RUTGERS EDUCATION AND EMPLOYMENT RESEARCH CENTER

GATEWAY REQUIREMENTS IN COMMUNITY COLLEGE WORKFORCE PROGRAMS

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EXECUTIVE SUMMARY

Today, the majority of community college credentials programs – 94 percent of certificates and 57 percent of associate degrees – are in career-oriented fields.[1] The popularity of workforce programs, which are herein broadly defined as any degree- or non-degree-granting program designed to directly lead to employment or enhance a career pathway, has attracted the attention of educators, funders and government leaders across the nation. These stakeholders are interested in tracking student success in these pathways as well as in learning how to improve retention and completion rates for both degree and non-degree programs.

While gateway requirements are known to affect success and retention rates in community colleges on a general level, little is known about gateway requirements in workforce programs specifically. Do they differ from the typical gateway requirements of liberal arts programs? Do they differ according to the credential being sought, or by college, state or industry sector? Answers to these questions have important implications for how student success is measured, and for future discussions of the content of workforce education.

Research Questions & Purpose

This study examines the frequency with which community college workforce certificate and associate degree programs require gateway math and/or English courses. We also look at how requirements vary by state, credential type, field of study, and institutional characteristics such as size and student body composition based on factors such as gender or race/ethnicity. Reflecting on our policy analysis and literature review, we also raise questions about the benefits or drawbacks of gateway requirements that can help frame future research and educational policy. A better understanding of workforce programs' gateway requirements can provide the foundation for rethinking whether, and which, gateway courses are necessary for students to succeed on their educational and career pathways.

Why the Research Matters and Who Should Care

Many community college degree programs and some certificate programs require the completion of one or more college-level math and English courses. Significant scholarship has demonstrated that math and English proficiency requirements act as barriers to student enrollment, academic progress, and the completion of credentials, especially for low-income, first-generation and adult learners as well as Black, Brown and Indigenous students.[2,3,4] These

[1] Carnevale, et al, 2020

[2] Center for the Analysis of Postsecondary Readiness, 2021.

[3] Douglas & Atwell, 2017.

[4] Broom, 2020.

barriers are often compounded when students are required to complete remedial coursework prior to enrolling in gateway courses, a determination often based on standardized test scores.[5]

This study builds on the above scholarship to find out what role math and English gateway requirements play in the earning of workforce education and training credentials – particularly non-degree certificates – at community colleges. As such, our research will inform multiple audiences including Strong Start to Finish, community colleges and policy makers.

- Significant data is lacking on workforce programming, particularly with regard to certificates. The data set created for this study may help inform policy makers and institutions about the breadth and depth of workforce programming, the types of workforce programming available and any gateway requirements associated with them.
- State and community college system policies often guide gateway math and English requirements. Findings from this study may aid the review of existing policies and the establishment of new ones at the state, system and institutional levels.
- As community colleges develop and refine workforce programming, this research can help us understand what requirements are appropriate for different educational and workforce pathways.
- In national data sets like IPEDS, the completion of gateway math and English requirements is considered an indicator of student success. Students who do not complete these courses may therefore be categorized as unsuccessful by default, even if they never registered for gateway courses in the first place. Data from this study could provide new insight into how best to measure success with regard to student progress and credential completion. It could also inform future data collection efforts.

Methodology

This study is based on the analysis of data collected from 196 community colleges in five states: Arkansas, California, Georgia, New York (CUNY and SUNY) and Ohio. A team of researchers were trained to harvest data from each states' community colleges' websites and their most recent course catalogs (2020–2021). The final data set includes information about gateway courses, program-level information, and institutional characteristics for 12,485 workforce programs across the five states. The data set is focused on workforce programs (again, degree and non-degree programs that directly lead to employment or enhance a career pathway) in selected industry categories: Agriculture/Natural Resources; Computer Sciences; Engineering, Engineering Technology/Architecture; Health; Manual Trades; Business.

[5] Research has shown that these exams have high rates of 'under-placement' – that is, placing students into developmental sequences who would have been successful in college-level coursework (Scott-Clayton, Crosta, & Belfield, 2014).

Using these data, we performed both descriptive and multivariate analysis to understand factors related to gateway course requirements. For a more detailed look at the methodology and data set compilation see Appendix A.

Key Findings

Nearly all workforce associate degree programs had at least one gateway requirement, whereas very few short-term certificate programs had any gateway requirements at all.

Most workforce programs required at least one gateway course. Over half of the workforce programs in our study required students to complete at least one gateway course in either math or English. Most programs required gateway courses in both subjects.

Gateway requirements in workforce programs were strongly related to the length of the program. Nearly all workforce associate degree programs had at least one gateway requirement in either math or English, and over three-quarters required both.

Gateway requirements for certificates were strongly related to how long it took to earn the credential – less than one-tenth of short-term certificates required any gateway courses, while over a third of medium- and long-term certificates[6] had such requirements. By subject, math and English requirements were about equally prevalent among medium- and long-term certificates.

The presence of gateway requirements depends most heavily on credential type, but program of study can also be a factor. Overall, programs in manual trades and computer science were least likely to have gateway requirements, whereas programs in health and business were the most likely to have them. This finding relates strongly to the types of credentials offered in these fields. Math gateway requirements were prevalent in engineering programs, while English requirements prevailed in health and business programs.

Among medium/long-term certificate programs, gateway requirements were more common nonmanual occupations. About half of engineering and business programs and a third of health and computer science programs have at least one gateway requirement. Only one-quarter of manual trades and agriculture programs had gateway requirements.

[6] Short-term certificates require 29 or fewer credits, a medium-term certificate requires 30 to 60 credits, and long-term certificates require more than 60 credits.

State-level policies matter. Controlling for credential type and program of study, California's workforce programs were significantly less likely to require gateway courses, suggesting the strong role played by state policy in shaping college requirements.

Conclusion and Recommendations

In this study, we were able to estimate the proportion of workforce programs with gateway requirements, distinguish between requirements in math and English, and point to program and institutional characteristics that shaped these requirements. But this is a start rather than a conclusion for three reasons. First, our data do not permit us to understand the relationship between gateway requirements and actual rates of student success in workforce programs. Second, our research does not answer the question of how these courses relate to student career choices and pathways. Third, our data do not examine the content of gateway courses or identify what content results in the best outcomes – academically or in terms of employment. We therefore suggest the following research, curriculum and policy activities:

- Study whether gatekeeper course requirements affect students' decisions to enroll in workforce programs of study.
- Examine the context of gateway courses, focusing on how they do and do not align with workforce expectations and which gateway courses are essential for specific workforce areas.
- Explore how gateway course requirements impact overall student persistence and credential completion. This includes looking at the impact of developmental education requirements prior to enrollment in gateway courses and examining how these practices affect equity of opportunity and outcome for women, first-generation students, students with low income and students from racially minoritized populations.
- Rethink the use of gateway course completion as a measure of student success. The successful completion of a credential program, regardless of field, should be the measure of success, not success in individual English or math gateway courses.

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BACKGROUND AND CONTEXT

Community colleges play a unique role in higher education in the United States. These open access institutions offer students a variety of options for gaining skills and earning credentials. Though perhaps best known for their academic associate degree programming, they also offer a range of credit-bearing and non-credit workforce education and training programs that prepare students for entry into the labor market. In fact, the majority of community college credentials programs (94 percent of certificates and 57 percent of associate degrees) are in career-oriented fields that prepare students for direct entry into the labor force.[7] As such, community colleges are the country's primary workforce training institution.[8] This is one of the reasons they are such an integral part of the Biden administration's post-pandemic economic recovery plan.[9]

The focus of this study is on credit-bearing workforce programming oriented toward either entry into the labor market or transfer to a four-year institution for further career-oriented training and preparation. Workforce education and training comes in a variety of forms, however. It can be offered as part of an associate degree or applied associate degree program, or it may take the form of a stand-alone credential such as a professional certification or short-, medium- or long-term certificate.[10] Workforce training can also include things like

[7] Carnevale et al, 2020.
[8] Community College Research Center, 2021b.
[9] Ibid.
[10] Short-term certificates require 29 or fewer credits; a medium-term certificate requires 30 to 60 credits; and long-term certificates require more than 60 credits.

industry-recognized certifications – for example, Cisco, Microsoft or Google certifications in data analytics, project management or android design – that may or may not receive academic credit. In recent years, some community colleges have even begun to offer workforce bachelor's degrees in areas like health and business.

Among this vast field of options, we have chosen to focus our research on associate degrees and certificates. In 2019, community college students earned nearly 879,000 associate degrees and nearly 620,000 certificates.[11] It may therefore come as no surprise that workforce education and training programs make up a substantial portion of community college offerings. These programs benefit the communities they serve by providing many individuals with crucial access to career pathways they may not be able to gain otherwise. Workforce education can serve as a bridge to further education or facilitate entry into, or advancement in, the labor market. Given the great importance of workforce training, it is essential that community colleges identify and address both existing and emergent barriers to student success as they build or expand their workforce programs, establish course and program learning outcomes and develop program pathways.

RESEARCH QUESTIONS AND PURPOSE

Community college degree programs as well as some certificate programs require the completion of one or more college-level math and English "gateway" courses. This study examines the prevalence of those requirements in workforce education and training programs.

[11] American Association of Community Colleges, 2021.

A large body of research has demonstrated that math and English proficiency requirements are often barriers to student enrollment, program progression and credential completion. While there has been a great deal of research on student outcomes in community college degree programs, far less is known about the specific effects of math and English requirements with regard to workforce education and training credentials in particular.

Whether students will be placed into a credit-bearing gateway course or required to enroll in one or more non-credit developmental education (pre-college) courses in math and/or English is typically determined by their score on a standardized exam. Research has shown that these exams often act as barriers to program entry and completion,[12] particularly for many first-generation, Black, Brown, and low-income students.[13] This is because the exams tend to screen out large swathes of students from credit-bearing courses – many of whom likely would have succeeded in such courses given the chance.[14]

The following questions emerge: Are gateway math and English courses necessary for students in all workforce training and education programs? Do math and English requirements for workforce programs align in an intentional way with educational and workforce pathways and the skills and competencies required for associated jobs? Are these requirements important for students' future educational pathways, or do they create unnecessary barriers to student

[12] Center for the Analysis of Postsecondary Readiness, 2021.

[13] Broom, 2020.

[14] A 2014 study by Scott-Clayton, Crosta, & Belfield revealed that these exams have high rates of "underplacement"; that is, they tend to (mis)place students who would have been successful in college-level coursework into developmental sequences they do not need.

success? We believe that answering these questions is imperative to the future development of workforce programming.

This study aims to shed some light on several of the above questions – and set the groundwork for studying the remaining ones. Our primary questions are:

- What are the federal, state and accreditation policies that govern gateway requirements in workforce degree and certificate programs?
- What role do gateway requirements have in establishing institutional academic standards?
- How common are English and math gateway requirements in community college workforce certificate and associate degree programs?
- How do English and math gateway requirements vary by state, credential type, field of study and institutional characteristics such as size and student body composition based on factors such as gender and race/ethnicity?

To carry out our examination, we created an original data set of workforce programs in selected industries. Our data comes from a review of 2020–2021 course catalogs and websites from community colleges in five Strong Start to Finish (SStF)[15] states: Arkansas, California,

[15] Strong Start to Finish (SStF) is a network of policy and research partners, institutions and system leaders and foundations advancing system reforms in developmental education, so every student can succeed in their first year of college. In particular, SStF addresses barriers to gateway course completion for Black, Brown, Asian American and Indigenous students, students with low incomes and returning adults, who have been underserved by the education system.

