Draft 1 (10/15/2025)

Vision and Purpose

What is Numeracy?

Numeracy is more than arithmetic or the memorization of procedures. As defined in this guidance, numeracy is the ability for all students to confidently understand, interpret, and apply mathematical concepts across all domains of mathematics in a variety of real-world and academic contexts.

Numeracy begins with strong foundational skills in both conceptual understanding and procedural fluency, applied with accuracy, flexibility, and reasonableness, and supported by mathematical practices that promote effective reasoning, problem solving and communication using mathematical language. It encompasses all domains of mathematics, including numbers, algebra, geometry, measurement, statistics, probability, and spatial reasoning. Numeracy supports the development of a positive mathematical identity, where students see themselves as capable, persistent, and confident problem solvers. It also involves cultivating mathematical habits of mind, such as using a mathematical lens to interpret the world, analyzing and critiquing quantitative information, and connecting reasoning to civic, career, personal, and interdisciplinary contexts. It develops into the capacity to reason, solve problems, and make informed decisions. It applies across the full K–12 continuum and supports the development of mathematically literate citizens prepared for the demands of the 21st century. All students have the capacity to develop numeracy when they are provided equitable access to high-quality instruction, culturally-relevant learning experiences, and opportunities to engage meaningfully in mathematics.

Why is This Guidance Important?

This guidance provides a roadmap for districts and schools to achieve educational equity. ISBE's Strategic Plan clearly states that, "Illinois has an urgent and collective responsibility to achieve educational equity" and to "provide each and every child with … equitable opportunities by practicing data-informed stewardship of resource and policy development." To realize these statewide goals, it is critically important that every district has equitable access to high-quality resources to ensure that all students are on their path to confidently use numeracy skills in everyday life. The numeracy plan outlines evidence-based practices for improving numeracy so districts will have the resources to plan strategically.

Based on nationally normed assessments like National Assessment of Educational Progress (NAEP), student achievement in mathematics is lagging in Illinois as in many states. The NAEP trend data for Illinois students shows that significant equity gaps in math proficiency have persisted for decades. Locally, districts have disparate access to resources as shown by the Percent of Adequacy detailed in the Evidence-Based Funding Formula (EBF) that outlines how far a district is from adequate funding. These disparities result in districts having to make tough decisions about how resources are allocated, whether it be professional learning opportunities, availability of high-quality instructional materials, high-impact tutoring, or instructional coaching. Yet through collaboration, creativity, and a steadfast commitment to student success, meaningful paths forward can be forged.

This guidance, rooted in evidence-based practices and data-driven decision making, allows district and school leaders to make informed choices about local policy and practice. This starting point will allow education leaders across the state to shift the focus from identifying best practices in isolation to identifying best practices in the context of the individual needs of their districts and schools for the most efficacious instructional planning and implementation.

ISBE's Commitment to Equitable Numeracy Instruction

The Illinois Comprehensive Numeracy Plan is founded on the principle that every student, in every classroom, deserves instruction that empowers them to be confident and capable mathematical thinkers. True numeracy extends beyond procedural fluency to encompass reasoning, problem-solving, and the ability to communicate and apply mathematical ideas. The Illinois State Board of Education is committed to ensuring equitable access to high-quality numeracy instruction for all students, including culturally, linguistically, and academically diverse student populations. This commitment requires intentionally designing instruction that recognizes and responds to the unique strengths and needs of each learner.

State of the State of Mathematics in Illinois

Across Illinois, educators, schools, and school districts are working hard to support student success in numeracy, yet the Illinois Report Card reveals persistent inequities. Students begin school with vastly different levels of numeracy preparedness, and these early differences, shaped by access to high-quality early childhood and preschool experiences, family support, and community resources , often widen as students move through K-12 public schools.

The 2024 Illinois Assessment of Readiness results show that 28% of students in Grades 3–8 met or exceeded grade-level standards in mathematics, with post-pandemic recovery progressing more slowly in mathematics than in literacy (Illinois State Board of Education, 2025). High school performance has remained stagnant, and persistent disparities continue across racial, ethnic, and income groups. Results from NAEP, Illinois SAT, and local benchmark assessments confirm these concerns. Achievement gaps by race, income, English proficiency, and disability status remain significant and longstanding, reflecting systemic inequities in access to high-quality instruction, rigorous coursework, and culturally relevant learning opportunities.

Progression of Numeracy

Early numeracy is as vital as literacy for predicting long-term academic success, and investing in high-quality early math instruction can help close opportunity gaps for all learners, including those from underserved communities.[1]

Algebra readiness in the middle grades is essential for access to advanced coursework and career opportunities, yet many Illinois students lack adequate preparation, highlighting the need for coherent, high-quality instruction aligned with postsecondary expectations.[2]

High school math mastery is critical for postsecondary readiness. Still many students struggle with foundational skills and numeracy, limiting their access to college-level coursework and career pathways due to a lack of targeted support and aligned instruction.

Building Conditions for Success

Math anxiety and negative perceptions of mathematics further compound the challenge for learners to succeed. When students and families view mathematics as an exclusive subject reserved for a few, rather than a right for all, it diminishes confidence and access. These perceptions disproportionately affect students in historically marginalized groups, reinforcing cycles of inequity. As the *Why Math, Why Now* report highlights, mathematics serves as a gatekeeper to postsecondary success, career opportunities, and economic mobility, making systemic improvement essential.[3]

Improving mathematics outcomes requires creating the right conditions for learning. While strong practices exist, access to evidence-based instruction and aligned professional learning remains uneven across districts.

Students thrive when educators have access to high-quality instructional materials, sustained professional learning, and collaborative supports. Research emphasizes that these systemic conditions play a vital role in advancing student success in mathematics.[4] The Illinois Comprehensive Numeracy Plan (ICNP) calls for statewide capacity-building, the expansion of evidence-based strategies, such as high-dosage tutoring, and assessment practices that value both conceptual understanding and procedural fluency. Additionally, this guidance provides an opportunity to chart a new course for numeracy in Illinois: one rooted in evidence, equity, and the belief that all students can develop the skills, habits of mind, and confidence needed to thrive mathematically. By focusing on proficiency, growth, and equity, Illinois can transform mathematics from a barrier into a pathway of opportunity for every learner.

Shared Commitments to Numeracy

Community Responsibility

We believe in the shared responsibility of schools, families, and communities to help every student grow in mathematics. Therefore, we value working together with clear goals, a common language, and consistent practices. When families, educators, and community leaders send the same message that math is important for everyday life, future jobs, and active citizenship, students have the opportunity to see mathematics as both useful and achievable. We also believe mathematics is not culture neutral.[5] Mathematics is an important component of cultures throughout the world, and ways of knowing and doing mathematics are culturally situated.[6] Communities that honor the many ways math connects to language, history, and traditions can help students feel that mathematics belongs to them and is a meaningful part of their world.[7]

Parent and Caregiver Responsibility

We believe parents and caregivers play a powerful role in helping children see themselves as capable mathematicians. Therefore, we value early family engagement with mathematics. Just as reading stories together builds early literacy, exploring math together by counting, comparing, or playing number games builds curiosity, persistence, and confidence.[8] These small, everyday activities at home form the foundation for later success in school. Research shows that differences in early mathematics experiences are closely tied to differences in socioeconomic circumstances and how much families engage in math talk with their children.[9] We also know that families have different resources, schedules, and levels of comfort with math. That is why schools and communities must share ideas, provide resources, and make math activities accessible so that every family has the tools to support their child's early numeracy.

School Leader Responsibility

We believe school leaders must create learning environments where every student can thrive. Therefore, we value structures that promote shared responsibility and synergy for teaching multilingual students and students with special needs and that facilitate continued professional learning around inclusive teaching.[10] Schools are also responsible for addressing the differences in readiness that children bring when they first arrive. By supporting families, offering strong early learning opportunities, and coordinating teachers' work, schools can provide the targeted interventions students need to grow and succeed. Moreover, we believe all students should be held to high expectations for achievement.[11] Therefore, we value leaders who recognize the importance of high expectations for student achievement and leaders who support teachers in incorporating evidence-based practices high expectations.[12]

Educator Responsibility

We believe effective teaching is at the heart of strong mathematics learning. Therefore, we value instruction that blends understanding concepts (why), practicing skills (how), and applying knowledge to solve real-world problems (when and where). Teachers who provide timely feedback, offer multiple ways to approach a problem, and use students' own strengths and experiences can create classrooms where every learner can succeed.13 We believe teachers must create learning environments where every student can thrive and is perceived as capable of achieving at high levels. Therefore, we value equity, inclusion, and culturally relevant instruction. Equitable instruction supports holding all students to high expectations.[14] Many evidence-based intervention strategies, including some tailored for students with special needs, have been collected in the What Works Clearinghouse. However, communication between classroom mathematics teachers and special education teachers of mathematics should also be strengthened.[15] When instruction affirms students' cultural identities, experiences, and languages, mathematics becomes meaningful and connected to students' lives.[16]

Student Responsibility

We believe students are key partners in learning. Therefore, opportunities for students to see themselves as confident problem solvers who can use mathematics to understand the world and make decisions about their future are the centerpiece from which instructional decisions ought to derive. Students who take ownership of their learning by asking questions, trying again after mistakes, and thinking carefully about information develop resilience and independence.[17] With encouragement from families, teachers, and communities, students grow into lifelong learners who see mathematics as a resource they can rely on.

End Notes

1. EdSurge. "Early Numeracy as a Cornerstone of Long-Term Academic Success." *EdSurge,* March 3, 2025.
   NORC at the University of Chicago. "Research and Practice in the Field of Early Mathematics Learning." November 2013. *Getting on Track Early for School Success*.
2. RAND Corporation. *Algebra and Coherence: Research Report*. Santa Monica, CA: RAND Corporation, 2022.
   Learning Policy Institute. *Conditions for Teaching and Learning: Mathematics Pathways*. Palo Alto, CA: Learning Policy Institute, 2023.
3. Bill & Melinda Gates Foundation. *Why Math, Why Now*. Seattle, WA: Gates Foundation, 2022.

4. Learning Policy Institute. *Conditions for Teaching and Learning: Mathematics Pathways*. Palo Alto, CA: Learning Policy Institute, 2023.
5. National Council of Teachers of Mathematics (NCTM). *The Intersection of Culture and Mathematics: A Position Statement of the National Council of Teachers of Mathematics*. Reston, VA: NCTM, May 2024.
6. Ascher, Marcia. *Mathematics Elsewhere: An Exploration of Ideas Across Cultures*. Princeton, NJ: Princeton University Press, 2002.
   D'Ambrosio, Ubiratan. "Ethnomathematics and Its Place in the History and Pedagogy of Mathematics." *For the Learning of Mathematics* 5, no. 1 (1985): 44–48.
   Lunney Borden, Lisa, and David Wiseman. "Considerations from Places Where Indigenous and Western Ways of Knowing, Being, and Doing Circulate Together: STEM as Artifact of Teaching and Learning." *Canadian Journal of Science, Mathematics and Technology Education* 16 (2016): 140–52.
   Robinson, Lisa, Katie West, Michelle Daoust, Sheri Sylliboy, Andrew Lafferty, David Wiseman, Lisa Lunney Borden, Emily Ghostkeeper, Florence Glanfield, Margaret Ribbonleg, and Karen Bernard. "When Mathematics Has Spirit: Aki Chike Win." *ZDM–Mathematics Education* (2023): 1–13.
7. Ladson-Billings, Gloria. "Toward a Theory of Culturally Relevant Pedagogy." *American Educational Research Journal* 32, no. 3 (1995): 465–91.
8. Blevins-Knabe, Belinda, and Linda Musun-Miller. "Number Use at Home by Children and Their Parents and Its Relationship to Early Mathematical Performance." *Early Development and Parenting* 5, no. 1 (1996): 35–45.
   Berkowitz, Talia, Matthew W. Schaeffer, Erin A. Maloney, Lindsey Peterson, Christina Gregor, Susan C. Levine, and Sian L. Beilock. "Math at Home Adds Up to Achievement in School." *Science* 350, no. 6257 (2015): 196–98.
   Elliott, L., and H. J. Bachman. "How Do Parents Foster Young Children's Math Skills? Child-Level and Parent-Level Predictors." *Early Child Development and Care* 188, no. 11 (2018): 1685–1702.
9. NORC at the University of Chicago. "Research and Practice in the Field of Early Mathematics Learning." November 2013. *Getting on Track Early for School Success*.
   Duncan, Greg J., Chantelle J. Dowsett, Amy Claessens, Katherine Magnuson, Aletha C. Huston, Pamela Klebanov, Linda S. Pagani, Leon Feinstein, Mimi Engel, Jeanne Brooks-Gunn, Holly Sexton, Katherine Duckworth, and Marie Japel. "School Readiness and Later Achievement." *Developmental Psychology* 43, no. 6 (2007): 1428–46.
10. Brooks, Kimberly, Sharlene R. Adams, and Trish Morita-Mullaney. "Creating Inclusive Learning Communities for ELL Students: Transforming School Principals' Perspectives." *Theory Into Practice* 49, no. 2 (2010): 145–51.

National Council of Supervisors of Mathematics (NCSM) & TODOS: Mathematics for All. *Positioning Multilingual Learners for Success in Mathematics*. 2021.
Theoharis, George, and Joanna O'Toole. "Leading Inclusive ELL: Social Justice Leadership for English Language Learners." *Educational Administration Quarterly* 47, no. 4 (2011): 646–88.
Cohen, Jacob, Nicole Jones, and Laurie Gibbons. "The Missing Middle? General and Special Educators' Views of Effective Mathematics Instruction." *AERA Open* 11, no. 1 (2025): 1–14.
Abdulrahim, Najwa A., and Michael J. Orosco. "Culturally Responsive Mathematics Teaching: A Research Synthesis." *The Urban Review* 52, no. 1 (2020): 1–25.

11. National Council of Supervisors of Mathematics (NCSM) & TODOS: Mathematics for All. *Positioning Multilingual Learners for Success in Mathematics*. 2021.
12. Gentrup, Svenja, Gunnar Lorenz, Cornelia Kristen, and Irena Kogan. "Self-Fulfilling Prophecies in the Classroom: Teacher Expectations, Teacher Feedback and Student Achievement." *Learning and Instruction* 66 (2020): 101296.
Madon, Stephanie, Lee Jussim, and Jacquelynne S. Eccles. "In Search of the Powerful Self-Fulfilling Prophecy." *Journal of Personality and Social Psychology* 72 (1997): 791–809.
Rubie-Davies, Christine M., Elizabeth R. Peterson, Chris G. Sibley, and Robert Rosenthal. "A Teacher Expectation Intervention: Modelling the Practices of High Expectation Teachers." *Contemporary Educational Psychology* 40 (2015): 72–85.
13. Fitz, James, with Helen Price. "Positive Conditions for Mathematics Learning: An Overview of the Research." *Learning Policy Institute,* 2025.
14. Jamar, Irvin, and Valerie R. Pitts. "High Expectations: A 'How' of Achieving Equitable Mathematics Classrooms." *Negro Educational Review* 56 (2005).
15. Fuchs, Lynn S., Rebecca Newman-Gonchar, Rachel Schumacher, Bethany Dougherty, Nicole Bucka, Karen S. Karp, John Woodward, Bryant Clarke, Nancy C. Jordan, Russell Gersten, Madhavi Jayanthi, Brandi Keating, and Sarah Morgan. *Assisting Students Struggling with Mathematics: Intervention in the Elementary Grades*. WWC 2021006. Washington, DC: National Center for Education Evaluation and Regional Assistance (NCEE), Institute of Education Sciences, U.S. Department of Education, 2021. https://files.eric.ed.gov/fulltext/ED611018.pdf
Cohen, Jacob, Nicole Jones, and Laurie Gibbons. "The Missing Middle? General and Special Educators' Views of Effective Mathematics Instruction." *AERA Open* 11, no. 1 (2025): 1–14.
16. López Leiva, Carlos A., Zareth Torres, and Liliana C. Khisty. "Acknowledging Spanish and English Resources during Mathematical Reasoning." *Cultural Studies of Science Education* 8, no. 4 (2013): 919–34.

Lunney Borden, Lisa. “What’s the Word For…? Is There a Word For…? How Understanding Mi’kmaw Language Can Help Support Mi’kmaw Learners in Mathematics.” *Mathematics Education Research Journal* 25 (2013): 5–22.
Seda, Pamela, and Kyndall Brown. *Choosing to See: A Framework for Equity in the Math Classroom*. San Diego, CA: Dave Burgess Consulting, 2021.

17. Lee, Clare, and Sue Johnston-Wilder. “The Construct of Mathematical Resilience.” In *Understanding Emotions in Mathematical Thinking and Learning,* edited by Ulises Xolocotzin, 269–91. Cambridge, MA: Academic Press, 2017.

Framework for the Evidence-Based Development of Numeracy Skills

Traditional and Reform Approaches in Mathematics

Traditional approaches to mathematical instruction focus on procedural fluency, memorization, and teacher-led instruction. Students learn through repetition, drills, and textbook exercises, with assessments emphasizing correct answers and speed. While this method builds foundational skills, it often lacks emphasis on conceptual understanding and real-world application.[1]

Reform approaches emphasize mathematical reasoning, problem solving, and student-centered learning. These methods encourage using tools like manipulatives and real-world tasks to spark exploration, discussion, and multiple solution strategies. Assessments focus on understanding and communication of ideas. Though more engaging and conceptually rich, these methods can be harder to implement and assess consistently.[2]

Despite these philosophical differences, both approaches ultimately converge on key principles: Procedural fluency must be grounded in conceptual understanding, students need to experience the practice of mathematics as interconnected rather than isolated facts, and effective instruction requires developing both computational efficiency and flexible mathematical reasoning.[3] While the methods may differ, successful mathematics education requires balancing the development of both procedural skills and conceptual understanding to create students who can think mathematically while maintaining computational proficiency.

Teachers require professional learning, resources, and time to design tasks that balance fluency and understanding, incorporate culturally relevant contexts, and engage students in meaningful discourse. Shifts in pedagogy should be accompanied by shifts in assessment and support structures so that teachers feel empowered to make instructional changes that align with the vision of numeracy for all.[4]

Coherent and Aligned Curriculum & Instruction

A coherent and standards-aligned curriculum is central to the development of numeracy skills. Students benefit when curriculum, instruction, and assessment are intentionally connected across grade levels and aligned to the [Illinois Learning Standards.](#) This coherence ensures that students experience mathematics as a logical progression of ideas rather than isolated skills.[5]

High-Quality Curricular Resources

Selecting high-quality instructional materials is essential for achieving alignment and coherence in mathematics education. Tools such as EdReports and the ISBE Curriculum Evaluation Tool provide frameworks to help educators and school leaders evaluate curriculum quality.

Mathematical Standards Domains

Illinois Learning Standards for Mathematics are organized into domains that highlight the major areas of focus across grade levels. Each domain represents a coherent body of knowledge, and within each domain, the standards are sequenced to progress across grade levels. It is vital that educators understand how these domains develop across grade levels and design instruction that meets students where they are but also prepares them for future progressions. The domains are:

- Counting and Cardinality (K)
- Operations and Algebraic Thinking (K-5)
- Number and Operations in Base Ten (K-5)
- Number and Operations-Fractions (3-5)
- Measurement and Data (K-HS)
- Geometry (K-HS)
- Ratios and Proportional Relationships (6-7)
- The Number System (6-8)
- Expressions and Equations (6-8)
- Functions (8-HS)
- Statistics and Probability (6-HS)

Together, these domains create a coherent learning plan from the earliest learning, such as counting to advanced mathematical reasoning. Understanding how the domains are interconnected and progress over time equips educators to create meaningful learning experiences that support student development and ultimately foster numerate students.

Understanding the Breadth and Progression of Standards

Educators must have a deep understanding of the breadth and depth of the standards as well as a clear vision of learning within a grade, between grades, and within and between content strands. This knowledge allows teachers to situate daily lessons within a larger progression, helping students see mathematics as purposeful and connected.

- Example: A Grade 4 educator teaching multi-digit multiplication needs to know that students' earlier work with arrays and equal groups in Grade 3 provides the conceptual foundation, while also recognizing how this work prepares students for proportional reasoning and algebraic thinking in middle school. Seeing this full arc ensures instruction connects past, present, and future learning.

It is also important to note that conceptual understanding, procedural skill and fluency, and application are sometimes addressed within a single standard, sometimes spread across several standards within the same grade, and at times extended into the next grade level. For example, Illinois Learning Standards for Mathematics, Measurement and Data, **5.MD.3** is primarily conceptual: Students develop an understanding of volume as an attribute of three-dimensional space and relate it to unit cubes. In contrast, **5.MD.5** brings together multiple dimensions; students use their conceptual understanding of volume (packing with unit cubes), apply procedural fluency (formulas such as $V = l \times w \times h$), and extend to application (solving real-world problems involving composite prisms). This example illustrates how standards are intentionally designed to weave conceptual, procedural, and application aspects of mathematics in different ways, sometimes within one standard and sometimes across a series of standards. Teachers need to plan with this interdependence in mind, ensuring coherence across instructional experiences and across grade levels.

