & Domina (2008)	Academic curricular intensity	NELS 1988	PSM	College enrollment, completion↑
Aughinbaugh (2012)	High school math curriculum	NLSY 1997	OLS	College enrollment↑
Berggren & Jeppsson (2021)	Decrease in math requirements	Statistics Sweden	RD-DD	College enrollment & completion↑
Clotfelter et al. (2019)	Higher math requirements for college admission	NC Dept. of public instruction, U of N. Carolina	IV	College enrollment, performance↑
Cohodes (2020)	Accelerated curriculum	Boston Public Schools	Fuzzy RDD	College enrollment↑.
Cortes et al. (2015)	Intensive algebra instruction	Chicago Public Schools	RDD	ACT scores, college enrollment↑
Dougherty et al. (2017)	Algebra 1 in 8th grade	Wake County Public Schools	RDD	College readiness, aspirations↑
Jacob et al. (2017)	Michigan Merit Curriculum	Michigan CEPI	ITS	ACT scores↔
Kim et al. (2019)	Michigan Merit Curriculum	Michigan Transcript Study	Pre-post design	College enrollment↑

Table 2. Dual enrollment and other high school-based interventions

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
A. Advanced Placement coursework				
Arce-Trigatti (2018)	Offer of AP programs	Arkansas Dept. of Education	DiD	High school enrollment↓ & graduation↑
Conger et al. (2020)	AP Chemistry/Biology enrollment	High school transcripts	RCT	College enrollment↔
Gurantz (2019)	AP score earning college credit	College Board	RDD	Depth and breadth of STEM college courses↑
Jackson (2010)	AP Incentive Program	Texas Education Agency	DiD	SAT/ACT scores, college enrollment↑.
Jackson (2014)	AP Incentive Program	Texas Education Agency	DiD	College enrollment↔, persistence↑, completion↔
Smith et al. (2017)	AP score earning college credit	College Board	RDD	College completion↑
B. Dual enrollment courses				
Hemelt et al. (2020)	Dual credit advanced algebra	Tennessee Longitudinal Data System	RCT	College enrollment↔
Miller et al. (2018)	Dual credit coursework	Texas Education Agency	IV, DiD	College enrollment, degree attainment↑
C. Early College High Schools				
Edmunds et al. (2017)	Early College High Schools	12 ECHSs in North Carolina	RCT	College enrollment, associate degree completion↑
Edmunds et al. (2020)	Early College High Schools	12 ECHSs in North Carolina	RCT	Postsecondary degree attainment↑
Haxton et al. (2016) See also Berger et al. (2013), Garet et al. (2014)	Early College High Schools	10 ECHSs across the US	RCT	College enrollment, degree attainment↑

Table 3. Remedial coursework

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Barnett et al. (2012)	Summer bridge program	Texas HECB	RCT	Credits attempted/earned, persistence↔
Bettinger & Long (2009)	Remedial courses	Ohio Boards of Regents	IV	Persistence, bachelor's degree completion↑
Boatman & Bennett (2020)	Tennessee SAILS	Tennessee Longitudinal Data System	DiDiD	Performance in college math↑, college enrollment↔, credential attainment↔
Boatman & Long (2018)	Remedial & developmental courses	Tennessee Board of Regents	RDD	Credits earned, persistence, completion↓ for students at the cutoff, ↑ for low-achieving
Calcagno & Long (2008)	Remedial courses	Florida Department of Educ.	RDD	Persistence↑, completion↔
Clotfelter et al. (2015)	Remedial courses	NC Education Research Data Center	IV	Performance in college-level courses↓, persistence ↔
De Paola & Scoppa (2014)	Remedial courses	University of Calabria	Fuzzy RDD	Credits earned↑, dropout↓
Duccini (2017)	Remedial policy	A university in Italy	RDD	Persistence, performance↔
Hodara & Xu (2018)	2 remedial English courses vs. 1	Large public college system	RDD	Persistence, taking/passing proficiency exam↑ for language minority students
Howell et al. (2010)	California's Early Assessment Program	California State University	ITS	Likelihood of remediation in college↓
Kane et al. (2021)	Tennessee SAILS, co-requisite remediation	Tennessee Department of Education	RDD, DiD	College-level math enrollment↑ & achievement↔

