



EXECUTIVE SUMMARY

Crossing Signals:

What College Websites Tell Students About Taking Mathematics

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THE MATH PATHWAY IMPERATIVE

Students' experiences in mathematics send powerful signals to them about their academic potential and self-worth. College students have historically faced placement tests that underestimate their math ability, remedial courses that rehash math they learned in high school, and math content with little relevance to their future studies. Such roadblocks deepen the challenges faced by students—particularly students of color, low-income students, and others who are already marginalized in the education system.

To ensure that math education is serving its purpose of equipping students for college and life success, rather than selecting students to pursue further education, colleges and universities across the country are implementing new, evidence-based policies, which center on three key reforms:

- Introducing new math pathways—such as statistics, data science, and quantitative reasoning—that align with a range of student aspirations, to complement the traditional one-size-fits-all pathway to calculus that mainly prepares students for majors in science and engineering.

- Using students' high school records for placement and limiting reliance on traditional college placement tests, which underestimate the math readiness of a significant proportion of students.
- Eliminating or reducing the prerequisite remedial courses that have typically been required for students deemed less than college ready in favor of “corequisites” (also called “support courses,” or “lab courses”) and other just-in-time approaches for helping students succeed in college-level mathematics.

THE CURRENT INQUIRY

This study builds on our recent report, [Go Figure—Exploring Equity in Students' Postsecondary Math Pathway Choices](#) (2020), to further understand the information students receive and how it can support or detract from equitable outcomes. It examines the content accessible via college and university websites that students use to select math courses and pathways during the onboarding process.

Equipping students to make optimal choices means improving a decision-making process that has been compared to “navigating a shapeless river on a dark night,” in Judith Scott-Clayton’s seminal 2015 analysis of community college structure.¹

¹ All citations and references can be found in the full report.

EQUITY CHALLENGES IN IMPLEMENTING MATH PATHWAYS

Mathematics presents particular challenges in ensuring that all pathway options are truly accessible and that students' choices are well-informed and based on authentic agency. By the time they complete high school and enter college (if they enter college), most students have experienced tracking, or ability grouping. Placement into college developmental (i.e., remedial) courses can perpetuate K-12 inequities, a pattern that corequisite initiatives are designed to help reverse.

New offerings such as statistics, data science, and quantitative reasoning provide an enormous opportunity for more students to develop math literacy in ways that are rigorous and relevant to their future lives. Still, algebra-intensive math courses are essential stepping-stones for engineering, physics, and other sciences that have traditionally excluded students of color. It is essential, therefore, that new pathways be implemented in ways that change the status quo—expanding, not limiting, access to STEM courses, especially for Black and Latinx students.

Students make assumptions about their math abilities, often in consultation with advisors who may hold their own biases, that can influence their choices. Those assumptions or biases can cause mismatches in terms of which pathway students pursue, at what level they enter the pathway, or both. Students who receive implicit or explicit signals that emphasize their deficiencies, rather than their potential, can understandably develop math avoidance and lower their aspirations.

To mitigate such risks, institutions have a responsibility to send effective signals. Course offerings themselves can send signals. The prevalence of remedial offerings, for example, might communicate to students that they aren't ready for college-level math courses, even though starting in college-level courses increases students' likelihood of college success.

While having a broad range of choices presents more opportunities for students to be successful, it also points to the need for clearer, more

nuanced guidance. To make effective math enrollment decisions, students need to have clear educational goals, accurate information about available math pathways, and guidance in selecting the appropriate course level within their chosen pathway. Given high counselor-to-student ratios at many colleges, accurate online information is essential for effective and efficient counseling—even more so during the ongoing COVID-19 pandemic, as students have had reduced access to college instructors, advisors, and fellow students.

POSTSECONDARY MATH REFORM: THE CALIFORNIA CONTEXT

Both the California Community Colleges and the California State University system have recently adopted reforms designed to accelerate students' progress through required college mathematics courses. Though the mechanisms differ, both systems now emphasize placing students in college-level courses, based on multiple measures from their high school records, and providing various forms of support. Corequisite courses—college-level courses with additional support in the form of a one- or two-unit course, lab, or workshop—are being widely adopted by institutions in both systems. Both systems have abandoned math placement tests to determine which courses students can access. And similar to systems across the country, both offer diversified pathways aligned with students' fields of study, with the most common being STEM, Statistics, and Quantitative Reasoning or Liberal Arts Mathematics.

VITAL SIGNS: ANALYZING POSTSECONDARY WEBSITE MESSAGES ABOUT MATH PATHWAYS

Since completing a math course is required across the board for hundreds of thousands of California college students, the process of doing so should be as seamless and transparent as possible. While campus websites are not the sole source of information available to students, their significance has increased due to the pandemic. Inaccurate and/or misleading information on websites can diminish the effectiveness of academic counseling and advising.

