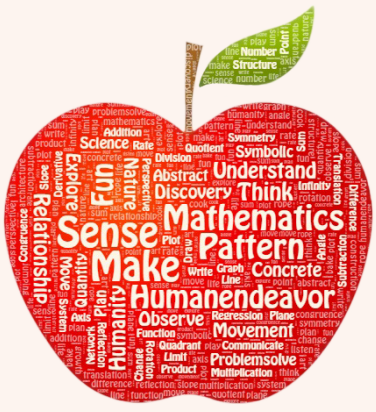
RIVERSIDE COUNTY OFFICE OF EDUCATION
Division of Educational Services
Instructional Services



Roadmap for Equitable and Effective Teaching, Learning, and Leadership

in TK-12 Mathematics

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INTRODUCTION

This document outlines our current reality and the recommendations made by the National Council of Teachers of Mathematics that will support and guide schools and districts on their journey towards more effective, equitable, and just mathematics experiences for each and every student. The document is organized into 5 focus areas that are intended to help begin and guide the critical conversations that are necessary to produce the change required in mathematics. Each focus area includes three sections: Acknowledgment, Action, and Accountability. The purposes of these sections are to help schools and districts understand where we are (acknowledgment), what could be focused on in the change process (action), and how to monitor the implementation (accountability). Throughout each section you will find linked resources that will help stakeholder teams to dive deeper in the topics discussed. In closing, we call all educators and parents to action in helping to realize the changes we need and we provide a list of more in depth resources that can help drive the work of districts and school sites.

BACKGROUND AND PURPOSE

Over the past eight years Riverside County has witnessed modest results and improvement in mathematics countywide. With pockets of success and growth within schools and districts, by and large we have seen a steady declining trend in performance from 3rd to 8th grade in mathematics. This trend is not unique to our county, but there are counties that have implemented equity-based teaching practices, changes to system-wide practices focused on social justice, and other changes recommended by research with great success, such as San Francisco Unified School District. Equitable teaching practices refers to how teachers and school sites implement the 8 Mathematics Teaching Practices, outlined by NCTM, in the most equitable ways for students' benefit. These will be discussed in more detail in Focus Area 3.

For many years educational research, writing, and scholarship have made clear the changes that should be made in mathematics education in order to see a profound difference in student outcomes. The research clearly indicates steps that should be taken to see increases in student preparedness for a quantitative-data literate life, college and career readiness, and participation within STEM fields for which math is a gateway. There are many obstacles that present current and future challenges as we move toward removing barriers to a just and equitable mathematical learning experience for each and every student and implementing equitable teaching practices. The National Council of Supervisors of Mathematics (NCSM) and TODOS: Mathematics for All argue for a social justice stance when considering reform to our current practices in the teaching and learning of math. As stated in their joint position statement:

> *"A social justice stance requires a systemic approach that includes fair and equitable teaching practices, high expectations for all students, access to rich, rigorous, and relevant mathematics, and strong family/community relationships to promote positive mathematics learning and achievement. Equally important, a social justice stance interrogates and challenges the roles power, privilege, and oppression play in the current unjust system of mathematics education—and in society as a whole (TODOS, 2016)."*

The critical conversations that are necessary will not be easy considering that the challenges we face are real and long-standing. It is crucial to keep in mind that the dominant cultural beliefs about the teaching and learning of mathematics continue to be obstacles to consistent implementation of effective teaching and learning in mathematics classrooms (Philipp, 2007).

It is Riverside County Office of Education's vision that TK-12 mathematics education will provide just and equitable mathematical experiences, high expectations for all students, prepare students for the data-rich world we live in, instill mathematical thinking in each and every student, and promote the joy and beauty of mathematics. We believe all students have a fundamental right to a rigorous, high-quality mathematics education regardless of perceived ability, race, ethnicity, gender, and/or socio-economic background. This video with Dr. Rachel Lambert highlights these ideas of supporting ALL students in mathematics. The mathematics that students learn in conjunction with how they learn mathematics should launch students towards postsecondary opportunities that will increase the likelihood for upward economic and social mobility and empowerment in today's global society.

We propose the following information, books, articles, and ideas to help districts and schools begin and/or continue the conversation around how to improve student readiness for a mathematically rich world. This is not an exhaustive list. These recommendations provide essential steps to build a shared vision within schools and districts for the next five years.

Mathematics Must Be Relevant

Mathematics instruction has not kept up with the pace of change over the last two decades. In many cases classroom instruction, textbook materials, and course sequences remain what they were 50 years ago. When we look at our current world and the access to technology that will compute for humans more quickly and accurately, we must recognize the need for change and the time is now. We must make the mathematics we are teaching relevant to the students we are teaching. To do this will require intense collaboration with teachers, parents, and students within districts. We must reimagine the core components of math instructions. This document will outline many of those components and provide resources for further critical conversations and work within districts, sites, and teacher teams.

