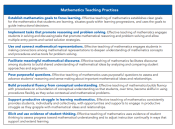
Utah State Board of Education | Teaching and Learning

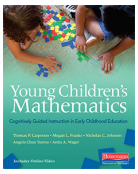
Early Mathematics Resources

Mathematical Components

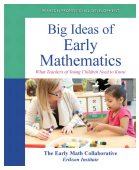
Conceptual Understanding: the comprehension and connection of concepts, operations, and relations.



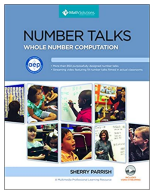
[NCTM's Effective Mathematics Teaching Practices]
Research indicates that these eight practices need to be consistent components of every mathematics lesson.



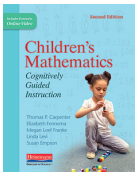
[Young Children's Mathematics]
Young Children's Mathematics explores the development of mathematical understanding in the youngest learners. Reinforced with classroom video clips, this book provides an in-depth, research-based look at how children's early learning develops and how teachers can authentically promote this kind of sense-making in mathematics.



[Big Ideas of Early Mathematics: What Teachers of Young Children Need to Know]
The Big Ideas that convey the core concepts of mathematics are at the heart of this new book that gives early childhood educators the skills they need to organize for mathematics teaching and learning during the early years. For teachers of children ages three through six, the book provides foundations for further mathematics learning and helps facilitate long-term mathematical understanding.



[Number Talks]
Number talks were developed for classroom teachers to engage students in "mental math" through grappling with interesting mathematics problems. Educators can use number talks regularly as introductions to the day's mathematical practice, as "warm ups" for other lessons, or as stand-alone extended engagements with mathematical concepts
insidemathematics.org/classroom-videos/number-talks
[Number Talks (extract from online course)]



[Children's Mathematics, Second Edition: Cognitively Guided Instruction]
This must-have resource for shifting your instruction to emphasize mathematical thinking and sense making explores an instructional approach unparalleled in its ability to help teachers develop children's mathematical understanding. Online videos complement this examination of the development of mathematical thinking and problem solving

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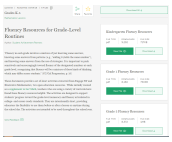
Procedural Fluency: the meaningful, flexible, accurate, and efficient use of procedures to solve problems.

Procedural fluency follows and builds on a foundation of conceptual understanding, strategic reasoning, and problem solving (NCTM, 2014). The use of regular timed testing will NOT be approved. "Mathematics facts are important but the memorization of math facts through times table repetition, practice and timed testing is unnecessary and damaging" (Boaler, 2015).

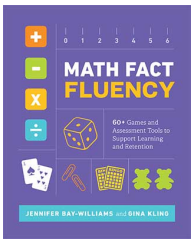
[Fluency Without Fear]

Fluency Without Fear: Research Evidence on the Best Ways to Learn Math Facts
By Jo Boaler, Professor of Mathematics Education, co-founder youcubed
With the help of Cathy Williams, co-founder youcubed & Amanda Confer, Stanford University



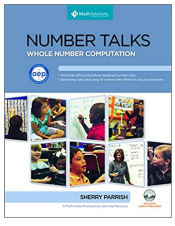
[Fluency Resources for Grade-Level Routines]

These documents provide a set of short activities extracted from open education resources. Teachers who are using a variety of curricula have found these fluency resources helpful. The activities are designed to support students' progress toward the grade-level numeracy and fluency articulated in college- and career-ready standards. They are intentionally short, providing educators the flexibility to use them before or after a lesson or anytime during the school day. The activities are intended to be used throughout the school year.



[Math Fact Fluency: 60+ Games and Assessment Tools to Support Learning and Retention]

In Math Fact Fluency, experts Jennifer Bay-Williams and Gina Kling provide the answers to questions about math fact fluency. This book offers everything a teacher needs to teach, assess, and communicate with parents about basic math fact instruction.



[Number Talks]

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insidemathematics.org/classroom-videos/number-talks
[Number Talks (extract from online course)]

[Build Math Minds]

These resources can be used for free for personal classroom use.