In their current form, the websites reviewed did only a moderate job of addressing students' needs and advancing the goals of the math reforms. Viewing the 23 sites collectively offered a bird's-eye view of math education trends. But an individual student entering the system and relying on the information on any one website is likely to hit roadblocks or feel confused about available course options and how to choose a relevant and appropriate math course. There were varying degrees of confusing, outdated, inaccurate, or inconsistent information on the sites, though the CSU websites were generally clearer and easier to navigate than the CCC websites.

Our review surfaced four interconnected themes that are reminiscent of Scott-Clayton's "shapeless river" analogy:

Obscure signposts: Navigating the websites and locating reliable information about enrolling in mathematics courses was not always obvious or intuitive. In many cases, we struggled to find relevant information and noticed discrepancies in information posted on different pages and places (e.g., course catalog vs. class schedule), and, in some cases, on different sites (e.g., college vs. district or campus vs. system). We also encountered unwieldy search functions and outdated links. Some colleges had limited information about available math pathways on their websites, requiring students to make an appointment with a counselor or access a password-protected portal.

False starts: Few sites offered resources for students to explore and make connections between their interests and aspirations and the school's available programs and majors. The resources that were available tended to be difficult to find and follow. Across sites, especially the community college sites, there was little information to assist students who had not yet settled on a major, or who were thinking of changing their major, to decide between STEM, statistics, or liberal arts pathways. Overall, most of the community college sites had an ad hoc feel that did not reflect the clarity and coherence that guided pathways reforms recommend.



Wrong turns: Although most sites reference current policies to some extent, information about the placement process was not always consistent, clear, or up-to-date. For example, nearly half of the community college sites directed students to an assessment webpage or center even though placement tests are no longer required.

Unexpected obstacles: Vestiges of prior remedial math policies and deficit-oriented language could lead students to make suboptimal decisions and delay their progress to completion, the very barriers that pathway policies are intended to eliminate. Despite system policies that reduce or eliminate placement exams and remedial courses, websites within both systems contain messages that appear to discourage students from pursuing college-level courses and/or STEM math pathways. For example, rather than explaining to students that they are more likely to succeed in mathematics if they begin in a college-level course, many community college sites give the false impression that remedial courses are required or at least

recommended by listing remedial prerequisites in course descriptions or displaying remedial math offerings before college-level courses in pathway maps or catalogs.

CSU campuses continue to require various proficiency tests, especially for STEM fields, even though CSU abandoned its statewide placement test in 2018. Such impediments could nudge students away from pursuing STEM fields.

CLEAR SIGNPOSTS: PROMISING PRACTICES FOR ONLINE MESSAGES ABOUT MATH PATHWAYS

Our review of campus websites found unique, creative, and student-centered approaches that institutions have adopted for providing math pathway information, support, and guidance. Examples include:

Elimination or reduction of remedial math offerings ensures that all, or virtually all, students enroll in college-level mathematics. This practice also makes websites far more useful for making decisions about courses.

Clear access to nontraditional math pathways, including statistics courses, ensures that students can make optimal decisions. This strategy can help meet needs of students across a range of disciplines.

Transparency around math course alignment with specific majors also supports students in making effective decisions. This includes clearly linking information about majors and programs with their specific math course pathways.

Visibility and availability of corequisite support ensures access to college-level math courses and maximizes student success.