Mathematical Practices

The eight standards of mathematical practice describe the "habits of mind" that all students should develop as they progress through the grades.[6] These are the foundations for mathematical thinking and practice that are part of being a confident and proficient problem solver. These practices should permeate throughout the whole curriculum, and as such are a unifying theme across the grades (i.e., the practices can be thought of as the "heart and soul" of what it means to do mathematics). These are the skills that all students should have in their mathematical toolbox and are the more important tools that students should take with them as they leave school and transition to their future world.

Mathematical practices are skills, dispositions, expertise, and understandings that all students should experience and develop. In this sense, mathematical practices are just as important as the content standards and need to be a part of every lesson in some way. Teachers are charged with establishing an environment through which they are able to model mathematical practices and provide meaningful experiences for the students to develop these habits of mind for themselves. Students are the ones who need to apply the mathematical practices during the learning of each lesson.

The Standards for Mathematical Practice (SMPs) are not discrete grade-level skills but enduring practices that deepen over time. Students apply mathematical practices during the learning of each lesson. [7]

SMP 1: Make sense of problems and persevere in solving them.

SMP 2: Reason abstractly and quantitatively.

SMP 3: Construct viable arguments and critique the reasoning of others.

SMP 4: Model with mathematics.

SMP 5: Use appropriate tools strategically.

SMP 6: Attend to precision.

SMP 7: Look for and make use of structure.

SMP 8: Look for and express regularity in repeated reasoning.

Illustrations of SMP progression:[8]

- SMP 1 (Make sense of problems and persevere in solving them):
  - *K–2:* Students use drawings or counters to represent problems and check by asking, "Does this make sense?"
  - *3–5:* Students begin to try multiple strategies and use models, such as arrays or number lines.
  - *6–8:* Students tackle multi-step real-world problems, evaluating efficiency of approaches.
  - *High school:* Students analyze constraints, relationships, and special cases, choosing efficient pathways and justifying with graphs, tables, or equations.

- SMP 3 (Construct viable arguments and critique the reasoning of others):
  - *K–2:* Students explain their thinking with objects, drawings, or simple words ("I know 3+2=5 because I counted on.").
  - *3–5:* Students begin to justify strategies mathematically and listen to or question others' reasoning.

- *6–8:* Students develop formal mathematical arguments, identify flawed reasoning, and compare solution methods.
- *High school:* Students construct logical proofs, critique others' justifications, and use counterexamples to refine understanding. [8]

These illustrations show how mathematical practices evolve: beginning with concrete explanations and representations, then building toward abstract, formal reasoning in later grades. Instruction that highlights both the progression of content standards and the progression of practices ensures that students not only master skills but also develop lasting habits of mathematical thinking.

Avoiding Fragmented Instruction

A well-aligned curriculum builds conceptual understanding, procedural fluency, and application skills together over time.[9] When curriculum is designed with a clear continuum, students revisit concepts with increasing sophistication, strengthening both retention and reasoning.

- Example: Fraction learning begins with equal sharing in the elementary grades, extends to equivalent fractions and operations in upper elementary, and builds toward rational expressions in high school algebra. This progression helps students revisit concepts with increasing sophistication, strengthening both retention and reasoning.

Consistency and Shared Expectations

Instructional alignment also requires shared expectations across classrooms and districts. Educators, families, and students should be able to clearly see how learning connects within each grade and from one grade to the next. Coherence allows teachers to focus on depth rather than rushing through content.

Illinois' vision emphasizes coherence and alignment with mathematics learning standards. Coherence and alignment suggest that districts and schools should adapt curriculum to reflect local contexts, student interests, and cultural assets while maintaining fidelity to evidence-based progressions of mathematical learning. Coherence comes not from scripted pacing but from the intentional design of learning experiences that make mathematics meaningful, rigorous, and connected.

Collaboration

Educators also play a critical role in ensuring alignment through collaborative planning, cross-grade conversations, and the use of data to adjust instruction. Professional learning communities can help teachers analyze student work, identify learning progressions, and share strategies that strengthen alignment within and across schools.[10] Teachers need focused professional learning for how to use the adopted curriculum effectively as well as how to adapt lessons while maintaining rigor but addressing students' needs. Collaboration is essential for maintaining a cohesive continuum. Educators need structured opportunities to examine standards and progressions across grade levels, identify where students may struggle, and design instructional supports. Families also play an important role in reinforcing numeracy development across a child's lifetime, especially in early years.[11]

Ultimately, a coherent and aligned curriculum, supported by a cohesive continuum of learning, ensures that all students in Illinois, regardless of school or district, can move along a progression that recognizes and builds upon the interests and assets each child possesses. A coherent progression prepares students to reason, solve problems, and apply mathematics in real-world contexts.

A Cohesive Continuum of Learning

Numeracy skills develop over time as students build on prior knowledge and extend their understanding to new contexts.[12] A cohesive continuum of learning ensures that students experience mathematics as a connected progression of ideas rather than as disconnected topics.

Intentional Sequencing of Instruction

This continuum requires instruction that is intentionally sequenced to be developmentally appropriate, evidence-based, and aligned to the Illinois Learning Standards. Students should encounter mathematical concepts multiple times across grade bands with increasing sophistication. Early experiences with number sense, for example, support later work in algebra, proportional reasoning, and statistics. This learning progression gives students confidence to apply mathematics flexibly and to transfer learning across domains and contexts.

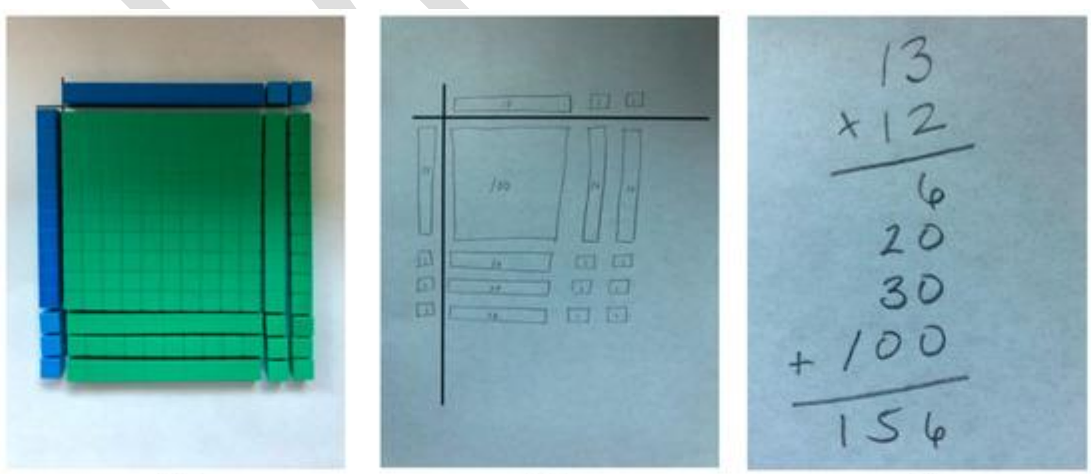
A key element of sequencing is aligning mathematical strategies and models across K–12. Students move from concrete, hands-on representations to visual models, and eventually to abstract symbolic reasoning.[13] For example:

- Multiplication: grouping objects (concrete) → arrays or area models (representational) → symbolic algorithms (abstract)
- Division: physically sharing objects (concrete) → visual representations or number lines (representational) → long division algorithm (abstract)

Integrating SMP supports this sequencing. SMP describes the habits of mind and processes students should develop across all grades, ensuring consistency in how students approach problems. For instance, in geometry, students begin by identifying and classifying 2D shapes in early elementary, move to analyzing attributes like angle measure and parallel lines in upper elementary, and later prove theorems about triangles and circles in high school. Each stage builds on the prior, helping students see geometry as a connected system of reasoning.

- SMP 1: (Make sense of problems and persevere) encourages flexible approaches to multi-step problems.
- SMP 3: (Construct viable arguments and critique reasoning) is reinforced when students compare strategies and explain reasoning.
- SMP 4: (Model with mathematics) aligns with using concrete and visual models before symbolic work.
- SMP 6: (Attend to precision) develops as students refine reasoning and representations at each stage.

Concrete–Representational–Abstract Progressions



(a) (b) (c)

A developmental continuum supports students as they move from concrete to representational to abstract reasoning.

- Example: Understanding multiplication as "groups of" (concrete) leads to area models and arrays (representational), and eventually to symbolic work with variables (abstract).[14]

Teachers plan instruction by carefully selecting manipulatives and visual models, such as counters, base-ten blocks, and fraction strips, that align with the concept and grade-level standards to help students internalize mathematical ideas before moving to representations or symbols. Lessons are sequenced so that students first explore concepts hands-on, then transition to visual or diagrammatic representations, and finally to symbolic or abstract reasoning, with opportunities to revisit concrete and representational models to reinforce understanding or address misconceptions.

By anticipating how students typically progress through these stages, teachers can design guided questions, discussion prompts, and problem sets that connect each stage and make learning explicit. Instruction is also structured to integrate SMP, fostering habits such as modeling relationships (SMP 4), reasoning about patterns (SMP 8), and explaining thinking (SMP 3) throughout the progression. This progression also helps students develop SMP-aligned habits, such as modeling, reasoning, and critiquing.

Over-Scaffolding: A Caution

Scaffolding is an effective teaching method whereby teachers provide targeted supports for students to learn new concepts by building on prior knowledge. While scaffolding is critical to support students in a cohesive continuum of learning and plays a key role in building conceptual understanding, coherent instruction does not mean over-scaffolding. Over-scaffolding can limit opportunities for productive struggle and independent thinking. Excessive or prolonged support can have negative consequences:

- Prevents independent learning: Students may rely on the supports rather than developing internal strategies.
- Limits knowledge application: Over-scaffolded students may succeed on tasks but struggle to apply their knowledge in new contexts.
- Fosters learned helplessness: Continuous assistance can reduce motivation and confidence, leading students to believe they cannot solve problems independently.

- Fails to address the Zone of Proximal Development: Scaffolding should be temporary, helping students progress until they can perform independently. Over-scaffolding keeps them dependent and hinders mastery.[15]

Effective instruction balances support and independence. Scaffolds should be deliberately removed as students develop competence, ensuring they move confidently through concrete, representational, and abstract stages while building mathematical resilience and problem-solving skills.

Addressing Misconceptions to Support Continuity

A key element of maintaining this continuum is anticipating and addressing common student misconceptions. When teachers know the stumbling points students are likely to encounter, they can plan supports that deepen understanding rather than reinforce errors. Misconceptions, if left unaddressed, disrupt the progression of learning from one grade to the next. For example, when first learning fractions, students often believe that a larger denominator means a larger fraction (thinking 1/8 >¼). If this misunderstanding persists, students will struggle with comparing fractions, finding common denominators, and eventually with rational number operations in middle school. Addressing this misconception early with visual models and number lines supports a smoother transition into proportional reasoning and algebraic applications.[16]

Equity in the Continuum

A continuum of learning must also be equitable. Students should not be excluded from advanced pathways or enrichment because of early challenges, systemic barriers, or inequitable access to high-quality instruction. Instead, schools must provide supports and interventions that honor the interests and assets students bring to school while maintaining high expectations. [17]

Balanced, Aligned, and Coherent Assessment Systems in Mathematics

Assessment is a central component of teaching and learning, providing essential information about how students develop numeracy skills. At its core, assessment is the process of collecting information on student learning, serving a dual purpose: to promote student growth and to guide instructional decisions. Without thoughtful assessment, educators lack the evidence needed to ensure students are progressing toward mastery.

Assessment operates at multiple levels. At the classroom level, teachers examine student learning through scaffolded instruction, identifying strengths and areas that need additional support. At the program or team level, educators analyze which standards students are mastering, which are challenging, and how effective the core curriculum and instruction are across the group. At the school level, assessment data reveals whether curriculum, interventions, and resources are truly impacting student achievement. As DuFour and colleagues (2006) note, the critical factor in assessment is what happens after the test: If students receive additional support and opportunities to demonstrate learning, the assessment is formative; if not, it functions as summative.[18]

Formative and Summative Assessment: Assessment as Learning

Formative and summative assessments play distinct but complementary roles in supporting numeracy development. Formative assessments are used during the learning process to gather evidence about student understanding and to guide immediate instructional adjustments. Summative assessments, in contrast, evaluate student learning at the conclusion of an instructional period, often for comparison or accountability purposes. While summative assessments can inform future instruction, formative assessments provide feedback that allows educators to close learning gaps in real time. Both forms of assessment require intentional planning, consistent documentation, and deliberate use of data to drive teaching decisions.[19]

Static Assessments of Numeracy Versus Dynamic Assessments of Numeracy

Static assessments often emphasize speed, rote computation, and isolated procedures. These assessments focus on students' ability to produce correct answers quickly, typically in a multiple-choice or worksheet format, and rarely capture reasoning, problem-solving, or conceptual understanding.[20] They often assess one skill at a time, without showing connections to other topics or real-world applications.

Examples of Static Assessments:

- Procedural Drill: A worksheet with 20 addition problems like 36 + 47, 58 + 69, 24 + 18, requiring students to complete all calculations correctly and quickly.

- Isolated Standard Assessment: Solve 5 × 7 without explanation or context.
- Single-Operation Word Problems: Sally has 12 apples. She buys 7 more. How many apples does she have?
- Timed Tests: Students answer as many problems as possible in a limited time.

Dynamic assessments measure numeracy holistically, combining conceptual understanding, procedural fluency, reasoning, and problem solving, while emphasizing connections across standards and domains. [21]

Examples of Dynamic Assessments:

- Conceptual Task with Multiple Representations: Regroup 106 into tens and ones to subtract 37. Show your thinking using a drawing, equation, or number line.
- Multi-Step, Real-World Problem: A school is planning a field trip. Each bus can hold 48 students. If 210 students are going, how many buses are needed? Can you solve this in more than one way?
- Connecting Concepts Across Domains: Draw a rectangle with a perimeter of 24 units. What possible side lengths work? Can you generalize a rule?
- Open-Ended or Non-Routine Tasks: Plan a playground with a $5,000 budget. Show calculations and reasoning.

Key Differences Between Static and Dynamic Assessments:

Feature	Static Assessment	Dynamic Assessment
Focus	Speed and rote computation	Reasoning, understanding, application
Task type	Isolated standard, single operation	Multi-step, conceptual, cross-domain
Feedback	Minimal or delayed	Immediate, actionable, supports metacognition
Real-world connection	Rare	Often authentic and relevant
Student thinking	Not captured	Central, assessed explicitly
Equity	Favors fast calculators	Values multiple strategies, multiple ways of demonstrating understanding

Dynamic assessments support formative assessment as learning opportunities, allowing students to reflect on strategies, identify errors, and refine their thinking. They emphasize metacognition, giving students ownership of their learning.[22]

Equitable Access in Assessment

In classrooms where thinking is made visible, feedback is multidirectional: teachers observe, students learn from each other, and collective understanding grows. Formative assessment, when implemented as a tool for learning, supports metacognition development by enabling students to actively regulate their learning and take ownership of their mathematical development.[23]

Access and assessment are deeply connected to the principles of Universal Design for Learning (UDL).[24] By embedding UDL into assessment practices, educators ensure that every learner has equitable opportunities to demonstrate what they know and can do. Traditional assessments often assume that all students can access content, instructions, and response formats in the same way, but this approach unintentionally creates barriers. UDL challenges that assumption by proactively designing assessments that provide multiple pathways for access and multiple ways to express understanding.

When assessments are designed through the UDL lens, students encounter content that is accessible from the start. This might mean offering questions with visual supports, read-aloud options, translations, or flexible text formats so that the focus remains on the construct being measured rather than on a student's ability to navigate inaccessible text. Similarly, students are given opportunities to respond in ways that match their strengths. For some, this may include using speech-to-text tools, drawing or modeling solutions, or creating digital artifacts to represent their thinking. These flexible approaches do not dilute rigor; instead, they ensure that the assessment is measuring the intended skill or concept rather than a barrier unrelated to the learning target.

Formative assessments within a UDL framework allow teachers to capture student learning in real time, revealing both the strategies and the processes students use as they work toward mastery. Summative assessments, too, can reflect UDL principles when they extend beyond procedural accuracy to capture reasoning, problem solving, and communication. By designing with UDL, assessments become more authentic, reflecting how students use knowledge in real-world contexts. [25]

Ultimately, UDL-based assessments provide all students with a fair opportunity to show their learning.[26] It strengthens the accuracy of the data teachers collect, builds student confidence, and promotes equity by ensuring that access and assessment are not afterthoughts but essential components of instructional design.

Accessible Learning for ALL

Ensuring that every student develops numeracy requires a commitment to access, equity, and differentiation. Evidence shows that when instruction is designed to meet diverse learning needs, all students are more likely to engage meaningfully with mathematics and to see themselves as capable problem solvers.[27] This section emphasizes that numeracy is not reserved for some students; it is a right for all learners.

Differentiation and Equity

Effective differentiation in mathematics instruction recognizes the assets students bring to the classroom, including their cultural and linguistic resources, while also addressing gaps that may arise from systemic inequities. Instructional planning should consider all learners, not just the "average" student, ensuring that outliers, both students who need additional support and those who require enrichment, have meaningful access and challenge. [28]

UDL Principles: Instruction is designed to provide multiple means of engagement, representation, and expression. In practice, UDL encourages teachers to present information through diverse modalities, such as visuals, text, audio, manipulatives, or interactive simulations, so students with varying learning preferences can grasp concepts. [29] It also allows students to express their learning in multiple ways, including writing, speaking, drawing, or using digital tools, and provides varied opportunities for engagement through choice, real-world applications, collaboration, and appropriately challenging tasks. This approach ensures that all students can access, participate in, and demonstrate understanding of grade-level content, regardless of learning profile or background.

Low-Floor, High-Ceiling Tasks: Tasks are intentionally designed to provide an accessible entry point for all students (low-floor), while offering opportunities for extended reasoning and challenge (high-ceiling). Such tasks allow students to engage at their level, explore multiple solution strategies, and deepen conceptual understanding.[30]

Example: Students are asked to design a rectangular 24 square meter school garden, using whole-number side lengths. They must determine all possible dimensions and explain their reasoning. Students who are developing basic multiplication skills can use grid paper or manipulatives to count squares and explore simple length × width combinations, such as 4 × 6 or 3 × 8, providing a low-floor entry point. Advanced students can extend the task by generalizing patterns, calculating perimeter and fencing costs, considering fractional or mixed-number dimensions for irregular plots, or modeling the problem algebraically. They might also optimize for additional variables, such as sunlight exposure or plant spacing, creating a high-ceiling challenge that encourages rich mathematical reasoning and multiple solution strategies.

Additional differentiation strategies include:

- Offering varied entry points to mathematical concepts through visual, verbal, kinesthetic, or digital modalities.
- Providing scaffolds and extensions such as intervention, remediation, or enrichment to learning so that tasks remain accessible yet rigorous for all learners.
- Encouraging multiple solution strategies and representations to honor diverse ways of reasoning.
- Embedding opportunities for student choice and voice, which builds ownership of learning and affirms students' mathematical identities.

Equity in differentiation requires more than adjusting instruction within classrooms. It also involves ensuring that all students — regardless of background, prior achievement, or learning profile — have access to grade-level content, advanced coursework, and enrichment opportunities. Systemic barriers that track or limit students must be dismantled to create a truly equitable numeracy experience across Illinois schools.[31]
By intentionally planning for outliers and integrating UDL principles with low-floor-high-ceiling tasks, educators can meet students where they are, provide rigorous pathways forward, and ensure that all learners can engage meaningfully in mathematics.

Considerations for Learners with Specialized Needs

Students with specialized learning needs, including those with disabilities, English learners, and students requiring additional supports, as well as those who are gifted and talented – all benefit from evidence-based practices grounded in the principles of UDL.[32]

Key considerations include:

- Accessibility: Designing tasks and assessments to reduce barriers and allow all students to demonstrate mathematical understanding.
- Scaffolding and Supports: Using tools such as manipulatives, technology, visual aids, and structured peer collaboration.
- Flexible Pacing and Pathways: Recognizing that students may progress through numeracy development at different rates and require personalized supports.
- Strength-Based Approaches: Identifying and building on students' assets.
- Collaboration: Ensuring that general educators, special educators, and support staff work together to deliver coherent and aligned instruction.

  When classrooms implement these considerations, students with specialized needs including those who require intervention or enrichment not only access the same numeracy content as their peers but also engage in meaningful problem solving, reasoning, and communication. By adopting this approach, Illinois schools can ensure all students, regardless of ability, background, or need, have equitable opportunities to thrive mathematically.