The National Council of Teachers of Mathematics has provided key recommendations in elementary, middle, and high school that must be addressed in order to realize a mathematics vision that works for each and every student.

Elementary School

CATALYZING CHANGE IN EARLY CHILDHOOD AND ELEMENTARY MATHEMATICS (NCTM, 2020)

1. **Broaden the purposes of learning mathematics.** Each and every child should develop deep mathematical understanding as confident and capable learners; understand and critique the world through mathematics; and experience the wonder, joy, and beauty of mathematics.
2. **Create equitable structures in mathematics.** Early childhood and elementary mathematics should dismantle inequitable structures, including ability grouping and tracking, and challenge spaces of marginality and privilege.
3. **Implement equitable mathematics instruction.** Mathematics instruction should be consistent with research-informed and equitable teaching practices that nurture children's positive mathematical identities and strong sense of agency.
4. **Develop deep mathematical understanding.** Early childhood settings and elementary schools should build a strong foundation of deep mathematical understanding, emphasize reasoning and sense making, and ensure the highest-quality mathematics education for each and every child.

Middle School

CATALYZING CHANGE IN MIDDLE SCHOOL MATHEMATICS (NCTM, 2020)

1. **Broaden the purposes of learning mathematics.** Each and every student should develop deep mathematical understanding, understand and critique the world through mathematics, and experience the wonder, joy, and beauty of mathematics, which all contribute to a positive mathematical identity.
2. **Create equitable structures in mathematics.** Dismantle inequitable structures, including tracking teachers as well as the practice of ability grouping and tracking students into qualitatively different courses.
3. **Implement equitable mathematics instruction.** Instructional practices should be consistent with research-informed and equitable teaching practices that foster students' positive mathematical identities and a strong sense of agency.
4. **Develop deep mathematical understanding.** Offer a commonly shared pathway grounded in the use of mathematical practices and processes to coherently develop deep mathematical understanding, ensuring the highest quality mathematics education for each and every student.

High School

CATALYZING CHANGE IN HIGH SCHOOL MATHEMATICS (NCTM, 2018)

1. Each and every student should learn the Essential Concepts in order to expand professional opportunities, understand and critique the world, and experience the joy, wonder, and beauty of mathematics.
2. High school mathematics should discontinue the practice of tracking teachers and students into qualitatively different or dead-end course pathways.
3. Classroom instruction should be consistent with research-informed and equitable teaching practices.
4. Offer continuous four-year mathematics pathways with all students studying mathematics every year, including two to three years of mathematics in a common shared pathway focusing on the Essential Concepts, to ensure the highest quality mathematics education for all students.

These recommendations are a means to begin or continue critical conversations in schools and districts as we develop and implement our shared vision of school mathematics. The change process is significant and requires collaboration with students, parents, teachers, and leadership. The focus areas below are critical points of discussion and are offered as a potential starting point for schools and districts to engage with all stakeholders.

Additional resources are available at www.nctm.org/more4U.

SYSTEMIC STRUCTURES NECESSARY FOR PROGRESS

ACKNOWLEDGMENT:

"In mathematics education, to a much greater degree than English language arts, our efforts are often stymied by a culture of beliefs and mindsets that lower expectations and limit the opportunity to learn...Too often, our perceptions, policies, and practices fail to provide opportunities for all students, and in far too many places the link between high-quality mathematics education and social justice is missing from our actions as students fall through the cracks and leave school unprepared for the expectations and needs of today's workplace…" (NCSM 2014). This linked video with Dr. Rachel Lambert, UC Santa Barbara, gives further insight into these practices as they relate to IEP goals as a barrier to student success.

The Mathematical Association of America calls math "the most significant barrier" to finishing a degree- and ultimately to a path of greater opportunity for all students.

In TK-12 education, there are systemic structures in place that need to be addressed so that students are prepared for the variety of opportunities in their future lives, become mathematically literate, and experience the joy, wonder, and beauty of mathematics. A few of these systems and institutional ideas are described below with additional resources when available. The purpose of this focus area is to provide topics and concepts for critical conversations with stakeholders in order to move our educational system forward and create more just and equitable learning opportunities for each and every student.

Defining Mathematics

There are many ways to define mathematics depending on your perspective. For example, we could define mathematics as "pure mathematics," or from a social justice perspective, or perhaps centered on the creativity and joy found in mathematics. We offer a few key ideas or definitions to help center our work around mathematics.

"Mathematics is a way of thinking that involves studying patterns, making conjectures, looking for underlying structure and regularity, identifying and describing relationships, and developing mathematical arguments to show when and why these relationships hold (Russell, Susan Jo, Deborah Schifter, & Virginia Bastable, 2011)."

Mathematics is a social endeavor. It is a way to understand and interact with our world. It brings joy and depth to all that we see and experience throughout our lifetime. Mathematics should open doors of opportunity for each and every student. Mathematics is not the memorization of procedures, skills, and facts that will someday lead to understanding. As with any human endeavor, it must be experienced in a positive way that helps students understand its relevance and develop a positive disposition and identity towards mathematics.