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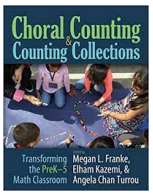
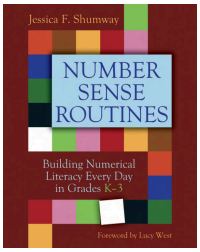


[Choral Counting & Counting Collections: Transforming the PreK-5 Math Classroom]
This influential book inspires preschool and elementary teachers to experience the joys and rewards of regularly using two activities—Choral Counting and Counting Collections—in their classrooms and in their partnerships with families. It paints a vision for how deeply and creatively children can engage with ideas of number and operations and mathematical sense-making through counting.



[Number Sense Routines, Grades K-3]
Just as athletes stretch their muscles before every game and musicians play scales to keep their technique in tune, mathematical thinkers and problem solvers can benefit from daily warm-up exercises. Jessica Shumway has developed a series of routines designed to help young students internalize and deepen their facility with numbers. The daily use of these quick five-, ten-, or fifteen-minute experiences at the beginning of math class will help build students' number sense.

Additional Articles:
[A Research-Based Approach to Math Fact Fluency]
[Depth Not Speed]
[Fluency-Simply-Fast-and-Accurate-I-Think-Not!]
[Procedural Fluency in Mathematics]

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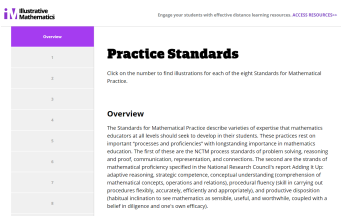
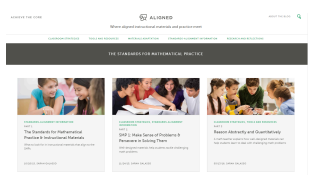
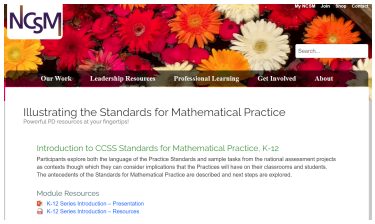
Strategic and Adaptive Mathematical Thinking: the ability to formulate, represent, and solve mathematical problems with the capacity to justify the logic used to arrive at the solution.



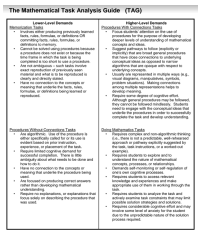
[Practice Standards (Illustrative Mathematics)]
The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. Click on the number to find illustrations for each of the eight Standards for Mathematical Practice.



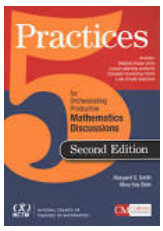
[THE STANDARDS FOR MATHEMATICAL PRACTICE (Achieve the Core)]
View resources for each of the Standards for Mathematical Practice.



[Illustrating the Standards for Mathematical Practice (NCSM)]
Explore both the language of the Practice Standards and sample tasks from the national assessment projects as contexts though which they can consider implications that the Practices will have on their classrooms and students. The antecedents of the Standards for Mathematical Practice are described and next steps are explored.



[The Mathematical Task Analysis Guide]
This resource describes lower-level and higher-level demands including memorization tasks, procedures without connections tasks, procedures with connections tasks, and doing mathematics tasks.



[5 Practices for Orchestrating Productive Mathematics Discussions]
Five practices provides a model for facilitating discussions in mathematics classrooms based on the thinking of students. The model—anticipating, monitoring, selecting, sequencing and connecting—focuses on planning prior to the lesson and, in so doing, limits the amount of improvisation required during the lesson.

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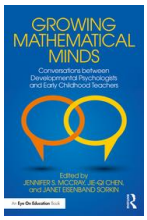
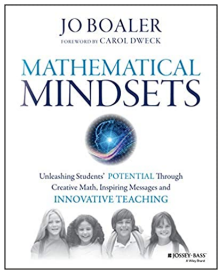
Productive Disposition: the ability to see mathematics as useful and worthwhile while exercising a steady effort to learn mathematics



[Growing Mathematical Minds: Conversations Between Developmental Psychologists and Early Childhood Teachers]

Growing Mathematical Minds is the documentation of an innovative, bi-directional process of connecting research and practice in early childhood mathematics. The book translates research on early mathematics from developmental psychology into terms that are meaningful to teachers and readily applicable in early childhood classrooms.



[Mathematical Mindsets]

Mathematical Mindsets provides practical strategies and activities to help teachers and parents show all children, even those who are convinced that they are bad at math, that they can enjoy and succeed in math. Jo Boaler—Stanford researcher, professor of math education, and expert on math learning—has studied why students don't like math and often fail in math classes. She's followed thousands of students through middle and high schools to study how they learn and to find the most effective ways to unleash the math potential in all students.