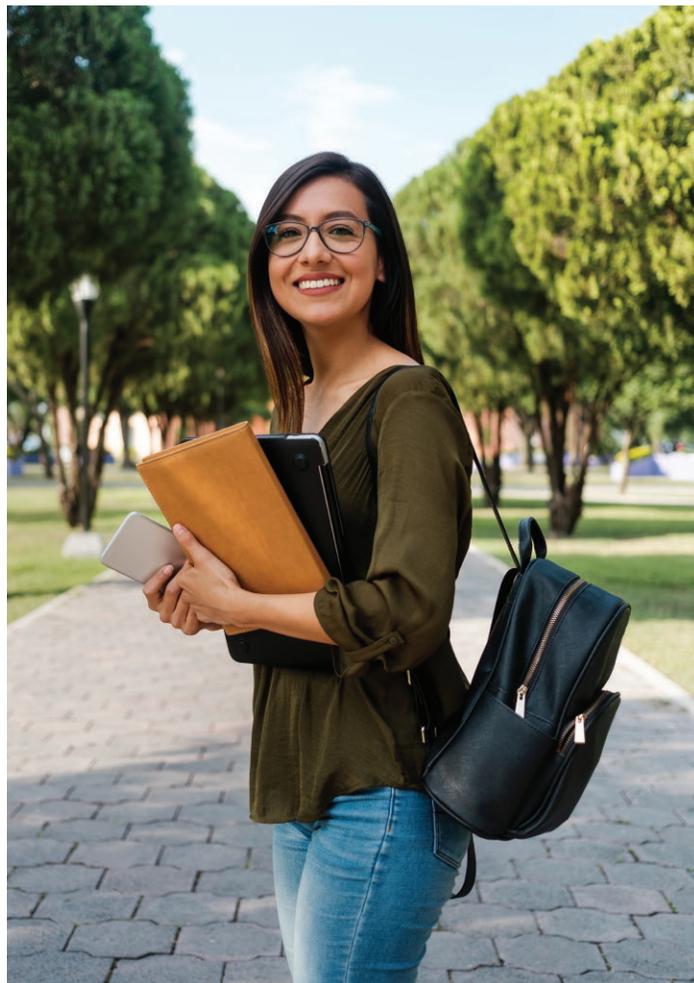
Guidance for students who are undecided about their majors, especially during the onboarding process, allows students to explore possible careers and makes linkages to specific academic programs explicit.

Transparent, consistent, and asset-based information regarding placement policies helps students reach their goals.

SIGNALING THE WAY FORWARD

If math pathway policies are effectively implemented, the door to STEM fields will remain open to interested students who previously struggled with math. At the same time, students whose interests lie outside of STEM will not be hindered from pursuing their aspirations by irrelevant math requirements.

But students who aren't aware that such opportunities are available to them can't receive the benefits of the new policies. Ideally, colleges would be structured so that poor options, such as remedial sequences, are not even offered. Still, even with only college-level courses available, students need support in making the choices most suitable for them given their previous math experiences and long-term goals. Websites offering comprehensive and transparent information can enhance students' understanding of their math placement options and make the process more seamless and effective.



Checklist for Strengthening Math-Related Guidance on College and University Websites

Criteria of Focus	Recommendations
<p>Information on math placement</p> 	<ul style="list-style-type: none"> • Simplify math placement processes by streamlining steps students take to identify recommended courses • Use asset-based language and positive messaging that highlight the benefits of enrolling in college-level or transfer-level courses (e.g., saving time and money, accessing available support, seizing opportunity to enroll in college-level coursework without undergoing testing) • Communicate the rationale for current policies and what they mean for students' long-term success • Eliminate mentions of assessments or tests when discussing placement • Confirm accuracy and currency of placement information regularly and update, as needed • Focus on the responsibility of the college to provide the support that students need
<p>Location of information on math</p> 	<ul style="list-style-type: none"> • Outline general education math options consistently across various webpages, e.g., math department, pages for onboarding, registration, and (for community colleges) transfer • Place math information on pages where students are most likely to search for it • Research accessibility of information through focus groups, surveys, or beta-testing
<p>Guidance for undecided students</p> 	<ul style="list-style-type: none"> • Offer opportunities to explore career interests and the skills and knowledge needed, and their connection to available programs or areas of study • Provide clear direction on who can support students' educational planning and offer multiple time windows and methods for reaching them (e.g., phone, email, chat) • Outline complete descriptions of various STEM, statistics, and liberal arts math pathway options • Identify and implement strategies to engage proactively with and offer guidance and direction to students who are undecided

Checklist for Strengthening Math-Related Guidance on College and University Websites, Cont.

Criteria of Focus	Recommendations
<p data-bbox="118 262 316 367">Explanation of math pathway options</p> 	<ul data-bbox="435 262 1485 609" style="list-style-type: none">• Explain why a math course is required and its learning outcomes• Offer clear descriptions or program maps illustrating various math pathways and their alignment with majors• Include course numbers and names on program maps, flowcharts, and course lists• Eliminate or limit remedial prerequisite courses and present college-level courses as default options for the majority of students• Clarify the status of courses as relates to students' transfer or program goals
<p data-bbox="118 646 305 787">Availability of math-specific supportive services</p> 	<ul data-bbox="435 646 1502 1102" style="list-style-type: none">• Offer corequisites and other just-in-time approaches to support students' success in college-level courses• Consider embedding corequisite support into core courses rather than as a free-standing course, to integrate instruction and allow students to register for a single class• Incorporate career planning into the onboarding process and highlight alignment with specific majors and programs• Offer course- or pathway-specific tutoring• Ensure that academic support services, such as tutoring, math labs, and other resources, are clearly listed on websites with information on how to access them

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