ACTION:

There are numerous pathways to effect change in mathematics teaching and learning that promote equity for all students and social justice. Our recommendation is that crucial conversations and critical first steps need to begin now around the following important topics. As stated prior these conversations are complex and must involve a range of stakeholders including teachers, parents, administrators and students.

Early Mathematics

Children's experiences in mathematics at an early age, as young as 3 and 4 years old, are crucial to their development and future success. In grades PK-2 we must start children out strong in mathematics by providing rich and challenging mathematical experiences that are embedded in children's own environments and grounded in play and exploration. While it may seem obvious that a child's early mathematical knowledge is a predictor of later success in mathematics (Claessesn, Duncan, Engel, 2009), most surprising is that early mathematics predicts later

reading achievement even better than a child's early reading skills (Duncan, et el., 2007). This is crucial information when we think about systems that overly focus on early literacy. There must be a balance. Districts, sites, and teams can ask themselves the following questions in an effort to further this crucial conversation:

1. How does your district, site, or team reach out to incoming and current parents regarding implementing rich math experiences at home?
2. How much time is spent at school per day on mathematical experiences grounded in play and exploration?
3. How much time do teachers have to collaborate specifically on math instruction and implementing math explorations that foster wonder and joy?

Depth vs. Speed

Speed should never be the focus of mathematics. Current practices such as timed math fact tests create anxiety and frustration for students and tend to be the initial reason why students begin to believe they are not a "math person." This diminishes students' personal and mathematical identities and eventually denies them access to the STEM pipeline. These practices should end immediately. In order for students to be prepared for future, not yet existing careers, and a diverse society, we must focus mathematics learning on studying patterns, making conjectures, looking for underlying structure and regularity, identifying and describing relationships, and developing mathematical arguments to show when and why these relationships hold. For more information and resources on this topic please click here.

Instructional Time

Given the current expectations that include teaching content standards and math practice standards through the lens of the eight Mathematics Teaching Practices, teachers and students experience insufficient instructional minutes during the school day. The minimum amount of instructional time for grades TK-12 should be 60 minutes and the preferred amount would be 70-90 minutes daily. This means every day of the week students should have at least 60 and up to 90 minutes of math instruction. It is essential that critical conversations begin now to increase instructional minutes in elementary, middle, and high school. According to Steve Lienwand, former president of NCSM, instructional time is the first and most crucial step to increase teacher feelings of success and student achievement in mathematics. This crucial structure has a massive impact on many aspects of our educational system and will require teamwork from all aspects of our organization in order to address it and take positive steps forward. This is difficult work but the right work nonetheless. It is crucial that we move beyond our past practices and traditions and instead look to current research as a basis for our conversations and next steps.

Ability Grouping and Acceleration

Ability grouping in elementary mathematics typically focuses on speed or moving students, who are perceived to be "ready" for faster math instruction/learning, at a more accelerated pace. It is also the precursor to tracking in later grades. Research shows this practice adversely affects students of color and those from low socio-economic groups. We must strive to create equitable structures in elementary schools that do NOT include ability grouping or tracking. We have to evaluate our societal belief that being good at math means being fast at math and how that impacts pathways for students in grades TK-12. If we instead focus on depth of understanding for all students rather than pushing students to acquire mathematical concepts more quickly, we can push them to more deeply understand the concepts at their grade level. This will allow them to flourish in future math classes and in society.

The practices of middle school acceleration and/or ability grouping in middle and elementary school are not in alignment with current research practices or the position of the National Council of Teachers of Mathematics (NCTM). Schools and districts should

work towards a common shared pathway for middle school mathematics that ensures high quality and equitable math instruction for all students. When we argue that some students are ready for acceleration and therefore it should be provided, we refuse to recognize the inequities built into our system. For example, we cannot guarantee that all students in middle school have been given the same mathematical experiences in elementary school. Additionally, when we make this argument we perpetuate the belief that being good at math means you learn traditional math quickly.

There are many resources available to assist sites and districts with these discussions. Some of these resources are listed below:

- A Case Against Acceleration - Robert Kaplinsky
- Mathematics Learning: A Journey, Not a Sprint - NCTM
- Ability Grouping - Youcubed.org

Tracking and Pathways

In many middle and high schools there is an unchallenged practice of teacher tracking. Teacher tracking involves assigning the most experienced teachers to the high-level classes. Teacher assignments that require all teachers to teach several levels of math will increase the use of equitable teaching practices because teachers will increase their content knowledge and their ability and willingness to collaborate. We must end the practice of tracking teachers and tracking/ability grouping of students. "Detracking is the intentional practice of placing students into heterogeneous classrooms usually in an effort to reduce the opportunity gap and allow all students to learn mathematics at high levels." (NCSM, 2019)

High schools should guarantee four years of mathematics for all students with a variety of options for students' third and fourth year. According to Catalyzing Change in High School Mathematics (NCTM 2018), high schools should provide a two to three-year common pathway for all students that covers the Essential Concepts (NCTM, 2018). The Essential Concepts are described in greater detail in the Catalyzing Change series published by NCTM.