Georgia, New York and Ohio. Please see Appendix A for detailed information about our methodology. Appendix B contains the final data set used in the study.

WHY DOES THIS RESEARCH MATTER, AND WHO SHOULD CARE?

Our research is important for multiple audiences including SStF, community college faculty and administrators and policy makers:

- SStF, along with many community colleges and national data sets (e.g., the Integrated Postsecondary Education Data System [IPEDS]), situate the completion of gateway math and English requirements as a marker of student success. Yet, when gateway course completion is directly aligned with successful student outcomes, students who do not complete these courses become categorized as unsuccessful by default, even if they never registered for such a course in the first place. If certificate and degree programs in workforce areas tend not to require the completion of these classes, students in these programs may be disproportionately misclassified as not successful in research that relies on course completion rates as an indicator of success. Data from this study could inform new thinking on how and what should be counted as markers of student success in ways that inform and reform data collection efforts related to non-credit programming and student success.
- As community colleges develop and refine both their non-credit and credit-bearing workforce programming, this research may help them better understand existing requirements so they may assess whether these requirements are appropriate for the various pathways they offer their students.

- Data are lacking on workforce programming, particularly on the non-credit side. The data set created for this project may be a helpful tool for policy makers and institutions as they seek to understand the breadth and depth of workforce programming, the types of workforce programming available, and the associated gateway requirements.
- Findings from this study may be helpful to industry professionals and policy makers reviewing existing policies and establishing new ones at the state, system and institutional levels.

WHAT DO WE KNOW ABOUT WORKFORCE EDUCATION IN COMMUNITY COLLEGES?

Policies and practices around gateway requirements reflect the dynamic intersection of community college education and the labor market. In the following sections, we explore some of the factors that inform and animate this intersection. We will examine changes in the labor market and perceived labor force needs, including workforce skill deficits, the role of the community college in students' educational and career trajectories, and the goals and realities of gateway requirements. Because a far greater portion of the literature deals with the labor market utility of math, that field will dominate our discussion. Where possible, however, we will also address the utility of English communication skills (reading and writing).

Changes in Perceived Labor Force Needs

We begin with an examination of the utility and need of the skills typically taught in gateway math and English courses in the workforce. Today's knowledge economy requires a

highly educated and skilled workforce able to adapt to rapidly changing industry demands. In this environment, employers seek general skills including written and verbal communication, numeric and computational skills, conceptual skills, problem-solving skills and the ability to work with others.[16] They also seek specialized skills sets, especially in science and technology, or STEM, fields. In fact, Vice President Kamala Harris recently commented that "STEM occupations are expected to grow at twice the rate of all other occupations in the next decade."[17] This echoes the projections of the US Department of Labor's Bureau of Labor Statistics about the continued demand for students trained in STEM fields. [18, 19]

Employers' demands for more skilled and specialized workers have resulted in an increased need for education and training off the shop floor. Employers have come to rely on community colleges, non-profit and for-profit technical schools, and publicly funded workforce training sites to provide current and prospective workers with entry- and mid-level skills. At the same time, there has been a rapid expansion in the number of non-degree occupation-related credentials, including certificates, industry certifications, badges and occupational licensure, intended to help regulators document, and employers to sort out, various skill types and competencies.[20, 21]

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[16] Carnevale & Smith, 2013.
[17] Harris, 2021
[18] US Bureau of Labor Statistics, n.d.
[19] Fayer, Lacey, & Watson, 2017
[20] Carnevale & Smith, 2013.
[21] Van Noy, McKay, & Michael, 2019.

Workforce Skill Deficits: Real or Imagined?

Employers often contend that they are unable to find enough skilled workers to fill their respective job openings. Given the heavy reliance on computers in today's commerce and service industries, employers say job applicants do not have the "mathematical literacy" they need.[22] The argument is that jobs now require more than basic numeracy, they require higher-level math skills including working with calculators, developing formulas and doing complex modeling.[23]

Yet, research examining the skill sets of US workers has found that most workers report they do not use the higher-level math skills that have currency in employers' requests. Studies by Handel[24] and by Douglas and Attewell[25] that used data from both the Bureau of Labor Statistics' O*NET database and the international Organization for Economic Co-operation and Development (OECD) indicate that the majority of workers do not draw upon their knowledge of the "topics and substance of high school and college-level math" – that is, geometry, statistics, complex algebra, trigonometry, calculus – in the workplace.[26] In fact, less than one-fifth (19.1%) of the workforce has a job that requires math more complicated than balancing a checkbook.[27] Interestingly, workers with only a bachelor's degree often use more advanced

[22] Douglas &Attewell, 2017.
[23] Ibid.
[24] Handel, 2016.
[25] Douglas & Attewell, 2017, p. 7.
[26] Ibid, p. 17.
[27] Ibid, p. 15

math than those with higher degrees, and many blue-collar workers "use as much or more advanced math at work than their white-collar counterparts."[28]

The significant disconnect between employers' perceived need for workers with higher math skills and the realistic demands of most jobs is clearly visible in the table abstracted from the work of Douglas and Attewell. If we consider "regular job tasks" to be tasks that are performed more than once a week, then workers would apparently benefit more from a thorough education in calculator use (57%), working with fractions (51%) and budgeting (40%) than they would a semester of basic algebra (28%) or advanced math (7%).[29]

Table 1: Frequency of use of math skills among US workers[30]

	Percentage Reporting Use of this Skill at Work:				
	Never	**Less than Once a Month**	**Less than Once a Week**	**Less than Every Day**	**Every Day**
All Workers					
Use Fractions/Percents	32.3	9.3	7.9	13.9	36.4
Use a Calculator	26.3	7.3	8.9	16.7	40.7
Make Charts/Tables	53.7	13.9	11.5	11.8	9.0
Use Simple Algebra/Formulas	52.0	10.4	8.5	10.8	18.3
Use Advanced Math/Statistics	81.3	8.0	3.9	3.6	3.1

Source: Douglas and Attewell, 2017. Based on data from *OECD Programme for the International Assessment of Adult Competencies Survey*, 2013.

Further studies indicate that the "obsession" with math and science education in the United States runs counter to the role of math education in economic growth.[31] Looking back,

[28] Handel, cited in Douglas & Attewell, p. 7.

[29] Douglas & Attewell, 2017.

[30] Ibid., Table 9: Frequency of use of math skills among US workers, p. 9. Permission for use pending.

[31] Ramirez, Luo, Schofer, & Meyer, 2006.

some scholars consider current policies to be remnants of the Sputnik age of the mid-twentieth century, during which there were aggressive efforts to expand science and engineering education to "boost the nation's technological prowess"[32] in the interest of outpacing the Soviet Union. Three decades later, the US National Commission on Excellence in Education released *A Nation at Risk* (1983), prompting still more rigorous math and science education in middle and high schools and related changes in postsecondary math education.

Almost a half century later, it is almost universally recognized that math education is important for most students regardless of their academic or workforce trajectory. But it remains unclear what math is needed and by whom. Research shows the majority of students (and future workers) benefit from math education that helps them think systematically and develop "context-specific strategies." [33] And many community college students can benefit from expanding their capacity to identify problems and solve them, to reason and to be able to estimate outcomes.[34] But are these the skills being taught in gateway math courses at community colleges?

Regarding the "labor utility" of English language skills, there is general agreement that the ability to read and understand text – literacy – is required for career education/job training as well as for actual employment. However, where a student needs to fall on the continuum of literacy skills to succeed in their career is highly dependent on the industry sector and occupation they pursue. In a study that used the *Survey of Skills, Technology, and Management*

[32] Burdman, 2015.
[33] Douglas & Attewell, 2017.
[34] Carnevale & Smith, 2013.

Practices (STAMP), 20 percent of workers reported they only needed the ability to read and understand single-page documents. Further, an OECD survey of adult skills found 40 to 50 percent of jobs required the ability to read and understand multiple-page documents – manuals, memos, articles, books – some of which involved complex and abstract content.[35, 36] While the STAMP study was based on self-reports, it also suggests that significant differences exist in the level of literacy required to be successful in today's workforce.

In terms of writing skills, the STAMP survey concluded that "the vast majority of US jobs require non-college levels of writing skills."[37] Overall, the literature suggests that college-level reading, writing and math skills are far from universal requirements across the US labor force.

Community college and students' educational and career pathways

Just as demands for skilled workers has been transformed, so has the timing and sequence of individuals gaining postsecondary education. In response to these shifts, community colleges have been especially valued for being able to perform diverse roles for diverse groups of students. For traditional students (ages 18 to 24), community colleges are often the entrance into either further postsecondary education or the workforce. For incumbent workers, they offer opportunities to enhance skills and keep pace with technological changes. For mid-level professionals, community colleges offer credentials that can facilitate progress up

[35] Organization for Economic Co-operation and Development, 2016.

[36] Handel, 2016.

[37] Ibid, p. 184.

occupational ladders. For many, they simply provide a cost-effective avenue to shift career paths or to explore new interests.[38]

The multiple roles of community colleges are reflected in the programs and credentials they offer – typically, associate degrees and credit-bearing and non-credit certificates. As indicated above, it is noteworthy that the majority of these credentials are in career-oriented fields.[39]

In Fall 2019, 5.5. million students were enrolled in the nation's community colleges, almost two-thirds of whom were attending school part-time.[40] In 2016 almost half of all community college students were nontraditional students (over 25 years of age), a trend that seems to be continuing. This trend suggests that most students enroll in community college to upskill or reskill[41] for the purpose of securing a higher paying job and facilitating economic mobility.[42]

Tracking students' academic pathways, we find that many who enroll in community colleges do not realize their goal of earning an associate degree or transferring to a four-year institution. A study of students entering community college in Fall 2013 with the intention of transferring to a four-year institution found that only about one-third had done so after six years.[43] Further, students with higher incomes were twice as likely as their lower-income peers

[38] Opportunity America Working Group on Community College Workforce Education, 2020.
[39] Carnevale et al, 2020.
[40] Community College Research Center, 2021a.
[41] Cushing, English, Therriault, & Lavinson, 2019.
[42] Opportunity America Working Group on Community College Workforce Education, 2020.
[43] Clearinghouse Research Center, 2021; Community College Research Center, 2021a.

to have reached that goal or to have gone on to attain a bachelor's degree in the same period.[44] In another study, fewer than 40 percent of the students who planned to major in a STEM field actually completed a STEM related degree.[45]

According to a 2020 report by the Urban Institute, students complete certificate programs at for-profit and public community colleges at considerably higher rates than they complete associate degrees.[46] While better rates of certificate completion are in large part a function of a shorter period of study, it also suggests the diverse barriers students face in completing an associate degree program, e.g., finances, work schedules and childcare. Academic requirements and pedagogy, as well as the perceived "relevance" of some coursework, are other significant factors impacting degree and certificate completion.

Gateway Requirements: Goals and Realities

We now turn to gateway requirements in math and English.

