



Fostering Student Success in Algebra I: Themes from a Scoping Review Focused on Latinx Students and English Learners

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Authors' Note

This publication was developed with support from UnidosUS as part of the Math Policy Project. We (Zahner, Calleros, and Ochoa) undertook this study in response to UnidosUS' Math Policy Project to advance a research-informed policy agenda to improve student success rates in Algebra I by 9th grade and college-level Math 101 during the freshman year, with a special focus on solutions that are effective for Latino students and English Learners.

About Unidos

UnidosUS is a nonprofit, nonpartisan organization that serves as the nation's largest Hispanic civil rights and advocacy organization. Since 1968, we have built a stronger America by creating opportunities for Latinos and breaking down barriers to expand economic and social progress for all. UnidosUS partners with an [Affiliate Network](#) of nearly 300 community-based organizations across the United States and Puerto Rico. For more information on UnidosUS, visit www.unidosus.org or follow us on [Facebook](#), [Instagram](#), [LinkedIn](#), [X](#) and [Threads](#).

AI Disclosure

The authors of this report used generative artificial intelligence at several points in the development and preparation of this work. NotebookLM was used to assist with structured data extraction as described in the Methods section. Additionally, the authors used ChatGPT 5.5 while writing this report for assistance with brainstorming and revising text. The authors manually reviewed and verified all work with AI and the authors take full responsibility for the content of this report.

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Executive Summary

Algebra I is a pivotal course in the typical U.S. mathematics curriculum. Success in Algebra I is associated with high school graduation, access to advanced secondary mathematics, and enrollment in postsecondary education. Because Algebra I serves as a gateway to later mathematics coursework, policies governing when students take the course, what support they receive once enrolled, and what pedagogy they experience within the class can shape their long-term educational opportunities. These decisions and practices are especially consequential for Latinx students, English Learners, and other minoritized students, who continue to experience unequal access to rigorous mathematics, disproportionate placement in lower-level courses, and higher rates of course repetition.

This report, prepared in response to a call from the UnidosUS Math Policy Project, examines what research published since 2015 says about the policies, school structures, and instructional practices associated with success in Algebra I and related secondary mathematics courses. The review gives particular attention to Latinx students, students classified as English Learners, and other minoritized students. We note that these populations overlap, but they are not interchangeable: Latinx identity is a cultural and ethnic identity, while English Learner status is an educational classification based on English proficiency. The available literature does not always distinguish clearly between ethnicity and English Learner classification, which remains an important limitation in the evidence base.

Approach

The research team conducted a systematic scoping review of the literature since 2015. Systematic searches of the ERIC and Scopus

databases yielded 1,867 records matching our search criteria. After removing duplicates, we screened titles and abstracts, assessed 105 articles through full-text review, and included 88 studies in the final synthesis. The selected studies examined Algebra I and related secondary mathematics coursework and addressed the experiences of Latinx students, English Learners, and other minoritized students. We categorized the studies based on primary focus. With the assistance of NotebookLM, we extracted article summaries and key information about each paper. The research team manually verified the AI-assisted extractions against the original studies and independently coded the articles and developed the themes.

The evidence base included 38 qualitative studies, 33 quantitative studies, 16 mixed-methods studies, and one study classified as other. Pedagogy was the most common primary focus, followed by school structures and policies. Twenty-six studies addressed more than one area, most often the interaction between policy and school structures or between pedagogy and school structures. These overlaps reinforce a central conclusion of the review: placement, school organization, and classroom instruction operate as parts of an interconnected system rather than as isolated levers.

Key Findings

Access to Algebra Is Important, but Placement Alone Is Insufficient to Address Inequities

The reviewed research affirms that completing Algebra I, particularly before ninth grade, is associated with taking more advanced mathematics courses in high school and broader

academic success. This overall finding is tempered by evidence that students' opportunities to learn can vary greatly across courses labeled "Algebra I," often in ways associated with student demographics and teacher beliefs. Additionally, the methods of placing students into mathematics classes in middle school and ninth grade can disrupt or reinforce inequities. For example, English-only mathematics assessments and English Language Development course-placement policies may unintentionally constrain multilingual learners' opportunities to learn mathematics. Placement based on teacher recommendations can be influenced by implicit and explicit biases. Finally, research in this area indicates that mandating Algebra I for all students in eighth grade may not yield the intended results. Several reviewed studies of California districts found that early Algebra I mandates were associated with high rates of course failure and repetition. One important implication is that expanded access through placement policies must be accompanied by adequate student support.

School-Level Structures Shape Student Support and Success

School level structures surrounding mathematics strongly influence whether students succeed in Algebra I and other critical gateway courses. The research shows that structures such as teacher characteristics, tutoring support, extra class time, summer learning opportunities, co-teaching arrangements, and intervention support can have meaningful influence on student success.

The most effective supports preserve access to grade-level content while providing students with the resources they need to succeed. In multilingual classrooms, English Learners achieved stronger outcomes in co-taught classes when language-support teachers also held certification in the relevant content area. In contrast, schedules that devote substantial time to English-development courses may restrict

multilingual learners' access to credit-bearing mathematics and advanced coursework. The Arbor High School vignette presented in this paper illustrates what is possible when a school combines a universal college-preparatory curriculum for all students with thoughtfully designed supports and structures. The example does not establish that these structures alone caused the school's outcomes, but it shows how rigorous expectations can be paired with substantial investments in time, staffing, and student support.

Rigorous Mathematics Instruction Can Build on Students' Linguistic and Cultural Resources

A large number of studies in this review examined pedagogical practices in diverse classrooms. Most of these studies used a qualitative approach to examine learning processes, and these studies can provide a vision of what is possible in diverse classrooms. Latinx students, English Learners, and other minoritized students demonstrated sophisticated reasoning when instruction allowed them to use multiple languages, diagrams, gestures, technology, and collaborative discussion to make sense of mathematics. In these classrooms, promising practices included the use of translanguaging, discussion routines, and the creation of classroom environments that affirm students' identities. These approaches did not simplify the mathematics. Rather, these approaches amplified students' access to grade-level mathematics learning opportunities.

In this body of work, the reviewed studies emphasized the importance of affirming students' identity and sense of belonging. Students persisted in challenging learning environments as teachers maintained high expectations and provided high levels of linguistic, relational, and instructional support.

Implications for Policy and Practice

Algebra I success cannot be produced through placement mandates alone. Placement policies determine access while school structures determine whether that access is supported and sustained. Classroom pedagogy determines the quality of students' opportunities to learn. Therefore, state and district leaders should:

- Establish transparent placement criteria based on multiple forms of evidence, emphasizing criteria linked to student success, and avoiding criteria that can be influenced by unintentional bias. There should be recurring opportunities for students to advance between course pathways.
- Pair early Algebra I requirements with funded supports such as tutoring, additional instructional time, summer learning, co-teaching, and intervention specialists.
- Monitor both outcomes and opportunities, including course access, failure, repetition, progression, movement between pathways, and participation in advanced mathematics, with results disaggregated by ethnicity and English Learner status. Equity should be monitored on an ongoing basis.
- Ensure that English-development courses for multilingual learners do not block students from credit-bearing mathematics or delay advancement through the mathematics sequence.
- Adopt assessment systems that allow multilingual students to demonstrate mathematical understanding through more than English-only performance.
- Invest in curriculum materials, teacher

preparation, coaching, and sustained professional learning that support rigorous mathematical discourse, multilingual participation, and asset-based instruction.

Finally, one gap we identified in this study was research linking pedagogy to learning. Policymakers should fund research that connects instructional practice to measurable student outcomes. Much of the pedagogy literature identified in this review documents promising classroom practices through qualitative and small-scale studies, but there is less evidence linking those practices to larger metrics of student success including course completion, achievement, persistence, and progression to advanced mathematics. Researchers should design and funders should support larger, longitudinal, and mixed-methods studies that examine how culturally and linguistically responsive instruction affects outcomes for Latinx students and English Learners across varied school contexts.

Fostering Student Success in Algebra I: Themes from a Scoping Review Focused on Latinx Students and English Learners

Algebra I is a critical milestone on students' pathways through K-12 mathematics. As the foundation of the typical hierarchical sequence of secondary mathematics, success in **Algebra I**¹ (or, equivalently, **Integrated Math I**) is associated with multiple positive outcomes, including overall academic success in high school and high school graduation (Gamoran & Hannigan, 2000), as well as matriculation in postsecondary education (National Center for Educational Statistics, 2019). Given Algebra I's role as a gateway in students' educational trajectories, Moses and Cobb (2001) argued that access to algebraic literacy is a civil right, especially for Black students and other historically marginalized students whose opportunities to learn mathematics have been constrained by structural inequities. This stance, in turn, has driven policies regulating which students take Algebra I and when they take the course. The most ambitious policies have required all students to take Algebra I as early as eighth grade.

However, research evidence on the universal, early mandate of an algebra class shows that many students fail or repeat Algebra I when it is required in eighth grade, especially when students lack adequate support (Fong et al., 2016; Howard et al., 2015; McEachin et al., 2020). In one California school district, Algebra I repetition was most common for Latinx² students, students classified as **English Learners**, and students with disabilities (Fong et al., 2016). More recent studies have demonstrated that, when supported by appropriate policies, resources, program structure, and careful course sequencing, a ninth grade baseline Algebra I requirement can yield positive outcomes including higher achievement scores, retention, and attendance (Dee & Huffaker, 2026). In summary, a body of research has established the significance of Algebra I success and has highlighted the need for effective instructional and systemic support to ensure equitable access and positive student outcomes. Yet inequitable outcomes remain a problem, particularly for **minoritized learners**. One area for deeper exploration is

1 Words in boldface are defined in the Glossary at the end of this report.

2 In this report we will use Latinx as an inclusive descriptor. Other authors choose to use Hispanic, Latino, Latina, Latine, Latin@, and Latin*. We acknowledge that all terminology has affordances and limitations. We have opted to use Latinx to challenge the gendered language forced by grammatical constraints. We use Latinx throughout this paper for the sake of consistency.

how policies, structures, and classroom interactions influence the Algebra I success of minoritized students, including Latinx students and multilingual learners.