Considerations for Learners with Specialized Needs in Numeracy

Creating accessible and inclusive numeracy instruction involves deliberate planning that proactively addresses the diverse needs of all learners. It is vital that all students, including those with disabilities, English learners, and advanced learners, have equitable access to rigorous mathematical thinking. Educators must present mathematical concepts in multiple ways, offering student choice, relevance, and real-world connections, while also providing real-world opportunities for students to demonstrate their learning. Professional learning grounded in evidence-based practices, such as those outlined in Institute of Education Sciences Practice Guides, is essential for equipping educators with strategies that are effective for students with learning disabilities and beneficial for all learners. Furthermore, educator preparation programs must ensure through coursework and field experiences that pre-service teachers understand and can apply evidence-based approaches to support students with specialized learning needs.

Collaboration and Shared Ownership

Collaboration and communication between general education and special education staff are crucial to supporting numeracy growth. Successful inclusive instruction requires structured, ongoing communication about what is being taught, how it is taught, and the strategies and accommodations being applied, as well as considerations for advanced learners. When general education teachers bring strong content knowledge and special education teachers contribute expertise in individualized supports and executive functioning, a co-planning model can maximize access for all students.

Shared ownership includes:

- Co-planning for differentiation and accessibility in advance of instruction.
- Structured communication protocols between general education teachers, special education teachers, and paraeducators, including discussion of goals, strategies, assessments, classroom observations, and data.
- Intentional scaffolding of mathematical discourse to ensure all students can participate, build understanding, and develop a positive mathematical identity.

Monitoring Progress for Equitable Outcomes

Equitable outcomes for students with specialized needs require constant monitoring and collaboration. Educators can use a combination of skill-based and general outcome measures such as formative assessments or progress monitoring to track student progress, adjusting instruction as needed.[33] When all educators are numerate and confident in teaching math, progress monitoring becomes meaningful and actionable. Conversely, when educators lack confidence or content knowledge, students' learning can be compromised. Therefore, building educator capacity and fostering a shared sense of responsibility is critical for ensuring that all students, including those with Individualized Education Programs as well as advanced learners, experience meaningful growth in numeracy.

By integrating evidence-based practices, collaboration, and ongoing progress monitoring, schools create numeracy instruction that is inclusive, asset-based, and responsive to the diverse needs of learners.

Cultural Responsiveness

Cultural responsiveness in mathematics education fundamentally begins through knowing your students and knowing your curriculum. Effective culturally responsive teaching requires educators to understand not only the mathematical concepts they are teaching but also the rich cultural assets, experiences, and ways of knowing that each student brings to the classroom. This dual knowledge creates the foundation for creating spaces where students feel they belong — not just in the physical classroom, but more importantly, as a part of the mathematical conversation itself. When students see themselves as mathematical thinkers whose voices, questions, and approaches are valued, they are more likely to engage authentically with challenging mathematical content and persist through difficulties.

The work of implementing culturally responsive mathematics pedagogy requires intentional planning and flexibility to relate mathematical concepts to students' cultural backgrounds in authentic, meaningful ways. As Gholdy Muhammad emphasizes in her framework for culturally and historically responsive education, this connection cannot be superficial or tokenistic; it must genuinely honor students' cultural knowledge systems while advancing rigorous mathematical learning.[34] This approach demands that teachers move beyond simply adding cultural examples to existing lessons and instead fundamentally reconsider how mathematical concepts can be explored through the lens of students' lived experiences, community practices, and cultural wisdom. Such authentic integration requires significant preparation, ongoing reflection, and a willingness to learn alongside students about the mathematical thinking present in their communities.

The investment in culturally responsive mathematics education yields significant returns, as demonstrated by the research of Danny Martin and Julie Aguirre, who have documented strong correlations between student success and their perceived mathematical identity. Martin's work particularly highlights how students' sense of themselves as mathematical thinkers directly impacts their achievement and persistence in mathematics, while Aguirre's research shows how inclusive pedagogical practices can transform students' relationships with mathematical learning.[35] For students who have been furthest from educational opportunity, tending to issues of identity and belonging becomes a crucial lever for improving academic outcomes. When students develop positive mathematical identities and see themselves as capable, valued contributors to mathematical discourse, they are more likely to take risks, engage with challenging problems, and pursue advanced mathematical study, ultimately expanding their educational and career opportunities.

Meeting Diverse Language Needs

To support English learners (ELs) as they become competent and confident problem solvers and contributors of mathematics knowledge while engaging in a mathematical discourse community, Celedón-Pattichis & Ramirez suggest the following guiding principles for teaching mathematics:

1) Challenging mathematical tasks

2) Linguistically-sensitive social environments

3) Support for learning English while learning mathematics

4) Mathematical tools and modeling as resources

5) Cultural and linguistic differences as intellectual resources. Effective teachers of ELs address these principles by using these practices and actions in their classrooms:[36]

- At the beginning stages of EL development, limit the use of various academic terms for calculations in word problems. Wait until ELs have shown mastery before introducing new terms.
- Use challenging problems and tasks and assess ELs' prior knowledge of the problem's background and context. This includes culturally relevant problems or tasks, planning the use of multiple tools, representations, and models, and focusing on what mathematical and everyday language demands of the problem or task.
- Form groups based on the cognitive demand of the task or problem and awareness of how students may use their native language to process and reason their way to a solution, particularly as the complexity of the problem increases. Try to avoid calling attention to a student who appears to need additional support.
- Sequence problems and tasks carefully to allow ELs to develop competence with mathematics while developing proficiency with language, both mathematical and English.
- Facilitate and model mathematical discourse (e.g. provide sentence starters, visuals, use topics that are familiar, provide models of how to respond or ask questions) in class so that students can develop conceptual understanding and procedural fluency while increasing their language proficiency.
- Provide support through multiple modalities (e.g. visual, auditory, native language) to address complexity of language demands in problems and tasks.
- Allow processing time while recognizing the mental requirements students have with speaking, reading, listening, and writing in a new language.
- Provide opportunities for ELs to read and write about their learning of math, receive feedback that purposefully addresses mathematical language development, and allow students to revise their writing to support students in their learning of language.
- Include opportunities for problems and tasks with rich mathematical contexts and sophisticated language to help students advance their language development and mathematical learning.

- Provide space in the classroom where mathematical vocabulary and meaning are visible, referred to often during class, and frequently used in students' oral and written communications during class.
- Allow for the use of multiple tools and representations to enhance mathematical discourse and understanding. Intentionally teach the use of these tools to ELs. Based on background and/or prior experience, students may be unfamiliar with calculators, math apps, or other manipulatives. Provide students the opportunity to practice with the tools after teaching their use.
- Make visual connections to mathematical models and representations found in surrounding environment.
- Call attention to the peculiarities between meanings of words (e.g. words with multiple meanings such as year, area, times, and others, as well as homophones like eight and ate) used in both everyday language and mathematical language.
- Meet the needs of students by listening to what they have to say while providing supporting guidance and mentoring and advocating for their rights as students and individuals.
- Learn about students' culture and community, language, dialects, and ways of knowing and understanding to enhance the teacher-student experience. This means being linguistically sensitive as well. Be cognizant of cultural differences in mathematical representations and notations, writing, and problem solving.
- Model acceptance and interest in students' language and culture to show ELs that they are part of the classroom community and valued for what they have to offer the class. This can have a positive effect on students' learning and identity.
- Model making sense of written instructions prior to using these instructions on exams so students are not seeing these instructions for the first time on an exam.
- Be mindful that for some students, writing in cursive may add an additional layer of cognitive demand on students.
- Communicate with and collaborate regularly with your school or district's ESL or Bilingual teacher(s).
- Identify the background knowledge a student may need to solve a word problem. Unfamiliarity with the topic of the word problem may be a barrier to the student demonstrating their understanding of the mathematical concepts being assessed. For example, in a math problem about receiving a coupon for a free t-shirt at a football game, the student may be distracted trying to figure out what a coupon is, and whether football and soccer are the same thing.

Multi-Tiered Systems of Support

A strong Multi-Tiered System of Support (MTSS) is foundational to ensuring that every student in Illinois develops numeracy. MTSS is not simply a framework for intervention; it begins with a solid, evidence-based core of instruction that meets the needs of most students, while also providing additional supports and interventions for those who need them. At its heart, MTSS is about delivering high-quality mathematics instruction, monitoring progress, and engaging all students in meaningful, grade-level learning.

An effective MTSS framework for numeracy includes:

- Tier 1 (Core Instruction): High-quality, evidence-based instruction delivered to all students. This core is culturally and linguistically responsive, differentiated to meet diverse needs, and aligned across grade levels. Tier 1 instruction emphasizes reasoning, problem solving, and application, which are essential components of numeracy.
- Tier 2 (Targeted Supports): Small-group or supplemental instruction for students who need additional support. These supports are guided by assessment data and may include reteaching of concepts, structured practice, or scaffolded tasks that reinforce mathematical reasoning and confidence.
- Tier 3 (Intensive Interventions): Individualized, intensive supports for students with significant and persistent learning needs. These interventions are evidence-based, tailored to student strengths, and delivered in addition to Tier 1 core instruction.
- Engagement and Belonging: MTSS also addresses student engagement, persistence, and sense of belonging in mathematics classrooms. When students feel safe, valued, and included, they are more likely to participate fully in learning opportunities and develop positive mathematical identities.
- Collaboration: Effective MTSS requires collaboration across general educators, interventionists, special educators, administrators, and families. Working together ensures that supports are coherent, timely, and aligned to each student's developmental needs.

By emphasizing both a strong core and tiered supports, MTSS helps prevent gaps in numeracy development while ensuring that interventions are available and equitable. It ensures that every student, including those with specialized needs, ELs, and those historically marginalized in mathematics, has access to high-quality instruction and the opportunity to thrive.[37]

Universal Screening

Math screening is a universal, efficient, and proactive approach to recognizing students' diverse strengths in numeracy, while also identifying areas where targeted enrichment or support can further enhance their mathematical development. As a critical component of a comprehensive MTSS framework, universal screening provides educators with timely information about all students' mathematical development and helps identify those who may require additional support.[38] Unlike diagnostic assessments, which are detailed and target specific areas of need, screening tools are brief, broad, and designed for all students, allowing educators to detect potential learning gaps before they become entrenched and make informed decisions about interventions and next steps.

Effective universal screening practices include:

- Administration to all students: Screenings are brief, efficient, and administered to every student multiple times throughout the year. This method ensures equity by providing an early look at numeracy development for all learners, rather than waiting until gaps are large and harder to address.
- Alignment to evidence-based numeracy skills: Screenings measure critical concepts that are predictive of long-term success in mathematics, such as number sense, reasoning, and problem solving.
- Use of multiple measures: While a single screening can provide helpful data, multiple sources of evidence, such as classroom observations, formative assessments, and student work, offer a more complete picture.
- Early identification and proactive support: Screening allows teachers to identify students who may be at risk for difficulties and provide timely, targeted supports before misconceptions become entrenched.
- Culturally and linguistically responsive practices: Screenings must be fair and accessible to all students, including ELs and students with disabilities. This includes attention to language demands, cultural contexts, and accessibility features.
- Teacher tools: To enhance the screening process, teachers often use unit pre-assessments and math running records. Unit pre-assessments provide a snapshot of students' readiness for upcoming content, identifying both strengths and potential gaps, while math running records capture the strategies and reasoning students use during problem-solving tasks. These tools help teachers refine screening data, anticipate misconceptions, and plan instruction that meets students where they are. By combining universal screening with these more

targeted measures, educators gain a fuller picture of student learning and can implement supports that maintain a coherent continuum of mathematical development.

The purpose of universal screening is not to label or limit students but to ensure equitable access to high-quality instruction. When paired with progress monitoring and diagnostic assessments, universal screening helps educators make data-informed decisions that support students' growth along the continuum of numeracy learning.

Diagnostic Assessments

Diagnostic assessments provide a deeper look into students' mathematical understanding once universal screening or classroom evidence indicates that additional support may be needed.[39] These assessments are more detailed than screenings and are designed to uncover specific skills, misconceptions, or gaps that may hinder students' numeracy development.

Key features of effective diagnostic assessments include:

- Targeted focus: Diagnostics zero in on areas of concern (e.g., number sense, operations, proportional reasoning) rather than covering broad content.
- Instructionally actionable: Results provide teachers with specific insights that can guide planning, differentiation, and interventions.
- Strength- and needs-based: Diagnostics identify not only where students struggle but also what strategies or concepts they have mastered, ensuring a balanced picture of student learning.
- Accessible and equitable: Assessments must be designed to reduce linguistic, cultural, or disability-related barriers so that results reflect mathematical thinking rather than unrelated challenges.

Diagnostic assessments also serve to identify prior knowledge and reveal misconceptions, helping teachers understand what students already know and where misunderstandings may block progress. For example, a screening on fractions can uncover whether a student understands that ¼ is smaller than ½, while a diagnostic assessment can reveal whether a student grasps the meaning of "groups of" versus relying on memorized facts alone.

- Teacher tools: In addition to traditional diagnostic tests, teachers often use unit pre-assessments and math running records to gain deeper insights. Unit pre-assessments administered before instruction help identify prior knowledge or prerequisite skills, uncover misconceptions, and inform lesson planning and differentiation. Math running records capture students' problem-solving strategies and reasoning in real time, allowing teachers to observe how students approach tasks, track progress over time, and plan targeted supports. Together, these tools provide a comprehensive view of student understanding and support the design of instruction that aligns with developmental needs and a coherent continuum of learning.

The goal of diagnostic assessments is not to sort or track students but to inform evidence-based instruction that addresses the root causes of learning challenges. When used appropriately, diagnostics empower teachers to align supports with students' actual developmental needs and to prevent widening achievement gaps.

Progress Monitoring

Progress monitoring is the process of regularly checking how students respond to instruction and interventions over time. It ensures that supports are effective, timely, and adjusted based on student growth. Unlike universal screening, which provides a broad snapshot, progress monitoring offers continuous feedback that drives decision-making in MTSS. [40]

Effective progress monitoring practices include:

- Frequent measurement: Students receiving Tier 2 or Tier 3 supports are monitored more often (weekly or biweekly), while Tier 1 progress may be checked through classroom-based formative assessment.
- Clear alignment to goals: Monitoring tools track the specific skills or concepts being targeted in instruction or intervention.
- Data-driven adjustments: Results help teachers determine whether a student is responding to support, whether strategies should be adjusted, or whether additional interventions are needed.
- Multiple forms of evidence: In addition to short assessments, progress monitoring can include student work samples, observations, or performance-based tasks.
- Collaborative use of data: Teachers, specialists, and families share progress monitoring results to make informed, collective decisions about student supports.

Progress monitoring reinforces the belief that all students can grow in numeracy when provided with the right opportunities. It shifts the focus from static measures of performance to dynamic evidence of learning, helping ensure equitable outcomes for students across Illinois.

Student Engagement and Mindset

The development of numeracy is not only about content and skills but also about how students view themselves as mathematical learners. Engagement, curiosity, and mindset shape whether students persist with challenging problems, see value in mathematics, and develop confidence in their ability to learn.

Research suggests that students' beliefs about mathematics strongly influence their achievement.[41] A growth mindset in mathematics can improve with effort, practice, and support which helps students approach challenges with persistence. Conversely, fixed mindsets and math anxiety often limit students' willingness to engage, even when they have the capacity to succeed.[42]

High-quality mathematics instruction should deliberately cultivate positive mathematical mindsets and mathematical curiosity by:

- Building relevance and wonder: Connecting math to students' interests, cultural contexts, and community issues increases engagement and demonstrates the usefulness of numeracy beyond the classroom. Presenting open-ended problems or puzzles sparks curiosity and invites students to ask "what if?" questions.
- Normalizing struggle: Framing mistakes as opportunities for learning helps students see challenge as part of the process, not as a sign of inability. Curiosity grows when students feel safe to explore and experiment and are provided the time to do so.
- Encouraging voice, agency, and discourse: Providing opportunities for students to explain their reasoning, share strategies, ask questions, and engage in rich mathematical discussions fosters ownership of learning.
- Valuing diverse ways of knowing: Inviting multiple approaches and representations allows students to see their thinking as valid and important and encourages exploration of alternative solutions.
- Strengthening belonging: Classrooms that emphasize collaboration, respect, and inclusion counteract stereotypes and help students feel they belong in mathematics.

Instruction should also include low-floor, high-ceiling tasks, which provide multiple entry points for learners of varying abilities while allowing all students opportunities to progress and deepen their understanding.[43] Tasks should be authentic and while also often messy, reflect real-world contexts, current interests or future possibilities. Authentic tasks challenge students to reason, model, problem solve, and engage in meaningful discourse which fosters and promotes curiosity through exploration.

Engagement is not only about motivation but also about creating conditions for active participation, exploration of curiosity, and collaborative discourse. When students are engaged in asking questions, investigating patterns, discussing, defending, and critiquing mathematical ideas, they may make connections to other subjects, civic life, and future careers. Building mathematical confidence, curiosity, persistence, and discourse skills ensures that students leave school with the habits of mind, skills, and mindset needed to navigate in the 21st century.

Actions to build Mathematical Confidence

	Teacher Actions	Student Actions
Introduction of a Concept	Presents a real-world problem (e.g., sharing snacks, calculating discounts, designing a garden) and models the concept using concrete materials, visual representations, and symbolic notation. Uses UDL principles to provide multiple entry points (visual, verbal, kinesthetic, digital).	Engages with the concept through manipulatives (concrete), diagrams or drawings (representational), and numerical symbols or equations (abstract).
Problem Solving	Facilitates a group or individual problem-solving activity. Encourages students to try multiple strategies, such as drawing diagrams or models, using manipulatives, applying mental math or algorithms, and exploring patterns and generalizations. Supports collaboration and discussion while scaffolding for diverse learners.	Works with partners or independently to explore solutions using concrete, representational, and abstract methods. Tries multiple strategies, justifies choices, and demonstrates flexibility in finding solutions.
Consolidating Learning	Collaboratively creates anchor charts, graphic organizers, or digital representations with student input. Highlights key strategies, patterns, and connections across representations.	Contributes ideas, examples, manipulatives, diagrams, and equations to the shared reference, reinforcing understanding across Concrete Representational Abstract (CRA) stages.
Check for Understanding	Uses formative assessments, such as exit tickets, quick sketches, oral explanations, or	Responds with hands-on materials, drawings, or symbolic work. Demonstrates

	short performance tasks, to evaluate understanding across concrete, representational, and abstract stages.	understanding and identifies areas needing clarification.
Deepening Understanding	Challenges students to explain reasoning, compare multiple approaches, justify solutions, and connect ideas across CRA levels and conceptual, procedural, application dimensions of the standards as written. Promotes rich discourse and reflection on mathematical thinking.	Explains thought processes, critiques peer strategies, applies reasoning to new problems, and demonstrates mastery through concrete, representational, or abstract methods.
Extending & Enrichment	Provides low-floor, high-ceiling tasks that allow all students to engage meaningfully while offering opportunities to extend reasoning or complexity for advanced learners. Connects tasks to real-world contexts and future applications.	Engages in tasks at their level of readiness, explores advanced or creative strategies, and applies concepts in novel or complex situations.

End Notes

1. Dairo, Oluwafemi Motunrayo, Chioma Angela Okonkwo, and Christiana Uchechukwu Orakwe. "A Review of Primary School Teachers' Insight into Traditional Instruction and Activity-Based Learning in Mathematics Education." *International Journal of Applied Research in Social Sciences* 6, no. 11 (November 2024): 2778–2790.
2. Dairo, Oluwafemi Motunrayo, Chioma Angela Okonkwo, and Christiana Uchechukwu Orakwe. "A Review of Primary School Teachers' Insight into Traditional Instruction and Activity-Based Learning in Mathematics Education." *International Journal of Applied Research in Social Sciences* 6, no. 11 (November 2024): 2778–2790.