Resources to aid discussion:

- Opportunity Gap Position Paper - National Council of Supervisors of Mathematics (NCSM)
- Work to End Tracking - NCTM
- Opening Our Ideas - Jo Boaler
- Pursuing Equity and Excellence in Mathematics: Course Sequencing and Placement - San Francisco USD

ACCOUNTABILITY:

Mathematics is a gateway for students to STEM fields, a better understanding of society, and increased opportunities for upward mobility and personal achievement. For these reasons we need to challenge the status quo and also recognize that continuing the educational structures that we currently have in place will only perpetuate the existing issues. Districts and sites need to begin to engage all stakeholders including teachers, unions, parents, and students in conversations about the topics mentioned in this section. It is a critical time in which the availability of technology and an ever increasing mathematical world require that our educational systems make drastic changes for the benefit of our students. Districts should begin by looking closely at their current systems with respect to these topics. Begin the challenging conversations about how to change those systems and make them more equitable for all involved. This will take several years of focused small steps and we must begin now.

FOCUS AREA 2

TEACHER AND STAFF PROFESSIONAL DEVELOPMENT

ACKNOWLEDGMENT:

The single best resource we have in education to ensure student success are teachers. Teachers that are trained in the implementation of high-yield strategies and have deep content knowledge in mathematics are essential to the success of our students. Most multiple subject credential programs only require one or two math courses and very few universities offer master's degree programs in K-8 mathematics. It is paramount to prioritize the ongoing learning in mathematics of our most precious resource: teachers. We must stop blaming teachers and start working with teachers to identify the training they want and need, then provide that training. We also need to recognize that initiative fatigue is real and make a concerted effort to focus for a continued period of time on our most necessary work: professional development in mathematics.

ACTION:

Ongoing Professional Learning

According to NCTM *Principles to Action*: "In excellent mathematics programs, educators hold themselves and their colleagues accountable for the mathematical success of every student and for the personal and collective professional growth toward effective teaching and learning of mathematics. As professionals, mathematics teachers recognize that their own learning is never finished and continually seek to improve and enhance their mathematical knowledge for teaching, their knowledge of mathematical pedagogy, and their knowledge of students as learners of mathematics." Math teachers, sites, and districts need to adopt these principles of professionalism as a first step towards a robust professional development program. Effective professional development programs support teacher growth in four critical areas: teachers' mathematical knowledge; teachers' capacity to notice, analyze, and respond to student thinking; teachers' beliefs and dispositions that foster their continued learning; and teachers' collegial relationships and learning structures (Helen M. Doerr, Lynn T. Goldsmith, and Catherine C. Lewis, 2010). The discussion in this video, Grading and Teacher Collaboration, describes a means of teacher professional development that aligns with NCTM's vision while being embedded into the Professional Learning Community structures that most districts already have in place. As an example of developing teachers' capacity to notice, analyze, and respond to student thinking, this video, Enhancing our Work with Collaboration, describes Routines for Reasoning and how these routines help students, teachers, and coaches to implement high quality instruction.

Math Success for ALL

Math Success for ALL is a professional development resource designed in collaboration with the Curriculum and Instruction Steering Committee under Change to California County Superintendents Educational Services Association (CCSESA) and the Placer County Office of Education. "The goal of this project was to create, test, and refine a series of versatile professional development modules which will increase the quality of K-6 math instruction to ensure equitable access and support for all students, specifically students with special needs, and to improve administrator's ability to support teachers and facilitate school structures that foster this equitable and high quality instruction... This project was coordinated by the Placer County Office of Education and it draws upon the Carnegie Foundation's work with Continuous Improvement, CAST's UDL framework, and the expertise of subject specific entities such as the California Math Project and Mathematics Assessment Project. (Math Success For All, 2020)" If utilized, these materials will provide districts focused professional development that will improve teachers' ability to provide equitable access to rich mathematical content.

Productive and Unproductive Beliefs

Principles to Action outlines productive and unproductive beliefs about mathematics on a variety of topics from curriculum to professionalism that could be utilized by districts to structure professional development. The productive beliefs about professionalism are vital to address while building

an in-depth professional development program for teachers. As an example, two of the seven productive beliefs are listed here:

1. All professionals, even experienced teachers, can benefit from content-focused instructional coaching.

2. Effective mathematics teaching results from purposeful planning. Highly effective teachers collaborate to design detailed mathematics lessons and then reflect on the effectiveness of those plans for student learning, in a cycle of continuous improvement.

