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New Mexico Math Framework

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New Mexico Math Framework 1.0

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Notes

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Introduction

The New Mexico Public Education Department partners with educators, communities, and families to ensure that ALL students are healthy, secure in their identity, and holistically prepared for college, career, and life. We are committed to proliferating New Mexico's economic development by providing STEM educators with equity-centered professional learning required to give K–12 students opportunities to pursue STEM college or career pathways.

Importance of Mathematics

Mathematics is the human activity of reasoning with number and shape, in concert with the logical and symbolic artifacts that people develop and apply in their mathematical activity. The National Council of Teachers of Mathematics (2018) outlines three primary purposes for learning mathematics PreK–12:

1. **To Expand Professional Opportunity**. Just as the ability to read and write was critical for workers when the early 20th-century economy shifted from agriculture to manufacturing, the ability to do mathematics is critical for workers in the 21st century as the economy has shifted from manufacturing to information technology. Workers with a robust understanding of mathematics are in demand by employers, and job growth in STEM (science, technology, engineering, and mathematics) fields is forecast to accelerate over the next decade.
2. **Understand and Critique the World**. A consequence of living in a technological society is the need to interpret and understand the mathematics behind our social, scientific, commercial, and political systems. Much of this mathematics appears in the way of statistics, tables, and graphs, but this need to understand and critique the world extends to the application of mathematical models, attention given to precision, bias in data collection, and the soundness of mathematical claims and arguments. Learners of mathematics should feel empowered to make sense of the world around them and to better participate as informed members of a democratic society.
3. **Experience Wonder, Joy, and Beauty**. Just as human forms and movement can be beautiful in dance, or sounds can make beautiful music, the patterns, shapes, and reasoning of mathematics can also be beautiful. On a personal level, mathematical problem solving can be an authentic act of individual creativity, while on a societal level, mathematics both informs and is informed by the culture of those who use and develop it, just as art or language is used and developed.

The learning of mathematics across PreK–12 is not only important for college, career, and life but also in the human endeavor to value the cultural, linguistic, social, and historical perspectives of mathematics. Broadening the purpose of mathematics should empower each and every student with a deep mathematical understanding and positive disposition toward mathematics to support mathematical interactions throughout life. Students must learn to use a mathematical lens to not only understand the world in all its facets (e.g. economic, ecological, social, cultural, linguistic, historical) but also question and critique the world using mathematical justification (NCTM, 2020).

Connecting the Standards for Mathematical Practice to the Standards for Mathematical Content

The Standards for Mathematical Practice describe ways in which developing student practitioners of the discipline of mathematics increasingly ought to engage with the subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle and high school years. Designers of curricula, assessments, and professional development all attend to the need to connect the mathematical practices to mathematical content in instruction.

The Standards for Mathematical Content are a balanced combination of understanding and procedures. Standards that include the word "understand" are often especially good opportunities to connect the practices to the content. Students who lack understanding of a topic may rely on procedures too heavily. Without a flexible base from which to work, they may be less likely to consider analogous problems, represent problems coherently, justify conclusions, apply the math to

practical situations, use technology mindfully to work with the mathematics, explain the mathematics accurately to other students, step back for an overview, or deviate from a known procedure to find a shortcut. In short, a lack of understanding effectively prevents a student from engaging in mathematical practices.

In this respect, those content standards which set an expectation of understanding are potential "points of intersection" between the Standards for Mathematical Content and the Standards for Mathematical Practice. These points of intersection are intended to be weighted toward central and generative concepts in the school mathematics curriculum that most merit the time, resources, innovative energies, and focus necessary to qualitatively improve the curriculum, universal instruction, assessment, professional learning, and student achievement in mathematics.