Table 3. Remedial coursework

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Kurlaender et al. (2020)	California State U's Early Start	California State University	DiD, fuzzy RDD	Passing remedial courses, credits earned, persistence↔
Lavy et al. (2021)	Bagrut 2000 remedial program	Israel Ministry of Education	PSM	Years of college schooling↑
Logue et al. (2019)	Corequisite remediation	3 CUNY community colleges	RCT, PSM	Performance in quant. courses, graduation↑
Martorell & McFarlin (2011)	Remedial courses	Texas Schools Microdata Panel	RDD	Credits attempted↑, degree completion↔
Martorell et al. (2015)	Remedial courses	Texas Schools Microdata Panel	RDD	College enrollment↔
Mokher et al. (2018)	College and Career Readiness Initiative	Florida K-20 Educ. Data Warehouse	RDD, pre-post design	Non-remedial course enrollment↑ for some
Park & Ngo (2021)	Developmental math	Administrative data	RDD	Probability of earning 18 STEM credits↓
Rutschow et al. (2019)	Dana Center Mathematics Pathways	4 Texas community colleges	RCT	Persistence, credits earned, credential attainment↔
Scott-Clayton & Rodriguez (2015)	Remedial courses	Community college system	RDD	College enrollment, credits earned, degree completion↔
Sommo et al. (2012)	Learning communities	Kingsborough Community College	RCT	Credits earned, degree completion↑

Table 3. Remedial coursework

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Weiss et al. (2010)	Learning communities	Hillsborough Community College	RCT	Credits earned↔
Weiss et al. (2015)	Learning communities	6 colleges	RCT	Credits earned↑
Weiss et al. (2021)	CUNY Start	CUNY	RCT	Enrollment, credits earned, credentialattainment↑
Weissman et al. (2011)	Learning communities	2 community colleges	RCT	Passing remedial courses, persistence, credits earned↑ **(**dissipates over time**)**
Weissman et al. (2012)	Learning communities	2 community colleges	RCT	Credits earned↔

Table 4. In-person college-going guidance and support

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Avery (2010)	College advising	Harvard Search File	RCT	College application quality↔
Avery (2013)	College Possible program	College Possible	RCT	College applications, enrollment↑
Barr & Castleman (2017)	Bottom Line	Bottom Line	RCT	College enrolment, persistence↑
Bettinger & Evans (2019)	Advise Texas	Texas HECB	RCT	College enrollment↔
Bos et al. (2012)	SOURCE program	SOURCE, LAUSD	RCT	College enrollment, persistence↑
Bowman et al. (2018)	GEAR UP Iowa	Mississippi BA Educ. Agency	DiD + PSM	College enrollment↑, persistence↔
Carrell & Sacerdote (2017)	Mentoring + $ incentives	New Hampshire Dept. of Educ.	RCT	College enrollment, persistence↑ for females
Castleman et al. (2020)	College Forward	College Forward	RCT	College enrollment, persistence↑
Castleman & Goodman (2018)	Bottom Line	Bottom Line	RDD	Persistence↑
Constantine et al. (2006)	Talent Search program	Administrative data	PSM	College enrollment↑
Cunha et al. (2018)	GO Centers	Texas HECB	DiD + PSM	Application↑, enrollment↔, completion↔
Hurwitz & Howell (2014)	High school counselors	Schools and Staffing Survey	RDD	College enrollment↑
Joshi & Barnes (2021)	Career Compass	Louisiana Dept. of Education	DiD	College enrollment↑