3. Hurrell, Derek P. "Conceptual Knowledge OR Procedural Knowledge OR Conceptual Knowledge AND Procedural Knowledge: Why the Conjunction Is Important for Teachers." *Australian Journal of Teacher Education* 46, no. 2 (2021). National Research Council. *How People Learn: Brain, Mind, Experience, and School: Expanded Edition.* Washington, DC: National Academies Press, 2000. https://nap.nationalacademies.org/read/9822/chapter/6#144
4. Baker, Eva L., Wang, Jia, and Zhou, Yipeng. *The Role of Policy in Large-Scale Reform: An Empirical Evaluation of State Mathematics Standards.* Los Angeles: CRESST, 2021. https://cresst.org/wp-content/uploads/TECH471.pdf
5. Kyeremeh, Patrick, and Bernard Osei. "Vertically Integrated Mathematics Curriculum and the Risks of Leaving Out Parts of the Curriculum." *International Journal of Education and Research* 11, no. 7 (2023): 1–15. https://www.researchgate.net/profile/Patrick-Kyeremeh/publication/372479228_VERTICALLY_INTEGRATED_MATHEMATICS_CURRICULUM_AND_THE_RISKS_OF_LEAVING_OUT_PARTS_OF_THE_CURRICULUM/links/653a5df51d6e8a7070505e93/VERTICALLY-INTEGRATED-MATHEMATICS-CURRICULUM-AND-THE-RISKS-OF-LEAVING-OUT-PARTS-OF-THE-CURRICULUM.pdf
6. Common Core State Standards Initiative. "Standards for Mathematical Practice." *Common Core State Standards for Mathematics.* Accessed 2025.https://www.thecorestandards.org/Math/Practice/
7. Common Core State Standards Initiative. "Standards for Mathematical Practice." *Common Core State Standards for Mathematics*.https://www.thecorestandards.org/Math/Practice/
8. Clark, Kevin F., James A. Middleton, and Kenneth R. P. Muir. "The Common Core Standards for Mathematical Practice: Teachers' Initial Perceptions and Implementation Considerations." *Research in the Schools* 21, no. 1 (2014): 25–40. https://www.researchgate.net/publication/265599108_The_Common_Core_standards_for_mathematical_practice_Teachers_initial_perceptions_and_implementation_considerations
9. National Research Council. *How People Learn: Brain, Mind, Experience, and School: Expanded Edition*. Washington, DC: National Academies Press, 2000. https://nap.nationalacademies.org/read/9822/chapter/6#144
10. Kanold, Timothy D., Matthew R. Larson, and Mona Toncheff. *Mathematics Instruction and Tasks in a PLC at Work®, Second Edition*. Bloomington, IN: Solution Tree Press, 2022.
11. Saçkes, Mesut, Julie Sarama, Douglas H. Clements, and Crystal Day-Hess. "The Impact of Professional Development on Preschool Teachers' Use of Mathematics

Curriculum.” *Early Childhood Research Quarterly* 64 (2023): 163–176. https://www.sciencedirect.com/science/article/pii/S0885200623001254
12. Kaur, Berinderjeet. “Teachers’ Learning and Students’ Gains: The Case of Mathematics Professional Development.” *International Journal of Research in Education and Science* 3, no. 1 (2017): 224–238.https://files.eric.ed.gov/fulltext/EJ1391459.pdf
13. Pennsylvania Training and Technical Assistance Network (PaTTAN). *Concrete–Representational–Abstract (CRA) Instructional Approach*. Harrisburg, PA: PaTTAN, 2017. https://www.pattan.net/getmedia/9059e5f0-7edc-4391-8c8e-ebaf8c3c95d6/CRA_Methods0117
14. Perdikaris, Panagiotis, and Dimitris Psycharis. “Implementing Universal Design for Learning in Mathematics: A Systematic Review.” *Education Sciences* 13, no. 10 (2023): 1061.https://www.mdpi.com/2227-7102/13/10/1061
15. Sparks, Sarah D. “The Consequences of Overscaffolding.” *Principal*, National Association of Elementary School Principals, May/June 2022.https://www.naesp.org/resource/the-consequences-of-overscaffolding/
16. Yaniawati, Risdawati Puspita. “Mathematics Literacy as the 21st-Century Skill.” *Southeast Asian Mathematics Education Journal* 6, no. 1 (2016): 1–12. https://qitepinmath.org/ojs/index.php/seamej/article/view/66/61
17. U.S. Department of Education, Office for Civil Rights. *Guiding Principles: A Resource Guide for Improving School Climate and Discipline*. Washington, DC: U.S. Department of Education, 2014.https://www.ed.gov/sites/ed/files/policy/gen/guid/school-discipline/guiding-principles.pdf

    Leung, Frederick K. S. “Culture and Mathematics Learning.” In *Mathematics Education in East Asia: Past, Present and Future*, 291–312. Singapore: World Scientific, 2023. https://www.worldscientific.com/doi/epdf/10.1142/9789811287152_0020
18. DuFour, Richard, Rebecca DuFour, Robert Eaker, and Thomas Many. *Learning by Doing: A Handbook for Professional Learning Communities at Work.* 3rd ed. Bloomington, IN: Solution Tree Press, 2016.
19. Kisa, Zehra, and Jennifer Langer-Osuna. “Shifts in Teachers’ Discourse Practices in Mathematics Professional Development.” *Journal of Mathematics Education Leadership* 24, no. 1 (2023): 39–52. https://files.eric.ed.gov/fulltext/EJ1309262.pdf
20. National Council of Teachers of Mathematics (NCTM). *Principles to Actions: Ensuring Mathematical Success for All*. Conference handout, Annual Meeting, San Antonio, 2017. https://conference-handouts.s3.amazonaws.com/2017-nctm-san-antonio/pdfs/1117-2012.pdf

21. National Council of Teachers of Mathematics (NCTM). *Principles to Actions: Ensuring Mathematical Success for All*. Conference handout, Annual Meeting, San Antonio, 2017. https://conference-handouts.s3.amazonaws.com/2017-nctm-san-antonio/pdfs/1117-2012.pdf
22. National Council of Teachers of Mathematics (NCTM). *Principles to Actions: Ensuring Mathematical Success for All*. Conference handout, Annual Meeting, San Antonio, 2017. https://conference-handouts.s3.amazonaws.com/2017-nctm-san-antonio/pdfs/1117-2012.pdf
23. Black, Paul, and Dylan Wiliam. "Inside the Black Box: Raising Standards through Classroom Assessment." *Phi Delta Kappan* 80, no. 2 (1998): 139–48. https://doi.org/10.1177/003172171009200119
    Earl, Lorna M. *Assessment as Learning: Using Classroom Assessment to Maximize Student Learning*. Thousand Oaks, CA: Corwin Press, 2003.
    Heritage, Margaret. *Formative Assessment: Making It Happen in the Classroom*. Thousand Oaks, CA: Corwin, 2010.
24. CAST. *Universal Design for Learning Guidelines, Version 2.2*. Wakefield, MA: CAST, 2018.
    Tomlinson, Carol Ann. *The Differentiated Classroom: Responding to the Needs of All Learners.* 2nd ed. Alexandria, VA: ASCD, 2014. https://www.ascd.org/books/the-differentiated-classroom-responding-to-the-needs-of-all-learners-2nd-edition?variant=120001
25. ASCD. *Assessment and the Common Core State Standards*. White Paper. Alexandria, VA: ASCD, 2012. https://files.ascd.org/staticfiles/ascd/pdf/siteASCD/publications/assessment-and-di-whitepaper.pdf
26. Tomlinson, Carol Ann. *The Differentiated Classroom: Responding to the Needs of All Learners.* 2nd ed. Alexandria, VA: ASCD, 2014. https://www.ascd.org/books/the-differentiated-classroom-responding-to-the-needs-of-all-learners-2nd-edition?variant=120001
27. https://www.edutopia.org/article/making-math-accessible-all-students/
28. Tomlinson, Carol Ann. *The Differentiated Classroom: Responding to the Needs of All Learners.* 2nd ed. Alexandria, VA: ASCD, 2014. https://www.ascd.org/books/the-differentiated-classroom-responding-to-the-needs-of-all-learners-2nd-edition?variant=120001
    Boaler, Jo, and Jeannie Oakes. "When Politics Trump Evidence: Research on Equity and Mathematics Education." *Educational Researcher* 44, no. 1 (2015): 19–29.

Aguirre, Julia M., Beth Herbel-Eisenmann, and Maria del Rosario Civil. "Identity and Equity in Mathematics Education." *Mathematics Education Research Journal* 24 (2012): 17–27. https://files.eric.ed.gov/fulltext/EJ1327937.pdf

29. CAST. *Universal Design for Learning Guidelines, Version 2.2*. Wakefield, MA: CAST, 2018.
30. Boaler, Jo. "Designing Mathematical Tasks That Promote Equity." In *Mathematics Education and Culture: Beyond Reform*, edited collection, 2015.
31. National Council of Teachers of Mathematics (NCTM). *Catalyzing Change in High School Mathematics: Initiating Critical Conversations*. Reston, VA: NCTM, 2018. Oakes, Jeannie. *Keeping Track: How Schools Structure Inequality*. 2nd ed. New Haven, CT: Yale University Press, 2005.
32. CAST. *Universal Design for Learning Guidelines, Version 2.2*. Wakefield, MA: CAST, 2018.
33. National Center on Intensive Intervention (NCII). *Academic Intervention Tools Chart*. Washington, DC: American Institutes for Research, 2020. https://intensiveintervention.org/
34. Muhammad, Gholdy. *Cultivating Genius: An Equity Framework for Culturally and Historically Responsive Literacy*. New York: Scholastic, 2020.
35. Martin, Danny B. *Mathematics Success and Failure among African-American Youth: The Roles of Sociohistorical Context, Community Forces, School Influence, and Individual Agency*. New York: Routledge, 2009. Aguirre, Julia M., Beth Herbel-Eisenmann, and Maria del Rosario Civil. "Identity and Equity in Mathematics Education." *Mathematics Education Research Journal* 24 (2012). https://files.eric.ed.gov/fulltext/EJ1327937.pdf
36. Celedón-Pattichis, Sylvia, and Nichole M. Ramirez, eds. *Beyond Good Teaching: Advancing Mathematics Education for ELLs*. Reston, VA: National Council of Teachers of Mathematics, 2012.
37. Illinois State Board of Education. *Leveraging MTSS: Building a Better Academic and Behavioral Support System*. Springfield, IL: ISBE, 2020. https://www.isbe.net/Documents/bat-toolkit-02-leveraging-mtss.pdf
38. RTI Action Network. *Essential Components of RTI—A Closer Look at Response to Intervention*. Washington, DC: National Center for Learning Disabilities, 2010. https://rtinetwork.org/essential
39. National Center on Intensive Intervention (NCII). *Academic Intervention Tools Chart*. Washington, DC: American Institutes for Research, 2020. https://intensiveintervention.org/

40. National Center on Intensive Intervention (NCII). *Academic Intervention Tools Chart*. Washington, DC: American Institutes for Research, 2020. https://intensiveintervention.org/
41. Karim, Azianah, and Noraini Idris. “Mathematics Teachers’ Professional Development through Lesson Study in Online Communities.” *International Journal of Educational Research* 120 (2023): 102197. https://www.sciencedirect.com/science/article/pii/S1747938X23000477
42. Boaler, Jo, and Carol S. Dweck. “Mathematical Mindsets and Student Achievement.” In *Mathematical Mindsets*. San Francisco: Jossey-Bass, 2016.
43. Boaler, Jo. *Mathematical Mindsets: Unleashing Students’ Potential through Creative Math, Inspiring Messages and Innovative Teaching*. San Francisco: Jossey-Bass, 2016.

Educator Professional Learning and Development

Purpose

Professional learning in mathematics plays a central role in achieving Illinois' vision *that all students graduate numerate, confident, and prepared for postsecondary success*. Students thrive when educators engage in sustained, evidence-based learning that deepens mathematical knowledge, strengthens teaching practices, and affirms professional and mathematical identities.[1] Professional learning clarifies a shared, evidence-based definition of numeracy: the ability to confidently understand, interpret, and apply mathematical concepts across all domains of mathematics in a variety of real-world and academic contexts. With that lens, teachers design instruction that advances reasoning, problem solving, and confidence.[2]

This section addresses educator learning across the continuum, from pre-service teacher preparation to in-service learning. High-quality professional learning does not occur in isolated stages. Instead, it forms a continuum that begins in educator preparation programs, deepens through in-service professional learning, and is sustained and extended by school and district leadership. Each stage builds on the last and depends on the others to achieve Illinois' vision for ambitious and equitable numeracy instruction.

- Educator Preparation Programs establish the foundation. Candidates build mathematical knowledge, develop inclusive practices, and cultivate positive identities as mathematical thinkers. They learn the habits of mind and pedagogical strategies that allow them to launch their careers with confidence.
- In-Service professional learning extends and strengthens that foundation. Through job-embedded professional learning like coaching, Professional Learning Communities (PLCs), mentoring, institutes, and equity-focused professional learning, teachers refine their practice, respond to student needs, and grow as instructional leaders. Sustained engagement ensures that teachers continue to develop across their careers.[3]
- School and district leaders support and maintain the conditions for ambitious and equitable instruction. By engaging in professional learning themselves, providing non-evaluative feedback, and sustaining collaborative structures like PLCs and

data teams, leaders ensure that high-quality professional learning becomes part of the fabric of every school and district.[4]

When aligned, these three elements of preparation, in-service learning, and leadership form a coherent system of professional learning. Each stage lends responsibility and opportunity to the next, ensuring that teachers in Illinois are not only well-prepared when they enter the profession but also supported and inspired to continue growing throughout their careers. This shared responsibility creates an ecosystem where teachers thrive, students flourish, and numeracy instruction reflects the ambitious, equitable vision outlined in this plan.

Equity in Professional Learning

Equity serves as the foundation of all professional learning in mathematics. Providing equitable access to high-quality learning opportunities ensures that all educators can deliver inclusive and effective instruction. Teachers who serve diverse student populations require targeted resources and supports to ensure that all students engage in grade-level instruction. By prioritizing equity, Illinois can reduce achievement gaps and foster mathematics classrooms where every student not only belongs but contributes to learning.

Focus of Professional Learning

Professional learning in mathematics is intentional, comprehensive, and aligned to the developmental trajectory of numeracy as described in the Framework for the Evidence-Based Development of Numeracy Skills. Educators will build numeracy in students by first strengthening their own knowledge, dispositions, and instructional practices. High-quality professional learning develops habits of mind, confidence, and evidence-based practices that bring mathematics to life.[5]

This focus extends beyond content. Professional learning builds teacher identity, advances equity, and connects mathematics to authentic contexts. Teachers benefit when they experience mathematics as learners by engaging in problem solving, reasoning, modeling, and discourse; those experiences translate into instruction that elicits and extends student thinking.[6]

Five interrelated domains of professional learning:

1. Strengthening Educators' Mathematical Knowledge

   Teachers must first have strong mathematical reasoning themselves before they can support students in developing it. This understanding includes deepening knowledge of numbers and operations, algebra, geometry, measurement, statistics, and probability.[7] Professional learning should allow educators to explore learning progressions, cross-domain connections, and fluent use of representations, such as manipulatives, visuals, symbols, and real-world contexts. Strong learning systems also nurture teacher confidence and positive mathematics identity.[8] Alignment to endorsement requirements in Illinois administrative code and to Illinois Licensure Testing System (ILTS) frameworks ensures coherence between teacher development and state standards.

2. Advancing Evidence-Based Numeracy Instructional Practices

   Teachers need access to instructional strategies that connect fluency with understanding and promote reasoning. Professional learning should focus on fluency as a progression that moves from counting to deriving to mastery and builds on evidence-based strategies such as those identified by Bay-Williams, SanGiovanni, Bay-Williams and Kling, and other experts in math education.[9] Educators should experience and enact proven routines like Number Talks, Problem Strings, and discourse structures that highlight student reasoning and multiple strategies to solve rich tasks.[10] These practices must always prioritize equity, with explicit integration of CRTL Standards and UDL so that every student can access rigorous mathematics.[11]

3. Centering Student Thinking and Development

   High-quality professional learning positions student thinking at the center of mathematics instruction. Teachers study how mathematical strategies develop from early counting through proportional reasoning and functional thinking.[12] They practice eliciting and extending student ideas, orchestrating classroom discussions, and analyzing student work to guide next steps.[13] Professional learning also helps teachers affirm students' mathematical identities and foster agency, persistence, and productive struggle as essential elements of learning.[14]

4. Ensuring Coherence Across Grades, Content, and Disciplines

   Teachers benefit from professional learning that frames mathematics as an interconnected system. Educators should explore how standards progress across grade levels, study cross-domain connections using tools like Achieve the Core's Coherence Map, and connect mathematics to other disciplines such as science, social science, and career and technical education (CTE). These experiences strengthen the ability to design instruction that emphasizes real-world application and reflects the numeracy skills students will need as adults.[15]

5. Aligning with Standards and Professional Expectations

   Professional learning must anchor teacher growth in state and national standards. Teachers need explicit opportunities to align their instruction to the Illinois Learning Standards for Mathematics and Standards for Mathematical Practice. Preparation and in-service learning should also reflect national expectations, such as the Association of Mathematics Teacher Educators (AMTE) Standards.[16] For secondary teachers, alignment includes building the capacity to connect instruction to assessments that measure college and career readiness.[17]

These domains guide growth across the career continuum and align with the Illinois Learning Standards, and national expectations for effective mathematics teaching.[18]

High-quality professional learning reflects the same principles expected in mathematics classrooms. It is content-focused, engaging teachers in mathematical ideas and pedagogy. It is active, giving educators practice with tools, manipulatives, strategies, and tasks they use with students. It is collaborative, creating structures for teachers to learn from and with one another. Additionally, it is sustained, moving beyond isolated workshops to sequential, spiraling opportunities that support long-term growth.[19] Just as students need time and multiple opportunities to master numeracy, teachers also need time and multiple opportunities to master effective numeracy instruction.

High Quality Professional Learning Considerations

	Definition	Characteristic
Content-focused	Teachers are engaged in mathematical ideas and pedagogical strategies specific to the discipline.	Teachers work on a mathematics problem and consider how the mathematics problem engages students in different Standards for Mathematical Practices.

Active	Teachers have hands-on practice with tools, manipulatives, strategies, and tasks they will later use with students.	Teachers use manipulatives to show multiple ways to solve a mathematical problem.
Models of effective practice	Provides clear vision of what best practices look like.	Teachers watch video cases of teachers enacting best practices, like Number Talks, and the elicitation of student thinking.
Coaching and expert support	A person knowledgeable in mathematics and mathematics teaching facilities and shares their expertise in professional learning.	Teachers are observed and given actionable feedback by a curriculum coach with training in instructional best practices for mathematics.
Feedback and reflection	Teachers are provided time to reflect, receive feedback, and make changes to their practice.	Teachers rehearse an instructional routine in professional learning before enacting it in their own classrooms, with feedback from peers and opportunities to reflect on changes.
Sustained	Teachers are provided time and multiple opportunities to learn, refine, and master effective numeracy instruction.	Instead of one-time workshops, teachers' learning is connected to their ongoing work with instructional coaches and in professional learning communities.

Teacher Preparation

Illinois Educator Preparation Programs (EPPs) are responsible for preparing candidates with mathematical knowledge, instructional practices, and professional dispositions through coursework and field experiences that form the foundation of numeracy instruction. In alignment with the principles of high-quality professional learning described previously, preparation must be content-focused, active, collaborative, and sustained. Candidates should experience mathematics as learners through problem solving, reasoning, and discourse so they build the confidence, flexibility, and identity needed to model numeracy for students.

Teacher preparation must do more than teach candidates about mathematics. It must build their numeracy as learners. Pre-service educators need opportunities to strengthen their own reasoning, build confidence through identity-affirming practices, and experience mathematics in the same active ways they will later facilitate for their students. By positioning pre-service teachers as learners of mathematics, programs help them develop the habits of mind, flexibility, and confidence that will transfer directly to their classroom students.

Knowledge and Skills Anchored in Standards

During preparation, candidates must build upon their extant content knowledge and learn and practice pedagogical skills that anchor effective numeracy instruction:

- Mastery of content domains: Pre-service educators develop deep understanding across numbers and operations, algebra, geometry, measurement, statistics, probability, and functions. This knowledge supports cross-domain connections, coherent instructional sequences, and anticipation of common misconceptions.[20]
- Flexibility with multiple approaches: Candidates solve problems using multiple strategies including estimation, manipulative modeling, and technology. They learn how to foster learning environments that engage students in mathematics.[21]
- Clear mathematical communication: Candidates practice explaining concepts, procedures, and reasoning to varied audiences, consistent with applicable national, state, and locally-identified standards. Strong communication equips them to create discourse-rich classrooms where students articulate reasoning and connect mathematics to authentic contexts.
- Proficiency with the Standards for Mathematical Practice: Candidates engage as learners and teachers with all eight Standards for Mathematical Practice. This focus ensures they promote genuine mathematical thinking rather than rote memorization.[22]
- Understanding of developmental progressions: Candidates study how mathematical ideas develop across grades. They connect prior learning to new concepts and to plan responsive interventions at key transition points through instructional planning, delivery and reflection with their cooperating teachers, peers, and college/university faculty.

Building numeracy for students requires more than knowing standards. Teacher candidates must also understand the application of standards. For example, how fractions connect to cooking, rates to shopping, or measurement to design projects. The understanding of application facilitates the building of connections of mathematical ideas across disciplines such as science, social science, and career and technical education, empowering students to apply understanding in multiple contexts. In addition, teacher candidates must understand how early concepts, such as base-ten place value, underlie operations with decimals and later support algebraic thinking.