In this paper, we present the results of a **scoping review** to address gaps in our understanding of how policies regulating placement and access, school/system-level structures, and instruction shape math achievement, with a focus on minoritized and linguistically diverse learners in Algebra I. Prior scholarship has synthesized research on English Learners³ in K–12 mathematics, including the review by de Araujo et al. (2018), which examined 75 empirical studies published between 2000 and 2015. The existing research offers evidence that multilingual students, including English Learners, can engage in rich mathematical reasoning while developing multilingualism. Multilingual students draw on multiple communicative resources including gesture, diagrams, and **translanguaging** practices to engage with mathematics. Additionally, culturally and linguistically responsive learning environments can support participation, meaning making, and learning. At the same time, the review by de Araujo and colleagues (2018) cautioned that the evidence base was still fragmented, and that the field needed more evidence beyond individual case studies if it was to inform policy, program design, and broad improvement efforts. Additionally, the 2018 review was focused on only English Learners, and spanned grades K-12. Here we provide a more focused review in order to understand the landscape of English Learners, Latinx students, and other minoritized learners in Algebra I. Specifically, we undertook an updated scoping review (Arksey & O'Malley, 2005) that investigates what has been learned since 2015 about the policies, school-level structures, and instructional practices that support the mathematics achievement

of historically marginalized students in Algebra I, particularly Latinx students and English Learners.

This review provides a clearer account of which policies, structures, and pedagogy are most consequential for supporting minoritized students, particularly Latinx students and English Learners, to meet the key educational milestones of succeeding in Algebra I. We note that English Learners and Latinx students are not the same. Yet, most students who are designated as ELs in U.S. schools speak Spanish as their primary language. Additionally minoritized students is a broader category that can include ELs, Latinx students, Black, Indigenous, Pacific Islander, low income students, students with disabilities and other students who face inequitable schooling structures. Learners experiencing marginalization span multiple experiences, and one challenge of this review is balancing a broad focus on marginalized students while simultaneously attempting to highlight the experiences of Latinx students in US schools.

Research Questions

Our overarching research question is: What policies, school-level structures, and pedagogical practices are associated with improved mathematics opportunities and outcomes for historically marginalized students, particularly Latinx students and English Learners, in Algebra I? Specifically, we investigate the following:

1. What **Algebra I placement** policies and **course pathways** are associated with broad student success?
2. What school-level structures—such as scheduling, student support, advising,

³ In this paper we use *English Learners* when referring to students who are designated by schools as needing English Language support to engage in grade-level academic activities in English. We use *multilingual learners* or *students* to describe students who speak more than one language. To highlight students' assets we use multilingual learners at times when discussing students who are designated as English Learners.

and remediation or co-requisite supports—are associated with improved Algebra I achievement and progression?

3. How do culturally and linguistically responsive instructional practices support students' mathematical learning, participation, and persistence in Algebra I?
4. How do Algebra I placement policies, school-level structures, and instructional practices interact to shape students' success in gateway mathematics courses such as Algebra I?

Methods

Our research synthesis included a scoping review and selective illustration of key ideas using qualitative data from our prior research studies. A scoping review allows for the systematic mapping of a broad and varied evidence base while generating findings that are both accessible and actionable for policy and practice (Arksey & O'Malley, 2005). The use of our existing qualitative vignettes, which were collected in earlier studies, are used to illustrate key themes from the scoping review.

Scoping Review

Scoping reviews are appropriate for synthesizing diverse bodies of literature and identifying patterns across heterogeneous studies (Arksey & O'Malley, 2005; Tricco et al., 2018). Our review followed established methodological frameworks for scoping reviews: (a) systematic search and screening using clearly defined inclusion and exclusion criteria, (b) data extraction into a structured evidence table, and (c) content analysis and inductive theme development. We present the study identification, screening, eligibility, and inclusion process using a PRISMA-style flow diagram (see Figure 1).

The parameters for the scoping review

included research on minoritized learners, with a focus on outcomes for Latinx students and English Learners in Algebra I. We prioritized studies that examined how outcomes for these student populations were conceptualized and measured, including achievement, course progression, participation, and identity development. We also analyzed each study to identify how instructional practices, school structures, and placement policies shaped opportunities to learn for these students. Through this synthesis, we identified themes related to research-based insights about improving opportunities and outcomes for Latino students and English Learners in Algebra I, as well as gaps in the existing literature.

The data for the scoping review consisted of published empirical studies focused on the U.S.-based K–12 mathematics education contexts. Studies were included if they explicitly examined: (a) mathematics learning, achievement, or progression in Algebra I or related secondary mathematics contexts; (b) the experiences of minoritized students, including Latinx students and/or English Learners; and (c) policies, school-level structures, or instructional practices related to mathematics learning opportunities. This focus reflected longstanding concerns about equitable access to Algebra I and its consequences for educational opportunity (Gamoran & Hannigan, 2000; Moses & Cobb, 2001). Studies that mentioned minoritized student populations without substantive analysis of policies, structures, or pedagogy were excluded. Additionally, we excluded commentaries and literature reviews.

We identified studies by searching the ERIC and Scopus databases for peer-reviewed studies published between 2015 and 2026. We used the ProQuest ERIC database through our university library. Search strings focused on combinations of terms related to algebra and secondary mathematics (e.g., “algebra,” “integrated mathematics,” “linear functions,” “rates of change”), student populations (e.g., “English

Learners,” “multilingual learners,” “bilingual students,” “Latin* students,” and racially or ethnically marginalized students), and secondary school contexts (e.g., “high school,” “middle school,” “K–12,” and “secondary mathematics”). Table 1 summarizes the four database searches, including search focus, number of records identified, duplicates removed, exclusions, and final studies included. In the Appendix the full search strings and filters are specified.

Across four searches conducted in ERIC and Scopus, we identified 1,867 records. After duplicates were removed, 1,655 records remained for screening. Following title and

abstract screening, 1,550 were screened out based on the exclusion criteria. The remaining 105 articles were assessed for eligibility via full text screening, and 88 studies were ultimately included in the qualitative synthesis. Studies excluded during full-text review included commentaries, literature reviews, theoretical studies without empirical data, and studies that mentioned Algebra I but were not focused on Algebra I. Figure 1 presents the PRISMA-style flow diagram used to document the identification, screening, eligibility, and inclusion process for the review.

Following screening, studies were orga-

Table 1. Summary of Database Searches, Screening Outcomes, and Included Studies for the Scoping Review

Database	Search Focus (description of search string)	Found	Duplicates	Exclud- ed	Final
ERIC	Peer-reviewed studies published since 2015 that focus on algebra or integrated mathematics education for English Learners, multilingual students, or bilingual learners in secondary or K–12 settings	36	8	14	14
ERIC	Peer-reviewed studies published since 2015 that examine mathematics topics such as algebra, linear functions, or rates of change for English Learners, multilingual students, or bilingual learners in secondary, middle school, high school, or K–12 settings	373	45	298	30
Scopus	Studies published since 2015 that focus on algebra or mathematics topics such as linear functions and rates of change for English Learners, bilingual, multilingual, or linguistically diverse students in middle or high school settings	742	121	607	14
Scopus	Studies published since 2015 that examine algebra or mathematics topics such as linear functions and rates of change among racially or ethnically minoritized students in middle and high school settings	716	38	648	30
Total		1,867	212	1,567	88

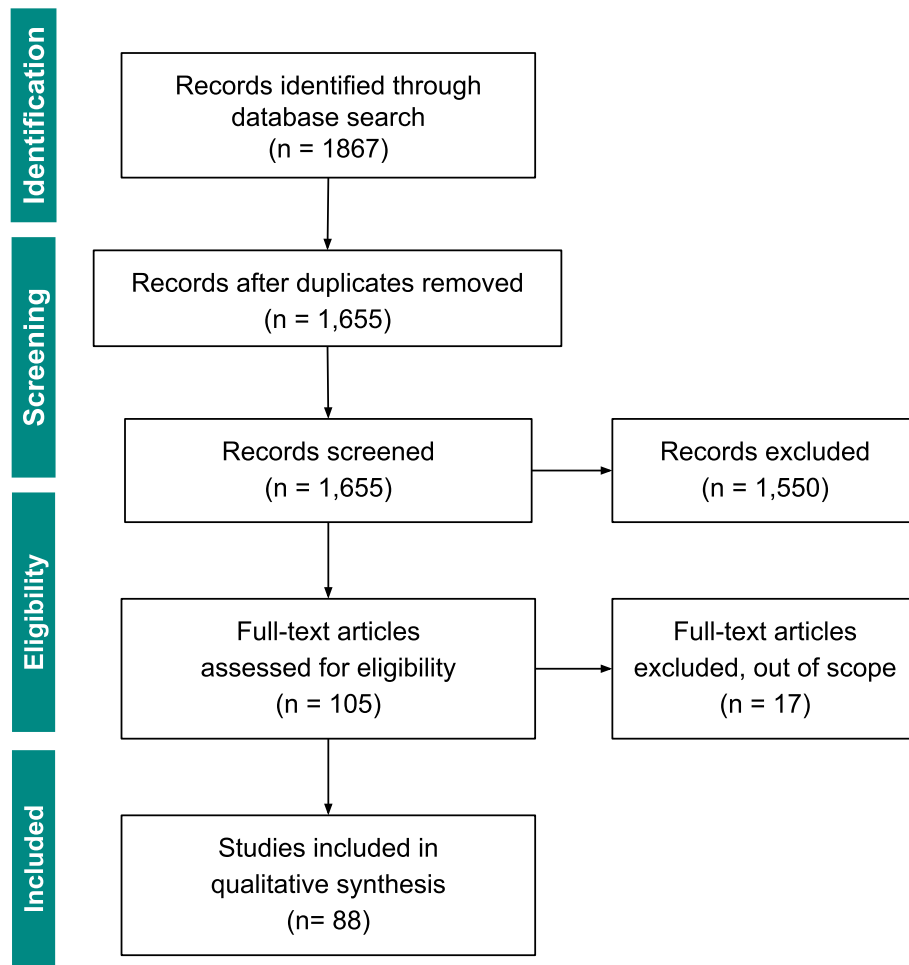


Figure 1. PRISMA-Style Flow Diagram of Study Identification, Screening, Eligibility, and Inclusion Procedures for the Scoping Review