Table 4. In-person college-going guidance and support

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Ly et al. (2020)	TALENS tutoring	Administrative data (France)	RCT	National high school exam scores↔, enrollment in selective colleges↔
Oreopoulos & Ford (2019)	LifeAfterHighSchool	Ontario Ministry of Education	2 RCTs	Applications, enrollment↑ in RCT1, ↔ in RCT2
Rizzica (2020)	Widening Participation	Administrative data (UK)	RDD	College aspirations↑, enrollment↔
Rodriguez-Planas (2012, 2017)	Quantum Opportunities	Administrative data	RCT	College enrollment↔, ↑ for youth with predicted risk of drug use
Schirm et al. (2003, 2006)	Quantum Opportunities	Administrative data	RCT	College enrollment↔
Seftor et al. (2009)	Upward Bound	Administrative data	RCT	College enrollment↔
Stephan & Rosenbaum (2013)	College coaching	Chicago Public Schools	Fixed effects	Completion of steps in college applications↑

Table 5. Technology-supported counseling for college access

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Avery et al. (2021)	Text-message based outreach and advising	College Board, uAspire	RCT	College application, selection, transition ↔ in national sample, ↑ in Texas
Gurantz, Pender, et al. (2020)	Virtual advising	College Board	RCT	College enrollment↔
Phillips & Reber (2019)	Virtual advising	EdBoost	RCT	College enrollment↔
Sullivan et al. (2019)	Technology-enabled remote advising	CollegePoint	RCT	Enrollment ↔, enrollment in highly selective colleges↑

Table 6. Counseling for college success

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Alamuddin et al. (2018) Also Rossman et al. (2021)	MAAPS program	11 universities	RCT	Course pass rate, first-year GPAs↔ overall, ↑ at Georgia State U
Bettinger & Baker (2014)	Individualized coaching	Participating universities, InsideTrack	RCT	Persistence↑
Dennehy & Dasgupta (2017)	Peer mentoring by females/males	University of Massachusetts Amherst	RCT	Female mentors: female students' self-efficacy & retention in engineering↑
Kim et al. (2013)	Mentoring by graduate students	Baccalaureate nursing program in California	RCT	Anxiety↓, self-efficacy↑, performance↑
Gordanier et al. (2019)	Informing at-risk students + referral to tutoring	University of South Carolina	RDD	Performance (econ courses)↑
Linkow et al. (2019; 2017)	Coaching + fin.aid filing support + text message reminders	Massachusetts Dept. of Elementary & Secondary Education	PSM	Persistence, earning credits, FAFSA renewal↑
Oreopoulos & Petronijevic (2018)	1) online activity (values & goals), 2) online activity + text/email messaging, 3) online activity + coaching	University of Toronto	RCT	Grades, GPAs↔ iff treatments 1 and 2, ↑ if treatment 3

Table 7. Lighter touch outreach and targeted supports for college access

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Barr & Turner (2018)	Pell Letters	2008 SINP	Fixed effects	College enrollment↑
Bettinger et al. (2012)	FAFSA filing assistance + financial aid estimates	H&R Block	RCT	FAFSA filing, college attendance, persistence↑
Biancardi & Bratti (2019)	Research Evaluation Exercise	MIUR Statistical Office	Pre/post	Enrollment in top-performing HEIs↑
Dinkelman & Martinez (2014)	Abre la Caja (financial aid info)	Schools in Santiago, Chile	RCT	College-prep high school enrollment↑
Dynarski et al. (2021)	College outreach	Michigan Dept. of Educ.	RCT	Application to, enrollment at U of Michigan↑
Gurantz et al. (2020)	Brochures and emails	College Board	RCT	College enrollment↔
Herber (2018)	Info on scholarships	German university students	RCT	Application for selective scholarships↑
Hoxby & Turner (2013)	Info + application fee waivers	College Board, ACT	RCT	College applications, enrollment↑
Hyman (2020)	Letter with link to website	Michigan Dept. of Educ.	RCT	College enrollment↔
Hurwitz et al. (2017)	More free SAT score sends	College Board	DiD	College enrollment, completion↑
Hurwitz & Smith (2018)	Info on earnings in the College Scorecard	College Board	DiDiD	Score sends received by colleges↑
Loyalka et al. (2013)	Info on college costs and aid	Schools in Shaanxi, China	RCT	Receiving aid, college attendance↑
Martinez et al. (2018)	Info + text messages + webinars	US Dept. of Education	RCT	College applications, selectivity of colleges↑