Professional Dispositions

Strong knowledge must be paired with professional dispositions that shape practice. Programs must cultivate:

- Positive mathematics identity and belief in all learners: Candidates project confidence, model persistence, and affirm student potential through joyful and identity-affirming instruction.[23]
- Commitment to inclusive practice through UDL: Candidates plan multiple ways to engage, represent ideas, and express understanding so ELs, students with disabilities, and other historically marginalized groups access rigorous mathematics.[24]
- Continuous improvement and collaboration: Candidates reflect, analyze evidence of learning (student data), and seek feedback. These habits position new teachers to thrive in future professional learning and contribute to collective growth.

Numeracy in Pre-Service Teachers

For teacher candidates, just like students in the classroom, numeracy is the ability to flexibly reason, apply mathematics in authentic contexts, and engage with the SMPs as active learners. Preparation programs should build numeracy in candidates by designing coursework and experiences that mirror high-quality K–12 instruction: content-rich, active, collaborative, and aligned directly to the Illinois Learning Standards and the Standards for Mathematical Practices.

Numeracy is also moving beyond completing math problems correctly. It includes:

- Confidence and flexibility in reasoning: Explaining why a method works, comparing strategies, and moving between representations (numbers, visuals, symbolic expressions).
- Application to authentic contexts: Interpreting mathematical ideas in real-world settings, such as budgeting, science labs, or analyzing data in the news.
- Active use of mathematical practices: Engaging in SMPs as learners; persevering (SMP 1), reasoning (SMP 2), constructing arguments (SMP 3), and modeling (SMP 4).

- Awareness of developmental progressions: Understanding how their own learning connects to the trajectories their future students will follow.
- Positive identity as mathematical thinkers: Seeing themselves as capable, persistent learners who can project confidence and affirm students' mathematical potential.[25]

Expected Outcomes at Program Completion

By the conclusion of preparation, candidates should be able to design and facilitate instruction that develops students' numeracy in alignment with the Illinois Learning Standards. They should be able to:

- Design and implement numeracy-rich instruction: Plan lessons that connect content to real-world and cross-disciplinary contexts, incorporate multiple representations, and select tasks that promote reasoning, problem solving, and discourse.
- Elicit and extend student thinking: Use questioning strategies to surface reasoning, recognize developmental stages of numeracy, and analyze student work to address misconceptions.[26]
- Build fluency through understanding: Facilitate number sense routines, math talks, fluency games, visual models, and intentional practice to develop foundational and derived addition and multiplication basic math facts to strengthen fluency grounded in reasoning.[27]
- Support equitable, inclusive numeracy development: Affirm all students as mathematical thinkers through culturally and linguistically responsive pedagogy.
- Engage in reflective, standards-driven practice: Align lessons with the Illinois Learning Standards, reflect on evidence of student learning, and collaborate with colleagues in PLCs.

Coursework and Field Work Integration

Preparation programs provide a balanced structure that integrates mathematics content and pedagogical approaches practiced through field work. High-quality preparation mirrors high-quality professional learning, which is content-rich, active, collaborative, and sustained.

- Mathematics content courses: Elementary candidates should complete at least 15 credit hours, with substantially more for middle and secondary, as recommended in *The Mathematical Education of Teachers II*.[28] Content courses emphasize reasoning, application, and connections among domains. They model how adults use mathematics in authentic contexts and how children think about and learn these concepts.

- Mathematics methods courses: Candidates should complete six to nine credit hours focused on pedagogy, consistent with AMTE Standards.[29] Methods courses emphasize active learning: Candidates engage in number talks, problem strings, and inquiry-based routines to experience mathematics as learners. Faculty model effective practices and provide opportunities for candidates to design lessons that elicit and extend student thinking.
- Foundational education courses: Programs connect development, psychology, curriculum, assessment, and diversity to numeracy. Research highlights the value of integrating content with foundational knowledge to strengthen instructional decisions.[30]
- Field work and integration: Candidates participate in a variety of field work including but not limited to residencies, tutoring, and co-teaching. Each setting should provide structured cycles of planning, teaching, feedback, and reflection.[31] Integrative experiences such as seminars or final residencies require candidates to synthesize content, pedagogy, and equity practices into a coherent vision of numeracy instruction and demonstrate readiness for licensure.

Program Organization

Educator preparation programs should be organized to include a balanced mix of mathematics content courses (minimum 15 credit hours for elementary; substantially more for middle/secondary), mathematics methods/pedagogy courses (six to nine credit hours), foundational education courses, and extensive opportunities to practice through fieldwork. Programs must align all coursework and fieldwork to the Illinois Learning Standards for Mathematics, SMPs, and Illinois endorsement requirements. Strong programs also include collaborations with local schools and actively work to recruit and support teacher candidates of color, strengthening Illinois' educator pipeline.

Examples of Evidence-Based Practices in Teacher Preparation

Practice	When Appropriate	Alignment to Professional Standards	Non-Example
Build fluency through reasoning strategies (i.e., number talks, math	During coursework that connects mathematical content to	Illinois Learning Standards for Mathematics (SMP 2, SMP 3, SMP 4);	Instructor lectures about number talks without engaging candidates in the

routines, math games, visual models, and problem strings in methods courses).[32]	pedagogy, allow candidates to experience mathematics as learners.	AMTE Standards (2017)	routine or analysis of student thinking.
Structured rehearsal cycles in clinical placements (plan–teach–reflect–revise).[33]	In clinical practice courses or residencies where candidates practice instructional moves and receive mentor feedback.	23 Ill. Adm. Code 25.99 (Clinical Experiences); Professional Standards for All Teachers, CRTL Standards, 23 Ill. Adm. Code 24.140	Candidate only observes or teaches a lesson once, without feedback or opportunities to revise practice.
Analysis protocols for student work aligned to Illinois Learning Standards.[34]	When building assessment literacy and practicing instructional decision making based on real or sample student artifacts.	Illinois Learning Standards for Mathematics; ILTS Frameworks (Middle Grades 202, Secondary 208); NCATE/CAEP Assessment Standards	Candidate reviews answer keys but does not analyze student misconceptions or reasoning.
Case studies applying CRTL and UDL.[35]	In foundations or methods courses where candidates design responses to common instructional challenges with equity at the center.	Universal Design for Learning Guidelines (CAST, 2018); CRTL Standards, 23 Ill. Adm. Code 24.140	Candidate studies generic lesson plans with no consideration for multilingual learners, students with disabilities, or cultural responsiveness.

Inservice Educators

Illinois educators need sustained professional learning across their careers to refine practice, deepen mathematical knowledge, and respond to the needs of students. In-service professional learning extends and strengthens the foundation established during educator preparation programs. It must reflect the qualities of high-quality professional learning outlined earlier: content-focused, active, collaborative, modeled, reflective, and sustained over time.[36] Districts, schools, and Regional Offices of Education (ROEs) carry shared responsibility for ensuring that educators have equitable access to these opportunities.

In-service learning addresses areas that preparation programs cannot, such as long-term growth in mathematical knowledge for teaching, leadership development, equity-driven instructional design, and advanced assessment literacy. Effective systems recognize that professional growth develops across a career continuum and requires coherent structures that support collaboration, coaching, mentoring, and leadership opportunities.

Core Components

These components reflect the qualities of high-quality professional learning (content-focused, active, collaborative, modeled, reflective, and sustained) and describe the structures Illinois districts, schools, and ROEs can use to support ongoing teacher growth.

Institutes and Intensives

Districts and ROEs can provide summer institutes, intersession programs, or multi-day workshops that strengthen teacher understanding of mathematics content and pedagogy. Institutes must actively engage teachers as learners of mathematics, using the same tools and routines — such as problem strings, discourse structures, and modeling — that they will later implement with students.[37]

Professional Learning Communities (PLCs)

Schools can structure PLCs where teachers collaborate to analyze student work, unpack standards, and design coherent progressions of learning. High-functioning PLCs go beyond pacing and logistics; they include co-planning, co-teaching, peer observation, and structured reflection to build shared expertise.[38]

Coaching and Specialists

Instructional coaching is a critical lever for changing practice. Math specialists and coaches provide modeling, co-planning, feedback, and cycles of observation. Coaches not only model effective strategies but also support teachers as they rehearse and refine these approaches in their own classrooms. Coaching must align to the Illinois Learning Standards and expectations for effective teaching.[39]

Mentoring and Induction

Novice teachers require structured support that bridges preparation to independent practice. Induction programs should emphasize lesson design, numeracy-rich routines, and equity-focused practices. Mentors help new teachers build confidence in discourse practices, student reasoning routines, and analysis of misconceptions.[40]

Online and Cross-District Networks

Virtual platforms extend access to teachers in rural or under-resourced districts. Online professional learning communities provide video-based lesson analysis, discussion forums, and statewide collaboration.[41] These networks allow teachers to share practice, reflect together, and build professional community.

Partnerships

Districts and ROEs should collaborate with universities, nonprofits, and professional associations to expand capacity. Partnerships bring in additional expertise, models of lesson study, and leadership development opportunities. Illinois examples include the Metro Chicago Mathematics Initiative and the Big Shoulders Fund.

Sustained Engagement and Evaluation

Professional learning must spiral across time, not occur as isolated events. Teachers need multiple opportunities to revisit ideas, apply them in practice, and refine through cycles of feedback and reflection. Districts and ROEs should monitor participation, collect teacher input, and evaluate impact using classroom observations, reflections, and student outcomes.[43]

Prioritizing Equity

Equity must guide in-service professional learning. Districts should prioritize access for educators in Tier 1 schools and those serving historically marginalized populations. Professional learning should integrate culturally responsive pedagogy, UDL strategies, and tools for supporting multilingual learners and students with disabilities.44

Examples of Evidence-Based Practices for Inservice Teachers

Practice	**When Appropriate**	**Alignment to Professional Standards**	**Non-Example**
Lesson study cycles with co-planning, observation, and refinement (Lewis et al., 2020)	When schools or districts want to build collective expertise through collaborative lesson design and reflection.	Illinois Learning Standards for Mathematics; Standards for Mathematical Practice (SMP 1, SMP 3, SMP 6); Professional Standards for All Teachers, Standard 2: Content Area and Pedagogical Knowledge (23 Ill. Adm. Code 24.140)	Teachers meet to discuss a lesson but do not observe or analyze student learning, leaving no actionable insights.
Long-term coaching cycles that include modeling and reflection (Gibbons & Cobb, 2017)	When districts aim to provide individualized, sustained support for teacher growth.	Professional Standards for All Teachers, Standard 8: Collaborative Relationships (23 Ill. Adm. Code 24.140); AMTE Standards (2017); Learning Forward Standards (2022)	A single coaching visit with generic feedback that does not include modeling, observation, or reflection.
PLC protocols for analyzing student work and misconceptions (IES/WWC, 2021)	During grade-level or department meetings where teachers collaboratively examine evidence of student thinking.	Illinois Learning Standards for Mathematics; ILTS Framework performance indicators (Middle Grades 202, Secondary 208); 23 Ill. Adm. Code 26.200	PLCs that focus only on pacing guides or logistics without analyzing student reasoning or addressing misconceptions.
Cross-district online communities with video libraries and discussion forums (Hanlon, 2024)	When educators in rural or under-resourced schools need access to professional	Learning Forward Standards (2022); Professional Standards for All	Teachers access a video library but receive no structure for reflection,

	learning networks beyond their district.	Teachers (23 Ill. Adm. Code 24.140)	collaboration, or feedback.
Equity-centered workshops using culturally relevant contexts and UDL (Gay, 2018; CAST, 2018)	When schools and ROEs focus professional learning on serving multilingual learners, students with disabilities, and historically marginalized groups.	CRTL Standards (23 Ill. Adm. Code 24.140); UDL Guidelines (CAST, 2018)	One-off workshops that cover equity in theory but do not connect to lesson design, practice, or student work.
Mentoring structures that provide feedback on numeracy routines and discourse (IES, 2016)	When districts design induction programs to support novice teachers in their first years.	Professional Standards for All Teachers, Standard 8: Collaborative Relationships (23 Ill. Adm. Code 24.140); AMTE Standards (2017)	Assigning a mentor without structured time, focus on numeracy, or observation/feedback cycles.

School and District Leaders

To support student learning of numeracy and teachers' evidence-based mathematics instruction, school and district leaders must act as instructional leaders. It is not enough for leaders to understand general, subject-neutral principles of learning and instruction. Leaders also need sophisticated visions of ambitious and equitable mathematics instruction so they can support teachers in developing such practices.[45]

When leaders cultivate their own understanding of high-quality mathematics instruction, they create the conditions for teachers and students to thrive. Leaders should engage in mathematics professional learning alongside educators, not only to strengthen their knowledge of evidence-based instructional strategies, but also to signal the value of collaborative learning at every level of a system.[46] Leaders can also deepen their understanding by engaging in classroom observations, or "math walks," with coaches and teacher leaders, using structured "Look For" tools to focus on evidence of student reasoning, teacher questioning, and equitable participation.[47]

Ambitious and equitable mathematics instruction requires leaders to:

- Develop a vision of high-quality numeracy in partnership with educational leaders, including teachers, community members, and students. Promote instruction that aligns to the Illinois Learning Standards, the Standards for Mathematical Practice, and evidence-based practices. Make sure that this vision is shared and explicit among teachers.
- Engage in observation and feedback cycles that emphasize teacher growth, reflection, and analysis of student thinking outside and apart from formal evauations.[48]
- Create and sustain collaborative structures, such as PLCs, vertical teams, and data teams, where teachers analyze student work, examine progressions, and plan instruction together.[49]
- Prioritize equity in professional learning, ensuring that teachers have access to resources, coaching, and collaborative time to meet the needs of all learners.[50]

Specific Learnings for Leaders

Leaders need explicit opportunities to learn *how* to recognize, support, and sustain ambitious and equitable numeracy instruction.

What to Look for in Classrooms

a. Evidence of student reasoning, not just correct answers.
b. Use of multiple representations (manipulatives, visuals, symbols, and real-world contexts).
c. Discourse structures that promote equitable participation.
d. Connections to developmental progressions of content standards and the Standards for Mathematical Practice.

How to Provide Feedback

e. Use observation tools that are formative, non-evaluative, and tied to instructional practices.
f. Focus feedback on student learning evidence rather than teacher compliance.
g. Highlight strengths while identifying 1–2 specific, actionable areas for growth.

h. Engage in reflective dialogue, asking teachers to analyze student thinking and consider instructional moves.

What Productive Collaborative Structures Look Like

i. PLCs: Teachers gather to co-plan, analyze student work, and reflect on instruction using shared protocols.
j. Vertical Teams: Educators across grade levels examine math content progressions to strengthen coherence in numeracy.
k. Data Teams: Teachers use multiple data sources (summative and formative) to inform instruction, focusing on growth, not deficit.
l. Leaders provide the time, resources, and facilitation to ensure these structures remain teacher-driven and student-centered, and that professional learning is sustained, ongoing, and iterative.

Resources and Tools for Leaders

Focus Area	Resource/Tool	Purpose/Use
Classroom Observation	Assessing Quality of Mathematics Teacher Candidates	Guides leaders in observing mathematical discourse, reasoning, and equitable participation.
Non-Evaluative Feedback	*Learning-Focused Feedback Protocol* [51]	Helps leaders structure post-observation conversations that prioritize student learning evidence and teacher reflection.
PLCs and Collaboration	*Learning by Doing*; *Achieve the Core Coherence Map* [52]	Supports leaders in structuring productive PLCs that focus on progressions and coherence across grades.
Equity and Access	*CRTL Standards* [53]; *UDL Guidelines* [54]	Anchors leaders professional learning in equity and accessibility practices.

Supportive Teacher Collaborative Planning	*5 Practices for Orchestrating Productive Mathematics Discussions* [55]	Supports leaders in structuring collaborative spaces for teachers to plan for student-centered, problem-based math instruction.
Leadership Development	*How Principals Affect Students and Schools* [56]	Provides evidence-based guidance on how leadership practices influence teaching and learning.

The Professional Learning Continuum

The table below illustrates how each stage contributes distinct, yet interconnected, responsibilities that, together, sustain ambitious and equitable numeracy instruction.

The Continuum of Professional Learning

Educator Preparation Programs (EPPs)	District Leadership	Building Leadership
Align coursework and clinical experiences with Illinois endorsement standards (23 Ill. Adm. Code 20, 21, 26, 27) and ILTS frameworks.	Provide professional learning that extends preparation through institutes, PLCs, coaching, and mentoring.	Participate in mathematics-focused professional learning alongside teachers to model shared commitment and signal the importance of numeracy.
Ensure candidates master core content domains: number and operations, algebra, geometry, measurement, statistics, probability, and functions.	Strengthen teacher content knowledge in applied contexts, including interdisciplinary connections to science, CTE, and social sciences.	Develop and communicate a clear vision of ambitious, equitable mathematics instruction aligned with the Illinois Learning Standards and SMPs.
Introduce evidence-based practices, such as number talks, problem strings, and analysis of student work.	Refine and extend these practices through lesson study, coaching cycles, and induction programs.	Support teacher implementation of these practices through classroom math walks,

		“Look For” tools, and non-evaluative feedback.
Cultivate dispositions that affirm equity and inclusivity.	Embed CRTL and UDL strategies into ongoing professional learning.	Prioritize equity in resource allocation and ensure that Tier 1 schools and historically marginalized student populations receive targeted support.
Provide clinical practice where candidates rehearse teaching, receive feedback, and analyze student learning.	Offer induction programs and mentoring that reinforce effective practices and provide feedback loops for novice teachers.	Guarantee teachers have protected time and resources for PLCs, vertical teams, and data teams to analyze student work and plan progressions.
Require integrative experiences, such as capstones, seminars, or portfolios that demonstrate readiness by connecting content, pedagogy, and equity.	Evaluate professional learning by collecting teacher feedback, monitoring classroom practice, and analyzing student outcomes.	Use data from observations, PLCs, and professional learning participation to guide continuous improvement at the school and district levels.

End Notes

1. Darling-Hammond, Linda, Maria E. Hyler, and Madelyn Gardner. 2017. *Effective Teacher Professional Development*. Palo Alto, CA.
2. National Research Council. *Adding It Up: Helping Children Learn Mathematics*. Washington, DC: National Academies Press, 2001.
   RAND Corporation. *Algebra and Coherence: Research Report*. Santa Monica, CA: RAND Corporation, 2022.
3. Learning Forward. *Standards for Professional Learning*. Learning Forward, 2022. https://standards.learningforward.org/standards-for-professional-learning/
4. Wallace Foundation. *How Principals Affect Students and Schools: A Systematic Synthesis of Two Decades of Research.* New York: Wallace Foundation, 2021.
5. Learning Forward. *Standards for Professional Learning*. Learning Forward, 2022. https://standards.learningforward.org/standards-for-professional-learning/

Lynch, Kathleen, et al. “Investing in What It Takes to Move from Good to Great.” *Phi Delta Kappan* 106, no. 8 (2025): 8–14.

6. Ball, Deborah Loewenberg, Mark Hoover Thames, and Geoffrey Phelps. “Content Knowledge for Teaching: What Makes It Special?” *Journal of Teacher Education* 59, no. 5 (2008): 389–407. https://journals.sagepub.com/doi/10.1177/0022487108324554
7. Hill, Heather C., Brian Rowan, and Deborah Loewenberg Ball. “Effects of Teachers’ Mathematical Knowledge for Teaching on Student Achievement.” *American Educational Research Journal* 42, no. 2 (2005): 371–406.
8. Boaler, Jo. *Mathematical Mindsets: Unleashing Students’ Potential through Creative Math, Inspiring Messages and Innovative Teaching.* San Francisco: Jossey-Bass, 2016.
9. Baroody, Arthur J. *Why Children Have Difficulties Mastering the Basic Number Combinations and How to Help Them.* Teaching Children Mathematics 13, no. 1 (2006): 22–31.

Bay-Williams, Jennifer, and John SanGiovanni. *Figuring Out Fluency in Mathematics Teaching and Learning, Grades K–8.* Alexandria, VA: ASCD, 2021.

Bay-Williams, Jennifer, and Gina Kling. *Math Fact Fluency: 60+ Games and Assessment Tools to Support Learning and Retention.* Alexandria, VA: ASCD, 2019.

Neil et al.

10. Parrish, Sherry. *Number Talks: Helping Children Build Mental Math and Computation Strategies, Grades K–5.* Sausalito, CA: Math Solutions, 2010.

Harris, Doug. *Value-Added Measures in Education: What Every Educator Needs to Know.* Cambridge, MA: Harvard Education Press, 2011, repr. 2014.