Purpose

The *New Mexico Math Framework* provides clear guidance on the critical components that are the foundation to build, implement and strengthen math instruction in New Mexico. It strategically responds to the inequities facing New Mexican students, leading to systemic changes that support ALL students. The *New Mexico Math Framework* serves as a tool, alongside the *New Mexico Literacy Framework* and the *New Mexico Instructional Scope*, to ensure equitable, culturally responsive learning occurs in New Mexico classrooms. This work is grounded in the PED's mission, vision and four strategic goals to promote equity, excellence and relevance in education statewide and directly align with PED's New Mexico State Plan for the Every Student Succeeds Act.

The *New Mexico Math Framework* will serve many different audiences, each of whom contributes to the shared mission of helping all students become powerful users of mathematics as envisioned in the NM CCSS. Primarily, this document is for all educators who have the most direct relationship with students around their developing proficiency in mathematics.

Through Lines

The New Mexico Math Framework is a response to learning inequities in mathematics learning. The framework emphasizes the value of students' identities, assets, and cultural resources which support student-centered learning and high achievement for all New Mexico students. Connecting each section of this document are through lines that ensure:

- All students, regardless of background, language of origin, differences, or foundational knowledge are capable and deserving of depth of understanding and engagement in rich mathematics tasks.
- Students' cultural backgrounds, experiences, and language are resources for learning mathematics (González, Moll, & Amanti, 2006; Turner & Celedón-Pattichis, 2011; Moschkovich, 2013).
- Leadership plays a key role in helping create and sustain a multi-layered system of support for educators through job-embedded professional learning.
- All students and educators benefit in utilizing a growth mindset to grow and appreciate mathematics.
- Students—and educators—understand how mathematical ideas relate to each other, to notice and generalize patterns, and to understand the logic, reasoning, and underlying structure that make mathematics a powerful tool (Seeley, 2016).

Leadership

Leadership Goal

Provide guidance, clarity, and focus for developing leadership capacity with school, district, community, tribal, and state-level stakeholders for leading PreK–12 mathematics in New Mexico and implementing a strategic approach to equitable, high quality mathematics education for all students.

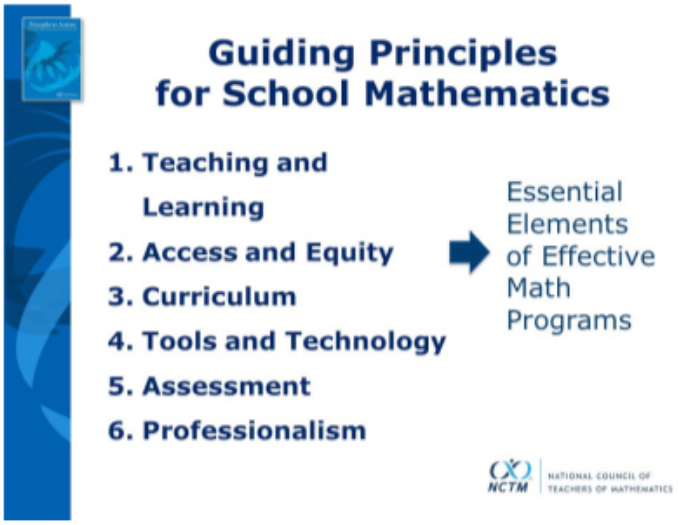
Foundation (Why is this important?)

Positive student mathematics outcomes start with leadership committed to implementing, supporting, and sustaining high quality mathematics education. Educational leaders from the classroom to the boardroom are encouraged to employ bold leadership in order to ensure that our students have equitable access to deep and meaningful mathematics. Successful implementation of a research- and data-informed mathematics framework requires knowledgeable and effective leadership that promotes shared responsibility, collaboration and commitment for supporting children's mathematics development. Educational leaders are change agents and have the power to create and support a culture of mathematics achievement. In NCTM's *Principles to Actions* (2014), school leaders are encouraged to make the mathematical success of every student a nonnegotiable priority and create opportunities that maximize the learning of mathematics.