Math

Math gateway requirements reflect a long history in education in which standard high school and college math curriculum is based on two years of algebra and a year of geometry.[47] Many institutions "view these courses as essential regardless of their actual applicability to a program of study … since they have played such a central role in the course sequencing structure for decades."[48] Although many college systems are now offering non-algebra

[44] Clearinghouse Research Center, 2021.
[45] President's Council of Advisors on Science and Technology, 2012.
[46] Baum, Holzer, & Luetmer, 2020.
[47] Burdman, 2015.
[48] House, 1974.

pathways for students, sentiment continues to favor algebra gateway pathways for students pursuing associate degrees and even some long-term certificates.

In this way, we can see the disconnect between employers' perceived needs and the actual demands of the jobs they seek to fill as a reflection of the same, decades-long disconnect in the academy. Despite the perceived need for more advanced math education, "'high' standards in math constitute a requirement to learn material [students] will never need … in their work, a bit like the requirement a century ago to learn Latin in high school."[49] In fact, some say that the math literacy community college students need for work is perhaps at the sixth- to eighth-grade level of skill.[50]

Of further concern is the fact that many standard placement exams require proficiency in areas related to Algebra II and geometry. The use of such placement exams results in many students "being denied entry to credit-bearing courses … who are in fact prepared to do the mathematics that will be required of them in their applied programs."[51] There are real, documented consequences for students misdirected into developmental education classes. Students placed into remedial courses, even when they pass them, are more likely than others to leave college without earning a certificate.[52] It is important to note that women, Black and Latinx students often experience misplacement into developmental math courses. This includes general misalignment between test scores and placement, which has disproportionally affected

[49] National Center for Education and the Economy, 2013, p. ii.
[50] Rosenbaum, Cepa, & Rosenbaum, 2013.
[51] National Center for Education and the Economy, 2013, p. ii.
[52] Bahr, 2013; National Center for Education and the Economy, 2013.

these students,[53] as well as students' self-placement into a lower level of developmental courses than college staff believe students need succeed.[54, 55]

Yet, gateway math requirements continue the sorting process, acting as gatekeepers or barriers to student success. Despite the questionable labor market value gained from gateway math courses, [56] students who fail them generally cannot progress with their studies and eventually drop out.

English (reading and writing)

As with math gateway requirements, there are questions about what is being taught in English gateway courses, and if the content of these courses is truly preparing students to be successful in the labor market or to continue to pursue academic pathways. Here the disconnect is not so much about content areas, but rather if entering students' reading comprehension and writing skill levels are being sufficiently addressed in gateway courses.[57] Some studies have identified that retrieval skills are emphasized in such courses far more than are analytic and synthetic tasks. Some educators have observed that we are not sufficiently building students' ability "to reflect on and evaluate what they have read."[58] Analytic and synthetic skills are not just germane to the workplace, but to participation in a civic society. In some respects, these concerns contrast with those about math, fundamentally altering our key concern. In gateway

[53] Ngo & Melguizo, 2020.
[54] Park et al, 2018
[55] Fong & Melguizo, 2017
[56] Douglas & Attewell, 2017.
[57] National Center for Education and the Economy, 2013.
[58] Ibid.

English, are we creating barriers for our students by not sufficiently preparing them for full participation in the labor force, and in society?[59]

WORKFORCE EDUCATION POLICY STRUCTURE

The Policy Structure

As we began to look at gateway requirements, we asked ourselves: What is, and who is involved in, the process for establishing gateway requirements in community college workforce programs? To answer this dual-pronged question, we engaged in a multilevel policy analysis that included federal- and state-level education policies as well as those of national-regional accreditation organizations and those specific to each of the six state community college systems receiving SStF funding.

We begin by presenting findings from our review of policy documents at the state, accreditation agency, and college-system levels to clarify the scope and intention of gateway requirements at community colleges. We then turn to our quantitative analysis to find out how common gateway requirements are in community college workforce programs.

[59] Opportunity America Working Group on Community College Workforce Education, 2020.

Table 2: Policy Authorities for the Six State Community College Systems

Policy Authority	Arkansas Community College System N=22	California Community College System N=116	Technical Colleges System of Georgia N=22	New York City University of New York N=7	New York State University of New York N=30	Ohio Community College System N=23
Federal Authority Strengthening Career and Technical Education for the 21st Century Act (Perkins V)	Yes	Yes	Yes	Yes	Yes	Yes
State Authority	Arkansas Higher Education Board & the Arkansas Division of Higher Education	Board of Governors of the California Community Colleges	State Board of the Technical College System of Georgia	New York State Department of Education Office of Higher Education & the CUNY Board of Trustees	SUNY Board of Trustees	Ohio Department of Higher Education advised by a Board of Regents
Accreditation Body	Higher Learning Commission (HLC)	Western Association of Schools and Colleges (WACS) Accrediting Commission for Community and Junior Colleges (ACCJC)	Southern Association of Colleges and Schools (SACS)	Middle States Commission on Higher Education (MSCHE)	MSCHE	HLC

Federal educational policies

The federal policy most relevant to community college workforce education is the Carl D. Perkins Career and Technical Education Improvement Act of 2006 and its re-authorizations, the most recent of which, the Strengthening Career and Technical Education for the 21st Century Act (Perkins V), was passed in 2018. Perkins V was established to improve the quality of workforce education and provide funds to support and build career and technical education (CTE) programs. Under Perkins V, the federal government is prohibited from requiring specific programs of study or establishing any specific academic standards.

Still, we believe that gateway requirements are in part a response to Perkins V. The Act explicitly "promotes the inclusion of rigorous academic coursework in CTE programs and instruction," prompting some states to link their postsecondary workforce training programs with academic content using gateway requirements.[60] Ironically, because much of the material taught in gateway courses may not apply to all career-related programs of study, these requirements may counteract another Perkins V objective: that of "seamlessly linking" academic and technical content in coherent programs of study.[61]

National-regional accreditation policies

Accreditation is a systematic, voluntary, self-regulatory and peer-reviewed evaluation of the quality of educational institutions and the programs they offer students. In the United States, the Council for Higher Education Accreditation – an independent non-profit – serves as

[60] Cushing, English, Therriault, & Lavinson, 2019.
[61] Carl D. Perkins Career and Technical Education Improvement Act of 2006, 20 U.S.C. § 2301, 2006.

the "national advocate and institutional voice for self-regulation of academic quality through accreditation" (CHEA, n.d.).[62] CHEA accreditation includes a review of "expected student achievement, curriculum, faculty, services and academic support for students, and financial capacity."[63] CHEA and its five regional accrediting organizations are recognized by the federal government for its role in validating the quality of higher education in the United States. Only students enrolled in a college that has been accredited by one of CHEA's regional organizations can receive federal student aid through the Higher Education Act (US Department of Education, n.d.).[64]

Four different regional accrediting bodies cover the five states in which the 2020 SStF-participating community colleges are located.[65] In our review of these organizations' websites and materials relating to degree or certificate requirements, we were unable to locate any information having to do with oral and written communication, quantitative math skills or general education (GenEd). The website for the Accrediting Commission for Community and Junior Colleges explains that it is good practice for institutions to uphold standards for student achievement and outcomes that are "generally acceptable for higher education."[66] Not one of the regional accreditation organizations, however, provided any details as to what those "generally acceptable" levels might be. None, for example, specifically defined "college

[62] Council for Higher Education Accreditation, n.d.
[63] Council for Higher Education Accreditation, 2006.
[64] U.S. Department of Education, 2021.
[65] Certain programs of study within an institution may participate in further accreditation reviews by a field-related professional organization.
[66] Accrediting Commission for Community and Junior Colleges, Western Association of Schools and Colleges, 2021.

readiness" nor the level of proficiency to be achieved at the college level. Such determinations appear to be left to the individual colleges under their jurisdiction.

All four regional organizations referenced GenEd and the requirement that students achieve competency in both communication and quantitative skills. But instead of guiding institutions through a set of recommended course requirements or a GenEd pathway, they tended toward vague explanations of desired student outcomes. For example, they variously referenced the need for students to master "…modes of intellectual inquiry or creative work […to develop] skills adaptable to changing the environments"[67] or to engage in the study of "values, ethics, and diverse perspectives."[68] However, only the Middle States Commission on Higher Education (MSCHE) and the Southern Association of Colleges and Schools – Commission on Colleges (SACSCOC) specifically identified the disciplines that fall under the GenEd category (e.g., humanities/fine arts, social/behavioral sciences and natural sciences/ mathematics).[69] Neither body went on to identify the types of gateway courses, nor the pathways students should take, to achieve the learning outcomes they espoused.[70]

[67] HLC, 2019.
[68] MSCHE, 2015, p. 8.
[69] SACSCOC, 2017.
[70] HLC, 2019; MSCHE, 2015; SACSCOC, 2017; ACCJC, 2014.

In summary, accrediting bodies require colleges to design programs that assure that students achieve competence in quantitative and communication skills but leave it up to individual college systems or colleges to determine what proficiency means, how it is measured, and the level and type of proficiencies required for the credentials they award.

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State-level education policies

Finally, we looked at state-level policies related to gateway requirements. The bodies governing state workforce education policy vary widely, and there was considerable variation in policies across the five states in our study.[71] Though the governing bodies may be structured differently, the authorities vested in them are fairly similar. They include "ensuring that the resources of the institution are adequate to provide sound educational, adult literacy, and economic development programs"[72]; "authorizing and approving new degree programs"[73]; regulating "the admission of students," and determining "qualifications for [students'] continued attendance."[74]

[71] For example, in 2010, the Georgia State legislature established the Technical College System of Georgia (www.tcsg.edu) under Title 20, creating the state's public community college system. In Arkansas, a state education law established the authority of the Arkansas Higher Education Coordinating Board (www.adhe.edu). New York's community colleges are governed by a Board of Trustees at SUNY (www.suny.edu/about/leadership/board-oftrustees/), and California's, by a Board of Governors (https://accjc.org/). Ohio looks to its Department of Higher Education (www.ohiohighered.org/).
[72] Technical College System of Georgia, 2017, p.1.
[73] Ohio Department of Higher Education, 2021a.
[74] SUNY, 2012.

Each state requires review and approval of all new associate degree programs by its designated state education office.

For any new degree program at CUNY[75] or SUNY,[76] including associate degrees, New York State also requires an amendment to that system's master plan. Georgia, the only state that offers a diploma,[77] requires that any new system-wide diploma in a pre-existing program or any new technical diploma program be approved by a state board. This process can be avoided only if the state has already approved an associate-level course in the same field, and that course has been evaluated and deemed to be performing satisfactorily.[78] Our analysis of publicly available materials related to this process found no explicit mention of math nor English competencies nor gateway requirements for Georgia's diploma programs.

In both Arkansas[79] and Ohio, the process for establishing a new certificate program[80] closely parallels that required for new degree programs – review and approval by the state's relevant governing body. In Georgia,[81] technical colleges can establish new certificate programs without going to the state under certain conditions: they must currently offer *all* credit-bearing courses contained in the new certificate, and the new certificate must relate to an existing certificate, diploma or associate degree that has been performing satisfactorily. In California, the Division of Curriculum and

[75] New York State Education Department, 2021.
[76] SUNY, 2016, p.3.
[77] A diploma is a credential offered by Georgia's community college system. By credits, it falls between an associate degree and a technical certificate.
[78] Technical College System of Georgia, 2020.
[79] Arkansas Division of Higher Education, 2019.
[80] Ohio Department of Higher Education, 2021b.
[81] Technical College System of Georgia, 2020.

Reviews by state educational authorities appear to focus on overall program quality without any clear definition of what quality means.

