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A "Powerful Way of Learning": Teacher Perceptions about Alternative Math Courses for High School Seniors

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"I can create opportunities for students to learn and discover things on their own, and that is a much more powerful way of learning for students when they come to a discovery on their own and they make sense of it in their own way." – High school math teacher

Math instructors teaching alternative 12th-grade courses outside the "traditional" high school math curriculum were overwhelmingly positive in interviews about the effectiveness of the classes, particularly for students who are planning to attend college but have struggled with math prior to this class. Teachers said that the courses' instructional approach, which is project-based and student-centered, is a better way for students to learn and for instructors to teach. They described the shift in content—from algebra or calculus to real-life problem-solving in areas such as data science and finance, for example—as engaging for students and aligned with what most students need in order to be successful in college and the workforce.

Teachers also said that many students in these classes changed their attitudes about math, becoming more confident as they mastered upper-level mathematical practices associated with problem solving, teamwork, and independent thinking. For high school seniors who are planning to pursue a STEM field in college, teachers recommended the course as an elective (along with precalculus or calculus) to strengthen their mathematical reasoning.

These findings reinforce existing research about the importance of providing students at both the high school and college level with alternatives to the traditional algebra- and calculus-based math pathways, with courses better aligned to student goals, and focused on content and skills that they will need to be successful in college and career (Burdman, 2018; Burdman et al., 2018; Daro & Asturias, 2019; Dana Center Math Pathways, 2019). The courses examined in this study provide additional options for college-bound students during their senior year. The potential impact of these courses is particularly important given the current landscape in California, where recent policy changes suggest growing recognition on the part of the education sectors of the value of math courses outside of the traditional calculus pathway (see box on page two).

This study is part of a larger project sponsored by The College Futures Foundation. The findings, takeaways, and questions in this brief are based on interviews by the Education Insights Center (EdInsights) with 20 high school math teachers from 20 different high schools in California. The study focused on high school instructors who had been teaching the new courses for at least three years. Additional research underway by a team at the California Education Lab at UC Davis examines 12th grade math enrollment statewide, including distribution of enrollment by key student characteristics. Future research will examine postsecondary outcomes for students who enrolled in these courses at sites for which data are available.

Examples of Policy Changes Impacting Upper-Level High School Math

A new policy adopted by the **University of California (UC)** in fall of 2020 allows for a broader range of courses that can satisfy the system's math admissions requirements. Students can now take courses such as data science, statistics, computer science and other quantitative reasoning courses instead of courses like Algebra 2 and Precalculus to meet the system's eligibility requirements (Johnson, 2020).

The California State University (CSU) is considering a change to its admissions policy that would require students take an additional quantitative reasoning course (beyond the three years of math currently required) (CSU System 2019). The CSU website highlights the alternative math courses studied in this brief as "bridge" courses that can help students meet this proposed new requirement (CSU System 2020).

An Executive Order issued by the **CSU** in 2017 removed the intermediate algebra pre-requisite for its General Education math courses, allowing for an expansion of the type of courses that students can take to meet that requirement (CSU Office of Academic Programs, 2017).

The proposed new math frameworks for California K12 education calls for providing students with more options (beyond the traditional algebra-based courses) in the last two years of high school to better align with their postsecondary goals (CA Department of Education 2021) in line with recommendations from the National Council of Teachers of Mathematics (2018).

Takeaways

Based on these findings from math teachers in California, several important takeaways emerged:

- **Equity.** Teachers said that the use of practical applications of real-life problems makes the courses more interesting and relevant for students. This may have implications for engaging more diverse populations of students in upper-level math and thereby preparing these students more effectively for college and the workforce.
- **Professional development.** Teachers cited the professional development (PD) utilized for these courses, both prior to and during the school year, as critical to their success. All interview respondents described the benefits of participation in a professional learning community (PLC) for their course with other math teachers as helping them address the challenge of teaching these new courses.
- **Target population.** Close communication among math teachers and the counseling department at high schools is crucial to ensure that students know about the purposes of these courses, that counselors and teachers see the courses as a viable pre-college option, and that students are appropriately guided toward these courses.
- **Scaling the pedagogy.** Project-based teamwork and problem-solving can be applied to other courses to make them more relevant and engaging for students during all four years of high school.

Questions for Consideration

The insights from these teacher interviews raise a series of questions concerning the potential of expanding the use of these or similar courses across the high school math landscape: for course developers, high school and district administrators, and higher education system and admissions officials.