Table 7. Lighter touch outreach and targeted supports for college access

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Miller & Skimmyhorn (2018)	4 types of college outreach	US Army	RCT	Applications↑, enrollment↔
Mulhern (2021)	Admissions info in Naviance	Administrative data	RDD	College application, enrollment↑
Oreopoulos & Dunn (2013)	Info on college & financial aid	High schools in Toronto	RCT	Plans to attend college↑
Page et al. (2020)	Financial aid info & support	Administrative data	RCT	FAFSA filing, college enrollment↑
Pallais (2015)	More free ACT score sends	ACT	Pre/post, DiD	Applications, college selectivity↑
Peter & Zambre (2017)	Info on college benefits and aid	Berliner-Studienberechtigten-Panel	RCT	College enrollment for students with non-academic background↑
Rosinger (2017)	Shopping Sheet	IPEDS, College Scorecard	DiD	Community college enrollment↔
Smith (2013)	Number of college applications	Educational Longtid. Study	IV	College enrollment↑
Smith et al. (2022)	College outreach	College Board	RCT	Applications, enrollment↑

Table 8. Nudges for college access and success

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Bird et al. (2021)	FAFSA nudging	National Student Clearinghouse	RCT	Aid receipt, college enrollment↔
Carrell & Kurlaender (2020)	Emails from professor	2 universities	RCT	Achievement ↔, course/prof. perceptions↑
Castleman et al. (2012)	Summer counseling	Participating schools	RCT	College enrollment↑
Castleman et al. (2014)	Summer counseling	uAspire	RCT	College enrollment↑
Castleman et al. (2015)	Counseling from school vs. uni	Albuquerque Public Schools	RCT	College enrollment↔
Castleman & Page (2015)	Summer text messaging, peer mentoring	Dallas ISD, Mastery Charter Schools	RCT	College enrollment↑ in some sites
Clark et al. (2020)	Performance-/task-based goals	Public university	RCT	Course performance↑
Himmler et al. (2019)	Soft commitment + reminders	A German university	RCT	Taking and passing exams↑
Linkow et al. (2021)	Text messaging advising	Administrative data	RCT	College enrollment, persistence↔
Nurshatayeva et al. (2021)	AI chatbot nudging	East Carolina University	RCT	Enrollment↔ overall, ↑ for first-gen students
O'Connel & Lang (2018)	Email reminders	Private university	RCT	Exam scores, effort↑
Oreopoulos & Petronijevic (2019)	Goal setting, mindset building, advice for study success, advice + reminders, text message coaching, in-person coaching	University of Toronto	RCT	↑ of coaching on mental health and study time, ↔of all treatments on achievement

Table 8. Nudges for college access and success

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Ortagus et al. (2020)	1. Info, 2. Info + one course tuition waiver	Community colleges in Florida	RCT	Re-enrollment and full-time re-enrollment ↔ if treatment 1, ↑ if treatment 2
Page & Gehlbach (2017)	AI chatbot nudging	University of Georgia	RCT	College application steps, enrollment↑
Page et al. (2020)	AI chatbot nudging	Georgia State University	RCT	Credits earned, GPA↑
Smith et al. (2018)	Grade nudge	Washington State U	RCT	Homework performance↑
Stoddard et al. (2017)	Information	Montana University System	DiD	Credits completed, GPA, retention↑