nized into a structured evidence table. For each included study, we extracted information regarding article focus, participant populations and contexts, level of analysis, sample size, research methods, theoretical frameworks, major findings, and notes containing implications for policy, practice, and equitable mathematics opportunities. Article focus categories aligned with our research questions and included algebra placement policies and pathways, school-level structures, culturally and linguistically responsive instructional practices, and other related equity-oriented themes. Given the number of studies that we needed to screen we opted to use a university-linked NotebookLM account to assist with data extraction. NotebookLM (Google,

2026) is an AI system that can analyze and summarize source documents, providing links to the original source in the summary. NotebookLM has specific affordances over a general large language model for the purpose of conducting literature reviews (Shor et al., 2026). In particular, NotebookLM is designed to summarize given sources and does not draw upon data beyond the sources provided to the system, which minimizes the risk of hallucinations. Additionally, each part of the summary produced by NotebookLM is linked back to the source, which allows for manual cross referencing of claims.

Since using an AI tool to summarize literature is relatively novel, we provide the readers

with details on our process. First, we note the safeguards we took. We used a university-linked NotebookLM account to ensure data privacy. Second, we verified information provided by the platform by manually checking AI generated summaries against each source. We put these two safeguards in place to protect data, prevent hallucinations, and prevent over-claiming based on the literature. Simultaneously, although these procedures reduced the risk of hallucination and source blending, NotebookLM produces probabilistic outputs, and exact replication of the extraction process may not yield identical wording or summaries.

Now we describe our process and prompting. To summarize each article we uploaded PDFs of the selected articles and prompted NotebookLM to produce a summary with the following prompt:

I am doing a scoping review. This is one of the papers. I want to use this tool to help extract structured information about each paper. Can you please give me the following? 1) Summary in 2 sentences 2) Article Focus: [choose from Algebra placement policies and pathways, school-level structures, culturally and linguistically responsive instructional practices, Other?] 3) Research question 4) Details: Who, what, where, how many 5) Theoretical framework / Theory 6) Major Finding in 1-2 sentences 7) Take-aways

After generating a few summaries to practice using the tool, we recognized that we needed more details on the methods of each study. Thus, we added to the prompt: "Please add methods to the 'who, what, how many' section of the structured summary." Once the prompt to generate summaries was stabilized, we attempted to upload all sources in one Notebook and prompted for a summary of each source, going one by one. However, the system was not able to produce more than three or four summaries at a time. At this point we also discovered that the AI was mixing language and information from multiple sources in the summaries. For example, NotebookLM used the phrase "brief interventions are insufficient" when describing the results of I and Son (I & Son, 2020). However, since we were familiar with the source, we recognized this phrase did not come from the cited source. We investigated further and found that while NotebookLM limits itself to uploaded sources, when it has multiple sources, it can use language from one source while summarizing another source. Realizing this limitation, we changed our process. We uploaded one source at a time, activated only that source, and then prompted for the summary. Then we repeated the process with the next source. Through this one-by-one process we were able to create a workflow to generate a summary of each source while avoiding blending.

With a summary of each source, we used an iterative process to do manual cross checks

Table 2. Number of included studies by method and primary thematic focus.

Primary Focus	Secondary Focus					Total
	Policies	Structures	Pedagogy	Other	None	
Policies		6			14	20
School Structures	6		4		16	26
Pedagogy	1	6		2	30	39
Other		1			2	3
Total	7	13	4	2	62	88

Table 3. Number of included studies by method and primary thematic focus.

Method	Primary Focus				
	Policies	Structures	Pedagogy	Other	Total
Mixed	4	3	9		16
Qualitative	2	6	28	2	38
Quantitative	14	17	1	1	33
Other			1		1
Total	7	13	4	2	88

and assign descriptive codes and organize studies into analytic categories related to policies, instructional practices, student supports, and structures shaping mathematics opportunities (Saldaña, 2016). We developed themes inductively through repeated review and comparison across studies, while also drawing on sensitizing concepts identified in prior research syntheses focused on multilingual learners and mathematics education (e.g., de Araujo et al., 2018). To ensure that the intellectual work was ours, we did not attempt to use the AI tool to generate themes for us.

Illustrative Vignettes

To complement the presentation of themes in this scoping review, we drew on existing qualitative datasets from our prior research projects focused on mathematics teaching and learning in linguistically diverse settings. From these datasets we have developed three vignettes that appear as sidebars in this report. For example, in one of our prior classroom-based design research studies, we collaborated with ninth-grade Algebra I teachers to redesign specific units of instruction, with a focus on meeting the unique learning needs of English Learners. From this multi-year collaborative research project we produced refined lessons, trajectories, and design principles (Zahner et al., 2021; Zahner & Wynn, 2023a) and we showed quantitative and qualitative evidence of the effects of our work (Zahner et al., 2026). This study provided us with the vignettes for Theme 1 and

Theme 3.

We have also done research on the school-level structures that support student success in secondary mathematics (Choppin et al., 2024; Zahner et al., 2025). Based on this study, we collected data for the case of Arbor High, which appears after theme 2. In the presentation of the results, after each summary of the quantitative data we provide a vignette from our work to illustrate themes and concepts emerging from the scoping review. In doing so, the integration of our prior empirical research extended the review by humanizing the literature summaries. We caution that we do not present these vignettes as representing a larger population, but rather these serve the purposes of humanizing and illustrating themes from the literature review.

Results

In the following sections, we summarize the overall results of the scoping review and then discuss the themes related to Research Questions 1-3 in more detail. The summary captures the overall landscape of the literature that we reviewed and can help with identifying gaps and areas for future research.

Summary of Scoping Search

Table 2 shows the number of studies by focus of research. We coded 26 studies with

both a primary and secondary focus. The most common primary focus was pedagogy, followed by school structures and policies. Three studies were classified as “other” in their primary focus (Gonzalez et al., 2023; Jackson et al., 2020; McGee & Pearman, 2015). These studies examined topics such as identity development and student-focused psychological factors in the context of Algebra I or high school mathematics.

For several studies, the members of the research team noted that there was a potential second area of focus. For these studies we assigned a “secondary focus” for the purpose of identifying potential patterns in the data. The most common combination of primary and secondary foci was policies and school structures (12 total, counting primary and secondary foci), followed by the combination pedagogy and school structures (10 studies). The least common combination was Policies and Pedagogy (one study). While this is not a major focus of our work, the overlaps indicate potential areas where our themes connect to each other.

Table 3 shows the research methods and the primary focus for the 88 reviewed studies. The research focused on pedagogy primarily used qualitative research methods. In contrast, the majority of the research on Policies and School-level structures used quantitative or mixed methods approaches. These patterns in the data likely reflect the orientations of researchers and the types of data that can be collected and analyzed to examine different phenomena. So, the policy work tends to use quantitative methods, reflecting the bias of policy researchers to examine large scale data sets (e.g. correlating student achievement and course placement for a whole school system). On the other hand, most researchers who examine classroom pedagogy focus on a small number of classrooms and do more in-depth qualitative analysis. This reflects a different focus on the process of teaching and learning versus the product or outcome of policy decisions.

Themes from Scoping Review

In the next three sections we present themes from the reviewed literature related to our research questions. Following the order of our research questions, we present themes related to policies first, then structures, and finally pedagogy. While we use these themes to organize the presentation of the results, we note that several papers addressed more than one theme.

Theme 1 - Policies for Placement and Timing

Policies for placement and timing are the rules, criteria, mandates, or guidelines that govern students’ access to and placement in mathematics courses. The majority of the research on policies focused on the downstream consequences of taking Algebra I, when students have access to Algebra I, and under what conditions students are successful in Algebra I. In this set of studies, multiple large-scale, quantitative studies documented the benefits of taking Algebra I, either in middle school or high school (as found in earlier work, e.g., Gamoran & Hannigan, 2000), which has led to more recent interest in research on the effects of algebra. For example, taking algebra in 8th grade increases the odds of taking advanced math in 11th grade by 16%, and the positive effects are particularly beneficial for students classified as ELs (McEachin et al., 2020). Also, among Black students in a school district in Southern California, taking 8th grade Algebra more than doubles the odds of taking mathematics beyond Algebra II or Integrated Math III in high school (Rogers, 2024). Additionally, passing Algebra in 8th grade is associated with a stronger sense of belonging in mathematics in 9th grade (Morales-Chicas & Graham, 2021). For minoritized students the effect of belonging is mediated by the representation of other minoritized students in their advanced classes. If minoritized students are not proportionally represented in advanced

classes (compared to the school demographics) then minoritized students who are in advanced math classes in high school feel less belonging (Morales-Chicas & Graham, 2021).