An Alternative 12th-Grade Math Course

Over the past several years, faculty from the CSU and the UC have worked with K-12 partners to develop and implement new math courses aimed at providing an alternative upper-level course to prepare more high school students for college-level mathematics. The six courses included in this research (see box below) have been taught in California high schools since at least the 2017-18 school year. Five of the six received funding from the California Department of Education through the California Math Readiness Challenge Initiative (CMRCI) (Bracco et al., 2018). While the courses vary in content (including such topics as data science, discrete math, financial decision making, and graph theory), they are similar in approach, providing primarily project-based and student-centered models designed for students who want to go on to college but have struggled in traditional mathematics courses (Bracco et al., 2018).

Alternative 12th-Grade Math Courses

The high school teachers interviewed in this study taught one of the following six courses developed by higher education partners. All the courses incorporate the Common Core Standards for Mathematical Practice and emphasize student-centered instruction.

Discrete Math for Pre-College Students. Developed by a team at San Diego State University. Introduces topics and concepts of discrete math, through problem-solving, sense-making, modeling, and reasoning.

Introduction to Data Science. Developed by a team at UCLA. Teaches students to reason with and think critically about data in all forms through work with actual data sets and introduction to basic coding.

Mathematical Reasoning with Connections. Developed by faculty at Cal Poly Pomona, CSU Long Beach, and CSU San Bernardino. Reorganizes topics and approaches from the traditional algebra sequences to facilitate deeper conceptual understanding.

Quantitative Reasoning with Advanced Mathematical Topics. Developed by a team at Sacramento State University. Builds on concepts learned in traditional algebra-based courses to develop greater understanding of the underlying structures and connections.

Transition to College Level Mathematics. Designed by a team led by faculty at Cal State Monterey Bay. Emphasizes modeling, problem solving, and math applications to the real world.

Transition to College Mathematics and Statistics. Developed by faculty at Cal State Northridge. Reviews and extends students' understanding of concepts and methods from algebra and functions, statistics and probability, discrete math, and geometry.

Who Are the Students?

"So, I think this is a good class for the students that think 'I'm going to college, but I don't know what I'm going to do when I get there,' or 'I'm going to college, but I've struggled with math.'" – High school math teacher

"I would recommend (the course) for students that are serious about moving on to postsecondary education, just in terms of the work that needs to be put in. It's not a class where you can miss a week and like take notes from a friend and kind of catch yourself on. You can't go watch ten Khan Academy videos and be back up to par. This is a class where attendance is huge. The ability to work in a collaborative environment is big." – High school math teacher

When asked which students were best served by these courses, teachers said that the courses are designed for those who have passed their high school math courses, but not necessarily with a lot of success, and for those who do not see themselves as math students. For five of the six courses, students are required to have received a grade of C or better in their Algebra II or Integrated Math III course in order to be eligible for the course. The Introduction to Data Science (IDS) course, by contrast, does not require students to have taken either of these courses and can serve to validate (or confer credit for) Algebra II (Burdman, 2018b). In some of the high schools where these teachers worked, students are required to take a fourth year of math. Teachers in these schools said that if students were not taking these courses, they would likely be enrolled in statistics, precalculus, or financial math, depending on the school. Teachers in schools where four years of math are not required said that if this class were not offered, a small percentage of students might choose not to enroll in a math course at all during their senior year.

Most interviewees said they would not recommend the course as the primary senior-year math course for students who know they want to enter a STEM field, because those students need to prepare for calculus. They said, however, that these courses could be an excellent elective for STEM students, because the skills developed (such as problem solving, group work, and communicating about strategy) are useful for STEM courses in college and for related careers. For those unsure whether they want to major in a STEM field, teachers feel like this course provides good preparation that could allow students to move into a STEM field in college if they decide to do so.

Findings

"Right off the bat I knew the class was different because they presented problems that were non-routine and by no means like anything I had seen before in a high school setting. They were challenging but they were accessible. I thought, 'This class, this is what the students have needed,' because even though we were calling it Integrated Math, what I had seen at that point was Algebra 2 and Geometry kind of just repackaged and sold as a new class even though it necessarily wasn't, and so this class really was a very different approach. I thought, 'This is just a great class to expose seniors to before they go on to college.'" – High school math teacher

Teachers were overwhelmingly positive about these courses both for their own growth as teachers and for the benefits provided to students. There were many similarities in the perceptions of teachers across all 20 interviews and across all six courses about the impact of the classes. In addition, teacher perceptions reinforced what course designers said they had intended for the courses (Bracco et. al. 2018).[1]

[1] Additional information form course designers was obtained from interviews conducted as part of the broader PLC work in the summer of 2020.