Table 9. Comprehensive supports for college access and success

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Andrews et al. (2020)	CS & LOS programs	Texas Education Agency	DiD + PSM	Enrollment: CS↔; enrollment, graduation: LOS↑
Angrist et al. (2009)	STAR program	A Canadian university	RCT	Grades↑ for females, ↔ for males
Angrist et al. (2014)	Opportunity Knocks	A Canadian university	RCT	# of courses scored 70+↑, GPA↔
Barrow et al. (2014)	Opening Doors program	3 community colleges	RCT	Course registration rate, credits earned↑
Bertrand et al. (2019)	One Million Degrees	Administrative data	RCT	Enrollment, persistence↑
Clotfelter et al. (2018)	Carolina Covenant	U of North Carolina system	RDD, DiD	GPAs↑, credits earned↑, graduation↔
De Paola et al. (2012)	Monetary incentives	University of Calabria (Italy)	RCT	Performance↑
Erwin et al. (2021)	Vista program	U of New Mexico	RCT	Graduation rates↑
Evans et al. (2020)	Stay the Course program	Tarrant Community College	RCT	Persistence↑, earning associate degree↔(↑for females)
Lavecchia et al. (2020)	Pathways to Education	Toronto District School Board	DiD	Persistence↑
Martinson et al. (2018)	Washington State I-BEST	3 participating colleges	RCT	Credits earned, credential attainment↑
Miller et al. (2020)	ASAP program	3 community colleges in Ohio	RCT	Persistence, graduation↑
Modicamore et al. (2018)	ACE program	Administrative data	RCT	Certificate attainment, employment, earnings↑

Table 9. Comprehensive supports for college access and success

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Page et al. (2019)	Dell Scholars program	Administrative data	RDD, DiD + PSM	Persistence, degree completion↑
Patel & Valenzuela (2013)	Adelante program	Pima Community College	RCT	Persistence, credits earned↑
Philp (2015)	FLIGHT program	Administrative data	RCT	College enrollment↑
Rolston et al. (2017, 2021)	VIDA program	VIDA administrative data	RCT	Credits earned, credential attainment↑
Scrivener et al. (2009) :	Opening Doors program	Chaffey College	2 RCTs	Credits earned, GPA: OD↔, enhanced OD↑
Scrivener & Weiss (2009)	Opening Doors program	3 colleges in Ohio	RCT	Registration, credits earned↑
Scrivener et al. (2015) & Weiss et al. (2019)	ASAP program	3 CUNY community colleges	RCT	Persistence, graduation↑
Sommo et al. 2018	ASAP program	3 Ohio community colleges	RCT	Persistence, graduation↑

Table 10. College entrance exams

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
A. Universal college entrance exam administration				
Goodman (2016)	Mandatory ACT	Data on ACT-takers	DiD	Enrollment in college: any↔, selective↑
Hurwitz et al. (2015)	Mandatory SAT	College Board	DiD	Enrollment in 4-yr colleges↑
Hyman (2017)	Mandatory ACT	Michigan public high schools	DiD	Enrollment in 4-yr colleges, attainment↑
Klasik (2013)	Mandatory SAT/ACT	IPEDS, CPS	ITS	College enrollment↑ in Illinois
B. Eliminating college entrance exams as an application requirement				
Belasco et al. (2015)	Test-optional policy	US Dept. of Education	DiD	Low-income, minority enrollments↔
Bennett (2021)	Test-optional policy	IPEDS	CITS, DiD + PSM	Low-income, minority enrollments↑
Saboe & Terrizzi (2019)	Test-optional policy	IPEDS	DiD	Low-income, minority enrollments↔