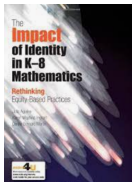
[Growth Mindset]

The term "growth mindset" comes from the groundbreaking work of Carol Dweck. She identified everyone holds ideas about their own potential. Some people believe that their intelligence is more or less fixed and in math – that you can do math or you can't. About 40% of students have these damaging "fixed mindset" ideas. Another 40% have a "growth mindset" – they believe that they can learn anything and that their intelligence can grow. The other 20% waver between the two mindsets.

Erikson Institute
Early Math Collaborative

[Erikson Institute Early Math Collaborative Research Publications]

The Early Math Collaborative publishes scholarly articles on education issues related to early mathematics.



[The Impact of Identity in K-8 Mathematics]

This book invites K–8 teachers to reflect on their own and their students' multiple identities. Rich possibilities for learning result when teachers draw on these identities to offer high-quality, equity-based teaching to all students. Reflecting on identity and re-envisioning learning and teaching through this lens especially benefits students who have been marginalized by race, class, ethnicity, or gender. The authors encourage teachers to reframe instruction by using five equity-based mathematics teaching practices: Going deep with mathematics, Going deep with mathematics, Leveraging multiple mathematical competencies, Affirming mathematics learners' identities, Challenging spaces of marginality, and Drawing on multiple resources of knowledge.

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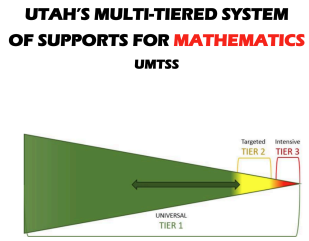
Assessment and Intervention Resources



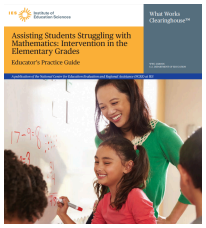
[Utah Multi-Tiered System of Supports (UMTSS) for Mathematics Framework]

The Utah Multi-Tiered System of Support (UMTSS) is designed to address student learning in mathematics encompassing these critical components: High-quality Instruction, Team-based Problem Solving, and Data-based Decision Making. The body of this document provides explanations of these critical components along with suggestions for implementation.

[APPENDIX A: RESEARCH] [APPENDIX B: RESOURCES]

[Mathematics Intervention Resources]

This document lists resources for web-based, book, and general resources for mathematics intervention.



[Assisting Students Struggling with Mathematics: Intervention in the Elementary Grades]

This practice guide provides evidence-based practices that can help teachers tailor their instructional approaches and/or their mathematics intervention programs to meet the needs of their students.

[Analyzing student work for actionable trends in math]: When it comes to student work, we need to move beyond "right" and "wrong" to looking at where students fall along a progression of learning—what do they already understand and what is holding them back from reaching the next level? When we approach student work in this way, we come away with actionable trends that truly inform, rather than evaluate, teaching and learning.

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General Resources

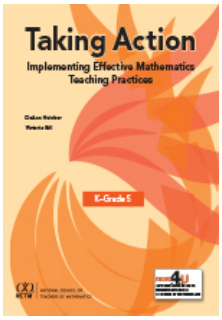
[Principles to Actions]

NCTM's landmark publication *Principles to Actions* connects research with practice. Specific, research-based teaching practices that are essential for a high-quality mathematics education for each and every student are combined with core principles to build a successful mathematics program at all levels.
Principles to Actions offers guidance to teachers, mathematics coaches, administrators, parents, and policymakers.

Join the USBE Principles to Actions book study (asynchronous, complete at your own pace and collaborative) here.

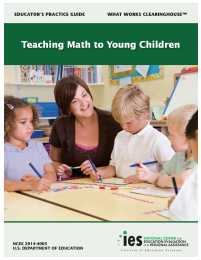
[Catalyzing Change in Early Childhood and Elementary Mathematics: Initiating Critical Conversations]

- Broadening the purpose of school mathematics to prioritize development of deep conceptual understanding so that children experience joy and confidence in themselves as emerging mathematicians
- Dismantling structural obstacles that stand in the way of mathematics working for each and every student
- Implementing equitable instructional practices to cultivate students' positive mathematical identities and a strong sense of agency
- Organizing mathematics along a common shared pathway grounded in the use of mathematical practices and processes to coherently develop a strong foundation of deep mathematical understanding for each and every child



[Taking Action: Implementing Effective Mathematics Teaching Practices in K–Grade 5]

This book offers a coherent set of professional learning experiences designed to foster teachers' understanding of the effective mathematics teaching practices and their ability to apply those practices in their own classrooms. The book examines in depth what each teaching practice would look like in an elementary school classroom, with narrative cases, classroom videos, and real student work, presenting a rich array of experiences that bring the practices to life.