11. *High-Leverage Mathematics Instructional Practices: A Guide for Educators.* Oakland, CA: CORE Learning, 2022.
National Center on Intensive Intervention (NCII). *Mathematics Intervention Tools Chart.* Washington, DC: NCII, 2024.
12. Carpenter, Thomas P., Elizabeth Fennema, Megan Loef Franke, Linda Levi, and Susan Empson. *Children’s Mathematics: Cognitively Guided Instruction.* 2nd ed. Portsmouth, NH: Heinemann, 2015.

"Early Numeracy as a Cornerstone of Long-Term Academic Success." *EdSurge,* March 3, 2025.

13. Institute of Education Sciences (IES). *Improving Mathematical Problem Solving in Grades 4 Through 8*. Washington, DC: U.S. Department of Education, 2021.
14. National Research Council. *Adding It Up: Helping Children Learn Mathematics*. Washington, DC: National Academies Press, 2001.

    Boaler, Jo. *Mathematical Mindsets: Unleashing Students' Potential through Creative Math, Inspiring Messages and Innovative Teaching.* San Francisco: Jossey-Bass, 2016.

15. Bill & Melinda Gates Foundation. *Why Math, Why Now*. Seattle, WA: Gates Foundation, 2022.

    RAND Corporation. *Algebra and Coherence: Research Report*. Santa Monica, CA: RAND Corporation, 2022.

16. Association of Mathematics Teacher Educators. *Standards for Preparing Teachers of Mathematics.* Raleigh, NC: AMTE, 2017. https://amte.net/standards
17. Institute of Education Sciences, What Works Clearinghouse. *What Works Clearinghouse Procedures and Standards Handbook, Version 5.0*. Washington, DC: U.S. Department of Education, 2023. https://ies.ed.gov/ncee/wwc/Handbooks
18. Association of Mathematics Teacher Educators. *Standards for Preparing Teachers of Mathematics.* Raleigh, NC: AMTE, 2017. https://amte.net/standards

    Conference Board of the Mathematical Sciences. *The Mathematical Education of Teachers II*. Providence, RI, and Washington, DC: American Mathematical Society and Mathematical Association of America, 2012.

19. Learning Policy Institute. *Conditions for Teaching and Learning: Mathematics Pathways*. Palo Alto, CA: Learning Policy Institute, 2023.
20. Hill, Heather C., Brian Rowan, and Deborah Loewenberg Ball. "Effects of Teachers' Mathematical Knowledge for Teaching on Student Achievement." *American Educational Research Journal* 42, no. 2 (2005): 371–406.
21. Illinois Administrative Code. *Title 23: Education and Cultural Resources, Part 26: Standards for Endorsements in Early Childhood, Elementary, Middle Grades, Secondary, Special, and Administrative Education. Section 26.200.* Springfield, IL: Illinois Secretary of State, Joint Committee on Administrative Rules. https://www.ilga.gov/commission/jcar/admincode/023/02300026sections.html

22. National Research Council. *Adding It Up: Helping Children Learn Mathematics*. Washington, DC: National Academies Press, 2001.
23. Boaler, Jo. *Mathematical Mindsets: Unleashing Students' Potential through Creative Math, Inspiring Messages and Innovative Teaching.* San Francisco: Jossey-Bass, 2016.

    Gay, Geneva. *Culturally Responsive Teaching: Theory, Research, and Practice.* 3rd ed. New York: Teachers College Press, 2018.

24. CAST. *Universal Design for Learning Guidelines, Version 2.2*. Wakefield, MA: CAST, 2018.
25. Boaler, Jo. *Mathematical Mindsets: Unleashing Students' Potential through Creative Math, Inspiring Messages and Innovative Teaching.* San Francisco: Jossey-Bass, 2016.
26. Institute of Education Sciences (IES). *Improving Mathematical Problem Solving in Grades 4 Through 8*. Washington, DC: U.S. Department of Education, 2021.
27. Bay-Williams, Jennifer, and John SanGiovanni. *Figuring Out Fluency in Mathematics Teaching and Learning, Grades K–8.* Alexandria, VA: ASCD, 2021.

    Carpenter, Thomas P., Elizabeth Fennema, Megan Loef Franke, Linda Levi, and Susan Empson. *Children's Mathematics: Cognitively Guided Instruction.* 2nd ed. Portsmouth, NH: Heinemann, 2015.

28. Conference Board of the Mathematical Sciences. *The Mathematical Education of Teachers II*. Providence, RI, and Washington, DC: American Mathematical Society and Mathematical Association of America, 2012.
29. Association of Mathematics Teacher Educators. *Standards for Preparing Teachers of Mathematics.* Raleigh, NC: AMTE, 2017. https://amte.net/standards
30. Lynch, Kathleen, et al. "Investing in What It Takes to Move from Good to Great." *Phi Delta Kappan* 106, no. 8 (2025).
31. National Center on Intensive Intervention (NCII). *Mathematics Intervention Tools Chart.* Washington, DC: NCII, 2024.
32. Carpenter, Thomas P., Elizabeth Fennema, Megan Loef Franke, Linda Levi, and Susan Empson. *Children's Mathematics: Cognitively Guided Instruction.* 2nd ed. Portsmouth, NH: Heinemann, 2015.

    Bay-Williams, Jennifer, and John SanGiovanni. *Figuring Out Fluency in Mathematics Teaching and Learning, Grades K–8.* Alexandria, VA: ASCD, 2021.

33. Lynch, Kathleen, et al. “Investing in What It Takes to Move from Good to Great.” *Phi Delta Kappan* 106, no. 8 (2025).

National Center on Intensive Intervention (NCII). *Mathematics Intervention Tools Chart*. Washington, DC: NCII, 2024.

34. Institute of Education Sciences (IES). *Improving Mathematical Problem Solving in Grades 4 Through 8*. Washington, DC: U.S. Department of Education, 2021.
35. Gay, Geneva. *Culturally Responsive Teaching: Theory, Research, and Practice.* 3rd ed. New York: Teachers College Press, 2018.

CAST. *Universal Design for Learning Guidelines, Version 2.2*. Wakefield, MA: CAST, 2018.

36. Darling-Hammond, Linda, Maria E. Hyler, and Madelyn Gardner. 2017. *Effective Teacher Professional Development*. Palo Alto, CA: Learning Policy Institute.

Learning Policy Institute. *Conditions for Teaching and Learning: Mathematics Pathways*. Palo Alto, CA: Learning Policy Institute, 2023.

37. Lynch, Kathleen, et al. “Investing in What It Takes to Move from Good to Great.” *Phi Delta Kappan* 106, no. 8 (2025).
38. DuFour, Richard, Rebecca DuFour, Robert Eaker, and Thomas Many. *Learning by Doing: A Handbook for Professional Learning Communities at Work.* 3rd ed. Bloomington, IN: Solution Tree Press, 2016.
39. Gibbons, Lynsey K., and Paul Cobb. 2017. “Focusing on Teacher Learning Opportunities to Identify Potentially Productive Coaching Activities.” *Journal of Teacher Education* 68 (4): 411–25.
40. Institute of Education Sciences. *Providing Feedback to Teachers: A Research-Based Guide*. Washington, DC: U.S. Department of Education, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Northeast & Islands, 2017. https://files.eric.ed.gov/fulltext/ED578873.pdf
41. Institute of Education Sciences (IES). *Teacher Induction Programs That Keep New Teachers Teaching and Improving*. Washington, DC: U.S. Department of Education, 2016.
42. Durr, Tyler, Jacob Kampmann, Paul Hales, and Luke Browning**.** “Lessons Learned from Online PLCs of Rural STEM Teachers.” *The Rural Educator* 41, no. 1 (2020): 20–26. https://scholarsjunction.msstate.edu/ruraleducator/vol41/iss1/3
Salazar, Dora, Zenaida Aguirre-Muñoz, Kendra Fox, and Lupe Nuanez-Lucas. “On-

Line Professional Learning Communities: Increasing Teacher Learning and Productivity in Isolated Rural Communities." *Journal of Systemics, Cybernetics and Informatics* 8, no. 1 (2010): 66–70. https://www.iiisci.org/journal/pdv/sci/pdfs/GE220YX.pdf

43. Learning Forward. *Standards for Professional Learning*. Learning Forward, 2022. https://standards.learningforward.org/standards-for-professional-learning/
44. Gay, Geneva. *Culturally Responsive Teaching: Theory, Research, and Practice.* 3rd ed. New York: Teachers College Press, 2018.

    CAST. *Universal Design for Learning Guidelines, Version 2.2*. Wakefield, MA: CAST, 2018.

45. Ball, Deborah Loewenberg, and Hyman Bass. 2003. "Toward a Practice-Based Theory of Mathematical Knowledge for Teaching." In *Research Companion to the Principles and Standards for School Mathematics*, edited by Jeremy Kilpatrick, W. Gary Martin, and Deborah Schifter, 13–44. Reston, VA: National Council of Teachers of Mathematics.

    Wallace Foundation. *How Principals Affect Students and Schools: A Systematic Synthesis of Two Decades of Research.* New York: Wallace Foundation, 2021.

46. Darling-Hammond, Linda, Maria E. Hyler, and Madelyn Gardner. *Effective Teacher Professional Development*. Palo Alto, CA: Learning Policy Institute, 2017. https://learningpolicyinstitute.org/product/effective-teacher-professional-development-report
47. Wahlstrom, Kyla L., Karen Seashore Louis, Kenneth Leithwood, and Stephen E. Anderson. 2010. *Learning from Leadership: Investigating the Links to Improved Student Learning*. New York: The Wallace Foundation. https://www.wallacefoundation.org/knowledge-center/pages/investigating-the-links-to-improved-student-learning.aspx
48. Wahlstrom, Kyla L., Karen Seashore Louis, Kenneth Leithwood, and Stephen E. Anderson. 2010. *Learning from Leadership: Investigating the Links to Improved Student Learning*. New York: The Wallace Foundation. https://www.wallacefoundation.org/knowledge-center/pages/investigating-the-links-to-improved-student-learning.aspx
49. DuFour, Richard, Rebecca DuFour, Robert Eaker, and Thomas Many. *Learning by Doing: A Handbook for Professional Learning Communities at Work.* 3rd ed. Bloomington, IN: Solution Tree Press, 2016.

50. Gay, Geneva. *Culturally Responsive Teaching: Theory, Research, and Practice.* 3rd ed. New York: Teachers College Press, 2018.
CAST. *Universal Design for Learning Guidelines, Version 2.2*. Wakefield, MA: CAST, 2018.
51. Garet, Michael S., Andrew J. Wayne, Susan Brown, Jordan Rickles, Min Sun, and David Manzeske. *The Impact of Providing Performance Feedback to Teachers and Principals* (NCEE 2018-4001). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education, 2017. https://ies.ed.gov/ncee/pubs/20184001/
52. DuFour, Richard, Rebecca DuFour, Robert Eaker, and Thomas Many. *Learning by Doing: A Handbook for Professional Learning Communities at Work.* 3rd ed. Bloomington, IN: Solution Tree Press, 2016.
53. Illinois State Board of Education**.** *Standards for All Illinois Teachers.* 23 Ill. Adm. Code 24.140. Springfield, IL: Illinois Secretary of State, Illinois Administrative Code. https://www.ilga.gov/commission/jcar/admincode/023/02300024sections.html
54. CAST. *Universal Design for Learning Guidelines, Version 2.2*. Wakefield, MA: CAST, 2018.
55. Smith, Margaret, and Mary Kay Stein. *5 Practices for Orchestrating Productive Mathematics Discussions.* 2nd ed. Reston, VA: NCTM, 2018.
56. Wallace Foundation. *How Principals Affect Students and Schools: A Systematic Synthesis of Two Decades of Research.* New York: Wallace Foundation, 2021.

Framework for Effective Leadership, Systems of Support, and Implementation Considerations

Introduction

Mathematics provides a critical foundation that empowers students to develop a strong sense of self and imagine the possibilities for their future. This section provides a roadmap for school and district leaders to develop and implement a local plan to improve numeracy teaching and learning.

Leaders play a critical role in ensuring that students thrive in mathematics.[1] Improving numeracy instruction across a school or district requires thoughtful leaders who set a clear vision, invest in teacher growth, and engage their communities as partners in the work. By supporting evidence-based teaching practices and teacher professional learning, leaders help students and their teachers build strong mathematical identities and develop fluency through engaging in meaningful collaborative learning. [2]

Overview: Adopting a Plan and Vision

You possess invaluable knowledge about your community: your students' interests and assets, your staff's expertise and capacity, your families' priorities and concerns, and your district's history with curriculum and instruction. This local knowledge is essential for translating state-level guidance into meaningful action that will improve numeracy outcomes for your students.

Effective numeracy transformation begins with leaders working with educational partners to set a clear, equity-centered vision that prioritizes inclusive, interdisciplinary, and evidence-based mathematics instruction. Enacting an equity-centered vision includes assessing systemic barriers, engaging diverse educational partners, and ensuring all students can access rigorous, culturally relevant math learning. Equity must not be added after a vision is established; it must shape the work from the start. Leaders must assess their own biases and the systemic barriers in their districts, then intentionally design plans that broaden access and opportunity.

This state-level guide is a starting point. While it provides important principles and frameworks for improving numeracy instruction, it is not a comprehensive roadmap to better student outcomes. The Illinois Comprehensive Numeracy Plan offers evidence-based guidance that should inform the work of educators, administrators, and policymakers across Illinois, but real improvement happens when district and school leaders take these principles and thoughtfully adapt them to their unique local contexts.

Work collaboratively with your school community to develop a numeracy vision that honors the principles outlined in the Illinois Comprehensive Numeracy Plan while reflecting your distinctive local context. Examine how the recommendations in the plan align with what you learn during a landscape assessment and stakeholder listening process. Where do you see natural connections between state priorities and local needs? Which principles resonate most strongly with your teacher leaders and community?

Your local vision should be ambitious, yet achievable, specific enough to guide daily decision making but flexible enough to evolve based on ongoing learning and experience. Build in regular opportunities for reflection and course correction based on teacher feedback and student outcomes. Your plan should be a living document that adapts as your community learns and grows together, staying true to both the principles in the Illinois Comprehensive Numeracy Plan and the evolving needs of your local context.

Before You Begin: Connections Between Identity and Numeracy

Every Illinois student is capable of learning math and using that learning as an important aspect of their developing selfhood. Every Illinois educator can be a champion for math, inclusive of providing families with many forms of information about their child's math achievement to support at-home learning. And every school leader can work to support numeracy teaching and learning in their districts and schools through setting and pursuing a vision of excellent numeracy teaching and learning.

Educators, students, and families take in messages about numeracy and math constantly. Some of these are explicit, and others more subtle, but over time these messages contribute to individual's self-conception when it comes to math.[3] Think about your own math identity: Are you a "math person?" Have you ever told someone you weren't, or made a joke to cover up a miscalculation? If so, could you imagine saying "I'm just not a person who can read?" Some reflection can help to unpack where these messages and selfconceptions come from, but as a leader, it's important to understand the varied kinds of inputs your community might be receiving.

Many of these inputs are specifically tied to identity, and it's important for leaders to recognize these messages. For instance, one common false western stereotype is that boys are "better at math" than girls.[4] The number of world-class female mathematicians, like Katherine Johnson who hand-calculated orbital trajectories for successful Mercury and Apollo missions, prove this stereotype false, but that doesn't keep it from doing damage if not countered. This stereotype could impact both female students, who may put less effort into math if they think it's something they can't succeed in, and teachers, who may treat students differently if they hold this belief.

Parents and guardians must consider their own math identity as well as potential misconceptions about math and the effect on students' math development. A strong numeracy vision is anchored in fairness, inclusivity, and justice, ensuring that all students can see themselves as capable mathematicians. Effective school leaders recognize that a student's ability to learn mathematics is not limited by race, gender, or other characteristics. Leaders who center equity provide adequate access to resources for all students, focus on student achievement at all learning levels, support student identity development as mathematicians, and nurture student agency.[5]

Schools can partner with families to foster the belief that every child is an emerging mathematician. By addressing misconceptions, school and district leaders encourage a shift in mathematical mindset. This shift includes cultivating a positive math identity, normalizing productive struggle as an essential part of learning, and affirming the importance of mathematical proficiency for success in today's world. Through family engagement, schools create a shared understanding that math is everywhere, everyone is a math person, and math discussions can happen organically.[6]

Leaders must actively work to recognize harmful stereotypes in themselves and those they lead by actively promoting counter-messages. At their most basic level, stereotypes are associations between two ideas, and one way to counter them is called "counter-stereotypic imaging," or intentionally pairing ideas that counter stereotypes.[7] The previous reference to Katherine Johnson is an example of combating a stereotype with counterexamples. Prominently displaying and routinely referencing counterexamples that mirror your community and/or the larger discipline is essential.

Leaders can set the right example by communicating these counter-messages regularly and explicitly to school staff. The words and actions of leaders should tell all teachers that they can do math, that all students possess the capacity to learn math, and, in doing so, position numeracy as a skill to be learned, not a talent that's innate.

Part 1: Getting Started

Before launching any initiative, successful leaders must take time to understand their unique context and build a foundation for sustainable change. This initial phase sets the tone for whether teachers will view the initiative as another burden, or as meaningful support for their professional growth and an opportunity to take leadership in implementing.

Building a Core Numeracy Team

Initiatives that depend on a single leader often struggle to win buy-in or produce sustainable change. Changes in district or building leadership are inevitable, so it's critical that key practices, initiatives, and instructional shifts are not solely person dependent. To make a meaningful and sustainable difference for students, establish a core numeracy team to guide your district's work. This team should include representatives from different roles, grade levels, experience ranges, and school buildings (if applicable) to ensure diverse perspectives and broad communication networks. This may include securing board-level approval or awareness of core practices and priorities. When board members understand and endorse the "why" behind numeracy initiatives, they can serve as consistent advocates — even as administrative roles change.

Provide the team with dedicated time to meet, learn together, and guide implementation across the district. Consider compensating teacher leaders for their additional responsibilities through stipends, additional planning time, or professional learning opportunities they value.

Empower this team to make decisions or offer meaningful input on instruction, resource allocation, and professional learning experiences for their colleagues. When teacher leaders have genuine authority to shape the initiative, they become authentic advocates for change, rather than messengers of administrative mandates.

Consider a community numeracy team that can provide outside feedback and guidance as the initiative evolves. While they may not have the instructional expertise necessary to guide classroom shifts, they'll be able to share how families and students are responding to change, how numeracy instruction aligns with the needs of the community, and how outside resources can support students both in and beyond the classroom. For some districts, a combined community and teacher team is a good fit; for others, separate teams might be better.

Consider faculty and staff of community colleges and universities as potential consultants and partners in the work to effectively support implementation of current research and ongoing professional learning related to building numeracy knowledge. They can also be effective partners in crafting professional learning opportunities with other members of your instructional leadership team.

Assessing Your Current Landscape

Leaders must begin by analyzing the local landscape with honesty. Acknowledge reality: Most Illinois students are not meeting expectations for math.[8] Needs assessments must go beyond surface-level data and probe for a more comprehensive picture of numeracy instruction in your schools: review existing curriculum materials, observe classroom practices, and examine professional learning offerings from recent years. Dig into what is and isn't working. Without honest reflection, plans won't have the urgency or clarity needed for real change.

Begin building support for change by including others in the process. These individuals might include others in different leadership roles that you see as potential allies, respected teachers who could be potential allies in leading change, or even students and families. When they're part of the process of reflection, they will be more likely to see what you see and understand the need for change. If you're not strong in numeracy content knowledge, invite one or more partners who are to join you in this process as another way to deepen your own understanding as a leader.

Examine data through an equity lens, disaggregating outcomes by student demographics and identifying which groups are not being served well by current instruction. Seek to learn more about the experiences of those groups and include them intentionally in your efforts to hear from the school community. As you move forward, ensure this engagement isn't a one-time event, and your core numeracy team includes diverse voices that reflect your student population.

Look for bright spots where strong numeracy instruction is already happening. These examples will become models for scaling successful practices and help in identifying educators who might help co-lead an initiative. Even teachers who struggle with numeracy probably have some instructional strengths and being able to recognize these will help them feel more invested and able to improve. Don't just focus on gaps and flaws, or you risk demoralizing the educators you need to energize.

Listening to Educational Partners

Create multiple, low-pressure opportunities for all educational partners to share their perspectives and recommendations before making any programmatic decisions. Be sure to include families so they can share what they observe or experience about students' confidence and engagement with mathematics at home. Host informal coffee conversations, conduct brief surveys, and arrange focus groups or town halls that recognize families' time constraints. When engaging with families, consider integrating these activities into existing events or routines, such as open house, parent teacher conferences, etc., rather than adding to already-full schedules. Be very intentional about proactively reaching out to marginalized communities in a way that actively invites and values their participation; they are more likely than most to feel disconnected from school and to be impacted by negative stereotypes about their math ability.