Other tables for unproductive and productive beliefs can be found by following these links based on these topics:

- Beliefs About Professionalism in Mathematics Education
- Beliefs About Mathematics Assessment
- Beliefs About Tools and Technology and Learning Mathematics
- Beliefs About Mathematics Curriculum
- Beliefs About Access and Equity in Mathematics
- Beliefs About the Teaching and Learning of Mathematics

Content-Focused Instructional Coaching

Many of our districts and sites are fortunate to have Teachers on Special Assignment (TOSA) or instructional coaches working closely with teachers and students. Research has shown that job-embedded coaching is one of the most successful ways to deliver professional development for teachers. NCTM argues in the book Principles to Actions "all professionals, even experienced teachers, can benefit from content-focused instructional coaching." Instructional coaches have the opportunity to be in and out of classrooms supporting and building relationships with teachers and students. Coaches have the ability to see injustices and inequality in math classrooms, call out when they see deficit language being used, and support teachers in shifting pedagogy. Coaches are instrumental in the change process but we must realize this change takes time. A critical mass or tipping point will only be reached after 5-7 years of content-focused coaching. It is crucial that districts recognize the need for instructional coaches and properly utilize them. Too often coaches are utilized as pseudo-administrators and their role rarely has them directly supporting teachers' ongoing learning and pedagogy. It is crucial to build coaching programs for success and utilize current research regarding components of successful coaching programs. For more information on effective coaching programs, districts can utilize the following resources to critically evaluate their current or future Instructional Coaching program:

Resources:

The Art of Coaching: Effective Strategies for School Transformation by Elena Aguilar

Content-Focused Coaching: Transforming Math Lessons by Lucy West

Instructional Coaching: A Partnership Approach to Improving Instruction by Jim Knight

ACCOUNTABILITY:

In order to realize systemwide change and increases in teacher's perception of effectiveness and student achievement as measured by local and state assessments, districts need to develop comprehensive professional development plans that are focused on a few key areas. The plans need to provide time for implementation and reflection. We must recognize that well designed plans for professional development take time to implement and therefore we need to develop these plans in collaboration with all stakeholders and not abandon them in favor of the next new thing. Refinement rather than replacement is the key idea with regard to professional development plans.

The resources described above provide a few possibilities when focusing on mathematics professional development. They are not an exhaustive list but rather suggestions to build a robust professional development plan around. It is important to be conscious of the fact that elementary teachers usually teach many subjects and that having professional development plans in all subject areas is overwhelming. When overwhelmed we tend to focus on what is most likely to produce a feeling of success and that may not be mathematics for all teachers. It is this reality that makes content-focused coaching an essential part of any professional development plan. We highly suggest a focused professional development effort on mathematics for several years using the resources above.

While we mentioned the importance of teacher content knowledge we have not provided reference to specific programs or resources. Teacher content knowledge must be developed by grade level and grade span, and can be greatly impacted through a well-structured instructional coaching program. Providing teacher learning that is vertically articulated is essential and should also be a core component of any professional development plan. Understanding of the content is only truly achieved with understanding of where students have been and where they are going.

CURRICULUM AND INSTRUCTION

ACKNOWLEDGMENT:

Many initiatives to improve mathematics performance in districts initially involve looking for new "curriculum" or textbooks. While this often seems to make sense, it is also what we have always done without significant results. While there are great resources to help with this endeavor such as EdReports.org, this cannot be the sum of our ambition. While textbooks are possibly necessary to provide a baseline resource, they should not be the basis for teacher training in mathematics. Textbooks do not address the needs of our individual learners, help build student agency, nor provide a social justice lens to mathematics.

Another commonly used tool within school districts are pacing guides or curriculum maps. While well intentioned, "curriculum maps and pacing guides attempt to ensure coverage of content but do not guarantee that students learn mathematics." (NCTM, 2014) Teachers need to have a clear understanding of the progressions of mathematics across grade levels to effectively teach the current grade level. This could be a focus of professional development within a school site or district.

ACTION:

The 5 Dimensions of an Effective Mathematics Classroom

The 5 dimensions of an effective classroom are described in detail in the Teaching for Robust Understanding (TRU) Framework. The TRU Framework is a concise and actionable description of what characterizes powerful learning environments. It provides straightforward and accessible language for discussing what happens (and should happen) in classrooms. TRU is consistent with what we know of good practice and it focuses teacher/classroom and administrator attention on what matters most in instruction. These documents and ideas should drive teacher/PLC work, classroom observations, administrator discussions, and district professional development.

Additional resources to more deeply understand and implement TRU:

- TRU Framework Video Guide - RX Math YouTube
- TRU Framework
- TRU Observation Guide

Mathematics Teaching Practices

Principals to Action, NCTM 2014, describe 8 Mathematics Teaching Practices that provide a framework for strengthening the teaching and learning of mathematics. These practices reflect the knowledge of mathematics teaching that has accumulated over the last two decades (NCTM, 2014). These 8 teaching practices are the teacher moves that coincide with the habits of mind we want to instill in students with the Standards for Mathematical Practice.

The Effective Mathematics Teaching Practices include:

1. Establish mathematics goals to focus learning.
2. Implement tasks that promote reasoning and problem solving.
3. Use and connect mathematical representations.
4. Facilitate meaningful mathematical discourse.
5. Pose purposeful questions.
6. Build procedural fluency from conceptual understanding.
7. Support productive struggle in learning mathematics.
8. Elicit and use evidence of student thinking.