Table 11. Equitable access to higher education by race/ethnicity

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Alon & Malamud (2014)	Affirmative action	4 universities in Israel	RDD	Admission↑, enrollment↑, achievement↔
Antonovics & Backes (2013)	Affirmative action ban	University of California	DiD	Minority admission↓, SAT score sends↔
Arcidiacono et al. (2014)	Affirmative action ban	University of California	Pre-post design	Minority graduation↑
Aygun & Bo (2021)	Affirmative action	Administrative data from Brazil	"Matching with contracts" model	High achieving minority admission↓, low achieving majority admission↑
Backes (2012)	Affirmative action ban	IPEDS	Pre-post design	Minority enrollment↔ (at top unis↓)
Bertrand et al. (2010)	Affirmative action	Survey (India)	IV	Lower caste enrollment↑
Black et al. (2020)	Texas Top 10% policy	Texas Educ. Research Center	DiD, event study	College enrollment, graduation↑
Cortes (2010)	Texas Top 10% policy	Texas HEOP	DiD	Lower-ranked minority retention, graduation↓
Cortes & Klasik (2020)	Texas Top 10% policy	UT Austin & Texas A&M U.	Fixed effects	Enrollment from underrepresented schools↔
Daugherty et al. (2014)	Texas Top 10% policy	A school district in Texas	RDD	Enrollment at flagships↑, at private unis↓
Dickson (2006)	Affirmative action ban	Texas Education Agency	OLS with FE	Minority applications↓
Francis &Tannuri-Pianto (2012)	Racial quotas	Survey (Uni of Brasilia)	DiD	%black↑
Frisancho & Krishna (2016)	Affirmative action	Engineering college (India)	PSM	Lower-caste enrollment↑, performance↓

Table 11. Equitable access to higher education by race/ethnicity

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Hill (2017)	Affirmative action ban	IPEDS	DiD	Minority STEM degree completion↓
Hinrichs (2012)	Affirmative action ban	Current Population Survey	DiD	Minority enrollment↓
Hinrichs (2014)	Affirmative action ban	IPEDS	DiD	Minority graduation at selective colleges↓
Khanna (2020)	Affirmative action	Indian National Sample Survey	DiD, RDD	Minority students' years of education↑
Long (2004)	Affirmative action ban	NELS	DiD	Minority SAT score sends↓
Niu & Tienda (2010)	Texas Top 10% policy	Texas HEOP	RDD	Diversity in flagship universities↑
Vieira & Arends-Kuenning (2019)	Affirmative action	Universities in Brazil	DiD	Disadvantaged students' enrollment↑

Table 12. Institutional resources/quality

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Bound & Turner (2007)	Lower public subsidies per student	Institutional data; 1990 & 2000 Census	IV	Undergraduate degree attainment↓
Cohodes & Goodman (2014)	Massachusetts Adams scholarship	Massachusetts Dept. of Elementary & Secondary Educ.	RDD	Degree completion↓
Deming & Walters (2017)	Higher public subsidies	IPEDS	IV	Enrollment, degree completion↑
Russell (2019)	Georgia's University System consolidations	University System of Georgia	DiD	Retention, graduation↑

Table 13. Match of characteristics between students and faculty

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Bettinger & Long (2005)	Same-gender instructors	Administrative data (Ohio)	IV	Course credits taken↑
Birdsall et al (2020)	Other-sex/-race instructors	Private elite law school	Fixed effects	Receiving A/A- in intro courses↓
Canaan & Mouganie (2021)	Advisor gender	American Uni of Beirut	RCT	Females: STEM enrollment & graduation↑
Carrell et al. (2010)	Instructor gender	US Air Force Academy	RCT	Academic outcomes↔ for males, ↓if male instructor taught females
Fairlie et al. (2014)	Minority instructors	Community college in the US	Fixed effects	Achievement, retention, completion of minority students↑
Griffith (2014)	Same-gender instructor	Private liberal arts college (sample taking classes with new faculty member)	OLS	Grades in fields dominated by the other gender↑, choice of major↔
Griffith & Main (2021)	Same-gender teaching assistants	University in the US	RCT	For females: majoring in high-earning fields↑, grades↔, persistence↔
Hoffman & Oreopoulos (2009)	Same-sex instructor	University of Toronto	Fixed effects	Achievement, subject interest↑
Kofoed & McGovney (2019)	Same-gender/race mentors	US Military Academy	RCT	Choosing the mentor's branch↑

Table 13. Match of characteristics between students and faculty

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Lusher et al. (2018)	Same-race teaching assistants	University in California	Fixed effects	Achievement in econ courses↑
Mansour et al. (2018)	Same-gender instructor	US Air Force Academy	RCT	Choosing STEM occupation, completing a master's program in STEM↑ for females
Porter & Serra (2020)	Female role model intervention	Southern Methodist Uni	RCT	Majoring in economics for females↑
Price (2010)	Same-race/gender instructors	Ohio Board of Regents	IV	Persistence in STEM: Blacks↑, females↓
Solanki & Xu (2018)	Female instructors	Uni of California-Irvine	Fixed effects	Engagement, interest in STEM fields↑ for females, ↓ for males