Pedagogy: A Better Way to Learn

"For this course, you have to change everything. You flip it over, you are not the star of the show, the kids are the star of the show… So, it's the idea that the kids are going to figure out the information, not me. I'm just giving them enough tools to figure out that information." – High school math teacher

"This class makes them realize, like how to think like a mathematician, and not just think to the answer. And it's not even about the answer, but it's about the process and about the exploration of mathematics." – High school math teacher

"We're able to stay with a problem longer and definitely a huge part of it is that it's never about the answer, it's about why the answer is true. And we're always asking why? Why is it true? What makes that true?" – High school math teacher

According to teachers interviewed for this study, the most significant difference between these alternative courses and more traditional math courses is a change in pedagogy toward more student-centered instruction and away from focusing on getting the "right answer." Instead, students work in groups to formulate strategies and approaches to solving problems, and the teachers overwhelmingly agreed that this is a better way for students to learn math skills. They said that through this approach, students learn to communicate with each other about their challenges and their thinking, which builds skills they will need in college and the workplace. Prioritizing group tasks also helped to develop more of a community in the classroom, teachers said, compared with most of their traditional math classes. Across the board, the teachers reflected positively on these changes, while acknowledging the challenges for both teacher and student. Several teachers noted their own tendency to be "control freaks" and the challenges that they experienced in holding back and letting students take the lead in figuring out problems with their peers.

Some teachers remarked that this was already how they were trying to teach, or that they had been looking for more engaging ways to reach their students. They said that the professional development associated with teaching the courses provided strategies and tricks that gave them confidence to change their approach. For some, the change in process was in line with other efforts currently underway in their district. One Discrete Math teacher, for example, noted that since the adoption of Common Core, the district had been moving away from the "sage on the stage" model of instruction, and so the shift to a student-centered approach aligned well with the district's goals. In Monterey, TCLM teachers said that their districts were employing an approach called Complex Instruction,[2] which focuses on group work and problem solving. The combination of that training along with the TCLM training made it much easier for these teachers to implement this pedagogical approach across other courses.

"Productive Struggle"

"I think a lot more learning takes place in [this course] environment rather than your traditional math environment … because of the struggle, the productive struggle. That's something kids don't necessarily learn in other classes … and they think if you struggle, you don't get it and you're not a good student. [But there is] value in the productive struggle for sure." – High school math teacher

"It gets them to think. I do like watching the students when they're coding, to sit there, and you can see the wheels spinning in their head when they're thinking, 'No. This has to come next, because this is why I'm getting this error message. That's why this isn't working.'" – High school math teacher

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[2] For more information on Complex Instruction see https://complexinstruction.stanford.edu/about

Teachers from several of the courses said that the learning process associated with the problem-solving approach required students to experience a kind of "productive struggle," which they described as particularly helpful in developing math and other learning skills. Many students in the classes, teachers said, had become very familiar with the process of struggling in math throughout their high school careers, and the students had also learned to associate these struggles with frustration and even a debilitating fear of math. What made these courses different, said the teachers, was that they saw students begin to understand and begin to trust the process of trial and error and communication with peers as comfortable ways to approach a thorny problem and work toward a solution. They said that students' ability to figure out how to approach a problem becomes the meaningful, productive skill that students actually need. Teachers credited students' abilities to overcome the frustrations of solving mathematical problems as a key reason the students tended to be more successful in this course than they had been in previous math courses.

Curriculum: Focus on Real-Life Problems

"The finance unit is always their favorite unit, and that one, I use it as the curriculum is, but I've added some things into it, so they have to research a job and look at income … Then they have to make a budget, and they tell me over and over again that it's the best part of the class, because it really is hands on, real life, and it matters." – High school math teacher

"And I think [the course] does a really good job of that, by putting things into understandable contexts. And sometimes the context is sort of humorous and lighthearted, sometimes it's a little more serious, but it's kind of seeing how mathematics can help us describe what's going on in the world around us." – High school math teacher

"And I think it's changed my teaching in that I feel like I can more directly apply real-world events and real-world experiences for my students and better show them the math in those things going on. And I always tell them that we can really use math as our superpower to really fight injustices around us." – High school math teacher

Many teachers emphasized the extent to which the courses incorporate real-life problems and situations into the curriculum, and they described these practical applications as beneficial for students. For example, they said that understanding the math behind elections and voting issues, the spread of infectious disease, or financial planning helps to engage students and supports them in understanding how math is connected to their daily lives.