Instruction or the Instruction unit within the Chancellor's office is responsible for reviewing and approving new certificates.[82] Finally, while it is unclear what SUNY requires for certificate programs, CUNY requires new certificate programs to be reviewed by the New York State Department of Education but does not require an amendment to the master plan.[83]

In summary, across the five states, we found considerable state oversight of the credentials offered by community colleges, but no explicit state policies about math and English proficiency nor any gateway requirements by credential. As we found in our analysis of accreditation policies, reviews by state educational authorities appear to focus on overall program quality without any clear definition of what quality means.

We now turn to an examination of policies specific to each of the state community college systems.

State Community College Systems

Admission and placement

"Open admissions" was the norm across the six state community college systems. In most cases, there was no indication of admissions standards specific to a credential or field of study. At the same time, state system websites identified the measures and instruments used to assess students' "college readiness." These measures were used both independently and in combination. Proficiency

[82] Chancellor's Office, n.d.
[83] SUNY, 2016.

indexes, used in California[84] and at CUNY,[85] for example, combined scores on exams including the ACT, SAT, PSAT, Accuplacer, Regents' or Compass exams with high school GPAs. College system websites also posted cut scores for many of these instruments that indicated which students would be able to enroll directly in college-level courses, and which students would require stand-alone or corequisite developmental education courses in math and/or English. As such, assessment and placement mechanisms, as well as default policies in English and math, provided a rubric for the existence of program and credential requirements. [86]

Associate degree and general education requirements

GenEd credits are a common requirement across associate degree programs. State systems, however, vary in the number of required GenEd credit hours and the range of subjects they must cover within each type of associate degree program. The mere existence of GenEd requirements suggests an implicit gateway policy that can act as a barrier to program completion, especially for racially minoritized students, adult learners and students with low incomes. Table 3 presents GenEd requirements by state and associate degree program as well as by diploma (Georgia) and certificate program.

[84] Los Angeles City College, *Matriculation*.

[85] Cruz, 2019, p. 2.

[86] Of note, under AB 705 legislation (https://legiscan.com/CA/bill/AB705/2017), California colleges must do as much as possible to place entering students directly into college-level courses, providing a range of academic supports to foster their success. In addition, under AB 705, students in workforce programs can use non-transfer-level college courses to fulfill their gateway requirements.

Table 3: General Education Requirements for Associate Degrees in Six State Community College Systems

Credential	Arkansas Community Colleges	California Community Colleges	City University of New York	Ohio Community Colleges	State University of New York	Technical College System of Georgia
Associate of Arts (AA)	Yes	Yes	Yes	Yes	Yes	NA
Associate of Science (AS)	Yes	Yes	Yes	Yes	Yes	Yes
Associate of Applied Science (AAS)	Yes	NA	Yes	Yes	Encouraged	Yes
Associate of Occupational Studies (AOS)	Yes	NA	NA	NA	No	NA
Associate of Applied Business (AAB)	NA	NA	NA	Yes	NA	NA
Diploma	NA	NA	NA	NA	NA	Varies
Certificates	No system-level info	No	Varies	Varies by certificate program	No	Varies

The California system offers a variety of GenEd plans that associate degree students can follow, e.g., the Los Angeles Community College District plan, the California State University General Education Breadth plan, the California State GE Breadth for STEM Plan and the Intersegmental General Education Transfer Curriculum Plan.[87] These plans vary in terms of the subject matter courses cover depending on whether they are transfer or non-transfer programs. All, however, indicate math and reading/English gateway course requirements.

[87] Los Angeles City College. *Course catalogue*, p.66.

Certificate programs

Across the six state systems, certificates are offered in a wide range of fields of study. In fact, they are perhaps the most varied of all credentials in higher education. Some are credit- bearing and others are not. They may be completed in a single term, or they may take years to complete. Some certificates are stackable and may lead to an associate degree, while others may act as a supplement or complement to another credential or professional pathway.

Requirements for certificates were identified by all community college systems with the exception of Arkansas. We found the requirements for reading/writing, math and other GenEd subjects varied by type of certificate, field of study and total number of credits needed for a certificate. In some fields, the California system offered either a Certificate of Achievement or Certificate of Proficiency based on whether a student completed GenEd requirements.[88] The Certificate of Achievement had the same requirements as an associate degree in the same field with the exception of GenEd requirements, while the Certificate of Proficiency varied from the field's associate degree program in its reading/writing and math requirements. Again, the indication of GenEd requirements suggests gateway requirements. Only by examining requirements by specific credential, program and college, however, can we track the frequency of such requirements across certificate programs.

In the next several sections, we do exactly that. Using college websites and course catalogs of 196 colleges across six community college systems in five states, we examine the gateway policies of

[88] See, for example, Irvine Valley College, 2018; Academic Senate, 2021; Porterville College, n.d.

each type of credential offered to students. A complete description of our methodology for this study can be found in Appendix A.

THE DATA

Gateway Requirements by Program & Institutional Traits

In this section we provide an overview of the characteristics of the offering institutions, their programs and the gateway requirements of those programs. For the purpose of this study, we define a gateway course as one in either math or English that is both college-level and credit bearing and has no prerequisites in the same subject. A gateway requirement can be the first math or English course in a sequence or a stand-alone requirement for program completion. The gateway requirement variable is divided into four categories: none, English only, math only, and both. Our focus is on workforce programs, defined for this study as any program that provides a clear and immediate career pathway. This determination was made for each program offered by the SStF-linked institutions in the study using the US Department of Education National Center for Education Statistics (NCES) Classification of Instructional Programs (CIP). (For more information on this process, see Methodology in Appendix A.)

Table 4: Workforce Programs' Gateway Course Requirements by Selected Credential and Institutional Characteristics (N=12,485 Workforce Programs)

Credential	# Credentials Offered	None	English Only	Math Only	Both
ALL PROGRAMS	**12,485**	**43.0%**	**7.4%**	**6.8%**	**42.8%**
Program Type					
Short-Term Certificates	4,486	92.0%	2.6%	3.9%	1.6%
Medium- and Long-Term Certificates	1,819	61.3%	10.6%	9.2%	19.0%
Associate Degrees	6,180	2.1%	10.0%	8.2%	79.7%
Program Major					
Agriculture/Natural Resources	885	40.0%	4.7%	11.6%	43.6%
Computer Science	1,797	49.7%	6.8%	6.6%	36.8%
Engineering/Engineering Tech/Architecture	1,761	35.0%	5.7%	10.9%	48.4%
Health	2,288	32.1%	14.7%	3.5%	49.7%
Manual Trades*	2,243	61.0%	3.6%	4.8%	30.5%
Business	3,432	40.2%	6.9%	7.1%	45.9%
State					
Arkansas	1,109	34.5%	7.7%	5.3%	52.5%
California	8,038	55.5%	4.3%	7.7%	32.4%
Georgia	66	1.5%	6.1%	0.0%	92.4%
New York	1,725	8.4%	17.6%	5.2%	68.8%
Ohio	1,547	24.8%	11.8%	4.8%	58.6%
IPEDS Institutional Characteristics					
Urbanity					
Rural	1,594	35.7%	8.0%	6.0%	50.3%

Suburban	4,905	43.9%	6.0%	7.4%	42.7%
Town	950	27.5%	13.2%	5.8%	53.6%
Urban	5,036	47.5%	7.4%	6.6%	38.5%
Institution Size					
Under 1,000	60	36.7%	35.0%	15.0%	13.3%
1,000–4,999	2,478	31.0%	9.0%	6.1%	54.0%
5,000–9,999	2,858	33.8%	9.9%	6.7%	49.7%
10,000–19,999	4,750	45.5%	6.2%	7.9%	40.4%
20,000 and above	2,339	62.2%	4.5%	5.2%	28.2%
Fall Enrollment % for Racially Minoritized Students (2019)					
Above the 50th Percentile	6,197	50.2%	5.0%	6.8%	38.0%
At or Below the 50th Percentile	3,151	49.0%	5.6%	7.3%	38.1%
At or Below the 25th Percentile	3,137	22.8%	14.0%	6.2%	57.0%

*Manual trades refers to: construction, mechanical trades, precision production, and transportation

More than half of the identified workforce programs required one or more gateway courses. Overall, 57 percent of workforce programs required students to complete at least one gateway course in either math or English. The number of programs requiring only math or only English was roughly even at around 7 percent, and about 43 percent of programs required gateway courses in both subjects. But these summative statistics conceal important variations, which we examine in detail below.

The presence of gateway requirements was strongly related to credential type. Nearly all associate degree programs – about 98 percent – had at least one gateway requirement in either math or English, and well over three-quarters (80%) required both. Among certificate programs, the presence of gateway requirements was strongly related to how long it took to earn the credential.

While only 8 percent of short-term certificates had any gateway requirements, nearly 40 percent of medium- and long-term certificates had such requirements. Among medium and long-term certificates, math and English requirements are about equally common.

The strong relationship between gateway requirements and credential type may largely explain the differences we observe in other categories. When we compare the five states in our study with one another, for example, we observe considerable variation in the proportion of programs with gateway requirements. New York (69%) and Georgia (92%) had the highest proportion of programs with both math and English gateway course requirements, whereas California had the highest proportion of programs with no gateway requirements at all (55%). But as we will discuss below, this may be related to the type of credential programs that are most common in each state.

Gateway requirements also appear to vary by field of study. Programs in manual trades (61%) and computer science (50%) were more likely to have no gateway requirements than were programs in health (32%) and business (40%). Similarly, urban schools, larger schools and those that serve a higher proportion of underrepresented minority students were all less likely to have gateway requirements in their workforce programs. In all these cases, however, we expect much of this variation to be related to the types of credentials awarded by the surveyed institutions in each state. We explore that relationship in the next section.

Credential Types by Program and Institutional Traits

Table 5 shows the distribution of credential types according to select program and institutional characteristics.

Table 5: Type of Credential by Select Program and Institutional Characteristics

	# Credentials Offered	Short-Term Cert.	Med- or Long-Term Cert.	Assoc. Deg.	Total
Field of Study					
Agriculture/Natural Resources	885	32.2%	11.0%	56.8%	100%
Computer Science	1,797	43.7%	11.9%	44.4%	100%
Engineering/Eng Tech/Architecture	1,761	30.4%	15.9%	53.7%	100%
Health	2,288	23.3%	17.2%	59.5%	100%
Manual Trades	2,243	49.0%	20.0%	31.0%	100%
Business	3,432	35.8%	11.0 %	53.2 %	100%
State					
Arkansas	1,109	36.2%	24.8%	39.0%	100%
California	8,038	45.1%	12.2%	42.7%	100%
Georgia	66	3.0%	0.0%	97.0%	100%
New York	1,725	5.9%	14.6%	79.6%	100%
Ohio	1,547	22.9%	20.4%	56.7%	100%
IPEDS Institutional Characteristics					
Urbanicity					
Rural	1,594	29.2%	19.6%	51.2%	100%
Suburban	4,905	36.7%	12.4%	50.9%	100%
Town	950	28.0%	19.4%	52.6%	100%
Urban	5,036	38.8%	14.2 %	47.0 %	100%
Institution Size					
Under 1,000	60	35.0%	23.3%	41.7%	100%
1,000–4,999	2,478	28.5%	20.5%	51.0%	100%
5,000–9,999	2,858	28.3%	11.5%	60.1%	100%
10,000–19,999	4,750	37.1%	14.6%	48.3%	100%
20,000 and above	2,339	50.7%	11.7 %	37.6 %	100%
Fall Enrollment % for 2019 Racially Minoritized Students & 1st Generation					

Above the 50th Percentile	6,197	40.9%	12.2%	46.9%	100%
At or Below the 50th Percentile, Above the 25th Percentile	3,151	40.7%	14.2%	45.2%	100%
At or Below the 25th Percentile	3,137	21.4%	19.6%	59.0%	100%
Total	**12,485**	**35.9%**	**14.6%**	**49.5%**	**100%**

*Institutional characteristics from IPEDS 2019 data.