[WWC: Teaching Math to Young Children]

This practice guide provides five recommendations for teaching math to children in preschool, prekindergarten, and kindergarten. Each recommendation includes implementation steps and solutions for common roadblocks. The recommendations also summarize and rate supporting evidence. This guide is geared toward teachers, administrators, and other educators who want to build a strong foundation for later math learning.

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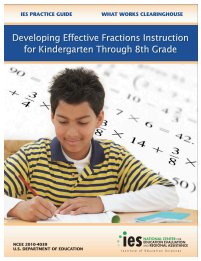
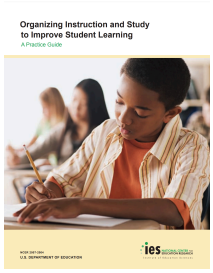
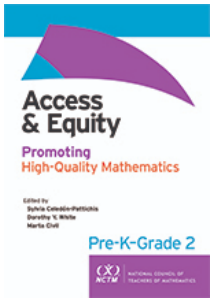


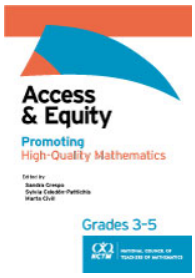
[WWC: Developing Effective Fractions Instruction for Kindergarten Through 8th Grade]:
This practice guide presents five recommendations intended to help educators improve students' understanding of fractions. Recommendations include strategies to develop young children's understanding of early fraction concepts and ideas for helping older children understand the meaning of fractions and the computations involved. The guide also highlights ways to build on students' existing strategies to solve problems involving ratios, rates, and proportions.



[WWC: Organizing Instruction and Study to Improve Student Learning]:
This guide includes a set of concrete actions relating to the use of instructional and study time that are applicable to subjects that demand a great deal of content learning, including social studies, science, and mathematics. The guide was developed with some of the most important principles to emerge from research on learning and memory in mind.



[Access and Equity: Promoting High-Quality Mathematics in Pre-K–Grade 2]
This book examines issues related to access, equity, and empowerment for early childhood mathematics. This book will help teachers in prekindergarten through grade 2 classrooms implement the Access and Equity Principle from NCTM's Principles to Actions: Ensuring Mathematical Success for All. It looks at diversity as an asset for teaching and learning mathematics with emphasis on multilingual settings and the need for deeper mathematics among younger children.



[Access and Equity: Promoting High-Quality Mathematics in Grades 3–5]
This book examines the challenges related to access, equity, and empowerment faced by students making the critical transition into mathematics of the third through fifth grades. It provides guidance for making essential improvements in practice. The third through fifth grades are a crucial period when educational imbalances begin to take hold, as inequities in resources and expectations become more pronounced and significant. This book will help teachers provide a challenging, effective mathematics education for each and every student in those classrooms, and thus fully implement the Access and Equity Principle in NCTM's Principles to Actions: Ensuring Mathematical Success for All.

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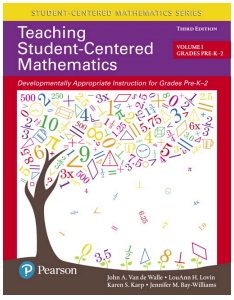
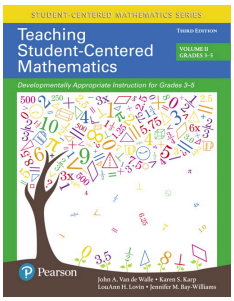


[Teaching Student-Centered Mathematics: Developmentally Appropriate Instruction for Grades Pre-K-2]

A practical, comprehensive, developmentally appropriate approach to effective mathematical instruction in grades Pre-K-2. Helping students make connections between mathematics and their worlds—and helping them feel empowered to use math in their lives—is the focus of this widely popular guide. Designed for classroom teachers, the book focuses on specific grade bands and includes information on creating an effective classroom environment, aligning teaching to various standards and practices, such as the Common Core State Standards and NCTM's teaching practices, and engaging families.