Listen to teachers and support staff. Because faculty and staff are essential to successful implementation, it's important to survey your teachers about their confidence levels, successes, resource needs, and current challenges with numeracy instruction. Ask specific questions about what's working well and what obstacles they face daily and suggestions for how to address to help you understand not just academic outcomes, but the instructional capacity and morale of your teaching staff. Pay particular attention to what teachers say about their current workload and capacity for change, and the student stories they must share. Again, try to make this a part of existing meetings and school-directed work time instead of adding to teachers' full plates.

Listen to all students and not just those who excel at math. Ultimately, the success of a numeracy initiative will be judged by whether it impacts student outcomes, so it's essential to understand the student experience before working to change it. Try following students around for a day to learn what their school experience is like, sitting down with them at lunch or other downtimes to hear their thoughts, or convening a student cabinet. Be cautious of engaging only with those students who are eager to engage. Though it's important to continue to provide great experiences for students who are already connected to school, it's just as important to talk to and learn about those students who are disengaged. Listen to their struggles and try to identify what led them to disconnect so you can address their needs.

Making the Case for Change

David Chrislip writes, “If you bring the appropriate people together in constructive ways with good information, they will create authentic visions and strategies for addressing the shared concerns of the organization or community.”[9]

Lead with your shared values about student success rather than deficits in current practice when presenting the need for numeracy improvement. Use the data you've gathered and, to the extent appropriate, identify from where the data/recommendation that grounds the value to tell a story about opportunity rather than failure, emphasizing how enhanced numeracy instruction will benefit all students. While it is important to illustrate the areas where students aren’t being served, pairing those opportunity gaps with a vision for the future is especially helpful.

Connect numeracy improvements to broader values and goals your school community already embraces, such as college and career readiness, critical thinking, or problem-solving skills. Help teachers see how stronger numeracy instruction aligns with their existing commitments to student growth rather than competing with other priorities. Show families how change will benefit their students and expand their opportunities.

Consider how to show the need for change through personal stories rather than data. Personal stories should be used to effectively advocate for change. These stories connect individual's lived experience to wider issues and offer a compelling vision for a different future.[10] While data can signal the need for change in math instruction, educational partners are more likely to support it when they understand current classroom struggles and can clearly see the benefits of what’s ahead.

Part 2: Numeracy Team Perspectives

Leaders don’t need to be math experts, but to lead this undertaking it is helpful for leaders to build their own numeracy understanding to support instructional shifts, provide meaningful feedback, and recognize high-quality teaching across grade levels. Leaders are also responsible for building and supporting the teams that will engage in this work. Sustainable change requires collaborative leadership structures, including core numeracy teams, teacher leaders, community partners, and more who co-design and guide implementation, with different groups contributing distinct but interconnected roles.

In this section, we explain distributed leadership as a way of sharing leadership responsibilities among different members of the school community, such as teachers, staff, and families.[11] We present a framework to help illustrate how this approach can be put into practice to support collaboration and shared decision-making. These roles won't look the same in large urban or unit districts and small rural schools, but as a local leader who knows your community, we know that you'll understand how to adapt these roles to suit your local context.

Numeracy Team

Forming a team to lead numeracy transformation ensures the involvement and buy-in of multiple stakeholder groups, brings multiple perspectives to the table to plan and adjust the work, and builds momentum so the change effort can continue even if one or more leaders move on to new roles or shift attention to other priorities. A numeracy team should be representative of the district or school undergoing numeracy transformation. It's important that it includes voices representing as many impacted groups as possible and includes leaders with enough decision-making authority to ensure the team's ideas make it to implementation. A numeracy team might include the following members, each with their own roles and needs:

A district-level decision maker: In a small district, the superintendent might serve on this team directly. In a larger district, this might be an assistant superintendent of teaching and learning, a district curriculum director, or another similar position. District leaders provide system-level vision and must have opportunities to come together to share successes and identify solutions to persistent "pain points."[12] They are responsible for aligning resources, policy, and professional learning with numeracy goals, and need the support of content experts who can ensure that the effort will be implemented in a way that positively impacts students. It's also essential that someone at the district level remains in the loop to clearly articulate the rationale behind instructional decisions and ongoing work. Whether this is a curriculum leader, instructional coach, or veteran administrator, continuity of knowledge ensures you won't lose momentum or abandon good practice simply because of leadership turnover.

School-level leaders: Principals may serve directly in smaller schools or appoint an assistant principal or other administrator as their representative. It is important that a school leader is empowered to make decisions about instruction, professional learning, and resource allocation. School leaders guide teachers through instructionally focused conversations about mathematics lessons.[13] Rather than being positioned as content experts, it is important that principals be informed observers able to support individual teachers.[14] School leaders need district leaders to support them with resources and trust them to lead teachers in instructional changes. Many also need the support of content experts who can help them develop sufficient understanding to lead productive conversations around numeracy instruction.

Teacher leaders: Teacher leaders might serve in formal or informal leadership roles. Formal teacher leadership roles might include math department chair, instructional coach, or grade-level lead. Teacher leaders are well positioned to lead instructional conversations that require both content-specific knowledge and a clear vision for what counts as high-quality mathematics teaching.[15] Their knowledge and skills should be harnessed as part of a broader leadership structure, an approach consistent with the Illinois Comprehensive Literacy Plan as well. Teacher leaders need school and district leaders to empower them in a distributed leadership framework to maximize their impact, and they need opportunities to use their content expertise to shape the work. Mathematics coaches and facilitators need to consider the classroom and community contexts and challenges their colleagues experience, and they should consider questions related to social justice concerns when working with teachers and students. These questions include, but are not limited to: "Are students' experiences in school more than just a result of these coaching interactions? What harms to students might arise from the instruction I observe? Am I supporting teachers to respond to students' humanity with care?"[16] Even so, teachers with a strong numeracy background who do not hold formal leadership roles should also be considered, as they may possess experience and be able to lead colleagues to implementation just as effectively.

Teachers with numeracy expertise: While not everyone on the numeracy team needs to be a content expert, it's important that the team include some content experts. This role may overlap with others but it's important to name this role and ensure math content knowledge is represented. Content experts need leaders to intentionally make space for their input, and see it included in planning, to feel invested and be comfortable with change. Mathematics teachers can provide support to ensure evidence-based practices are implemented to ensure all learners are able to access high-quality numeracy instruction. However, mathematics teachers may also need support in shifting from a "right answer" orientation to fostering a fail-to-learn, problem-solving mindset.[17]

Teachers who teach math: Note that this category includes both teachers who exclusively teach math, and others who teach math as part of their role (such as elementary generalists and special educators). It's wise to include some teachers who are involved in teaching math but do not consider themselves content area experts; they'll be charged with implementing instructional changes and will be able to surface concerns and questions that might not occur to numeracy experts. Many of these teachers do not see themselves as “math people,” and may need support in developing skills in numeracy instruction as well as reassurance that they are able to succeed. Yet, the perspectives of these educators are often a ground upon which a vision and its underlying values is developed. This stakeholder group is often easy to overlook and if that occurs, even inadvertently, the implementation of the change is likely not to be as robust or successful as envisioned.

Teachers who serve special populations: A subset of the above, teachers who serve specific populations like special educators, interventionists, EL teachers, and others need to be considered as vital members of the team. They have knowledge and expertise in Tier 2/Tier 3 interventions as well as intensive math interventions to ensure the plan meets all students’ needs. They need access to training, materials, and curriculum that are provided to general education teachers. They may also need access across multiple grade levels to ensure students are accessing general education curriculum. Also provide these teachers with opportunities to collaborate with general education peers.

Paraprofessionals: As practitioners who often work directly with struggling students, paraprofessionals will broaden the team’s perspective and provide insight into the ways the system can better meet their needs. In addition, including paraprofessionals on the numeracy team will increase buy-in and understanding so that these educators can actively support the work. Paraprofessionals can sometimes be seen only as implementers, tasked only with carrying out instructions from licensed teachers, but including them in planning will help address both student needs and their need to feel connection to and agency in the work.[18] Paraprofessionals require professional learning to integrate numeracy into individualized supports and ensure accessibility for learners with disabilities.

Family and community leaders: Educational partners also hold influence in supporting numeracy transformation.[19] They can extend learning beyond classrooms, encourage mathematical conversations in everyday contexts, and contribute to building a culture where mathematics is seen as valuable and accessible. In addition, they can help clarify purpose by providing connections to and applications for classroom learning. Members of this group care deeply about student success but can feel frustrated or helpless when students struggle because they feel or are treated as “outside the system.” Families need access to models to show how to implement learning at home. They might need support when numeracy work gets challenging or is different from their school experiences.[20] Including them in planning and broadly providing opportunities or resources for them to support their children as they learn mathematics will help build community support, as well as extend math learning time beyond the classroom to support students at home.

Community college and university personnel: Members of education and/or mathematics departments in higher education institutions are invested in the work of schools and care deeply about supporting the learning of teachers and students. They can provide ongoing resources for implementing effective instructional and assessment strategies grounded in research, and they can support the work of your instructional leadership team as they develop professional learning opportunities with teachers. They can also be effective partners in building numeracy knowledge, considering issues of equity, building pathways of sustainability, and developing systems of effective assessment.[21] This sort of partnership, where teachers, instructional leaders, numeracy experts from early childhood through grade 12, and universities come together to support numeracy learning in districts, can strengthen the field by supporting the learning of both in-service and pre-service teachers.

Students: Consider including a range of student perspectives on the team, as all the work around numeracy is ultimately designed to serve them. Numeracy needs to be made relevant to students' current and future experiences.[22] Students need support to see themselves as mathematicians and need to have successful classroom experiences to make this happen.

Getting Buy-In from Teachers

Teacher buy-in develops through involvement in decision making, not through persuasive presentations. Teacher leaders should be among the first to hear your case for change. Once you've helped them understand the problems and opportunities facing the school community, invite teacher leaders to help design the improvement process itself, from selecting professional learning approaches to determining implementation timelines. When teachers are agents in shaping their professional growth, they're more likely to engage authentically in the work, and less likely to undermine a change effort. [23]

Demonstrate your commitment by investing in meaningful supports such as substitute teacher coverage for collaboration time, instructional coaching, access to quality materials, and recognition for teacher leadership. Demonstrate that this initiative comes with genuine resources, not just additional expectations.

Creating Opportunities for Cross-District Collaborations

Every school and district possesses unique strengths, and often expertise that would benefit one school can be found in another on the other side of your district, or just across district lines. Community and business connections often cut across school district lines as well, so broader regional stakeholder groups might be more efficient than each district working independently. Cross-district collaboration allows teacher leaders to learn from peers in different contexts while reducing the burden on any single district to develop all resources and expertise internally.[24]

Specific opportunities for collaboration include arranging visits to schools with strong numeracy programs. Also make available for others to visit programming at your district or schools, encouraging teachers to engage with professional organizations like the Illinois Council of Teachers of Mathematics, forming or participating in regional or statewide numeracy networks, and engaging support from your Regional Office of Education. Collaboration within local context for leveraging learning from partner districts should be prioritized.

Part 3: Leading Change (Implementation and Continual Learning)

In leading a change effort, leaders must communicate clearly with families, teachers, and students; counter harmful math stereotypes; and foster positive math identities by supporting authentic engagement and real-world connections. Ongoing monitoring, data-informed decision making, and adaptive planning are essential to ensure continuous improvement and equitable outcomes in numeracy across schools and districts.

Recognizing that implementation detail, like professional learning and instructional approach, is included in earlier sections of the Illinois Comprehensive Numeracy Plan, the subsequent focus is on leading a change effort and providing logistical support.

Making Time for Math/Balancing Competing Priorities

One of a leader's critical roles during the process of change is clarifying priorities so everyone knows where their attention should focus. If math is a priority, communicate that, ensure it receives time, resources, and focus – and give explicit permission to deprioritize other things. If a school has too many priorities, it effectively has no priorities, and leaders must help schools and districts clarify focus and establish achievable goals.

Schools are increasingly facing challenges that impact leaders' ability to effectively administer multiple initiatives, including teacher shortages, funding, and changing public support.[25] School leaders can address these issues by streamlining priorities and focusing on a few high-leverage practices that all teachers can consistently implement. Leaders can provide just-in-time professional learning that is practical and directly connected to daily classroom needs, while also supplying easy-to-use instructional resources to reduce teacher workload. In environments with staffing shortages, they may need to creatively leverage support staff, interventionists, or technology-based tools to ensure students still receive Tier 2 and Tier 3 interventions.

As leaders establish systems for regularly monitoring student progress in mathematics, even when resources are limited, they increase opportunities to prevent struggling learners from falling further behind, while also identifying advanced learners who need enrichment. By communicating a clear, manageable vision, protecting time for instruction, and fostering collaboration among the available staff, leaders can maintain a focus on numeracy growth even amid significant challenges.

Knowledge Building

Leaders need working knowledge of the mathematics content they supervise. They don't need to be experts, but they do need to understand what quality instruction looks like, how fluency and conceptual understanding develop, and how to support teachers in closing gaps.

- As needed, school and district leaders must increase their own numeracy capacity to guide others effectively. Many leaders do not identify as "math people," but they can still grow their confidence and competence in mathematics. Building this knowledge allows leaders to recognize rigorous mathematics instruction, support problem-solving approaches, and engage in content-specific conversations with teachers.[26] Developing leaders' mathematical understanding models the growth mindset we hope to foster in students and teachers alike.
- Sustained, ongoing professional learning and coaching are essential. Professional learning cannot be episodic. It must build content knowledge *and* instructional capacity over time. Without embedded coaching and practice-based feedback, the likelihood of better outcomes for students and teacher growth is compromised. District leaders need to provide support and opportunities for teachers to put into practice what they have learned through professional learning with diverse learners.[27] In other words, they need to support the targeted implementation of instructional strategies learned through professional learning sessions.

Principal preparation programs should provide "purposeful, programmatic opportunities" that prepare principals to be leaders in supporting effective instruction related to math and science content and be able to connect teachers with other instructional leaders who can promote their growth as mathematicians[28].

Leaders at both the district and school level should focus on increasing their understanding of numeracy concepts and recognize the role numeracy plays in interdisciplinary contexts. Leaders should know enough to plan for appropriate ongoing professional learning experiences for teachers,[29] to identify key numeracy skills and instructional shifts while observing teachers, and to recognize how to assess students on numeracy skills and knowledge.[30] Leaders also have the vantage point of multiple content areas, allowing them to see the cross-subject applications of numeracy and create opportunities for math teachers to collaborate with other content area educators to bring numeracy into a wide array of contexts.[31] To competently engage in these activities, leaders should be knowledgeable of numeracy standards across grade levels, learning goals that stem from these standards, and how these standards may be used in practice.

Providing a level of support that reinforces a larger narrative about the importance of numeracy throughout a student's schooling experience may be difficult for district and school leaders who do not have a background in mathematics education and may not identify as a "math person".[32] Therefore, we encourage leaders to begin by taking part in a professional learning series aimed at numeracy teaching and learning with their mathematics educators and engaging in professional learning communities with mathematics experts to sustain that learning in their buildings. These experiences should be coupled with opportunities for leaders to sit in on lesson studies and observe teachers with their mathematics instructional specialists or coaches, thereby allowing for a clear connection between learning and practice. An important component to each of these activities is to set aside time to reflect on observations and new learnings on their own and with mathematics instructional leaders. Mathematics experts at the school or district level may also create tools that can help to scaffold the observation and numeracy development processes, such as rubrics or actionable look-for tools. Ultimately, leaders do not need to be experts but should have a holistic understanding of numeracy and conditions that allow for high-quality instruction.

When leaders have a solid understanding of numeracy, it helps them to navigate the broader tensions in the field. One of the major debates in mathematics education is the balance between procedural fluency and conceptual understanding.[33] The National Council of Teachers of Mathematics has weighed in on this debate to stress the importance of both, namely that fluency cannot be achieved if the focus is solely on remembering facts and learning algorithms in isolation.[34] True fluency connects these facts and algorithms to concepts and encourages flexibility depending on the situation. Relatedly, there is an ongoing tension within the field between direct instruction versus more inquiry-oriented methods, such as problem-based instruction.[35] The former is more teacher-directed, whole group instruction and the latter is more student-centered, small group, and exploratory. With direct instruction, all students receive sequenced and uniform information to apply a concept or skill through a lecture format, whereas with inquiry-based instruction places emphasis on exploration, leading to multiple strategies used to solve rich problems.[36] Leaders need to be aware of how numeracy can be developed using each pedagogical approach and the benefits and challenges of employing each approach. Ultimately, leaders need to understand the principles of evidence-based mathematics instruction in order to ensure that professional learning and instructional practices align with what works for students, not just past practice or ideological preferences. In addition, leaders set the expectation of the type of instruction teachers enact in their classroom by choosing the curriculum, professional learning opportunities, and providing feedback on instruction. All the while, leaders must be cognizant of established curricular timelines versus teachers needing to adjust instructional pacing to meet student needs.[37] This requires leaders to have a working understanding of numeracy-related standards and key skills that need to be developed to support teachers in making instructional decisions that will impact students as they progress through their immediate grade level and beyond.

Leveraging Distributed Leadership

The role of principals and superintendents in distributive leadership is to share a vision, create buy-in, provide guardrails, and then create conditions where teacher leadership can flourish. Rather than directing every aspect of implementation, effective administrators focus on establishing policy frameworks, protecting time for collaboration, and ensuring that teacher leaders have genuine authority to make decisions and shape the process. This approach transforms administrators from directive managers into supportive partners who empower teachers to lead the instructional changes that will most directly impact student learning.

Superintendents and principals should engage in distributive leadership to make a numeracy effort achievable and sustainable. When principals and superintendents distribute leadership responsibilities and genuinely leverage teacher expertise, they create conditions for sustainable change that extends far beyond any single administrator's tenure.[38] Distributive leadership is particularly critical for numeracy initiatives because mathematical instruction is deeply technical work that requires ongoing, job-embedded support, and collaboration that emerges most naturally from teacher leadership networks. Local teacher leaders should be supported as math specialists and skilled coaches. They should be able to mentor colleagues in implementing instruction that supports students’ high-cognitive engagement. They should challenge mathematical classroom discourse around content and identity as mathematicians.

Teacher leaders understand the daily realities of implementing new instructional strategies within existing classroom constraints and can facilitate authentic professional learning that feels collaborative rather than evaluative. Their credibility with colleagues stems from shared experience rather than positional authority, making them uniquely positioned to sustain momentum through the informal conversations, peer coaching, and spontaneous problem solving that happens naturally among teaching colleagues.

School and district leaders still need to be in the room. Empowering teacher leaders doesn't mean walking away. If you expect educators to prioritize math instruction, you should show it by being visibly and actively invested in the learning. That means attending development sessions even if you are a superintendent in a small district, an assistant superintendent, or a building principal. Evaluation of instruction is part of the work, but modeling commitment is more powerful. When leaders walk out of those rooms, they unintentionally send the message that this work is for teachers (or for some teachers), not for everyone.

Planning for Staffing Structures

- How might staffing shift to promote evidence-based numeracy instruction?
- Importance of instructional coaching and embedded PD to practice change.
- Differences in large districts vs. rural districts.
- How staffing shifts might impact instructional schedules (and how to do that well).
- Formalizing the role of a mathematical facilitator in a building nurtures systems of support related to mathematics (like the roles of literacy coordinators and/or coaches, which are more common in schools). Systems of support related to mathematics need to nurture interactions among staff members, helping them to become the instructional leaders who facilitate students' growth as mathematicians.[39] These mathematics coaches/facilitators need to consider the classroom/community contexts and challenges their teachers experience, and they should consider questions related to social justice concerns when working with teachers and students.[40] These questions include, but are not limited to: "Are students' experiences in school enhanced because of these coaching interactions? What harms to students might arise from the instruction I observe? Am I supporting teachers to respond to students' humanity with care?"[41]

Funding

It is also important to consider alternatives for funding early in the planning process in the event federal funding sources are no longer available. Community-based agencies and their potential funding resources should be included in the planning process. District leaders should consider how existing funds may be reallocated to implement the necessary components of the initiative.

Sustainability

Once districts have identified their equity-centered vision for numeracy, the execution of the numeracy plan requires sustainability measures.

As mentioned, distributed leadership is key to making improvements sustainable by ensuring the work is owned by multiple educational partners who can continue the work. Systemic changes to organizational routines can also make continuous learning part of the organizational culture. Learning structures like “Plan-Do-Study-Act" (PDSA) cycles can serve as a mechanism for continuous improvement. As you implement changes, look for opportunities to create systems that lead to change rather than pushing for specific changes, where possible.

Likewise, higher education institutions can be critical partners in building, modeling, and sustaining systems of support for area districts. Leveraging these partnerships with public, private, and community college institutions should be a consideration for district leadership and should be part of the early planning process for sustainability.