Since high school mathematics is typically arranged in a hierarchical sequence, the timing for when students start the sequence matters. Algebra I is typically considered a ninth grade class by the Common Core State Standards (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010), so a key question in diverse schools is, which students are allowed to take Algebra by 8th grade? Morton and Riegle-Crumb found that placement in one large, urban school district with a majority Latinx student population generally aligned with student academic results in seventh grade, but Black students in majority Latinx schools were less likely to be enrolled in Algebra than their peers (Morton & Riegle-Crumb, 2019). Teacher beliefs about students appear to be shaped by the courses they teach: Ninth grade teachers of lower-level mathematics courses held stronger deficit-based beliefs about students and assigned lower grades than their peers in higher-level courses (Buontempo et al., 2025). Such factors can reduce opportunities for minoritized students to learn Algebra. Addressing racial disparities in learning is a key theme in this area of work, and Dougherty and colleagues (Dougherty et al., 2015) studied the placement process in one school system and found that the implementation of an achievement-based rule for assigning students to Algebra in 8th grade significantly increased enrollment overall and reduced the effects of race and student family income on course placement. However, Lopez and colleagues note that linguistic interference might reduce the validity of inferences of mathematics tests administered to students who are English Learners (Lopez, 2023).

Requiring Algebra in eighth grade does not necessarily resolve the issue of placement. Thompson (2017) found that nearly half of all stu-

dents in six California districts repeated a math class between eighth and tenth grade. Similarly, Fong et al. (Fong et al., 2016) found that nearly 45% of students who they tracked in a California Secondary school district repeated Algebra. Additionally, the level of rigor in mathematics classes is shaped by school demographics and teachers' perceptions of students. Some teachers have deficit-based views of students in lower academic tracks (Buontempo et al., 2025) and Morton and Ridgle-Crumb (2020) documented that in predominantly Black schools the level of rigor is lower in Algebra I compared to non-predominantly Black schools.

The vignette "The Case of Leyla" (see sidebar) illustrates how course placement policies for immigrant students who know mathematics but who are learning English can limit students' access to grade-level algebra and more advanced mathematics.

Theme 2 - Structures

School-level structures are the organizational arrangements, staffing patterns, schedules, pathways, and support systems through which mathematics opportunities are provided and students are supported. These structures shape when students take Algebra I, their chance of success, and their chance of taking subsequent mathematics courses in high school. These structures are important in mathematics because high school mathematics courses are in a hierarchical relationship, where introductory courses precede more advanced courses.

One school-level structure is student demographics. There is a well-documented pattern of de facto school segregation, where students from minoritized backgrounds are more likely to attend schools where there is a high percentage of minoritized students (Kucsera et al., 2015). In terms of Algebra I and subsequent mathematics courses, students who attend segregated schools are less likely to take advanced mathematics classes in their high

Policy in Practice Vignette: The Case of Leyla

In our prior work (Pelaez et al., 2023), we examined the experience of a **transfronteriza** student, Leyla, who demonstrated persistence and resourcefulness while simultaneously navigating structural barriers, such as English and mathematics course placement policies, that limited her opportunities to fully engage in mathematics learning. Leyla moved back and forth between the US and Mexico during her K-12 schooling. In the year before we met her, Leyla was preparing to enter 11th grade in Mexico. She expected to take courses in engineering and advanced mathematics. However, her family chose to move back to the U.S.

After enrolling in a U.S. high school, Leyla was placed into two English Language Development courses, a Physical Education class, and a ninth grade mathematics course. We were observing Leyla's mathematics class as part of a larger study. During class discussions, Leyla demonstrated strong knowledge of the content, particularly when discussing mathematics with her peers in Spanish. However, during whole class discussions, Leyla's contributions were often missed. For example, one day the teacher showed four graphs on the board and she asked the class "which one doesn't belong?" Leyla quietly discusses the task with Denise who sat next to her.

Leyla, whispering to Denise: Dile que la tres. [Teacher overhears the whispering]

Tell her number three.

Teacher: Leyla, why does number three not belong?

Leyla: Dile Denise, tú por me dile.

Tell her, Denise. You tell her for me.

Leyla, to Denise: Porque empieza en cero.

Because it starts at zero.

Denise, to the class: It starts at zero.

Teacher: Oh, it starts at zero. Cool. What's that called, "starting at zero"?

This brief interaction showed us that Leyla identified the relevant mathematical feature, used Spanish to formulate an answer, and used Denise as a translator to voice her ideas. The whole class exchange took up Leyla's idea, but the speaker (Denise) may have obscured whose idea was being voiced. Ultimately, Leyla's English proficiency and the apparently shared assumption that whole class interaction should take place in English, may have limited Leyla's opportunity to show mathematical competence.

During an interview, Leyla highlighted how mathematics placement and language learning were in tension. She also noted that balancing language learning, school schedules, and content courses was challenging. She explained,



Por ejemplo, yo tengo dos clases en las que aprendo ingles. Y esas clases son como aparte. Porque esas no, como que no me dan créditos... En cierta forma, me están ayudando pero mis creditos no me los dan.

For example, I have two classes where I learn English. And those classes are, like, separate. Because those don't, like they don't give me credit [toward high school graduation]... In a way, they are helping me but they don't give me credits.

Such examples illuminated how broader policy and instructional decisions were experienced by students. In particular, for Leyla, access to advanced mathematics and science coursework was shaped by language more than it was by her understanding of mathematics. In fact, we noted that she was one of the most advanced students in her Integrated I mathematics class, which was likely the case since she had already completed mathematics courses through tenth grade in Mexico. The case of Leyla raises a number of questions. For example, how do language norms shape whose mathematical knowledge becomes publicly visible? How might Leyla's placement in Integrated Math I affect her access to advanced mathematics, particularly given her age and time to graduation? What policy changes would allow schools to support English development without delaying mathematical progression for students such as Leyla?



school years, and this disparity starts as early as middle school (Kim & Campbell, 2024). Student demographics also correlate with the positive effects of taking advanced mathematics: While taking advanced mathematics classes confers advantages, English Learners experience lower educational returns on their academic preparation than their peers, often requiring significantly higher levels of coursework—specifically three or more advanced math courses beyond the school average—to close the enrollment gap at four-year colleges (Black et al., 2025; Callahan et al., 2024). Additionally, there is a disproportionately large number of (long-term) English Learners in lower math courses than in advanced courses (Biernacki et al., 2023; Callahan et al., 2021). These trends point to the importance of considering school demographics when examining mathematics outcomes and efforts to improve mathematics.

Another school structure is student support systems. These supports might take the form of tutoring, additional time, summer classes, or co-taught classes. These structural supports can make a difference for minoritized students, including English Learners. For example, summer programs can increase opportunities for newcomer English Learners to enroll in and complete mathematics classes (Johnson, 2020). Additionally, intensive mathematics interventions can provide a statistically significant increase in mathematics achievement scores, though Snipes et al. (2016) noted that these programs may not be sufficient on their own. Schools can increase educational equity in outcomes for English Learners by requiring access to rigorous, four-year mathematics sequences, which Maldonado et al. (2018) noted can contribute to closing the achievement gaps between minoritized students and non-minoritized peers. Additionally, schools that provide specialized language programs can sometimes create barriers to access to advanced mathematics and science classes. School administrators can structure dual language bilingual education

programs and intensive support for English Learners to ensure multilingual learners have access to advanced STEM courses in high school (Morita-Mullaney et al., 2020). The case of Leyla, above, illustrates this structural trap of language classes precluding advanced mathematics courses.

Curriculum and assessment are other forms of structural support in mathematics. Relevant to our focus on Algebra I, researchers have found that using integrated mathematics curriculum in classrooms in schools with a high percentage of minoritized students yielded significantly higher assessment results when compared to the results from students in similar settings without integrated curriculum (Krupa & Confrey, 2017). This effect was most pronounced when comparing Algebra I and an Integrated curriculum addressing the same topics. Relatively, dual language mathematics assessments allow English Learners to demonstrate their mathematical knowledge, drawing on all their linguistic repertoire and not limited to their English linguistic proficiency (Lopez, 2023). These findings have implications for practice in classrooms with English Learners, which are further discussed below.

Another structural dimension of school is human resources. Teacher characteristics and students' experiences of teachers are associated with different dimensions of mathematics opportunity. Grissom et al. (2020) found that teacher–student racial or ethnic congruence was associated with higher grades, end-of-course scores, and subsequent enrollment in more advanced mathematics. Relatedly, Shifrer et al. (2023) found that ninth graders who perceived their mathematics teacher as equitable generally reported stronger mathematics identities. In multilingual classrooms, teacher preparation is consequential. For multilingual learners, one key structural support is language support from a teacher certified to teach multilingual learners. DeVoss et al. (2024) found that English Learners earned higher assessment scores in co-taught

classes when the ESOL **co-teacher** also held certification in the relevant content area. This finding suggests that co-teachers may be better positioned to integrate linguistic support with subject-matter instruction when they possess expertise in both areas. Complementing this evidence, Roberts et al. (2025) illustrated how sustained, collaborative professional learning can support the development of mathematics teachers' adaptive expertise (flexibility, deeper level of understanding, and deliberate practice) to teach multilingual learners.

Lastly, schools can be structured to include parents as collaborators in their children's education. The role of parents is also significant in determining the academic success of students, which is not as well documented. Wassel et al. (2017) researched middle school STEM teachers' perspectives on family involvement, particularly the families of their ELLs students. Their study found that teachers had specific expectations for how families should get involved with school or support their children's academic responsibilities outside of the school hours. The teachers' expectations were consistent with middle-class family involvement practices (such as homework help or STEM at-home tutoring). These expectations frame the teachers' perspectives of what is a "good parent", which led to framing diverse families as problematic. Lower-SES Latinx parents, however, can also be examples of "good parents." As a counter point, Tulugan et al. (2025) carried out a study on how minoritized parents provide math support through adaptive responses, particularly by drawing on their community wealth (i.e. seeking help from social networks, using digital tools) to provide their students support.