[Teaching Student-Centered Mathematics: Developmentally Appropriate Instruction for Grades 3-5]

A practical, comprehensive, developmentally appropriate approach to effective mathematical instruction in grades 3 to 5. Helping students make connections between mathematics and their worlds—and helping them feel empowered to use math in their lives—is the focus of this widely popular guide. Designed for classroom teachers, the book focuses on specific grade bands and includes information on creating an effective classroom environment, aligning teaching to various standards and practices, such as the Common Core State Standards and NCTM's teaching practices, and engaging families.

DREME Development and Research in Early Math Education

[DREME: Development and Research in Early Math Education]

The DREME Network was created in 2014 to advance the field of early mathematics research and improve young children's opportunities to develop math skills. The Network focuses on math from birth through age eight years, with an emphasis on the preschool years. Network members and affiliates collaborate to conduct basic and applied research and develop innovative tools that address high-priority early math topics and inform and motivate other researchers, educators, policymakers and the public.

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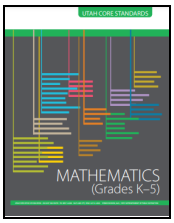
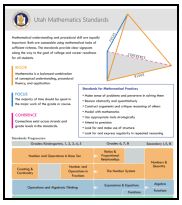
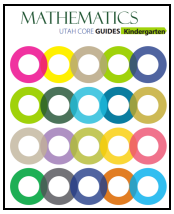
Utah Core State Standards for Mathematics Resources



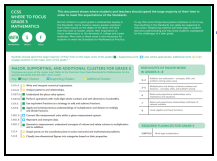
[Utah Core Standards for Mathematics]
The Utah State Board of Education adopted the K-12 Utah Core Standards for Mathematics in January 2016.



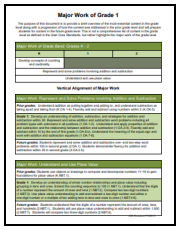
[Utah Mathematics Standards Infographic]
This one page document gives a broad overview of the principles behind the Utah Core Standards for Mathematics.



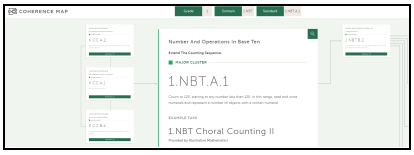
[Utah Mathematics Core Guides]
Core guides provide a description of the Core Standards, including concepts and skills to master, critical background knowledge and academic vocabulary.



[Achieve the Core - Mathematics: Focus by Grade Level]
This document shows where students and teachers should spend the large majority of their time in order to meet the expectations of the Standards.



[Utah Major Work of the Grade]
The purpose of this document is to provide a brief overview of the most essential content in the grade level along with a progression of how the content was addressed in the prior grade level and will prepare students for content in the future grade level. This is not a comprehensive list of content in the grade level as defined in the Utah Core Standards, but rather highlights the major work of the grade level.



[Achieve the Core - Coherence Map]
Mathematics standards are not isolated concepts. Standards relate to one another, both within and across grades. The

LEAs have the duty to select instructional materials that best correlate to the core standards for Utah public schools and graduation requirements. (UCA 53G-4-402(1(a)). Posting of these resources by USBE staff curriculum content specialists does not imply the resources have received official endorsement of the State Board. Educators are responsible to ensure use of these materials complies with LEA policies and directives.

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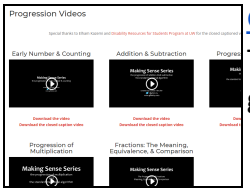
Coherence Map illustrates the coherent structure that is fundamental to college- and career-ready standards.

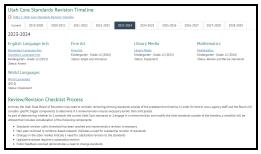


[Graham Fletcher Progression Videos]

The math progressions videos describe the progressions of standards across grades.

[Progressions Documents for the Common Core Math Standards]

Narrative documents describing the progression of a topic across a number of grade levels, informed both by research on children's cognitive development and by the logical structure of mathematics.



[Utah Core Standards Timeline]

In an effort for Utah to ensure high quality core content standards, the Utah State Board of Education has approved an internal process for review and revision. First and foremost, the Utah State Board of Education established a timeline for revision of core content standards for Social Studies, English Language Arts, World Languages, Library Media, Fine Arts, Mathematics, Physical Education, Driver Education, Health, Science, and Preschool. The revision timeline provides local education agencies with an expected timeline for when each of the core content standards will be up for review and potentially revision.

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