Strategies for Equitable Mathematics Instruction

Building a coherent mathematics program involves much more than simply adopting a textbook and providing teacher training on the adopted text. There are many different strategies that could be explored by districts and sites to improve mathematics performance. Open-source materials should be considered collaboratively within districts and sites as a way to supplement current learning progressions and build a coherent mathematics program. Dan Finkel offers excellent guidance for TK-8 math teachers regarding the ideal mathematics learning environment in an engaging TED Talk entitled 5 Principles of Extraordinary Math Teaching. These principles embody the ideas of Universal Design for Learning, Culturally Responsive Teaching, and Complex Instruction.

Universal Design for Learning (UDL) is an instructional framework that supports flexible ways for educators to teach lessons, as well as multiple ways for students to demonstrate what they know. The goal is to reach all learners, design lessons to the edges, and to include students with disabilities and English language learners.

Additional equitable instructional frameworks:

- Culturally Responsive Teaching
- Complex Instruction
- Equity-based Teaching practices

In the Catalyzing Change series of books published by NCTM from 2018-2020 they layout a crosswalk between the 8 Mathematics Teaching Practices and how these practices could be implemented in the most equitable way. The section of the crosswalk taken from Catalyzing Change in Middle School Mathematics NCTM 2020 is meant to generate discussion regarding how to implement the 8 practices to promote learning opportunities that are just, equitable, and inclusive. More examples of equitable teaching practices can be found in the book series mentioned above.

Mathematics Teaching Practices: Supporting Equitable Mathematics Teaching

MATHEMATICS TEACHING PRACTICES	EQUITABLE TEACHING
Establish mathematics goals to focus learning.	Establish classroom environments that promote learning mathematics as just, equitable, and inclusive.
Implement tasks that promote reasoning and problem solving.	Engage students in tasks that are culturally relevant. • This video describes an excellent example of where to start when implementing reasoning routines in a classroom, school, or district.
Use and connect mathematical representations.	Use multiple representations to draw on knowledge and experiences related to the resources that students bring to mathematics (culture, contexts, and experiences).
Facilitate meaningful mathematical discourse.	Use discourse as a means to disrupt structures and language that marginalize students.
Pose purposeful questions.	Be mindful of the fact that the questions that a teacher asks a student and how the teacher follows up on the student's response can support the student's development of a positive mathematical identity and sense of agency as a thinker and doer of mathematics.
Build procedural fluency from conceptual understanding.	Connect conceptual understanding to procedural fluency to help students make sense of the mathematics and develop a positive disposition toward mathematics.
Support productive struggle in learning mathematics.	Allow time for students to engage with mathematical ideas to support perseverance and identity development.
Elicit and use evidence of student thinking.	Promote a classroom culture in which mistakes and errors are viewed as important reasoning opportunities, to encourage a wider range of students to engage in mathematical discussions with their peers and the teacher.

Conceptual Understanding and Procedural Fluency

Procedural fluency builds on a foundation of conceptual understanding. We must acknowledge that if our focus is on students mastering procedures at the expense of conceptual understanding, then we are simply teaching them to do what computers can already do faster. Our goal must be greater than that, we must strive for more. Our students deserve to understand the reasons why procedures work. The California Mathematics Framework defines rigor as instruction that develops conceptual understanding, procedural skill and fluency, and application (California Math Framework, 2013). Often, because of our previous standards, a lack of time, and pacing guides, classroom teachers opt to focus on procedural skills primarily. These are also the most systematic to teach and the easiest to assess. Our goal must be to address all three components of rigor mentioned in the framework: conceptual understanding; procedural skill and fluency; and application. We must provide ongoing professional development, ensure textbook and supporting materials emphasizes an alignment to this goal, and give teachers time and authentic support to shift their practice.

ACCOUNTABILITY:

Districts that choose to focus on Curriculum and Instruction as an area of improvement can begin by learning about and adopting UDL, Culturally Responsive Teaching, Complex Instruction, or equity-based teaching practices. Although, many elements of each of these framework/philosophies overlap, do not fall victim to the erroneous idea that more than one should be implemented at a given time. Sites or districts can create teams of teachers that develop or modify rubrics for high quality equitable instruction. These teams should include teachers, parents, outside experts. The team can give objective feedback, based on the public rubrics, to teachers and site administrators outside of the formal evaluation process. This feedback would be the basis for continuous improvement and professional development over several years.