The vignette "Arbor High School's Student Support Systems" (see sidebar) illustrates how placement policies, allocation of resources, and school structures can work together to create more equitable learning outcomes for minoritized students, including Latinx students, Black students, and low income students.

Theme 3 - Pedagogy

Across the literature, culturally and linguistically responsive instructional practices were consistently documented as supporting minoritized students to succeed in algebra. These practices expanded opportunities for mathematical sensemaking, participation in mathematical discourse, and persistence in rigorous mathematics learning environments. These pedagogical practices were particularly salient for Latinx students and multilingual students classified as English Learners. Consistent with the call for non-deficit framing in de Araujo et al. (2018), the studies we reviewed on pedagogy generally positioned students' linguistic and cultural resources as assets for learning rather than barriers to overcome. Additionally, these studies extended or challenged the traditional focus on language as a barrier by emphasizing translanguaging—the flexible use of students' full linguistic repertoires to communicate, reason, and make meaning (Celedón-Pattichis et al., 2024; Yi et al., 2024)—as well as identity affirmation (Gargroetzi, 2024a; Marshall & Battey, 2025) and humanizing pedagogies (Marshall et al., 2022; Warden, 2022). Humanizing pedagogies affirm students' full humanity by cultivating relationships, belonging, dignity, agency, and meaningful opportunities for students to contribute as intellectually capable members of the mathematics classroom community.

The first subtheme focused on supporting students' mathematical sensemaking through drawing on students' linguistic and cultural resources. Across studies, multilingual learners demonstrated strong conceptual reasoning when teachers integrated translanguaging (Celedón-Pattichis et al., 2024; Morales & DiNapoli, 2018, 2025), culturally meaningful contexts (Andrei & Daley, 2024; Warden, 2022; Wilson & Smith, 2022), multimodal representations (Chang et al., 2025; Oliver & Gregory, 2020), and opportunities to connect every-

Structures Illustration: Arbor High School's Student Support Systems

The following is from a case study of successful schools (Aniceto et al., 2025). Arbor High School¹ is a charter high school serving approximately 2,500 students in a diverse community located at the urban-suburban interface. Arbor High serves a large Latinx population (46%), and about two-thirds of Arbor's students are low-income, as indicated by eligibility for free or reduced-price lunch. In the mid-1990s, the school leaders and teachers voted to convert the school into a district-sponsored charter school. Their motivation for converting was to gain control over structures, including graduation requirements and daily schedules. Today, the school enrolls students through a lottery system, with first priority going to students from Arbor's historic school boundaries, maintaining a racially and economically diverse student body.

Since its conversion to a charter, Arbor has demonstrated impressive success on metrics such as rates of college-preparatory mathematics course completion and results on state assessments. For example, on the state 11th grade mathematics assessment, all subgroups of students at Arbor outperform students across the state on the mathematics assessment (Table 3), though there continue to exist some within-school differences in achievement. Arbor successfully enables more than 80% of its students to complete the coursework required for four-year college eligibility—far exceeding the statewide average of about 50%.

In terms of course pathways, all students are enrolled in Algebra I by default in ninth grade, and all students are required to complete the college preparatory coursework of Algebra I, Geometry, and Algebra II as part of the school's graduation requirements. The school has an honors track, and students can join the honors track based on a placement test. About 15% of entering ninth graders start in Honors Algebra I or Geometry. The school allows students in Algebra 1 to transition to the honors pathway at the end of ninth grade and there are also opportunities to accelerate through summer coursework. Beyond the required Algebra II course, Arbor offers an extensive sequence of advanced mathematics classes, including Precalculus, Data Science, Statistics, AP Calculus BC, and Multivariable Calculus. In 2024, 130 students were enrolled in AP Calculus BC, representing 20% of a graduating class. Since then Arbor has expanded dual enrollment opportunities with a local community college, enabling students to earn college credit while still in high school.

The case of Arbor does not negate the extensive evidence connecting segregated schooling to unequal mathematics opportunities (Kim & Campbell, 2024). Rather, it illustrates how a school serving a racially and economically diverse population can organize course pathways, staffing, time, and support in ways that interrupt commonly observed patterns of inequity. Below we provide additional detail on the mathematics program and describe two major support systems at Arbor: (a) the tutoring program, and (b) double-dosed mathematics classes.

Tutoring: Arbor provides both general and subject-specific tutoring throughout the school day, including a required ninth-grade “academic success” course that combines study skills instruction, supervised study time, and targeted tutoring delivered by paid tutors. The tutoring program director collaborates closely with teachers (including mathematics teachers) to identify students who need

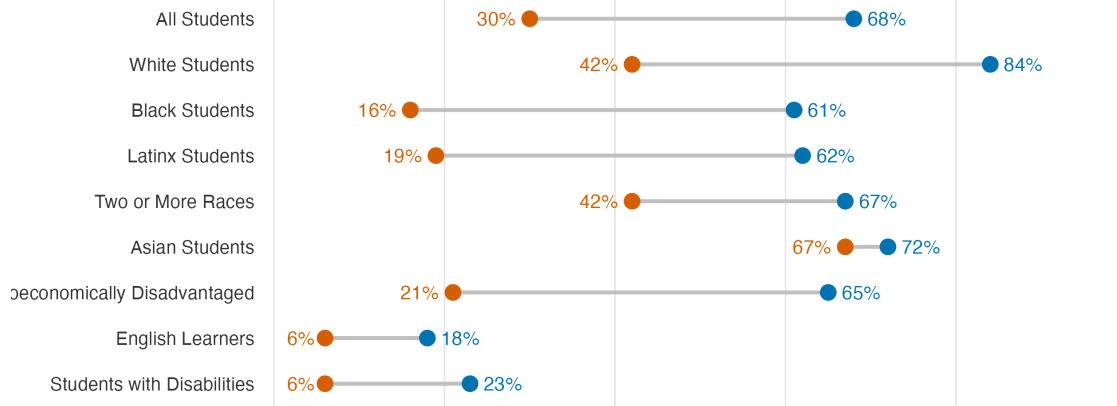
1 This is a pseudonym

Student Outcomes at Arbor High Compared with California

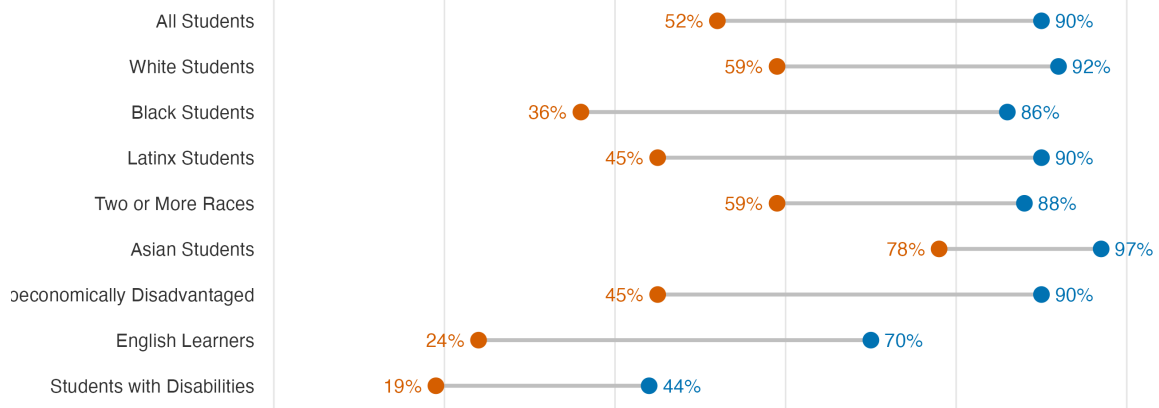
Percentage of students meeting each outcome

● Statewide ● Arbor

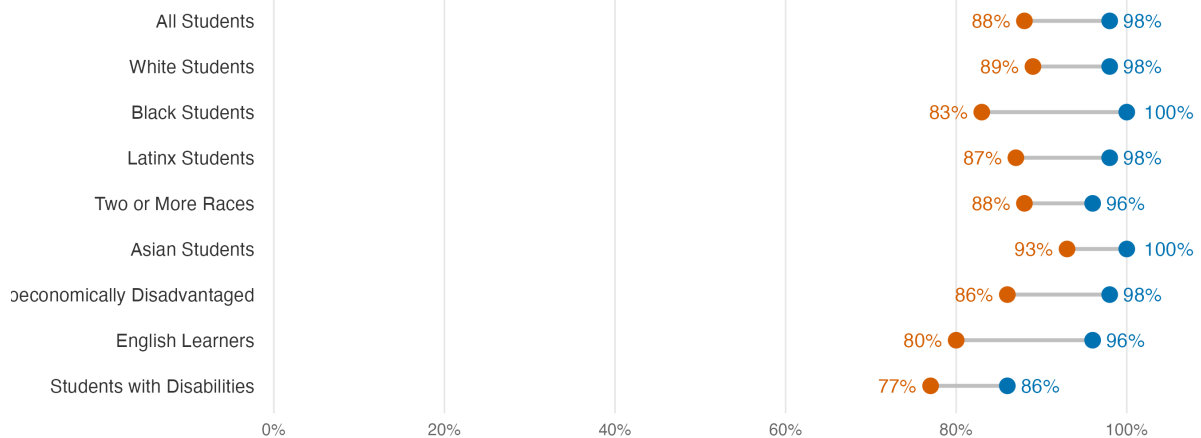
Met or exceeded the standard on the 11th-grade mathematics assessment



Completed college and career readiness requirements



Graduation rate



Source: California Department of Education

additional support and match them with tutors during the academic support period. Beyond tutoring, students can also receive extra help, take makeup tests, and meet one on one with teachers during weekly office hours. These hours are part of the school's weekly schedule.