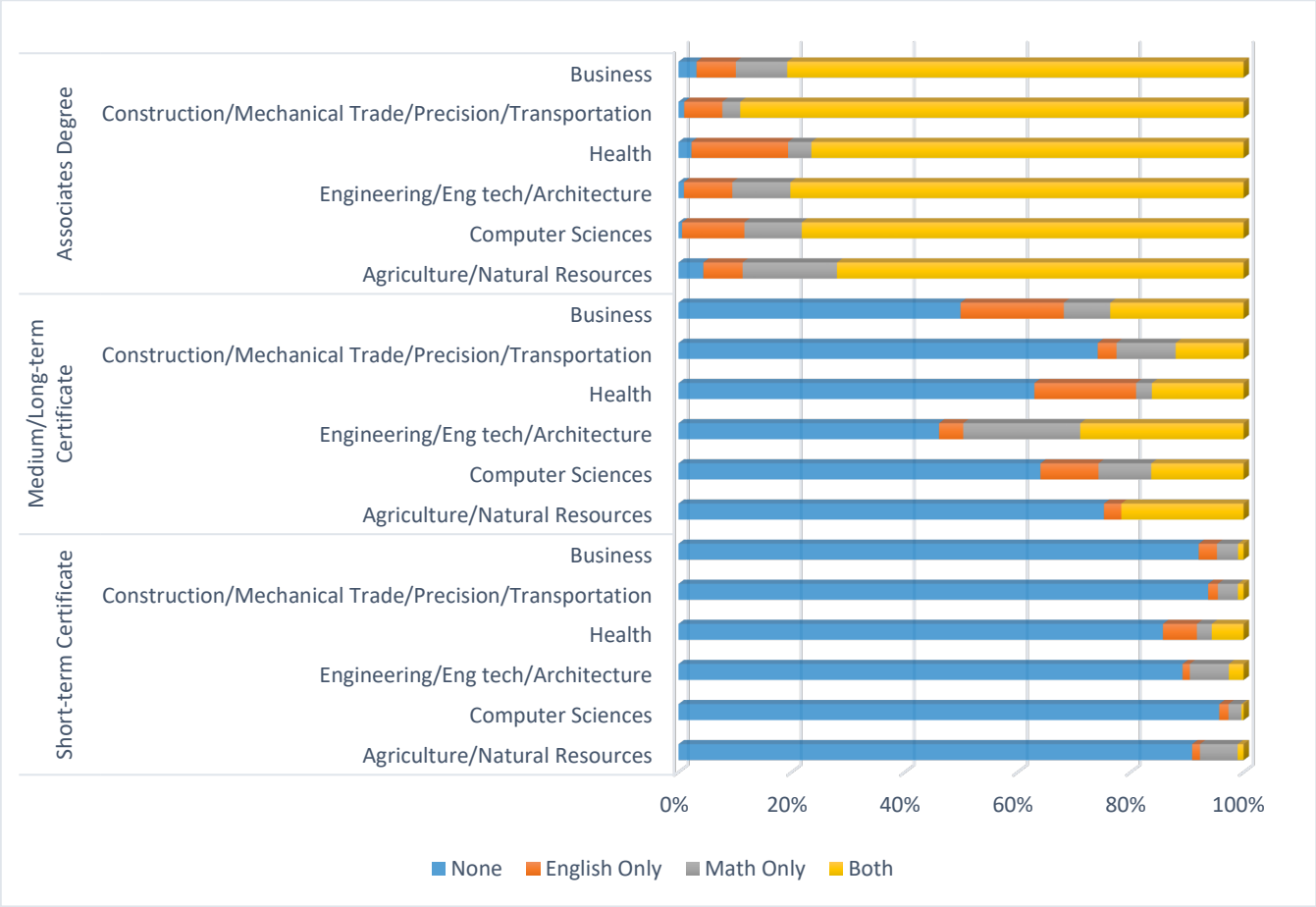
Credential types vary by field of study. Looking at broad programs of study, we observe that most of the credentials offered in manual trades and computer science are short-term certificates. These are likely to be industry-focused credentials in specific computer software and manufacturing technologies (e.g., Cisco Systems, Microsoft Office or computer numerical control machines like lathes and mills). The focused nature and short duration of these credentials partially explain the lower incidence of gateway requirements in programs in these fields. By contrast, workforce programs in healthcare and engineering were more likely to be associate degrees, which partially explains the higher incidence of gateway requirements in programs in these fields. Because these programs demand broader skill sets, the credential generally takes multiple years to complete.

Credential types vary by state. California's community colleges were the only system to offer more short-term certificates than associate degrees; indeed, short-term certificates offered in California accounted for nearly half of the short-term certificate programs analyzed in the study. Community colleges in Georgia and New York offered far more associate degrees than any other type of credential. Associate degrees also dominated program offerings in Ohio, but not as markedly as in Georgia and New York. Arkansas had the most balanced distribution of program types. These results, coupled with the higher frequency of short-term certificates at larger

institutions and those that serve a higher proportion of underrepresented minority students, partially explain the lower incidence of gateway requirements by state and institution type.

Program-of-Study Variation within Credential Types. Since the presence of gateway requirements was related to both the credential a student chose to pursue and the subject area they chose to pursue it in, we next examined how gateway requirements varied by program of study within a given credential type. Figure 1 visualizes this relationship as a series of stacked bar graphs (see Appendix B, Table B1 for the underlying statistics).

Figure 1. Gateway requirement by Credential Type and Program



Short-term certificates in engineering and health have relatively more gateway requirements. As observed in Table 4, gateway requirements were very rare in short-term certificate programs. When we look within this credential category, we find that the majority of those that existed were concentrated in engineering (11%) and health (14%) programs. Predictably, among short-term certificate programs, math gateway requirements were more common for engineering students (10%), while English requirements were more common for student studying health fields (12%).

Medium/Long-term certificates in competitive fields often have gateway requirements. Slightly over half (54%) of engineering and business programs, and over one-third of health (37%) and computer science (36%) programs, had at least one gateway requirement. The rates in manual trades and agriculture programs were around 25 percent. Again, math requirements were prevalent in engineering programs (21%), while English requirements were more prevalent in health and business programs (18%).

Gateway requirements are ubiquitous in associate degree programs. The data in Table 4 showed that nearly all associate degree programs in workforce fields had at least one gateway requirement. We further note that between 70 and 90 percent of workforce associate degree programs required both math and English gateway courses. This aligns with the earlier observation that most state systems in our study required degree students to complete some kind of GenEd coursework, however loosely defined. Interestingly, about one-sixth of associate programs in health did not have a gateway math requirement, while the same proportion – about one-sixth – of associate programs in agriculture lacked a gateway requirement in English. The absence of gateway

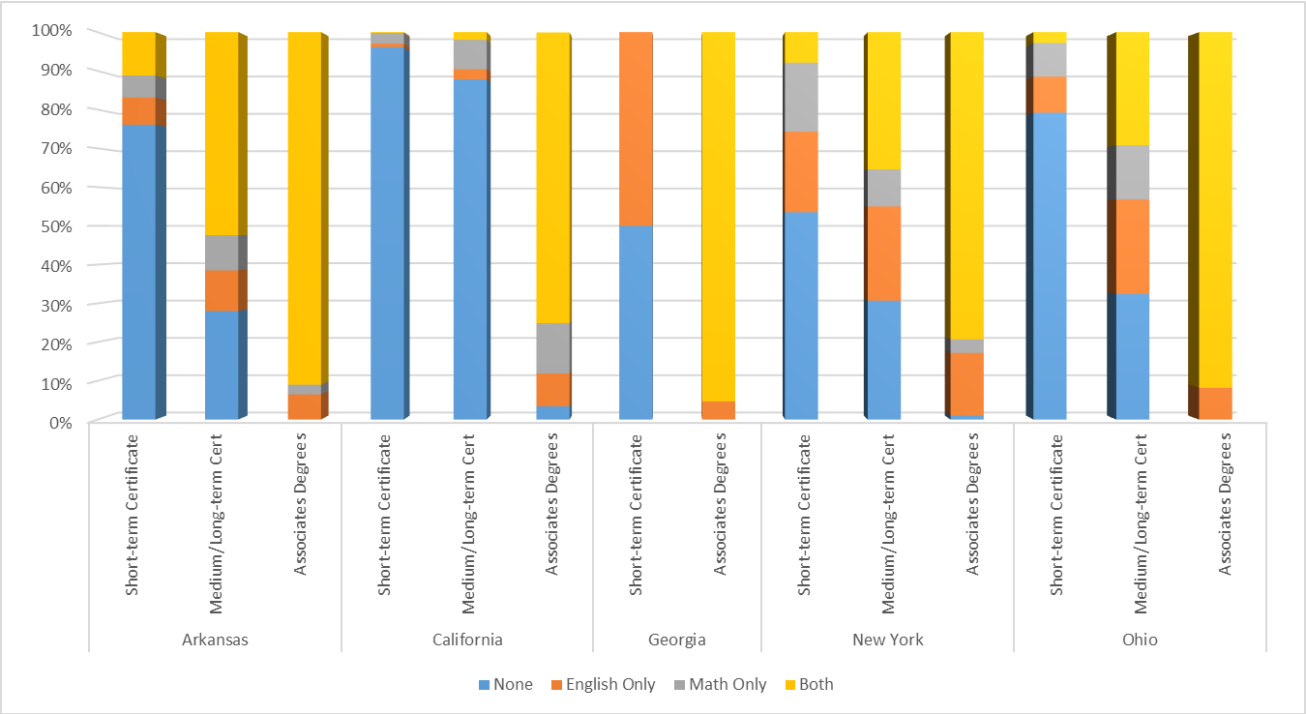
requirements in these programs may be a function of their status as transfer or non-transfer programs of study. Since our analysis did not separate transfer and non-transfer programs, however, we cannot be sure this is always the case.

State-Level Variation within Credential Types

Based on our observation that states varied significantly in the types of workforce credentials offered, we next opted to investigate how gateway requirements varied within credential types offered in each state in our study. Figure 2 visualizes this relationship (see Appendix B, Table B2, for the underlying statistics).[89] In general, the data suggested that California stood apart from the other four states in its persistent lack of gateway requirements among its certificate programs, perhaps in part because of the enactment of AB 705 and the state's focus on moving students rapidly through their programs of study. However, among associate degree programs, gateway requirements were nearly universal across all states.

[89] We also provide tables for individual states in Appendix B.

Figure 2. Gateway Requirements by State and Credential Type



California has lower rates of gateway requirement in its certificate programs. In California community colleges, the presence of gateway requirements generally correlated with the length of the program. The proportion of short-term certificate programs with no gateway requirements was only slightly higher in California (96%) than in the overall sample (92%). Notably, California's colleges accounted for over 80 percent of the short-term certificates analyzed in this study. As such, this state heavily influences the overall figures for short-term certificates. Among medium- and long-term programs, where California only accounts for about half of those analyzed, California's rate of any requirement (12%) was markedly lower than that of the overall sample (39%). Associate degree programs in California were similar to the overall sample in their rate of any requirement and were somewhat more likely to require only a math gateway course.