Most teachers said that there was more material in the curriculum than could be covered in a single academic year, and this was particularly true, they said, during the 2020-21 academic year (the time of this study), with classes meeting remotely. However, most teachers noted that they have flexibility in these courses to select their areas of focus and coverage. This prerogative was described as a benefit because it allowed teachers to spend more time on topics their students were having difficulty understanding, and it provided them with an added sense of responsibility for their students and a professionalism concerning their own roles as teachers.

While most teachers described this flexibility as a benefit, one teacher suggested that slowing things down for students might provide them with an unrealistic picture of the rigors of college math courses. However, the teacher also recognized the importance of engaging the students and covering some topics in greater depth:

"That's one that I struggled with. I would like to move quicker through the material, but I know at the same time if I did that, I would probably lose more students." – High school math teacher

Teacher Perceptions: Student Mindset Changes

"I'm finally not dumb in math. I finally understand what's going on." – High school math teacher quoting a former student

"A lot of them said that they never knew math could be this interesting or they never thought of themselves as a math person, just because it helped build their math identity—at the beginning they were very reluctant to share their thinking because they didn't want to be right or wrong, but lot of the class focus is not just on right and wrong but also, like, how did you approach the problem, how did you connect it to a previous problem?" – High school math teacher

"We do get a lot of student comments about how successful they feel for the first time. For the first time they can come to believe that they can do mathematics and that mathematics is not … about being a human computer." – High school math teacher

Most of these courses were designed specifically to reach students who had aspirations to go on to college but had struggled somewhat in traditional math courses. Course designers hoped that these courses would be helpful for students who did not think of themselves as mathematicians, and potentially change that mindset. The perception of teachers across the board in this study is that these courses are succeeding in that area. Whether because students don't think of what they are doing in these courses as math or because they are asked to approach math in a way that is so different from what they have done in the past, teachers said that students tend to enjoy the classes and by and large are more successful than they have been in traditional math courses.

One reason that teachers noted for the change in mindset was that students who previously did not think of themselves as being "good" at math now have opportunity to demonstrate their strengths:

"So, you could find those skills that they were really good at, even though maybe math wasn't always their thing. And that was really cool, because sometimes in math classes, you don't see that side of them, whether—for like their speaking or their presentation or their creativity in their presentation or their graphics, or even in their coding." – High school math teacher

Challenges

Teachers were overwhelmingly positive about the courses and their impacts on students, but they also described challenges with getting full buy-in at their school site. They also said that the move to remote instruction made implementation of the new pedagogical approaches particularly challenging.

Resistance of teachers/counselors

"Again, at my school, in particular, it is kind of a fight, because the counselors are still saying they need to go into precalculus, or they need to go more the traditional math route, instead of the stats route." – High school math teacher

"I wish more kids would take it. I wish it was offered more places, and more teachers would step up to teach it. If I can't teach it, I don't know who would teach it at my site. It is a lot of work, but there's a lot of support." – High school math teacher

Several teachers described their school counselors as hesitant to recommend the course to students early on, usually because they did not really know what the course included and because they felt it was more appropriate to steer students into precalculus to best prepare for college. Other teachers noted that some of their colleagues at their schools were not interested in teaching the course, especially given the demands on teachers to change their approach to teaching. Teachers who raised these issues noted the importance of communication with counselors, principals, teachers, and students, to raise interest in and awareness of the benefits of these courses.

COVID-19 and the Switch to Remote Instruction

While the switch to remote learning during the COVID-19 pandemic has been challenging for all high school teachers, interviewees noted that this was particularly the case for these courses, since they rely so heavily on group work and student interaction. Several teachers said they were unable to cover some units because the remote environment would not allow for the hands-on interactions that were necessary. While teachers adapted to using breakout rooms and other small group strategies, they said this limited their ability to be the "fly on the wall" and hear how students were talking with each other, and otherwise to get a sense of how well the room was understanding a concept or approaching a problem. Several teachers said that the regular meetings with other math teachers in the PLC associated with their specific course helped them share strategies with one another about how best to approach the activities in a remote setting. Some teachers said that their participation in ongoing professional development was actually easier this year, as the remote meetings took place after school in short time blocks rather than requiring a full day away at a different site.