Double Dose Algebra: The administrators at Arbor High School have also invested significant instructional time to support student success in mathematics, particularly in courses identified as obstacles to completing college-preparatory requirements. Algebra 1 and Algebra 2 have been implemented with a “**double-dose**” model, which allows for additional instructional time. This also makes it possible for students to change from the regular to honors track each year. The former mathematics department chair explained the structure:

We repopulate our classes after spring break [of ninth grade], so the kids that didn't pass or need remediation get to start “summer school” [before summer]...for the kids that have really excelled, maybe this is a big opportunity for them to go to the honors track. Then in the fourth quarter, they're all together, and we really kind of coach them up and prop up their skills as much as we can. So then the following year, their sophomore year, now they've overtaken the honors level, the more rigorous track of math classes. four-by-four. They can make up assignments, retake assessments, and stay on track.



The provision of these supports is expensive, and Arbor developed its student support structures over the course of a decade. One of the most striking things to us (as researchers) was that the leaders of Arbor High described the struggles candidly and described the process through which they were able to work toward their vision. Rosa, the director of student support at Arbor High teacher also graduated from the school. She shared how the mathematics requirements at the school had changed over 35 years:

When I went here [in the late 1980s], there were all kinds of different tracks—tracking going on with students. I know that I took Algebra 2 in high school, but I know there were kids who graduated with Consumer Math way back in the day. I know that when I started working here, in 1998, [that] was the beginning of the charter and the transition to more of a college readiness curriculum. But initially students did not have to meet the A-Gs [the sequence of courses required to apply to public colleges, including Algebra II], and so a lot of 'em chose not to do that. I know that when we decided to go to the A-Gs as a requirement, there was a lot of angst in the math department and other staff thinking, “well, kids aren’t going to be able to do that” and “not every kid can pass Algebra II.” And I remember our big discussions, a lot of meetings and big discussions and that was a big contention at that time. But we went ahead and made the change proving that when you raise standards, as long as you provide kids with the support that they need, they can meet those standards.

Rosa’s quotation points to the interplay of rising demands and the necessity of provisioning supportive structures. The Arbor case illustrates how rigorous mathematics requirements can be paired with school-level structures to support student success. As Rosa explained, the school’s decision to require college-preparatory coursework was accompanied by structures intended to help students meet those expectations. These included tutoring and office hours embedded in the school day, additional instructional time in Algebra I and Algebra II, and formal opportunities for students to move from college-preparatory into honors pathways. Together, these structures expanded both students’ chances of succeeding in required mathematics courses and their opportunities to progress to advanced mathematics.

- Baseline College Preparatory Curriculum with Advancement
- Double Dose Mathematics
- Track Flexibility
- Academic Support Class
- Tutoring
- Office Hours
- Dual Enrollment options along with Advanced Placement



day and academic language (Cahill & Bostic, 2025; Sigley & Wilkinson, 2015). To illustrate these results, Celedón-Pattichis et al. (2024) found that translanguaging was effective in technology-supported learning environment while Yi et al. (2024) found that translanguaging and collaborative prediction tasks supported bilingual students' algebraic reasoning in Algebra I. Morales and DiNapoli (2018, 2025) demonstrated that Latinx bilingual students in an advanced mathematics class used spontaneous translanguaging to engage in collective perseverance through mathematical obstacles. This linguistic practice allowed them to build conceptual understanding within a self-created unofficial social space, which served to affirm their bilingual identities even when the official curriculum marginalizes their contributions. Similarly, Oliver and Gregory (2020) highlighted how collaborative meaning-making activities supported multilingual learners by helping them collectively interpret problems, connect representations and complex mathematical language, and reason through mathematical ideas together. Such activities included inquiry-based group work, card-sorting activities, and total physical response (TPR), or the use of purposeful physical movements and gestures to represent and respond to ideas. These findings are relevant in light of Zahner and Wynn's (2023b) observation that linguistic complexity can obscure multilingual learners' sophisticated mathematical understanding.

The second subtheme in the Pedagogy articles centered on supporting students' participation in mathematical discourse and classroom communities. Studies showed that participation depended heavily on classroom discourse structures and how teachers positioned students. Practices such as using Accountable Talk (Ardasheva et al., 2016), higher-order questioning (Roberts, 2021), small-group collaborative inquiry (Celedón-Pattichis et al., 2024; Moschkovich & Zahner, 2018; Oliver & Gregory, 2020), support for participation in

whole-class discussions (Byun, 2024; Gargroetzi, 2024a; Zahner et al., 2021), **mathematical language routines** (Roberts & Olarte, 2025; Zahner et al., 2021), and translanguaging spaces (Celedón-Pattichis et al., 2024; Yi et al., 2024) increased opportunities for multilingual learners to explain their reasoning and contribute publicly to mathematical discussions. To elaborate, Ardasheva et al. (2016) found that Accountable Talk—a structured discourse framework that explicitly taught students norms for active listening, building on peers' ideas, and supporting claims with evidence—expanded EL students' participation in classroom discourse communities. Similarly, Byun (2024) demonstrated that the use of interactional scaffolds such as establishing epistemic congruence, or a shared understanding of what a student knows before inviting them into whole-class discussions, helped minoritized students publicly display mathematical competence. Extending these findings, Zahner et al. (2021) found that using mathematical language routines and dynamic, interactive representations shifted classroom interactions from teacher-led recitation toward student-driven mathematical discussion, while Roberts and Olarte (2025) illustrated how Mathematical Language Routines could be incorporated into preservice teacher approximations of practice, where the goal was to support multilingual learners' opportunities for mathematical discussion and explanation.

The third subtheme related to pedagogical practices focused on supporting minoritized students' persistence, identity development, and long-term engagement in mathematics. Studies consistently found that minoritized students were more likely to persist when classrooms maintained high cognitive demand—a high level of thinking induced by the mathematical activity—while also providing linguistic (Wilson & Smith, 2022; Yi et al., 2024), relational (Douglas et al., 2024; Phillips, 2019), and identity-affirming supports (Gargroetzi, 2024a; Marshall & Battey, 2025). Humanizing pedagogies (Marshall et al.,

2022; Warden, 2022), collective responsibility (Marshall et al., 2022), autonomy-supportive environments (Marshall & Battey, 2025), and dignity-affirming relationships (Douglas et al., 2024; Gargroetzi, 2024b) strengthened students' mathematical identities and engagement. For example, Marshall and Battey (2025) found that “homeplace” classroom environments supported Black girls' sustained engagement in mathematics, while Douglas et al. (2024) showed that students' negative experiences with inadequate teacher support, low expectations, and limited access to meaningful mathematical engagement contributed to weakened mathematical identities, including seeing themselves as less capable in mathematics and questioning whether advanced mathematics or STEM careers were attainable for them.

Taken together, these findings suggest that culturally and linguistically responsive mathematics instruction supports minoritized students not by simplifying mathematics, but by recognizing multilingualism, cultural knowledge, and discourse participation as central to rigorous mathematical learning. Across the studies, minoritized students were most successful learning algebra and advanced mathematics when instructional practices simultaneously supported conceptual understanding, meaningful participation, and their development of positive mathematical identities within humanizing classroom environments. In the classroom vignette “Lorenzo Shares His Method” (see sidebar), we illustrate how one teacher used a task that included multiple representations and the teaching practice of translanguaging to support one student's explanation of the connection between slope and rate of change. In the next section we discuss the implications of this work and possible next steps.

Limitations

This scoping review has several limitations. First, we (and the underlying literature we re-

viewed) often discuss Latinx students and multilingual students, including students classified as English Learners, together. Although these populations overlap, they are not interchangeable. However, the reviewed studies rarely focused on Latinx students without also identifying them as multilingual or EL students, and many studies treated these populations as a combined or overlapping group. Consequently, we could not consistently disentangle research results related to Latinx identity from language proficiency, language background, EL classification. This limits what we can conclude specifically about Latinx students who are not classified as English Learners and may obscure important differences among current English Learners, former English Learners, multilingual students who have never been classified as English Learners. This limitation reflects both our synthesis and a broader gap in the literature.

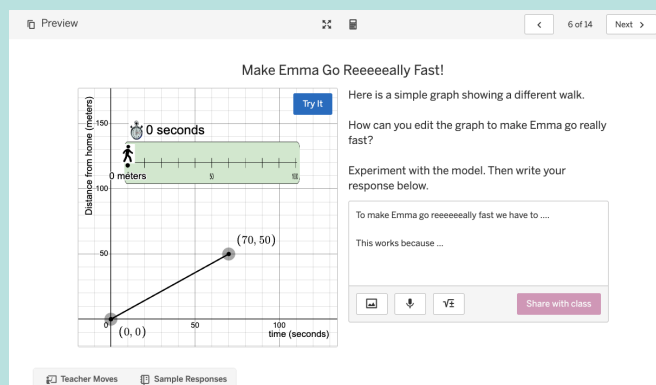
Second, the breadth of this scoping review required us to synthesize findings across a diverse body of research. Given this scope and the report's policy-oriented audience, we necessarily simplified some of the theoretical, methodological, and contextual nuances of individual studies. Additionally, given the number of studies and space constraints, we could not represent every paper in its full complexity.