FOCUS AREA 4

FORMATIVE ASSESSMENT

ACKNOWLEDGMENT:

Since the passage of No Child Left Behind there has been an increasing focus on summative state and district assessments as a means to track student growth and system-wide success. These assessments are inherently biased in favor of the White majority population and thus racist by their very nature. In addition to the racial inequity that is promoted by the intense focus on these summative assessments, they have also eroded instructional time and shifted the focus and resources of many districts and classroom teachers to test preparedness rather than authentic assessment tools that provide formative information. This formative data should drive teaching and learning and students must have an integral role in this process. As mentioned previously, NCTM has created a crosswalk between equitable teaching practices from the Catalyzing Change series and the 8 Mathematics Teaching Practices from *Principles to Action*. This crosswalk can be used by teachers and sites as a guide to continuously improve instruction. As an example, the 8th teaching practice "Elicit and Use Evidence of Student Thinking" is the essence of how formative assessment helps create more equitable environments. This practice creates a more equitable learning environment by sending positive messages about student mathematical ideas and identities, making student thinking public, and creating a classroom culture in which mistakes and errors are valued.

ACTION:

Research shows that formative assessment, if implemented with integrity, can increase student achievement significantly. The effect size related to formative assessment is 0.4-0.7 (Black, William, 1998). Its implementation would result in significant gains in student achievement. This video describes the benefits to formative assessment and how appropriate feedback can help increase students engagement and achievement in mathematics.

The Riverside County Math Task Force (2017-2019) recommended that Riverside County Office of Education should work with districts to focus on embedded formative assessment and assist in the training of site/district leaders who influence the implementation by teachers. Embedded formative assessment can look different in each classroom. While it can include the use of rich tasks with teachers providing feedback and time for students to act on this feedback, it can also be a teacher questioning student understanding during a classroom discussion, information gleaned from a Number Talk or "How many ways?" routine, and/or teacher notes on group work discussions. The key component is that the feedback is provided to the student with time set aside for the student to respond to the feedback and improve. See the RCOE Math Task Force Whitepaper (2020) for more information.

There are several key questions that organizations must attend to in order to increase the focus on embedded formative assessment practices. These include but are not limited to:

1. How frequently are students given actionable feedback on their learning? (Giving grades is not actionable feedback on learning.)
2. How often are teachers using student work samples (for collaboration) to inform instruction?
3. How often are teachers collaborating around the data from formative assessments including student work samples?
4. What is your site or districts shared understanding of formative assessment?
5. What types of formative assessments do you use?
6. What role do students play in the formative assessment process?
7. Do classroom discussions include student thinking?
8. Does instruction respond to students thinking and help students think more deeply?
9. How often does instruction build in time for students to reflect on the feedback given?

Ongoing, reimagined, and focused teacher professional development must be provided by districts in order for teachers to have the time and opportunity to develop formative assessment practices. The TRU Framework describes Formative Assessment in clear actionable ways. According to TRU, formative assessment is the extent to which classroom activities elicit student thinking and respond to those ideas. Powerful instruction meets students where they are and gives them opportunities to deepen their understanding of mathematics. Districts, sites, and classrooms could focus primarily on formative assessment and use the TRU Framework as a guide for implementation.

ACCOUNTABILITY:

"Shifting the primary focus of assessment from accountability to effective instructional practices is a key component of ensuring mathematical success for all students." (NCTM, 2014) We must keep in mind that formative assessment requires that students engage with the feedback provided and that their response to feedback informs future instruction. In order to monitor the implementation of formative assessment practices, teacher teams and administrators can look at the types of feedback that teachers use in their classroom and when/how students respond to this feedback. The frequency with which teacher collaboration time is focused on looking at, learning from, and using student work samples to determine next steps instructionally. Formative feedback can only occur if teachers are listening to student thinking and looking at student work samples.

Three recommended actions that teachers, sites, and districts can take to increase the use of formative assessment:

1. Stop grading formative assessment - studies have shown (video) that feedback is overlooked by students when a grade is given. In most schools traditional letters grades are required but we are not required to grade all student work. While we might traditionally grade a quiz or summative assessment like a chapter test, feedback but not grades should be given on all assignments leading up to those graded summative assignments.

2. Reinstate policies and practices that protect the protect the teaching and learning time teachers and students have; eliminate assessments that are not formative and erode instructional time. "Teachers deserve protected time and quality support as they learn to observe closely and analyze deeply; students deserve a classroom context that allows teachers to do this. Over time, this professional development raises the quality of teaching and, in turn, the level of student learning. The more teachers can see and understand what students are doing, the better they can support those students in their learning." (NCTE, 2013)

3. Student work samples should be the core focus of collaboration time.

District and site leaders have numerous methods at their disposal to train, implement, and monitor the use of formative assessment. The key is to be consistent and recognize that deep implementation will take 3-5 years. It is key to remember that implementing a few tools or strategies will have a deeper sustainable effect than attempting to use them all.

Finally, the TRU Framework provides 5 dimensions of a math classroom that can be clearly articulated in actionable ways. Using this framework as the basis of your work to improve math teaching and learning would be an excellent first step.