Other states had similar rates of gateway requirements for certificate students. Among states outside of California, New York's community colleges were the most likely to have at least one gateway requirement for certificate students. New York's rate of any gateway requirement for short-term certificates was 46 percent, compared to only 4 percent in California and 21 percent in Ohio. Among medium- and long-term certificate programs in New York, 70 percent had at least one gateway requirement as compared to 40 percent in the full sample.

Among programs offered in Arkansas community colleges, we see a distinction between certificate and degree programs. About one-quarter (24%) of short-term certificates have any gateway requirement. Over half of medium- and long-term certificates had both math and English requirements. In Ohio, about 21 percent of short-term certificates had at least one gateway requirement. This proportion grows to two-thirds among medium- and long-term certificates. All associates programs in Ohio required an English gateway course, and over 90 percent required both math and English. There were very few certificate programs in the data we analyzed from Georgia's community colleges.

Multivariate Analysis & Discussion

The preceding presentation provides a lot of information as to the requirements of gateway courses in workforce programs. But that information does not give a conclusive answer to what factors determine whether a given program will require students to take one or more gateway courses. To answer this question, we ran a series of five logistic regression models predicting whether a given program had any gateway requirements. We included control variables for credential type, program of study, the state in which the institution was located and the institutional traits examined above. The regression models are presented in Table 6. The first model only includes credential type, and the

second adds program of study. The third model adds the institution state, and the last two include institutional traits (urbanicity and enrollment characteristics).

Table 6: Predicting Gateway Requirements by Program and Institutional Traits, Logistic Regression with Marginal Effects

	Gateway Requirement: Yes=1/No=0				
Covariates	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Credential Type (ref short-term cert)					
Mid-/Long-Term Cert	0.307***	0.305***	0.210***	0.210***	0.200***
	(0.012)	(0.012)	(0.011)	(0.011)	(0.011)
Associate	0.898***	0.893***	0.847***	0.846***	0.838***
	(0.004)	(0.005)	(0.007)	(0.007)	(0.007)
Program (ref. Agriculture)					
Computer Sciences		0.015	0.008	0.008	0.01
		(0.011)	(0.011)	(0.011)	(0.010)
Engineering/Eng Tech/Arch		0.068***	0.038***	0.038***	0.039***
		(0.011)	(0.011)	(0.011)	(0.010)
Health		0.039***	-0.002	-0.003	-0.001
		(0.011)	(0.010)	(0.010)	(0.010)
Manual Trades		0.003	-0.003	-0.003	0.001
		(0.010)	(0.010)	(0.010)	(0.010)
Business		0.036***	0.022*	0.021*	0.022*
		(0.010)	(0.010)	(0.010)	(0.010)
State (ref. Arkansas)					
California			-0.186***	-0.180***	-0.183***
			(0.010)	(0.012)	(0.016)
Georgia			0.108	0.128	0.108
			(0.143)	(0.141)	(0.140)
New York			0.016	0.018	0.012
			(0.016)	(0.016)	(0.018)
Ohio			-0.023	-0.011	-0.016

			(0.013)	(0.014)	(0.017)
Urbanicity (ref. Rural)					
Suburban				0.013	0.004
				(0.007)	(0.009)
Town				0.018*	0.012
				(0.009)	(0.009)
Urban				-0.005	-0.016
				(0.007)	(0.009)
Institution Size (ref. less than 1,000)					
1,000 to 4,999					0.016
					(0.021)
5,000 to 9,9999					0.036
					(0.022)
10,000 to 19,999					0.039
					(0.023)
20,000 and above					-0.014
					(0.023)
Racially Minoritized students Enrollment % (2019) (ref. At or Below 25th Percentile)					
Above 25th but Below the 50th Percentile					-0.007
					(0.008)
At or Above the 50th Percentile					0.010
					(0.009)
Women Enrollment % (2019) (ref. At or Below 25th Percentile)					
Above 25th but Below the 50th Percentile					-0.010
					(0.007)
At or Above the 50th Percentile					0.009
					(0.006)
N	*12,406*	*12,406*	*12,406*	*12,406*	*12,406*

Gateway requirements depend most heavily on credential type. Credential type was the strongest independent predictor of gateway requirements. It showed a statistically significant result and consequently a strong impact on the presence of gateway requirements. As the above model indicates, relative to short-term certificates, medium- and long-term certificates were 30 percent more likely to have a gateway requirement, and associate degree programs were 90 percent more likely to do so. The finding related to credential type is to be expected given that associate degree programs typically include college's GenEd requirements. In earlier iterations of these analyses, not shown here, we distinguished between transfer- and non-transfer degrees, but this distinction did not meaningfully relate to the presence of gateway requirements.

The subject of study sometimes affects the likelihood of gateway requirements. Certain programs of study – engineering, business and health – were slightly more likely to have gateway requirements than the other program types included in our analyses. Because this model controlled for credential type, such a finding could indicate that competitive programs imposed additional requirements. Another interpretation is that colleges believed that gateway requirements – even for certificate students – would benefit students in their subsequent employment or their pursuit of a higher credential in some fields more than others.

California's workforce programs were the least likely to require gateway courses. Our third model controls for the institution state. We observe in this model that, after accounting for differences in credential types and programs of study, workforce programs in California are 19 percentage points less likely than the reference group (Arkansas) to have any gateway requirement. Figure 2 indicates that California has a disproportionate number of short-term certificates, which are less likely to require any gateway courses. Figure 2 also indicates that in addition to California's

larger share of short-term certificates, Arkansas, the reference state, also has a relatively large share of short-term certificates. Nevertheless, variation in programs does not fully account for this result in California. In model 2 we see that the programs that are the most likely to have at least one gateway requirement are engineering, health and business. If we compare California with Arkansas (reference category), it looks like the share of health and engineering programs is higher in Arkansas compared to California. At the same time, the share of business programs is higher in California. As such, variations in programs might actually balance itself out and therefore should not account for the lower likelihood of gateway requirements in California.

Moreover, program of study itself is dependent on credential type – in other words, it is the combination of program and credential type that is likely to affect whether a program has a gateway requirement. Figure 1, for example, shows that the presence of a gateway requirement, even for programs such as engineering, health and business, depends on credential type. Thus, if a business program is a short-term certificate, it unlikely to have a gateway requirement.

The variable for state also lowers the marginal effect of credential type in this model: in the previous two models, long-term certificates were 31 percent more likely, and associate degree programs 89 percent more likely, than short-term certificates to have a gateway requirement. In the model controlling for institutional location, these percentages were reduced to 21 and 85, respectively. This finding recalls our earlier discussion about California's AB 705, which set policy in respect to assessment and placement into transfer-level gateway courses for degree students, but also clarified that students seeking a local degree or certificate could be "placed in the math or

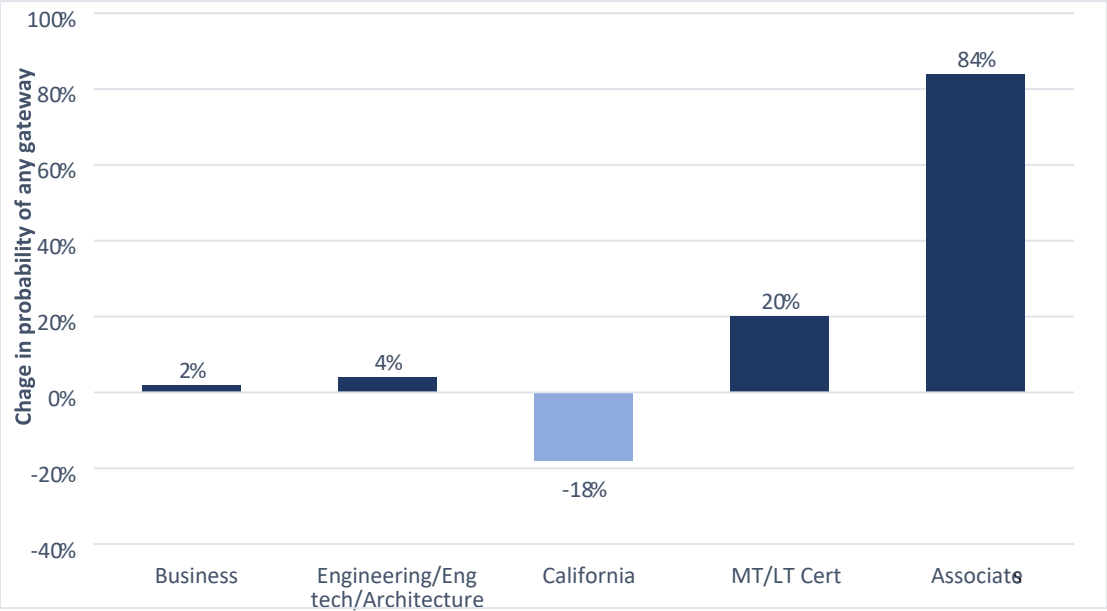
quantitative reasoning that matches the student's goal." [90] California thus serves as an example of the strong role state policy can play in shaping college requirements. We discuss this further in the conclusion below.

No institutional traits were correlated with gateway requirements. The fourth and fifth models, which add institutional traits including urbanicity, institution size, proportion of racially minoritized students and gender composition, did not markedly change the coefficients for either credential type or state. Nor do any of these characteristics significantly predict the presence of gateway requirements.

Overall, we interpret these results to mean that credential type is the most consequential predictor of gateway requirements, and that state-level variation – specifically in California – is also a consequential predictor. Certain programs of study, particularly those in engineering fields and business, are statistically also slightly more likely to have gateway requirements. To further clarify these findings, Figure 3 gives a graphic representation of these overall results.

[90] California Community Colleges, n.d.

Figure 3: Summary of Significant Regression Analysis Findings



CONCLUSION

The goal of this study was to better understand math and English gateway requirements in community college workforce programs. So, what have we learned? Our analysis of 12,485 certificate and associate degree programs at 196 colleges in five states supported by SStF funding found that 57 percent of workforce programs required students to complete at least one gateway course. We also found that gateway requirements were largely determined by the type of credential being sought. Associate degree programs were near universal in requiring gateway courses in both math and English. Among certificate programs, we found that program length (short- versus medium- or long-term), program of study and the state of the offering institution were all important predictors of the presence of gateway requirements.

Further unpacking certificate gateway requirements, we also observed patterns of difference with respect to which gateway course(s) was required. Thus, certificates in engineering required

math but not English, while many certificates in health only required English. We know across all sectors of postsecondary education, introductory college-level math courses – those that meet our definition of gateway courses – have the lowest rates of course success[91] and often act as barriers to student retention and completion. In the context of community college open admissions, assessment and placement practices, these findings suggest that gateway requirements are creating additional barriers for some fields of study and therefore career pathways, especially for students coming from racially minoritized and low-income communities.

This study suggests the need to rethink the use of gateway course completion as an academic measure of student success at community colleges. The findings from this study throw into relief the convergence of several issues. Many community college students are returning students or incumbent workers seeking to retool or advance their careers. Many of the workforce programs in which they enroll are certificate programs, which often require only one, if any, gateway course. The successful completion of a certificate program – regardless of what field it is in – should be the measure of a student's success, not whether they complete an individual English or math gateway course that may or may not contain content relevant to their career pathway.