Takeaways

Several takeaways emerge from the findings, with implications for the potential expansion and impact of these alternative math courses.

Equity

> *"And then I think the aspect of equity that I always come back to is the agency and ownership … They come into the class very hesitant and very unsure and not wanting to try something. And (they find) that agency over time and knowing that their attempts are going to be valued and respected. And then (they begin) owning the mathematics by finding the way that it makes sense to them I think those aspects of the course definitely speak to equity." – High school math teacher*

> *"It is a class that … made kind of a level playing field for some of the concepts." – High school math teacher*

One potential implication of these new math courses is the provision of an option that helps prepare broader populations of students for math at the college level. Teachers said that students tended to be more engaged in these courses because the use of practical applications of real-life problems makes the courses more interesting and relevant for students. Several teachers noted that success in these courses is not necessarily dependent on prior math skills, but rather on a student's willingness to work with peers, communicate with each other, and take some risks together in problem solving. This may have implications for engaging more diverse populations of students in upper-level math courses (those that go beyond Algebra 2 or Integrated Math III) and thereby preparing these students more effectively for college and the workforce.

Professional Development: Not an Off the Shelf Curriculum

"And I don't think that the principals fully appreciate how different the course is and so they're just like, "Oh, you're a math teacher. Well, today you're teaching [this course]." And so, these teachers, they are [just] one lesson ahead of kids. And that's a really difficult way to teach these units because you don't see the whole arc of it." – High school math teacher

"It (the PD) really helped me out, to take the apprehension away … They (the PD providers) always were very comforting, and always giving us the support that we needed. Even though I was apprehensive at first, it [the training] definitely helped me out." – High school math teacher

In earlier research, program directors highlighted that that these courses were not intended to be just pulled "off the shelf" (Bracco et. al 2018) and that professional development was necessary to introduce teachers to new content and to provide guidance and practice with the student-centered and project-based pedagogy. All teachers interviewed for this study emphasized the need for and value of professional development received, both regarding course content and pedagogy.

Several teachers said that a challenge of teaching the course for the first time was that much of the content either was new to them or was material that they had not covered with much depth in other courses. They said that the professional development support they had received reintroduced them to concepts they had not seen much (or at all) since their own college classes.

Teachers were generally complementary of the initial professional development provided in the summer, while noting that there was too much content to cover in the allotted timeframes. They also described the ongoing supports throughout the year as especially important. All interviewees noted that there is some form of ongoing PLC where teachers are able to reach out for support and guidance either to the curriculum developers or to other teachers. At several sites, teachers who have taught the course for several years have become facilitators of the professional development and provide ongoing support both for one another and for those new to the courses. Teachers said that there is more of a "community" around these courses than they have experienced with other courses. This is particularly important since in most cases the teacher was the only one in their school teaching the course, meaning they had no colleagues on site with whom they could share experiences in teaching the course. Tapping into these ongoing PLCs will likely be important as additional schools and districts consider adopting these courses.

Defining and engaging the target population

"I would say those are the biggest challenges, is the buy-in for the course. Once they're there they [the students] will tell everybody that they like it, but to get them to participate is a challenge because just the style of the course is so different." – High school math teacher

"There was just this mystery around what it actually was ... There wasn't a lot of background knowledge on what it actually entailed. So, a lot of people were like 'I don't want to touch those things. I don't know what it is.'" – High school math teacher

Several teachers cited lack of knowledge about the courses amongst counselors, school administrators and teachers as a challenge for ensuring that students are appropriately placed in the courses. Miscommunication about the content or substance of the course can create problems. For example, at one site, counselors were under the impression that the course was very easy and had communicated that to students; students were then surprised and disappointed to learn that there were substantial amounts of upper-level math involved. Others noted that counselors had some concerns that these courses would not be given as much credence by UC or CSU in their admissions process as more traditional course like precalculus or statistics. Several teachers said they often did their own outreach

for the course, recruiting some of their former students for the course. If these courses are to be a worthwhile option, both within and across schools, students need to know about the purpose of these courses; counselors need know how best to advise students; and higher education admissions officers need to see the courses as a valuable 12th-grade math offering.