Finally, the reviewed studies varied substantially in their research designs, samples, settings, and forms of evidence. For example, some findings were based on data from a single student or classroom, whereas others drew on large-scale or national samples. Qualitative, quantitative, mixed methods studies also support different types of claims. Although we sought to calibrate our conclusions to the strength and type of evidence available, this review did not systematically distinguish or weigh studies according to their methodological scope or our perceptions of the strengths of each study. Future work should examine these differences more critically, including the extent to which findings are transferable across con-

Pedagogy Illustration: Lorenzo Shares His Method

The following excerpt was recorded during a classroom design experiment at City High. The overall project focused on creating a classroom learning environment in which all students, including English Learners, benefit from participating in discussion. In this excerpt ninth graders enrolled in Integrated Mathematics were learning about the relationship between slope and rate of change in linear functions. Students worked with a dynamic model that showed a graph of distance and time and a linked animation of “Emma” walking on a number line. They answered the question “How do you make Emma go really fast?” Students worked in pairs, with access to the dynamic model. After a few minutes of pair / group work, the teacher called Lorenzo, a former English learner, to share his work with the help of his group. The teacher gave Lorenzo advanced notice so he and his group could prepare before presenting in front of the class.

1. T: Okay, so Lorenzo can you please come up and show us. How do we make Emma go really fast and can you explain your answer to your question. Come on up.
2. Lorenzo: ((Stands at board. Drags the endpoint of the line segment))
3. Ana: Más pa la izquierda.
More to the left.
4. Lorenzo: Pa la izquierda? ((starts moving to right))
To the left?
5. Kane: No, pa la izquierda, estúpido.
((said with a joking tone))
No, to the left, stupid.
6. Ana: Mas pa' arriba. Sí sí!
7. Kane: Ya. Ya.
8. Ana: Donde tú quieres.
Wherever you want.
9. Kane: Try it. Try it. ((Lorenzo presses play))
10. T: Okay, did you all see what Lorenzo did? I want to make sure everyone followed that. Can you do that again, one more time and explain to us what you are doing?
11. Ana: Tú enséñales que tú si sabes. Tú puedes.
You show them that you know. You can do it. ((Encouraging))
12. T: Lorenzo, ¿puedes decir a nosotros que estás haciendo? Can you tell us what you are doing?
13. Lorenzo: Sí. Es que, estoy moviendo esta. ((The dot. Lorenzo moves the end of the line to the upper left.))
Yes. It's that, I'm moving this one
14. Several Students: ((several)) In English!



15. Lorenzo: ((Inaudible))

16. T: Puedes hablar en el idioma que quieras.
You can talk in whichever language you want.

17. Lorenzo: Oh because you put that up and it goes faster. ((the dot))

18. ... ((brief crosstalk))

19. Lorenzo: So, you move the dot up and-

20. Kane: To the left!

21. Lorenzo: There! ((inaudible))

22. Kane: Left and then-

23. Lorenzo: Pa ya ((pointing right)).

24. Kane: Left!

25. Ana: Steeper the line the faster.

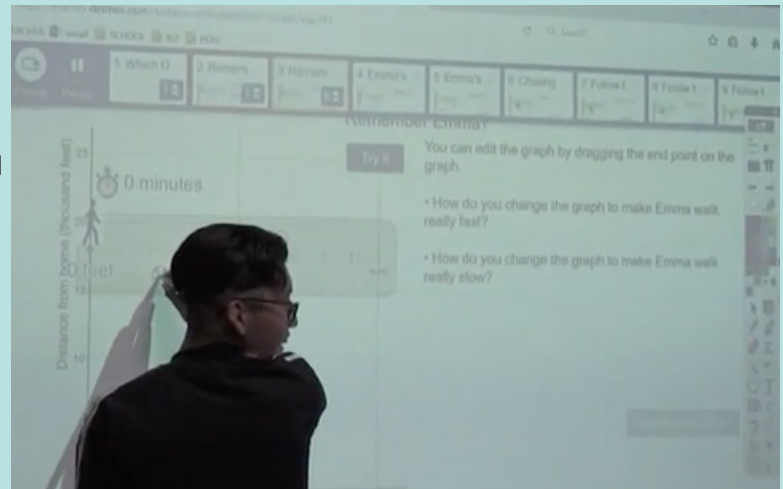
26. Lorenzo: ((moves the line to the left and presses play. The Runner goes really fast.))

27. Kane: yea, like that look. That's gonna go super duper fast look. ((Makes a car sound. Class laughs))

28. [... Omitting multiple lines where the students try to make Emma go slow. Teacher presses for reasoning...]

29. Ana: Because the line isn't as steep. She's traveling, more distance, wait- less distance and more time. See look. ((Lorenzo plays it)) More time.

30. T: Okay, what, I want you to turn and talk to your neighbor for a minute and Katia is going to add to that. So thank you Lorenzo, that was excellent. I really appreciate you sharing. And turn and talk to your neighbor how do we make her go fast, I want you to use mathematical words to explain this.



This episode illustrates how pedagogical supports can expand multilingual students' opportunities to participate in rigorous mathematical discussion without reducing the mathematical demand. Lorenzo's public explanation was supported before he came to the board: he had worked with peers, used a dynamic representation, and received advance notice that he would be asked to present. During the presentation, his reasoning was expressed through movement of the graph, gesture, Spanish, English, and contributions from his peers. When a few of Lorenzo's classmates requested that he speak in English, the teacher explicitly legitimized translanguageing, reducing the linguistic risk of public participation for Lorenzo. Yet, the teacher simultaneously continued to press for a mathematical explanation. The episode illustrates more than permission to translanguage. It shows how advance preparation, peer support, multimodal representations, and teacher positioning can work together to help a former English learner publicly display mathematical competence. At the same time, the teacher maintained the mathematical goal by asking students to connect the steepness of the line to distance, time, and rate of change, and pressed until this idea was made available for public reflection.

texts and the kinds of policy conclusions that each form of evidence can support.

Implications for Policy and Practice

In the foregoing sections of this scoping review we have addressed three of our four research questions. In this section, we address our final research question: How do Algebra I placement policies, school-level structures, and instructional practices interact to shape students' success in gateway mathematics courses such as Algebra I? We answer this question by synthesizing the results so far and providing recommendations for policymakers and school personnel. Looking across all of the literature we have synthesized, one key insight is that Algebra I course placement, school level support structures, and classroom pedagogy should be thought of as parts of an integrated system that can support the success of minoritized students. Placement policies determine access, school structures determine whether access is supportable and sustained, and classroom pedagogy determines the quality of students' opportunities to learn once they enter the classroom. With this integrated approach in mind, we turn to implications.

Implications for Mathematics Placement Policies

The research based on large scale data sets examining the consequences of taking Algebra I is clear: Completing Algebra I is a predictor of academic success, both in mathematics and in other classes. The benefits of completing Algebra I are greatest for students who take the course in middle school. Yet, many middle schools do not offer Algebra I, and others offer the course, but have restrictive placement policies and procedures. We recom-

mend that schools and districts establish transparent placement criteria, communicate those criteria to students and families, and create regular opportunities for students to move into more advanced coursework based on multiple forms of evidence.

To ensure that placement policies are equitable, schools and districts must collect and monitor data on an ongoing basis. These data can include both outcome data (e.g., test scores, rates of course completion) as well as data on opportunities for learning (e.g., do students have access to high quality courses and support structures?).

In recent years, there has been considerable controversy surrounding middle school and high school mathematics placement policies (Huffaker et al., 2025). The origin of this controversy is the reality that mathematics is consequential, particularly for creating or foreclosing learning opportunities in science, technology, engineering, and mathematics-related fields. Additionally, when students have access to Algebra I strongly influences the number of advanced mathematics courses students can take in high school (Hanson et al., 2016; McEachin et al., 2020; Rogers, 2024; Yamaguchi et al., 2020). Based on the research reviewed for this study, there is evidence that placement alone is not the sole driver of equity and inequity, particularly for English Learners taking Algebra (Fong et al., 2016; Thompson, 2017). Rather, it is placement in combination with academic support that can support more equitable outcomes. The results from Sequoia school district (Dee & Huffaker, 2026) and the case of Arbor High School presented in one of the vignettes here suggest that schools can achieve equity and excellence by setting a common baseline of ninth-grade algebra, and supporting all students to succeed in that baseline.

Implications for School Structures

Based on the research we reviewed about school structures, the first implication for policy is that academic support for students who need assistance meeting grade-level expectations should be provided in ways that preserve students' access to grade-level mathematics. During early "algebra for all" mandates many students were placed into classes that were called Algebra I, but which did not provide the opportunity to learn grade level mathematics. Intervention structures that repeatedly remove students from core instruction, delay Algebra I enrollment, or place students in non-credit-bearing coursework may unintentionally reproduce the barriers they are intended to address. Policymakers should design intervention programs to allow students to participate in both core instruction and intervention/support. In line with the case of Arbor High in this paper, the existing research shows that, when designed well, interventions can make a meaningful difference for students (Dee & Huffaker, 2026).

Second, for multilingual students and English Learners who are receiving English Language Development support, schools should develop schedules that allow students to learn English while they simultaneously continue to advance in grade-level mathematics. The case of Leyla in this paper illustrates how an English Learner's mathematics learning can be delayed or possibly derailed by well-intentioned policies. Rather than isolate English Learners in English classes for the majority of the school day, schools can use models such as co-teaching or bilingual mathematics courses to allow English Learners to continue learning mathematics while they develop English language proficiency. Relatedly, assessments and placement systems should distinguish mathematical knowledge from English proficiency. For all students, placement decisions should rely on multiple sources of evidence so that placement measures that rely most heavily on language do not underesti-

mate multilingual students' mathematical understanding.

For policymakers, one implication of this review is that educators need time and resources to support robust mathematics learning for all students. Meeting rigorous requirements such as universal access to a college-preparatory mathematics curriculum requires sustained investments in teachers, support staff and time for coordination. Rosa's summary in the case of Arbor "when you raise standards, as long as you provide kids with the support that they need, they can meet those standards" provides a guiding principle for the allocation of resources. Broad access to college-preparatory mathematics is most credible when accompanied by tutoring during the school day, additional instructional time, flexible movement between course pathways, office hours, and access to advanced coursework. We note that providing such an educational program requires the allocation of resources, not simply statements of desire for equity.