FOCUS AREA 5

DISTRICT AND SITE LEADERSHIP

ACKNOWLEDGMENT:

Educational systems tend to have a strong focus on literacy in early grades and multiple goals across disciplines in upper grades (6-12). This often results in a lack of focus on mathematics as other important aspects of instruction, such as literacy and socio-emotional learning, take precedent. While these are crucial to a student's future success, we rarely recognize the importance of math in our society and and do not make comprehensive plans to improve students' disposition towards mathematics, students' depth of understanding, and teacher content and pedagogy. A significant shift is required to ensure that students develop a positive math identity, are positioned as competent learners, and are thus well prepared for their future.

ACTIONS:

Districts and sites can work to develop comprehensive multi-year plans for improving math instruction and equitable access to high-quality mathematics that reaches beyond adopting new textbooks, textbook training, and a focus on improving results on state-wide assessments. We need to focus on mathematics, and changing the inequitable and unjust practices found in mathematics education policies, and the critical conversations with all stakeholders needed to sustain change. This is the moment to take a systematic look at the inequitable and unjust policies within our school systems and take significant steps to rebuild these structures together on a foundation of social justice. Districts, such as San Francisco USD and others across the state and country have taken action towards changing systems that create unjust and unsafe learning environments. These steps have been taken by some districts within the state and country and there are models to follow. Dr. Rachel Lambert, UC Santa Barbara, discusses in this video how important inclusion and appropriate supports are for students with learning disabilities. If we are going to challenge the inequitable and unjust systemic problem that are currently creating inequitable access and achievement in mathematics, we must turn a critical eye towards exclusive but normalized polices around inclusion, IEP goals, English learners, black students, students in foster care and all other culturally and linguistically diverse students.

New plans need to be co-created with teachers, parents, students, and administrators from all racial and socio-economic groups within schools and districts.

School site and/or district plans may include any, but not all, of the actions described in these sections. Many of these actions will take an extended period of time to implement and realize change. The key to making the significant changes that are necessary for building a just and equitable system is to focus on a few key actions.

During this process of change leadership should be conscious of time provided to teachers for collaboration (time focused on content and pedagogy), initiative fatigue, and the emotional well-being of both teachers and students. Plans that include the elimination of timed tests for math fact fluency must also recognize the need to replace this practice with activities that achieve the same result of fluency built on conceptual understanding and train teachers deeply on how to implement these activities. Similarly, if plans include the detracking of teachers and students, leaders must realize that extensive conversations and training with teachers, teacher unions, and parents will be essential prior to implementing these changes. These are all topics that stakeholders are very passionate about and if we want changes to be meaningful they cannot be imposed upon a system. These conversations need to start today for the sake of each and every student.

ACCOUNTABILITY:

We often hear in education that we must "go slow to go fast" yet this is rarely the practice. Districts are plagued with initiative fatigue and new expensive programs that are marketed to them in an effort to increase student performance on state assessments and increase the number of students that are college and career ready. We need to begin to act on our words and truly go slow to go fast, minimize the number of initiatives, and invest in our most influencial learning resource: teachers. The most successful districts are those that recognize the multi-faceted needs of students and teachers, create comprehensive multi-year plans, and have the courage and capacity to work the plan.

Monitoring the implementation of any one of the actions described in this document will require concerted effort, focus, and the long-term vision of a better schooling system for each and every student. These actions are complex endeavors and for the benefit of all our students and society they require our attention now more than ever.

CALL TO ACTION

These are unprecedented times within our educational system and society. We work within a system that was designed over 100 years ago and remains virtually unchanged, we have standards that are benchmarked internationally, and a social responsibility to address the unjust, racist, and harmful practices within our system. More than ever mathematics is the gatekeeper for students that often hinders their ability to realize their full potential and become involved members of society. We call upon all educators to engage in this work, to help dismantle the structures that continue to oppress our Black, Indigenous, and People of Color (BIPOC) students, our students with disabilities, our students who receive foster care and homeless services, and all other marginalized student populations, and to help students see the beauty, joy, and wonder of mathematics. It is crucial that we move beyond our past practices and traditions and instead look to current research as a basis for our conversations and next steps.

OTHER RESOURCES

Essential Reading List

- Catalyzing Change in High School Mathematics, NCTM
- Catalyzing Change in Middle School Mathematics, NCTM
- Catalyzing Change in Early Learning and Elementary School Mathematics, NCTM
- Principles to Action, NCTM 2014
- Impact of Identity in K-8 Mathematics
- Beyond Good Teaching
- Teaching Mathematics for Social Justice Conversations with Educators

Other Articles and Books

- "Mathematics Education Through the Lens of Social Justice: Acknowledgment, Actions, and Accountability." - NCSM and TODOS: Mathematics for All
- Calculator Use in Elementary Grades, NCTM Position Statement 2015
- Fluency Without Fear, Youcubed.org
- Calculus in High School, NCTM Position Paper 2012
- Embedded Formative Assessment, Dylan Wiliam

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Mathematics Education Through the Lens of Social Justice: Acknowledgment, Actions, and Accountability, A Joint Position Statement from the National Council of Supervisors of Mathematics and TODOS: Mathematics for ALL.

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