Challenges

We note three primary challenges in the process of conducting this research. The data collection required a substantial and coordinated effort. Locating information across hundreds of course catalogs and college websites required navigating the idiosyncrasies of states, college

[91] Douglas & Salzman, 2019.

systems, and individual institutions and programs. Once collected, harmonizing the data required numerous iterations and retracing of steps.

We were able to estimate a proportion of programs with gateway requirements, distinguish between requirements in math and English and point to program and institutional characteristics that shaped the presence of these requirements. But this seems a start rather than a conclusion for two reasons. First, our data do not permit us to understand the relationship between gateway requirements and actual rates of student success in workforce programs. We therefore suggest future research to deepen our understanding of how gateway course requirements impact overall student persistence and credential completion. This includes looking at the impact of developmental education requirements prior to enrollment in gateway courses and examining how these practices affect equity of opportunity and outcome.

Second, our research does not answer the question of how these courses relate to student career choices and pathways. For example, it would be important to know how and why students are coming to workforce programs of study. While gateway courses may make sense for traditional students with no prior postsecondary education, they may be less plausible or useful for incumbent workers retraining or upgrading their skills or students in terminal associate degree programs who seek immediate entry into the labor market. At the same time, they might be important for students who are considering an academic pathway that includes transfer and earning a higher degree.

Similarly, it would be important to understand the rates at which workforce program completers go on to employment in their target industry, and whether and how often they actually use the skills they learn in gateway courses. This relates to a third challenge that fell beyond the scope of our research: the content of gateway courses, and which ones result in the best outcomes –

academically and in terms of employment. Student outcomes by type of gateway courses including non-transfer college-level courses that meet gateway requirements, e.g., technical math, would be an important area of research. In addition, we believe a study of course content in English gateway courses would help facilitate better alignment of the communication skills students need for successful employment.

Recommendations

Descriptive projects do not easily lend themselves to policy recommendations. The challenges noted above certainly lead us to recommend further data collection and detailed study in certain areas. But we also need to continue to ask some questions to better ground our research.

If we require gateway courses, we need to ask: To what extent do these courses align with the skills needed by workers and their employers? Many colleges partner with regional industry in developing their workforce programs, but have we asked these partners to speak to us about the math and English skills they want employees to have? Do we need to modify or revise our curriculum – to contextualize content by adding more real-world problems? Do we also need to rethink our pedagogy in gateway courses, and have students more actively engage in critical thinking and problem solving?

We need to consider the reality that many community college students may be required to do remediation before entering a gateway course as well as the disproportionate burdens that reality places on racially minoritized and low-income communities. We have to question whether it always makes sense to require gateway courses – or to require the ones that have been traditionally required. Some college systems already have moved away from one-size – [read: algebra] – fits-all math. For example, recognizing different needs for different academic and career

trajectories, the Colorado Community College System has established algebra and non-algebra pathways that extend into developmental education.[92]

Finally, this study's review of national, accreditation and state policies suggests that there is in fact wide latitude to define associate degree and certificate workforce program requirements. The commonality across the multiple levels of oversight is the ability of a given program to effectively educate and train students for their futures. While quality may remain an elusive concept,[93] it would seem that the successful alignment of needed skills and knowledge to required curriculum is of utmost importance for students as members of both the workforce and their communities.

To this end, our finding that California's certificate programs were substantially less likely to require gateway or transfer gateway courses points to one way forward. As ever, California is serving as a laboratory for policy innovation in its progressive innovations in community college education.[94] Other states ought to attend to research on student trajectories in California to understand the possible benefits as well as possible disadvantages of removing gateway requirements from some or all community college workforce programs of study.

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[92] Colorado Department of Higher Education, 2015.

[93] Van Noy, McKay & Michael, 2019

[94] Baker, 2020.

APPENDIX A: DATA & METHODS

Qualitative Methods

The literature and multilevel policy reviews involved extensive use of *Google Scholar* and the Google search engine and employed content analysis of website posts, downloaded policy documents and peer-reviewed journal articles.

Literature review

Rutgers' Education and Employment Research Center (EERC) conducted a comprehensive literature review of existing analyses related to gateway course requirements for credential and certificate programs. We examined potentially relevant national policies in addition to state-level policies. Using tools including the Rutgers University Library System, Google Scholar, and the Education Resources Information Center (ERIC) from the Institute of Education Sciences of the US Department of Education, we searched academic databases and conducted internet searches on numerous terms in varying combinations to find relevant articles and resources. These terms included but were not limited to: *community college gateway course requirements*, *certificate gateway course requirements, labor market value of certificates, math prerequisites for certificates*, *English prerequisites for certificates, workforce program prerequisites*, and *Perkins requirements for workforce programs*. Using a "snowball approach," we also examined each source's citations to collect additional source material and expand our search terms. To keep track of useful articles and other resources, we kept an account of each source containing the author(s') name(s), source title, date and publication as well as a short summary of its key takeaways and arguments. This list of sources and summaries was then organized by theme, which helped form the foundation of our analysis of the existing literature around this topic.

Multilevel policy analysis

Accreditation

Using the CHEA website, we identified the four regional accrediting organizations that cover the five states in which the 220 SStF-participating community colleges are located: the Higher Learning Commission (HLC) for *Arkansas* (22) and *Ohio* (23) ; the Accrediting Commission for Community and Junior Colleges, Western Association of Schools and Colleges (ACCJC) for *California* (116); MSCHE for *New York* (CUNY & SUNY) (37); and SACSCOC for *Georgia* (22). We reviewed the websites of each of these four regional organizations along with any posted guidance for self-studies or campus preparation for an accreditation review. As indicated in the full report, we found that, across the four accrediting bodies, publicly available information included some general references to skills and knowledge but no explicit mention about proficiency requirements in English or math for any credential or program of study.

State-level education policies

For each state included in the study, we identified the department or office within state government that has oversight for community colleges. We reviewed websites for these entities and downloaded and read any relevant documents, e.g., the 2016 Board of Governors for the California Community Colleges; the State Department of Education Policies and TCSG Procedures Manual for the Technical College System of the State of Georgia. Despite the vested authority in these state entities to review and approve new programs of study and, in some cases, new credentials, specifics about gateways requirements were not identified in any of these documents.

State community college systems

We reviewed the websites for each of the state community college systems and again, downloaded relevant documents. It was only at this level that we were able to identify specific gateway requirements. System policies were organized by type of credential, including variations within credentials. We began our analysis by separating different types of associate degrees and certificates by state system and then creating a matrix to track gateway requirements for workforce programs.

Quantitative Methods

Sampling

The sampling frame for this study was 250 SStF institutions across five states: Arkansas, California, Georgia, New York and Ohio. Institutional characteristics were collected from IPEDS.

Based on these characteristics, we selected 196 SStF institutions that were community colleges.

Table AI: Sample selection by state

State	Not a Community College	Yes, Community College	Total
Arkansas	10	22	**32**
California	0	114	**114**
New York (CUNY and SUNY systems)	11	37	**48**
Georgia	21	5	**26**
Ohio	12	18	**30**
Total SStF Colleges	**54**	**196**	**250**

Given the sheer size of the California system, it follows that the majority of institutions in the study were located in that state (114), followed by New York (37), Arkansas (22), and Ohio (18). Georgia had the smallest number of institutions (5).

Once the community college list was finalized, the next step was to select workforce programs within these institutions. A program was considered a workforce program if its completion provides a clear and immediate career pathway. An important indicator we chose in operationalizing the definition of workforce programs is the NCES Classification of Instruction Programs (CIP). NCES developed CIP as a taxonomic coding scheme of all instructional programs. CIP codes are arranged at major, minor and detailed levels such that the first two digits represent the major grouping of instruction programs – the overarching field of study – into which each program falls, and each additional digit provides further details about the program. The CIP database also provides the title of the program that corresponds to each CIP code as well as a description of that program. We used these details to classify which programs were more likely to show a clear and immediate career pathway.

To be selected for the study, programs not only had to qualify as workforce programs under our definition but also had to demonstrate having granted a sufficient or sizable number of awards[95] in 2019. Using IPEDS, we tabulated award level by NCES CIP for each SStF institution. Our final sample of programs included agriculture & natural resources, computer science, engineering & engineering technology, and manual trades (including construction trades, mechanical and repair technologies/technicians, precision production, and transportation and material moving). In addition, given the significant use of certificates within both the health and business sectors, we included both fields in our sample.

[95] At least 100 or above awards

Data collection

Data collected from college websites included each institution's most recent posted course catalog. If a college's website contained more current information, data collected from course catalogs was verified against the website information.

With our institution and program lists complete, we developed a data collection template. The excel template was a blueprint for the type of program-level data to be collected. Basic program traits included the credential type (e.g., Certificate or Associate Degree), the number of credits required to complete program and the NCES CIP code. To construct our dependent variables, we collected data on any gateway course requirements in English and math. The data points collected were Course ID, Course Name, and Course Description.

The lead researchers pilot tested the data collection template with a small sample of institutions within each state. This pilot test led to revisions of the data collection template. In general, these revisions related to removal of certain columns and the addition of others such as adding a unique institutional ID corresponding to IPEDS as well as the addition of general CIP code. Once the template was finalized, the supervising researchers trained a data collection team to populate the spreadsheet. Data collectors were trained to locate relevant information on college websites and in course catalogs. Each data collector was allocated one or more states. Throughout the data collection process, the supervising researcher validated the data collection by spot-checking throughout the spreadsheet. We collected data on a total of 12,485 programs at 196 community colleges.

Measures

Each individual state file was read into R statistical software for processing. The state files then were combined into a single file. Initial data cleaning was done to check for inconsistencies as well as to restructure the data. Once complete, we proceeded with creating the variables for analysis. Below is the list of variables created:

Gateway requirement

This variable describes the nature of the gateway requirement, if any: a) no required gateway course; b) only a required English course; c) only a required math course; or d) a requirement for both English and math courses. To create this variable, each individual course offered by a college included in the study was initially coded as a gateway course or non-gateway course. Per our definition, a course is considered a "gateway" course if it is a college-level course in math or English that requires no other college-level pre-requisite course. The gateway course itself can be a pre-requisite to other college-level courses or could be a stand-alone requirement for completing the program in which it is offered. In most cases, the program listed multiple course options in either English or math, all of which have been included in the coding process. The institutional websites, course catalogs and state polices were revisited in the process of coding each course. For example, in the early stage of analysis, some associate programs appeared to have no gateway category. However, we discovered that many of these null cases actually turned out to have gateway requirements, which had not shown up in the initial data collection process. . Therefore, any associate degree program with no gateway requirement was recoded into having both English and math gateway requirements. This decision was made based on written policies found in our reviews.

Credential type

This variable sorts the workforce programs into three categories: short-term certificates, medium- and long- term certificates, and associate degrees. Short-term certificates are those that require 30 or less credit units, medium-term are those requiring between 30 and 60 credit units, and long-term certificates are those that require more than 60 credit units. Due to the small sample size of long-term certificates, they are grouped together with medium-term certificates. In addition, given the array of associate degree credentials and variations across the states by field of study, we decided to collapse all associate degrees – both transfer and non-transfer – for the quantitative analysis.

Program of study

Each program entry includes its detailed 6-digit CIP code. The CIP 2010 classification system was then used to create a Major CIP by extracting the first two digits. These correspond to the six major programs: agriculture & natural resources (01), computer sciences (11), engineering/engineering tech & architecture (14, 15, 04), manual trades (46–49), health (51), and business (52).