Last, this review suggests implications for policy regarding the role of teachers and family involvement in supporting student learning. Teacher preparation and professional development should be designed to equip mathematics educators to meet the linguistic and academic needs of ELs while also promoting equitable instructional practices. While nearly all schools have plans for family engagement, school districts should critically examine how their plans might implicitly assume middle class forms of parental involvement (e.g., volunteering at school activities during the workday). This issue is particularly important in minoritized communities where the majority of English Learners' families are working class and may not have flexibility to be physically present during school hours. Rather, school and district family engagement policies should examine and leverage the various ways parents can support students' mathematics learning beyond the well-documented middle-class expectations.

Implications Related to Pedagogy

The policy recommendations in this subsection are derived from our review of pedagogy-focused studies. Although these studies examined classroom instruction rather than policy interventions, they point to several policy levers that could promote the implementation of rigorous and equitable Algebra I instruction for minoritized students, particularly Latinx students and students classified as English Learners. Accordingly, the recommendations below translate the three instructional themes identified in the pedagogy findings into three complementary policy levers: (a) curriculum adoption policies and instructional materials, (b) teacher preparation and sustained professional learning, and (c) mathematics curriculum frameworks and district instructional guidance.

One finding of this scoping review is that research shows positive outcomes from asset-based pedagogy. Policymakers can encourage asset-based Algebra I instruction through curriculum adoption policies and instructional materials that recognize multilingual students' linguistic and cultural resources as assets for learning. Consistent with the pedagogy findings, curriculum adoption policies, textbook evaluation criteria, and instructional materials can prioritize bilingual mathematical vocabulary supports, culturally meaningful problem contexts, multiple representations, embedded mathematical discussion routines, and accompanying teacher resources that support translanguage and other asset-based instructional practices. In consideration of multilingual learners such as Lorenzo and Leyla from the vignettes, curriculum adoption criteria can also encourage instructional materials that authentically incorporate multilingual communication and translanguage into mathematical tasks, explanations, and narratives, thereby normalizing multilingualism as a resource for mathematical thinking and collaboration.

Policies that invest in teacher preparation and sustained professional learning can better prepare teachers to facilitate structured mathematical discourse in Algebra I for minoritized students and multilingual students, including those classified as ELs. Policies that provide dedicated funding, collaborative planning time, instructional coaching, and ongoing professional learning can equip teachers to implement the discourse practices identified across the reviewed literature, including Mathematical Language Routines, Accountable Talk, collaborative inquiry, and purposeful questioning. These investments can help build teachers' capacity to facilitate meaningful mathematical discussions that expand opportunities for all students, including minoritized and multilingual students to explain their reasoning, build on one another's ideas, participate in rigorous mathematical practices, and simultaneously develop academic language.

Mathematics curriculum frameworks and district instructional guidance can define, communicate, and illustrate what rigorous and equitable Algebra I instruction looks like in practice. The 2023 California Mathematics Framework (California Department of Education, 2023) can serve as a model for such a focus. Policies can communicate that high-quality mathematics instruction for Latinx students and students classified as English Learners includes maintaining high expectations through opportunities to engage in high-cognitive-demand mathematical tasks while providing the linguistic, relational, and instructional support structures needed for students to engage successfully with those tasks. Mathematics curriculum frameworks and district instructional guidance can make these expectations concrete by illustrating grade-level algebra tasks, the teacher moves that support the implementation of those tasks, and the teacher moves that position Latinx students and students classified as ELs as mathematically capable. In doing so, these frameworks and guidance documents can move beyond artic-

ulating broad principles to providing concrete examples of how teachers can maintain rigorous mathematics instruction while affirming the identities and strengths of Latinx students and multilingual students.



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Glossary

Algebra I: A foundational mathematics course that typically includes setting up and solving linear equations and inequalities, reasoning with linear and quadratic functions, solving quadratic equations, and analyzing patterns of change in linear and exponential growth/decay. In this report Algebra I and Integrated Mathematics I are treated as equivalent. We use *Algebra I* with capitalization to refer to the course and *algebra* without capitalization to refer to the more general area of mathematics related to solving equations, modeling, and functional thinking.

Algebra I Placement: The process and criteria by which students are assigned to take Algebra I, and which version or level of the course they are placed into. In middle school it is common for some students to take Algebra I in eighth grade and others to take an eighth grade mathematics class that is not Algebra I.

Co-Teaching: An arrangement in which two teachers take responsibility for teaching the same class. In a multilingual classroom, this might include a certified mathematics teacher and a teacher certified in bilingual teaching.

Course Pathways: The sequence of mathematics courses through which students progress, such as Algebra I, Geometry, Algebra II, Precalculus, and Calculus. Course pathways often have a pre-requisite structure that shapes students' access to advanced mathematics and future educational opportunities.

Double Dose: A scheduling model that gives students additional instructional time in mathematics, often by enrolling them in an extended class or an additional mathematics period.

English Learners: Students who are developing proficiency in English and are formally identified by a school or district as needing English-language-development support. English Learner status is a language classification and is not the same as racial or ethnic identity.

Integrated Mathematics I: A foundational mathematics course that typically includes setting up and solving linear equations and inequalities, reasoning with linear and quadratic functions, solving quadratic equations, and analyzing patterns of change in linear and exponential growth/decay. Integrated Mathematics I also includes topics from statistics, data analysis, and geometry.

Mathematical Language Routines: "A 'math language routine' refers to a structured but adaptable format for amplifying, assessing, and developing students' language. The routines emphasize the use of language that is meaningful and purposeful, not inauthentic or simply answer-based." (Zwiers et al., 2017, p. 9)

Minoritized Students: Students from groups whose educational opportunities have been constrained by social structures, institutional practices, and unequal power relations. The term emphasizes that marginalization is produced by social structures and systems, rather than by the numerical size of a group. (Wingrove-Haugland et al., 2021). Given the historical segregation of schools, in many settings minoritized learners are the numerical majority of students.

Multilingual Learners: Students who use or are developing proficiency in more than one language. The term emphasizes multilingualism as an asset and may include students who are formally classified as English Learners as well as students who are not.

Scoping Review: A systematic method for identifying, organizing, and synthesizing a broad and varied body of research. A scoping review is used to map major themes, patterns, and gaps in the literature rather than to estimate a single overall effect.

Tracking: The practice of placing students into different mathematics courses or levels based on perceived readiness, prior achievement, or other criteria. Because tracks often determine access to later courses, early placement decisions can shape students' long-term mathematics opportunities.

Translanguaging: The flexible use of a person's full linguistic repertoire to communicate, reason, and make meaning. Translanguaging is often contrasted with code switching.

Transfronterizo/a: A person whose life and experiences extend across national borders, especially the U.S.–Mexico border. Transfronterizo/a students may move between countries, schools, languages, and educational systems.

Appendix

Search Strings

Search Name	Search String	Additional Filters
Eric1	TI,AB,SU(algebra* OR "integrated math*" OR "integrated mathematics*") AND TI,AB,SU("English learner*" OR "English language learner*" OR multilingual* OR "emergent bilingual*" OR bilingual* OR "language minority" OR "multilingual learner*") AND TI,AB,SU(secondary OR "secondary mathematics" OR "high school*" OR adolescent* OR "middle school*" OR "K-12")	Apply filter Date >= 1/1/2015 Apply filter "Peer Reviewed"
Eric2	TI,AB,SU(mathematic* OR algebra* OR "linear function*" OR "rates of change") AND TI,AB,SU("English learner*" OR "English language learner*" OR multilingual* OR "emergent bilingual*" OR bilingual* OR "language minority" OR "multilingual learner*") AND TI,AB,SU(secondary OR "secondary mathematics" OR "high school*" OR adolescent* OR "middle school*" OR "K-12" OR "ninth grade")	Apply filter Date >= 1/1/2015 Apply filter "Peer Reviewed"
Scopus1	TITLE-ABS-KEY((Algebra* OR math* OR "linear function*" OR "rate* of change") AND ("English learner*" OR "English language learner*" OR multilingual* OR bilingual* OR "language minority*" OR "linguistically diverse" OR ESL OR EL OR "second language" OR latin*) AND ("secondary school" OR "high school" OR adolescent* OR "middle school*" OR "junior high")) AND PUBYEAR > 2014	
Scopus2	(TITLE-ABS-KEY ((Algebra* OR math* OR "linear function*" OR "rate* of change") AND ("secondary school" OR "high school" OR "middle school*" OR "junior high" OR ninth OR eighth OR seventh) AND (minorit* OR ethnoracial OR rac*)) AND PUBYEAR > 2014)	

Author Biographies



William Zahner is a professor of Mathematics Education and the director of the Center for Research in Mathematics and Science Education at San Diego State University. He conducts research on creating school learning environments in which multilingual learners can learn grade-level mathematics, with a focus on high school and college level mathematics classrooms. Zahner has led multiple research projects and his work has been funded by the National Science Foundation, the California Department of Education and private foundations.



Dr. Ernesto D. Calleros is an Assistant Professor in the Department of Mathematics at California State University, Fresno. His research examines equitable mathematics teaching and learning, particularly for Latino and multilingual students in K–12 and university settings. Through NSF-funded projects, he has investigated ambitious teaching, student engagement, discourse, and how language shapes learning, participation, identity, and power in mathematics. A Latino and multilingual scholar, Dr. Calleros advances asset-based approaches that value students' cultural and linguistic resources.



Dr. Esperanza Ochoa is a graduate of the San Diego State University and University of California San Diego joint doctoral program in mathematics and science education. Her research investigates how families are positioned in middle school mathematics. She is currently an instructor of Mathematics at Southwestern College in Chula Vista, California.

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