Table 14. Adjunct instructors

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Bettinger & Long (2010)	Adjunct faculty	12 public colleges in Ohio	Fixed effects, IV	Subsequent enrollment in education, engineering, and the sciences↑
Bettinger et al. (2016)	Graduate student instructors	Ohio's public colleges	Fixed effects, IV	Majoring in discipline↑
Chen et al., (2021)	Part-time non-tenured instructors	Boise State University	Fixed effects, IV	Grades↑
Figlio et al. (2015)	Contingent/tenure-track faculty	Northwestern University	Fixed effects	Interest, subsequent performance↑
Griffith & Sovero (2021)	Temporary/pre-tenure female instructors	Public research university	Fixed effects	Grades↑
Ran & Sanders (2020)	Part-time instructors	6 community colleges	Fixed effects, PSM	Current course outcomes↑, subsequent enrollment↓
Ran & Xu (2019)	Non-tenure-track instructors	Anonymous college system	Fixed effects, IV	Grades in a course they teach↑, taking another course in discipline↓, grades in subsequent courses↓
Xu (2019)	Part-time adjunct instructors	Community college system	Fixed effects, IV	Performance in courses they teach↑, grades in subsequent courses↓
Xu & Ran (2021)	Part-time instructors	Anonymous college system	Fixed effects, IV	Persistence, credits earned↓

Table 14. Adjunct instructors

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Xu & Solanki (2020)	Tenure-track research faculty vs. tenure-track teaching faculty vs. adjunct instructors	University of California	Fixed effects	Current and subsequent academic outcomes↔

Table 15. Online vs. face-to-face instruction

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Alpert et al. (2016)	Online/blended instruction	Public university	RCT	Exam scores↓ if online, ↔ if blended
Altindag et al. (2021)	Face-to-face instruction	Public research university	Fixed effects	Course grades↑, course dropout↓
Bettinger et al. (2017)	Online instruction	Large for-profit university	IV	Grades in current & subsequent courses, persistence↓
Bosshardt & Chiang (2018)	Online instruction	Large public university	Ordered probit	Grades↓, courses taken & majoring in discipline↔
Bowen et al. (2014)	Hybrid instruction	6 public uni campuses	RCT	Achievement↔
Cellini & Grueso (2021)	Online college programs	Colombian Institute for the Evaluation of Education	PSM, fixed effects	Test scores↓ for bachelor programs, ↑ for vocational programs
Figlio, Rush & Yin (2013)	Online instruction	Research university	RCT	Test scores↓
Goodman et al. (2019)	Georgia Tech's online M.S. in Computer Science	Georgia Tech's Computer Science Department	RDD	Enrollment↑
Hart et al. (2018)	Online instruction	California Community College System	Fixed effects	Course completion & achievement↓, retaking courses↑; interest in field↓
Kofoed (2021)	Online instruction	US Military Academy	RCT	Grades↓

Table 15. Online vs. face-to-face instruction

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Kozakowski (2019)	Emporium model of online instruction (remedial math)	Kentucky Community and Technical College System	DiDiD	Course pass rates, retention, degree attainment↓
Xu et al. (2020)	Blended program	A university in Mexico		English language course achievement↑
Xu & Jaggars (2013)	Online courses	Washington State's 34 community/technical colleges	IV	Course persistence& grades↓

Table 16. Systems of transfer across institutional sectors

Authors	Treatment	Main data source	Method	Direction of impacts on key outcomes
Baker (2016)	Structured transfer programs	California Community Colleges	DiDiD	Degree completion↑
Boatman & Soliz (2018)	Ohio transfer module	Ohio Board of Regents	PSM	Probability of transfer to a four-year college, associate degree completion, number of credits transferred, time to degree↑