Scaling the pedagogy

"I was already wanting to move in that direction, but actually being trained in teaching this course has kind of given me the tools to be more confident in allowing that to happen in my other classes." – High school math teacher

"And so, I've taken this approach to presenting the material when I teach my other classes: What is the big picture? What is the big idea that I want to get across?" – High school math teacher

Most of the teachers interviewed for this study said that the student-centered, project-based approach requiring teamwork and problem-solving can and should be utilized in math courses more broadly. They suggested that encouraging more independent thinking, problem-solving and collaborative activities among students are strategies that can be used in all classes, and that if students are introduced to the approach earlier on, they may have more confidence in their mathematics abilities. Several teachers noted that this pedagogical approach is aligned with other efforts already underway in their district. By leveraging these complimentary professional development efforts, districts helped these teachers hone their skills in these areas.

Questions for Consideration

"It's just very rewarding in my own teaching practice to see so many kids having a different experience with math, a better, more positive experience with math and then going off to college. If they are going to have to take math in college even just to satisfy their GEs, to have a change in their attitude towards mathematics [while still in high school] is huge … I think it's that attitude change that is really awesome to see and gives them that confidence going forward." – High school math teacher

The feedback from this small sample of teachers suggests that these newly designed math courses have the potential to provide a viable alternative to courses such as precalculus or statistics for students who may have struggled in math. But what needs to happen to ensure that courses such as these can be more widely adopted as viable options for college-bound high school students? The insights from these teacher interviews raise a series of questions for consideration.

Questions for Course Developers

- Teachers are very positive about their experience with the professional development aspects of these courses. As programs expand, how will professional development keep pace? Will there be sufficient resources to provide the necessary PD? Are there master teachers who can help provide ongoing PD and/or support smaller PLCs? Are remote PD sessions during the school year (such as those offered during the pandemic) a viable option for ongoing PD?
- Teachers appreciate the flexibility to pace the course according to their students' needs and to select the specific units that they want to focus on. Does this flexibility lead to some units/topics not being covered? If so, is there a reason that certain topics/tasks are avoided? Are there any topics that should be added and/or dropped?
- Teachers cited the real-life examples and relevance to student lives as a benefit of these courses. How often are examples updated and are there topics and activities that need more regular updating in order to ensure that examples are current and are pertinent for diverse student populations?

Questions for High School and School District Administrators

- Communication with principals, counselors and teachers about the content of the courses and the potential benefits for students is important both for ensuring that students are properly placed in the courses and that the courses are presented as a viable option for college-bound students. What procedures are in place (or should be) to inform school site teachers, counselors, and administrators about these courses? How can the benefits of these courses be presented to students and parents?
- Providing time and support for teachers who are assigned to teach these courses to engage in the PD activities (both prior to teaching the courses and at least during the first year) was described as critical by teachers in this study. How can schools and districts ensure that there is support for ongoing PD for these courses?
- Are there opportunities to leverage other PD activities to introduce strategies used in these courses (such as student-centered instruction, group work, and problem solving) into the math curriculum earlier on?

Questions for Higher Education Administrators

- These courses are designed to provide an alternative to the calculus pathway for students who intend to go on to postsecondary education. How will these be viewed in admissions decisions? Will they be seen as a viable, and competitive, alternative?
- While teachers were very positive about the pedagogical approach used in these courses, for most it was a new model for teaching, compared with how they had been trained. Are these approaches being incorporated into teacher education programs to ensure that new math teachers enter the profession with this critical skillset?

Research currently being conducted as part of this broader project will examine how well students from different backgrounds and schools perform in these courses and the postsecondary pathways (i.e., enrollment and performance in college math, choice of major) of students who completed these courses. That information, in turn, will provide additional context to this study of teacher perceptions about the importance of these courses for students. Widespread adoption of alternative math courses in high school, such as those studied in this report, may be an important step toward ensuring that broader populations of students have meaningful and relevant experiences in quantitative reasoning prior to college.

Methodology

This study about teacher perceptions is based on interviews with 20 teachers from 20 different high schools in California. To identify prospective interviewees, researchers asked the lead developers for each of the six courses to suggest teachers who had taught the course for at least three years. The purpose of this timeframe was to gather experiences about teaching the courses as they were originally designed, prior to the shift to remote learning during spring 2020. Researchers conducted interviews via Zoom using a semi-structured interview protocol, between December 2020 and March 2021. Interviews were recorded and transcribed and then coded and analyzed. A limitation to this approach includes selection bias, as the course developers may have suggested teachers who are more actively engaged and supportive of the courses. Sixteen of the 20 teachers had been teaching math for more than ten years, and most had taught a broad array of high school math courses. Only two of the teachers interviewed had been teaching for less than five years. For this study, each of the six project sites that had designed the courses was represented by at least one teacher interviewee.

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