Sustainability at the local level relies on school leaders creating a clear vision for numeracy instruction that emphasizes both equity and high expectations, while also ensuring teachers have the tools and time to meet diverse student needs. Leaders must help teachers manage the balance between whole-class numeracy instruction and the need for targeted support. Providing ongoing professional learning around differentiation, allocating time for collaborative data analysis, and coordinating resources for both intervention and enrichment help teachers feel supported rather than overwhelmed, thereby creating a system that sustains numeracy instruction beyond the beginning numeracy initiative. Sustainability requires leaders to create systems that protect instructional time, reducing unnecessary initiatives that compete with core teaching, and fostering a culture of shared responsibility for every student's success.[42]

Assessment

Effective numeracy implementation requires ongoing monitoring and a commitment to continuous improvement. Leaders, teachers, and teams must use multiple sources of data to assess and create a comprehensive picture of the extent to which the plan is achieving its intended goals. In doing so, the planning team can identify challenges and make informed decisions that strengthen teaching and learning.

At the classroom level, actionable data are essential for day-to-day decision making. Formative assessments, student work samples, and evidence of mathematical discourse offer teachers insight into what students know and where they struggle. This information allows educators to adjust instruction in real time, provide targeted support, and celebrate evidence of growth.[43]

Data collection, both quantitative and qualitative, should be meaningful and tied to a direct purpose for instruction. Classroom assessment that drives informed decision making includes formative, summative, and diagnostic data.[44] The data from classroom assessments contributes to the improvement cycle and provides an opportunity to give feedback to students and families on student growth.

Institutional partners can be pivotal here as well, by offering frameworks to analyze data, such as student work, assessment results, and other systems-level structures.

Sharing data with families strengthens family engagement with their students' numeracy skills. Educating families on math assessments, data, and related terminology helps them understand their child's performance and engage more meaningfully in discussions about student progress.

Continuous improvement is not a one-time event, but an ongoing process that could be organized into learning cycles that take advantage of this data. By embedding PDSA cycles of reflection, data use, and responsive action, schools and districts can sustain progress and ensure that all students have access to high-quality mathematics learning.

An important component of centering equity is to ensure that there is a system in place for assessing equitable practices. School leaders should identify the elements of instructional strategies that can ensure equitable practices and target those elements as part of the regular assessment process.[45] How teachers nurture their students' critical thinking, how they help students connect mathematical principles to the students' personal knowledge of the world, how they center students' cultural and lived experiences, and how they nurture student agency are all pedagogies that need to be part of a system of assessment when centering equity.[46]

Analyze Results: Using Data for Decision Making

Using Data for Decision Making

Districts and schools should cultivate a culture of data-informed decision making. Leaders and teachers must possess the skills to analyze data effectively. Data literacy ensures equitable decision making for all students. Leaders need to understand data available from a variety of levels, such as state and local, and guide staff to make informed instructional decisions from numerous data points.

Assessments used in data collection should be aligned with the district's vision and goals for student learning in numeracy.[47]

Schools and districts must utilize systems of data collection and analysis to understand student progress. Collecting data across multiple measures (qualitative and quantitative) ensures a more comprehensive understanding of students' learning and allows educators to make informed decisions about curriculum resources, planning, instructional strategies, interventions, and enrichment.

Data collection should be meaningful and tied to a direct purpose for instruction. Classroom assessment that drives informed decision making includes formative, summative, and diagnostic data. The data from classroom assessments contributes to the improvement cycle and provides an opportunity to give feedback to students and families on student growth.

Sharing data with families strengthens family engagement with their students' numeracy skills. Educating families on math assessments, data, and related terminology helps them understand their child's performance and engage more meaningfully in discussions about student progress.

Family Engagement

Communication and community/family engagement are critical during the change process.

Fostering family engagement with numeracy is essential for developing students' math identity. Decades of research shows that family engagement in school is one of the strongest predictors of childhood success.[48] Furthermore, parental attitudes towards math impact students' sense of self as a learner and the creation of strong math habits of mind.[49]

Family engagement is based on the shared responsibility of the parents, school, and community in the development of students. All educational partners must understand that the learning environment extends beyond the physical school to the students' home and world around them. Cultivating family engagement is a continuous, ongoing process that is a responsibility of the school. This process includes meaningful interaction and communication between families and schools with the purpose of supporting student learning. The foundation of this partnership is the shared goal of providing environments in school and at home that develop an appreciation for and understanding of math.[50]

Schools can structure partnerships by learning about the local community/families. Include:

- Gaining information about cultural lens of the community
- Developing cultural competencies for school staff
- Building on strengths of families and community members
- Ensuring shared understanding of roles with engagement

Adjust the Plan

No plan is perfect. You'll discover new needs along the way; better to pivot than stick to a bad plan. Overcommunicate change.

Leaders and educators must also make deliberate decision points about when to stay the course and when to adapt. Change in mathematics outcomes takes time; results are not always immediate. At times, perseverance is necessary to allow strategies and professional learning to take root. In other cases, data may indicate the need to change direction, scale back ineffective practices, or introduce new approaches. When adjustments are made, clear and transparent communication with educational partners is critical to maintaining trust and momentum.[51]

At the school and district levels, leaders should examine broad data trends, such as student achievement, growth, and participation. This data provides a picture of systemic progress and helps determine whether initiatives are producing equitable outcomes across student groups. [52]

End Notes

1. Downton, Ann, Jill Cheeseman, and Anne Roche. "Goals and Challenges of School Mathematics Leaders." *Mathematics Teacher Education and Development* 24, no. 1 (2022): 96–115. Mathematics Education Research Group of Australasia. https://files.eric.ed.gov/fulltext/EJ1361395.pdf
2. Sample McMeeking, Laura B., Rebecca Orsi, and R. Brian Cobb. 2012. "Effects of a Teacher Professional Development Program on the Mathematics Achievement of Middle School Students." *Journal of Research on Educational Effectiveness* 5 (2):159-181. https://www.researchgate.net/profile/Laura-Sample-Mcmeeking-2/publication/259749636_Effects_of_a_Teacher_Professional_Development_Program_on_the_Mathematics_Achievement_of_Middle_School_Students/links/5bf4701992851c6b27cd172a/Effects-of-a-Teacher-Professional-Development-Program-on-the-Mathematics-Achievement-of-Middle-School-Students.pdf?_sg%5B0%5D=started_experiment_milestone&origin=journalDetail
3. John, Jennifer E., Kristin D. Vierra, and Rachael D. Robnett. 2022. "'I Have Cried in Almost All of My Math Classes': Relations between Math Self-Concept, Math Attitudes, and Past Experiences with Mathematics." *Contemporary Educational Psychology* 68:

102094.https://www.sciencedirect.com/science/article/abs/pii/S0361476X22000534

4. John, Jennifer E., Kristin D. Vierra, and Rachael D. Robnett. 2022. "'I Have Cried in Almost All of My Math Classes': Relations between Math Self-Concept, Math Attitudes, and Past Experiences with Mathematics." *Contemporary Educational Psychology* 68: 102094. https://www.sciencedirect.com/science/article/abs/pii/S0361476X22000534
5. Gutiérrez, Rochelle. "Context Matters: How Should We Conceptualize Equity in Mathematics Education?" In *Equity in Discourse for Mathematics Education: Theories, Practices, and Policies,* edited by Beth Herbel-Eisenmann, Jeff Choppin, and David Wagner, 17–33. Mathematics Education Library. Springer, 2012.

   Nguyen, P. "School Mathematics as Context: Examining Discourses about the Subject in District Policymaking." *Educational Studies in Mathematics* 117 (2024): 485–509.

6. Sharma, S. *Math Mind: The Simple Path to Loving Math.* New York: Penguin Random House, 2024.
7. Finnegan, Emily, Jane Oakhill, and Alan Garnham. "Counter-Stereotypical Pictures as a Strategy for Overcoming Spontaneous Gender Stereotypes." *Frontiers in Psychology* 6 (2015): 1291. https://doi.org/10.3389/fpsyg.2015.01291
8. Illinois State Board of Education. *Illinois Report Card: IAR Trends – State of Illinois.* Accessed October 3, 2025. https://www.illinoisreportcard.com/State.aspx?source=trends&source2=iar&Stateid=IL
9. Flower, Joe. *Collaboration: What Makes It Work.* Denver: National Civic League Press, 1995.
10. Sloan, Tena. 2023. "The Power of Storytelling in Organizational Change: Inspiring Behavioral Shifts through Relatable Narratives." *Medium*, February 28, 2023. https://medium.com/organizational-leadership-human-intelligence/the-power-of-storytelling-in-organizational-change-inspiring-behavioral-shifts-through-relatable-1f0c6e0bd334
11. Firestone, William A., and Beth A. Martinez. 2007. "Districts, Teacher Leaders, and Distributed Leadership: Changing Instructional Practice." *Leadership and Policy in Schools* 6 (1): 3–35.https://www.researchgate.net/profile/William-Firestone/publication/240511191_Districts_Teacher_Leaders_and_Distributed_Leadership_Changing_Instructional_Practice/links/00b49537d29fe095e1000000/Distri

cts-Teacher-Leaders-and-Distributed-Leadership-Changing-Instructional-Practice.pdf

12. Perry, R., et al. *Principals as Instructional Leaders in Mathematics.* Palo Alto, CA: Learning Policy Institute, 2020.
13. Grissom, Jason A., Anna J. Egalite, and Constance A. Lindsay. *How Principals Affect Students and Schools: A Systematic Synthesis of Two Decades of Research.* New York: Wallace Foundation, 2021.
14. Cunningham, K., V. Rangel, C. Lochmiller, and M. Farmer. "Developing Educational Leadership in Mathematics and Science: Insights from Teaching and Learning Faculty." *Journal of Research on Leadership in Education* 19, no. 2 (2024): 241–65.
15. Schoen, Robert C. "Principals' Content Knowledge of Mathematics and Its Relationship to Observations and Feedback." *Journal of Mathematics Teacher Education* 13, no. 4 (2010): 343–58.
16. Marshall, S., and P. Buenrostro. "What Makes Mathematics Teacher Coaching Effective? A Call for a Justice-Oriented Perspective." *Journal of Teacher Education* 72, no. 5 (2021): 594–606.
17. Dorland, AnneMarie**.** "Failing to Learn: Design Thinking and the Development of a Failure-Positive Mindset in the University Classroom." *Collected Essays on Learning and Teaching* 14, no. 1 (2023). https://doi.org/10.22329/celt.v14i1.7155
18. Urbani, Jacquelyn M., Pamela LePage, and Samantha Watson-Alvarado**.** "Building and Sustaining a Collaborative Educational Team: Teachers and Paraprofessionals." *Teaching Exceptional Children* 57, no. 1 (September/October 2024): 6–13. https://doi.org/10.1177/00400599241231215
19. Oostdam, Ron, and Edith Hooge. 2013. "Making the Difference with Active Parenting: Forming Educational Partnerships between Parents and Schools." *European Journal of Psychology of Education* 28 (2): 337–351. https://doi.org/10.1007/s10212-012-0117-6
20. Muir, Tracey**.** "Numeracy at Home: Involving Parents in Mathematics Education." *Australian Primary Mathematics Classroom* 16, no. 3 (2011): 30–35.https://www.nationalnumeracy.org.uk/sites/default/files/documents/numeracy_at_home/numeracy_at_home_involving_parents_in_maths_education.pdf
21. Schnittka, Christine, Elizabeth A. Parry, Lizette D. Day, Augusto Z. Macalalag Jr., Albert Padilla Jr., Malinda S. Zarske, and Patty Ann Quinones. "Best Practices in K–12/University Partnerships." Paper presented at the American Society for Engineering Education Annual Conference and Exposition, San Antonio, TX, June 2012. ASEE https://peer.asee.org/21018.pdf

Reed, Sherrie, Kathy Bracco, Michal Kurlaender, and Cassandra Merritt. *Innovating High School Math Through K–12 and Higher Education Partnerships.* Policy Analysis for California Education (PACE), February 2023. https://edpolicyinca.org/publications/innovating-high-school-math-courses-through-k12higher-education-partnership

22. Hurst, Chris. "Numeracy in Action: Students Connecting Mathematical Knowledge to a Range of Contexts." In Mathematics: Essential Research, Essential Practice, Volume 1, edited by Jane Watson and Kim Beswick, 440–449. Proceedings of the 30th Annual Conference of the Mathematics Education Research Group of Australasia. Hobart, TAS: MERGA, 2007 https://d1wqtxts1xzle7.cloudfront.net/85284320/ED503746-libre.pdf?1651419496=&response-content-disposition=inline%3B+filename%3DThe_Annual.pdf&Expires=1759426982&Signature=fn5JLgz~wJEBfuH17Zx7WtGFsPiZBtL-ZmzTyIVg84wySA3e-r5BFqucuWkYOEaa8u~YrjQOKGrJfQOoCRdFCNJvWAjOM51TWW93v0L~v3hhbMMESLIiRIqMdxqMMkSFDlHPGL31v0uRvBVXj18KiRESusG7SlrRfPSmHef51aO7SMtVQpR4MUOGlbHlKBl6jzFSoPJsd306xfT3LXJIaI-tb9eU9f8tA3DeDtZ-LeWOImEjlw9okkofc0Uw3DdYs5WfwmXRjp08YU3jBLL2amOcWHZJ7x6244oS5dRVE13nG6Ed9wQ8Md-YVCGJusm7syPquTu9QGjX86Dq0i8Wkw__&Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA#page=446
23. Nwisagbo, Ayodele Ebunolu, Catherine U. Osuji, and Telema Amachree. "Leading Changes in Education: Strategies for Managing Resistance and Building Buy-In." International Journal of Educational Management 1, no. 1 (January 2025): 387–402. Rivers State University, Nigeria. https://www.ijedm.com
24. Gersten, Russell, Ben Clarke, Nancy B. Nelson, and Madhavi Jayanthi. *Instructional Strategies for Improving Students' Learning in Mathematics (Practice Guide).* NCEE 2017-4024. Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education, 2017. https://files.eric.ed.gov/fulltext/ED578788.pdf
25. Nguyen, Dat Bao. "Distributed Leadership in Education: A Critical Literature Review." *Educational Management Administration & Leadership* 51, no. 5 (September 2023): 918–937. https://doi.org/10.1177/17411432221096238
26. Grissom, Jason A., Anna J. Egalite, and Constance A. Lindsay. *How Principals Affect Students and Schools: A Systematic Synthesis of Two Decades of Research.* New York: Wallace Foundation, 2021.

27. Cobb, Paul, Kara Jackson, Erin Henrick, and Thomas M. Smith. *Systems for Instructional Improvement: Creating Coherence from the Classroom to the District Office.* Cambridge, MA: Harvard Education Press, 2018.
28. Cunningham, Katie, Virginia Rangel, Chad Lochmiller, and Melissa Farmer. "Developing Educational Leadership in Mathematics and Science: Insights from Teaching and Learning Faculty." *Journal of Research on Leadership Education* 19, no. 2 (2024): 241–265. https://doi.org/10.1177/19427751221134567
29. Leithwood, Kenneth, Alma Harris, and David Hopkins. "Seven Strong Claims about Successful School Leadership." *School Leadership & Management* 28, no. 1 (2008): 27–42.
30. Perry, R., J. Neumayer DePiper, B. Tsinnajinnie, B. E. Jackson, and L. Thornley. "Numeracy Education for Adult Learners: A Scan of the Field and Principles for Course and Materials Design." *Adult Learning* 36, no. 2 (2024): 84–95.
31. Goos, Merrilyn, and Carmel O'Sullivan. "Numeracy Across the Curriculum." In *Oxford Research Encyclopedia of Education.* Oxford: Oxford University Press, 2022.
32. Perry, R., J. Neumayer DePiper, B. Tsinnajinnie, B. E. Jackson, and L. Thornley. "Numeracy Education for Adult Learners: A Scan of the Field and Principles for Course and Materials Design." *Adult Learning* 36, no. 2 (2024): 84–95.
33. Hiebert, James, and Douglas A. Grouws. "The Effects of Classroom Mathematics Teaching on Students' Learning." In *Second Handbook of Research on Mathematics Teaching and Learning,* edited by F. K. Lester, Jr., 371–404. Charlotte, NC: Information Age, 2009.
34. National Council of Teachers of Mathematics. *Procedural Fluency: Reasoning and Decision-Making, Not Rote Application of Procedures*. Reston, VA: NCTM, 2023.
35. De Jong, Ton, Ard W. Lazonder, Clark A. Chinn, Frank Fischer, Janice Gobert, Cindy E. Hmelo-Silver, Kenneth R. Koedinger, Joseph S. Krajcik, Eleni A. Kyza, and Marcia C. Linn. "Let's Talk Evidence – The Case for Combining Inquiry-Based and Direct Instruction." *Educational Research Review* 39 (2023): 100536.
36. De Jong, Ton, Ard W. Lazonder, Clark A. Chinn, Frank Fischer, Janice Gobert, Cindy E. Hmelo-Silver, Kenneth R. Koedinger, Joseph S. Krajcik, Eleni A. Kyza, and Marcia C. Linn. "Let's Talk Evidence – The Case for Combining Inquiry-Based and Direct Instruction." *Educational Research Review* 39 (2023): 100536.
37. Ball, Deborah Loewenberg, and TeachingWorks. "Brief 8: The Role of Leadership Supporting Evidence-Based P–12 Mathematics Teaching Practice." New York State Education Department, 2025.
38. Firestone, William A., and M. Cecilia Martinez. 2007. "Districts, Teacher Leaders, and Distributed Leadership: Changing Instructional Practice." *Leadership and Policy in Schools* 6, no. 1 (2007): 3-35. https://doi.org/10.1080/15700760601091234

39. Spillane, James P., and Megan Hopkins. “Organizing for Instruction in Education Systems and School Organizations: How the Subject Matters.” *Journal of Curriculum Studies* 45, no. 6 (2013): 721–47.
40. Marshall, S., and P. Buenrostro. “What Makes Mathematics Teacher Coaching Effective? A Call for a Justice-Oriented Perspective.” *Journal of Teacher Education* 72, no. 5 (2021): 594–606.
41. Marshall, S., and P. Buenrostro. “What Makes Mathematics Teacher Coaching Effective? A Call for a Justice-Oriented Perspective.” *Journal of Teacher Education* 72, no. 5 (2021): 602
42. Santos, Leonor, and Ana Paula Canavarro. “Instructional Leadership in Mathematics Education in Portugal: Perspectives of School Leaders.” *School Effectiveness and School Improvement* 32, no. 1 (2021): 20–39. https://doi.org/10.1080/09243453.2020.1767657
43. Grissom, Jason A., Anna J. Egalite, and Constance A. Lindsay. *How Principals Affect Students and Schools: A Systematic Synthesis of Two Decades of Research.* New York: Wallace Foundation, 2021.
44. Brookhart, Susan N. *Classroom Assessment Essentials.* Alexandria, VA: ASCD, 2024.
45. Cobb, Paul, Kara Jackson, Erin Henrick, and Thomas M. Smith. *Systems for Instructional Improvement: Creating Coherence from the Classroom to the District Office.* Cambridge, MA: Harvard Education Press, 2018.
46. Cunningham, K., V. Rangel, C. Lochmiller, and M. Farmer. “Developing Educational Leadership in Mathematics and Science: Insights from Teaching and Learning Faculty.” *Journal of Research on Leadership in Education* 19, no. 2 (2024): 241–65.

    Jackson, Krista, and Jonee Wilson. “Supporting African American Students’ Learning of Mathematics: A Problem of Practice.” *Urban Education* 47, no. 2 (2012): 354–98.

    Gutstein, Eric, Pauline Lipman, Patricio Hernandez, and Ruben de los Reyes. “Culturally Relevant Mathematics Teaching in a Mexican American Context.” *Journal for Research in Mathematics Education* 28 (1997): 709–37.

47. Cobb, Paul, Kara Jackson, Erin Henrick, and Thomas M. Smith. *Systems for Instructional Improvement: Creating Coherence from the Classroom to the District Office.* Cambridge, MA: Harvard Education Press, 2018.

    Rubel, Laurie H. “Equity-Directed Instructional Practices: Beyond the Dominant Perspective.” *Journal of Urban Mathematics Education* 10, no. 2 (2017): 66–105.

48. California Department of Education. *Family Engagement Framework: A Tool for California School Districts.* Sacramento: CDE, 2011.
49. Sharma, S. *Math Mind: The Simple Path to Loving Math.* New York: Penguin Random House, 2024.
50. Sharma, S. *Math Mind: The Simple Path to Loving Math.* New York: Penguin Random House, 2024.
51. Schoen, Robert C. "Principals' Content Knowledge of Mathematics and Its Relationship to Observations and Feedback." *Journal of Mathematics Teacher Education* 13, no. 4 (2010): 343–58.
52. Perry, R., et al. *Principals as Instructional Leaders in Mathematics.* Palo Alto, CA: Learning Policy Institute, 2020.