IPEDS institutional characteristics

In addition to the core variables, we also included other institutional characteristics from the IPEDS. These included "urbanicity" (rural, suburban, town, urban) and institution size as well as the percentage of racially minoritized students and women students enrolled in Fall 2019.

Table A2: List of Variables for Analysis and Data Dictionary [96]

Variable	Type	Value	Value Labels
Gateway Requirement	Categorical	0	None
		1	English Only
		2	Math Only
		3	Both
Credential Type	Categorical	0	Short-Term Certificate
		1	Medium- and Long-Term Certificate
		2	Associate
Program	Categorical	1	Agriculture/Natural Resources
		2	Computer Sciences
		3	Engineering/Engineering Tech/Architecture
		4	Health
		5	Manual Trade
		6	Business
State	Categorical	1	Arkansas
		2	California
		3	Georgia
		4	New York
		5	Ohio
Urbanicity	Categorical	0	Rural
		1	Suburban
		2	Town

[96] Using different category ranges – below 25%, 25% to 50%, 50% to 75%, above 75% – we found there were no major changes in the result for either racially minoritized students or women students.

		3	Urban
Institution Size	Categorical	1	1,000 to 4,999
		2	5,000 to 9,9999
		3	10,000 to 19,999
		4	20,000 and above
Racially Minoritized Students Enrollment Percentile	Categorical	1	Above the 50th Percentile
		2	At or Below the 50th Percentile
		3	At or Below the 25th Percentile
Women Enrollment Percentile	Categorical	1	Above the 50th Percentile
		2	At or Below the 50th Percentile
		3	At or Below the 25th Percentile

Analysis

Our analysis plan consisted of two parts. First, we performed a bivariate analysis looking at the gateway requirement by each of the selected characteristics above. This will show us the variation of gateway requirement. Because we knew that gateway requirements are heavily dependent on credential type, we also looked at the variation in credential type within selected characteristics. Following that we looked at changes in gateway requirement as a function of credential type and program level. And finally, we looked at state-level variation in gateway requirement and credential type.

We followed the bivariate analysis with a multivariate analysis using gateway requirement as an outcome and credential type, program, state, and other IPEDS characteristics as covariates. For the multivariate analysis, we create a binary outcome variable for whether the program has any gateway requirement or not. Using logistic regression, we then calculated the marginal

changes in the probability of gateway requirement as a result of changes in credential type, program, state, and other IPEDS characteristics.

Challenges

In the policy analysis portion of this study, we performed content analysis on documents that were easily accessible online – we therefore may not have gained access to the most recent or most specific policy-and-practice documents that exist for each case in the study.

The quantitative study required the creation of a totally new data set based on a variety of qualitative sources including institutional websites and course catalog documents. The process included locating discrete information about program requirements and course information for each workforce program and transferring those data into an excel template. While a process of validation reviews was in place, the resulting data set has limitations. For example, many departments list the names of their programs but not their specific CIP codes. The team therefore had to match program names with numeric CIP, a process that was challenging at times. Further, the hand coding of courses – determining the nature of any gateway requirement(s) – involved tracing back each course and looking for any and all requisite requirements. Given the subjective and arduous nature of this process, there is a possibility of human error in the data through, for example, omission or miscoding. Though we believe any such error would be minimal, it could potentially affect the analysis.

APPENDIX B: ADDITIONAL TABLES

Table B1: Gateway Requirement by Credential Type and Program [a]

Credential Type	Program	N	None	English Only	Math Only	Both	Total
Overall	Agriculture/Natural Resources	885	40.0%	4.7%	11.6%	43.6%	100%
	Computer Sciences	1,797	49.7%	6.8%	6.6%	36.8%	100%
	Engineering/Eng Tech/Architecture	1,761	35.0%	5.7%	10.9%	48.4%	100%
	Health	2,288	32.1%	14.7%	3.5%	49.7%	100%
	Manual Trades	2,243	61.0%	3.6%	4.8%	30.5%	100%
	Business	3,432	40.2%	6.9%	7.1%	45.9%	100%
	Total	**12,406**	**43.1%**	**7.4%**	**6.8%**	**42.7%**	**100%**
Short-term Certificate	Agriculture/Natural Resources	285	90.9%	1.4%	6.7%	1.1%	100%
	Computer Sciences	785	95.7%	1.7%	2.3%	0.4%	100%
	Engineering/Eng Tech/Architecture	536	89.2%	1.3%	6.9%	2.6%	100%
	Health	532	85.7%	6.0%	2.6%	5.6%	100%
	Manual Trades	1,098	93.7%	1.7%	3.6%	1.0%	100%
	Business	1,230	92.0%	3.3%	3.7%	1.0%	100%
	Subtotal	***4,466***	***91.9%***	***2.6%***	***3.9%***	***1.6%***	***100%***
Medium/Long-term Certificate	Agriculture/Natural Resources	97	75.3%	3.1%	0.0%	21.6%	100%
	Computer Sciences	214	64.0%	10.3%	9.3%	16.4%	100%
	Engineering/Eng Tech/Architecture	280	46.1%	4.3%	20.7%	28.9%	100%
	Health	394	62.9%	18.0%	2.8%	16.2%	100%
	Manual Trades	449	74.2%	3.3%	10.5%	12.0%	100%
	Business	377	49.9%	18.3%	8.2%	23.6%	100%
	Subtotal	***1,811***	***61.2%***	***10.6%***	***9.2%***	***19.0%***	***100%***
Associates	Agriculture/Natural Resources	503	4.4%	7.0%	16.7%	72.0%	100%
	Computer Sciences	798	0.6%	11.0%	10.2%	78.2%	100%
	Engineering/Eng Tech/Architecture	945	1.0%	8.6%	10.3%	80.2%	100%
	Health	1,362	2.3%	17.1%	4.1%	76.5%	100%
	Manual Trades	696	1.0%	6.8%	3.2%	89.1%	100%
	Business	1,825	3.2%	7.0%	9.1%	80.8%	100%
	Subtotal	***6,129***	***2.2%***	***10.0%***	***8.3%***	***79.6%***	***100%***

[a] Corresponds to Figure 1

Credential Type	Program	N	None	English Only	Math Only	Both	Total
Overall	Agriculture/Natural Resources	885	40.00%	4.70%	11.60%	43.60%	100%
	Computer Sciences	1,797	49.70%	6.80%	6.60%	36.80%	100%
	Engineering/Eng Tech/Architecture	1,761	35.00%	5.70%	10.90%	48.40%	100%
	Health	2,288	32.10%	14.70%	3.50%	49.70%	100%
	Manual Trades	2,243	61.00%	3.60%	4.80%	30.50%	100%
	Business	3,432	40.20%	6.90%	7.10%	45.90%	100%
	Total	**12,406**	**43.10%**	**7.40%**	**6.80%**	**42.70%**	**100%**
Short-term Certificate	Agriculture/Natural Resources	285	90.9%	1.4%	6.7%	1.1%	100.0%
	Computer Sciences	785	95.7%	1.7%	2.3%	0.4%	100.0%
	Engineering/Eng tech/Architecture	536	89.2%	1.3%	6.9%	2.6%	100.0%
	Health	532	85.7%	6.0%	2.6%	5.6%	100.0%
	Construction/Mechanical Trade/Precision/Transportation	1,098	93.7%	1.7%	3.6%	1.0%	100.0%
	Business	1,230	92.0%	3.3%	3.7%	1.0%	100.0%
	Subtotal	**4,466**	**91.9%**	**2.6%**	**3.9%**	**1.6%**	100.0%
Medium/Long-term Certificate	Agriculture/Natural Resources	97	75.3%	3.1%	0.0%	21.6%	100.0%
	Computer Sciences	214	64.0%	10.3%	9.3%	16.4%	100.0%
	Engineering/Eng tech/Architecture	280	46.1%	4.3%	20.7%	28.9%	100.0%
	Health	394	62.9%	18.0%	2.8%	16.2%	100.0%
	Construction/Mechanical Trade/Precision/Transportation	449	74.2%	3.3%	10.5%	12.0%	100.0%
	Business	377	49.9%	18.3%	8.2%	23.6%	100.0%
	Subtotal	**1,811**	**61.2%**	**10.6%**	**9.2%**	**19.0%**	100.0%
Associates Degree	Agriculture/Natural Resources	503	4.4%	7.0%	16.7%	72.0%	100.0%
	Computer Sciences	798	0.6%	11.0%	10.2%	78.2%	100.0%
	Engineering/Eng tech/Architecture	945	1.0%	8.6%	10.3%	80.2%	100.0%
	Health	1,362	2.3%	17.1%	4.1%	76.5%	100.0%
	Construction/Mechanical Trade/Precision/Transportation	696	1.0%	6.8%	3.2%	89.1%	100.0%
	Business	1,825	3.2%	7.0%	9.1%	80.8%	100.0%
	Subtotal	**6,129**	**2.2%**	**10.0%**	**8.3%**	**79.6%**	100.0%

Table B2: Gateway Requirement by Credential Type and Program [b]

State	Credential Type	N	None	English Only	Math Only	Both	Total
Overall	ST Cert	4,486	92.0%	2.6%	3.9%	1.6%	100%
	MT/LT Cert	1,819	61.3%	10.6%	9.2%	19.0%	100%
	Associate	6,180	2.1%	10.0%	8.2%	79.7%	100%
	Total	**12,485**	**43.0%**	**7.4%**	**6.8%**	**42.8%**	**100%**
Arkansas	ST Cert	402	76.1%	7.0%	5.7%	11.2%	100%
	MT/LT Cert	275	28.0%	10.5%	9.1%	52.4%	100%
	Associate	432	0.0%	6.5%	2.5%	91.0%	100%
	Subtotal	**1,109**	**34.5%**	**7.7%**	**5.3%**	**52.5%**	**100%**
California	ST Cert	3,626	96.1%	0.9%	2.8%	0.3%	100%
	MT/LT Cert	978	87.8%	2.6%	7.6%	2.0%	100%
	Associate	3,434	3.4%	8.5%	13.0%	75.0%	100%
	Subtotal	**8,038**	**55.5%**	**4.3%**	**7.7%**	**32.4%**	**100%**
Georgia	ST Cert	2	50.0%	50.0%	0.0%	0.0%	100%
	MT/LT Cert	0					0%
	Associate	64	0.0%	4.7%	0.0%	95.3%	100%
	Subtotal	**66**	**1.5%**	**6.1%**	**0.0%**	**92.4%**	**100%**
New York	ST Cert	101	53.5%	20.8%	17.8%	7.9%	100%
	MT/LT Cert	251	30.7%	24.3%	9.6%	35.5%	100%
	Associate	1,373	1.0%	16.2%	3.5%	79.3%	100%
	Subtotal	**1,725**	**8.4%**	**17.6%**	**5.2%**	**68.8%**	**100%**
Ohio	ST Cert	355	79.2%	9.3%	8.7%	2.8%	100%
	MT/LT Cert	315	32.4%	24.4%	14.0%	29.2%	100%
	Associate	877	0.0%	8.2%	0.0%	91.8%	100%
	Subtotal	**1,547**	**24.8%**	**11.8%**	**4.8%**	**58.6%**	**100%**

[b] Corresponds to Figure 2

APPENDIX C: RESOURCES

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