The role of a school leader is not only filled by an administrator but by any educator with the necessary knowledge and skills to support an environment of mathematical success. Teacher leaders, instructional coaches, school and district administrators, and state education leaders ensure that all educators share a vision and understanding of high quality mathematics instruction. These same education leaders work to ensure that every educator has the necessary knowledge, skills, and resources to meet the expectation of meaningful mathematics learning experiences. Leaders advocate for teaching and learning needs and continual, job-embedded collaborative professional learning. School leaders establish a learning environment that promotes equity and equitable assessment practices to support mathematics achievement for all students. They empower educators to create a culture of reflection, refinement and action focused on continuous improvement of mathematics learning. The consistent goal should be to build school and district capacity for data-driven decision making, always with the focus on students and actionable steps for improvement.

Figure 1

Guiding Principles for School Mathematics



Note: This figure identifies six guiding principles to implement an effective mathematics program. From NCTM. (2014). *Principles to actions: Ensuring mathematical success for all*. (2014). Reston, VA: The National Council of Teachers of Mathematics (NCTM).

Essential Elements (What do I need to know?)

These elements suggest behaviors, knowledge, mindset, and attitudes which comprise characteristics of educational leaders necessary for the implementation of a successful, high quality mathematics instructional program. School leadership teams are composed of stakeholders from a variety of perspectives, including community and business leaders, parents, educators, and other school/district support staff. The focus should be on *all* students meeting or exceeding grade-level mathematics learning goals, which are part of a coherent, strategic plan for equitable mathematics instruction using NCTM's Guiding Principles for

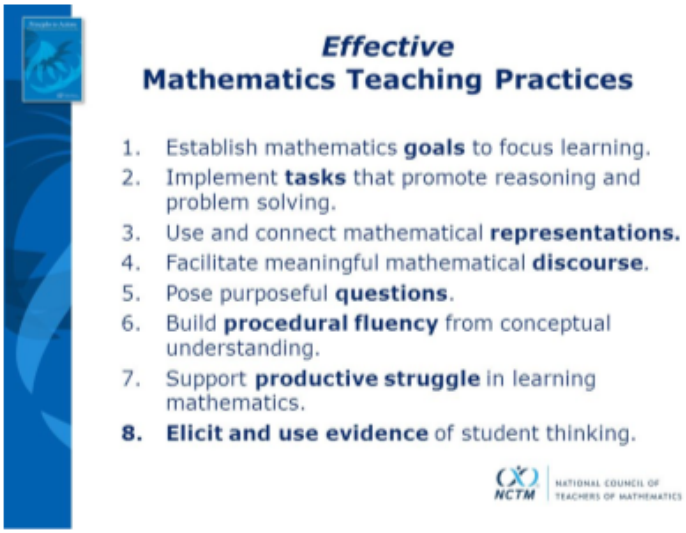
School Mathematics (2014) (Figure 1). School leadership teams can utilize the NM DASH web-based action-planning tool, provided by the PED at no cost to all local education agencies, in developing a school improvement plan and identifying research-informed, evidence-based interventions to meet student learning needs.

Teaching, Learning, and Assessment

All educators contribute to the success of the school's strategic plan for coherent mathematics instruction and are supported in obtaining or maintaining the knowledge and skills necessary to undertake this endeavor. School leaders provide support through professional learning around understanding and applying the eight Mathematical Teaching Practices, as outlined in Figure 2 (NCTM, 2014).

Figure 2

Effective Mathematics Teaching Practices



Note: This figure identifies the eight effective Mathematics Teaching Practices. From NCTM. (2014). *Principles to actions: Ensuring mathematical success for all*. (2014). Reston, VA: The National Council of Teachers of Mathematics (NCTM).

All mathematics educators and math education leaders should possess a firm knowledge of the Standards for Mathematical Practice (SMPs), as well as the content contained within the NM Common Core State Standards for Mathematics (CCSS-M). Beyond knowledge of the SMPs, math educators should also have a solid understanding of the role of the SMPs and how they contribute to establishing effective mathematics learning environments (See Appendix A for resources). School leaders support mathematics educators in creating a balance of conceptual understanding, procedural fluency, and application in their approach to rigorous mathematics instruction. The Instructional Acceleration Guidance for Math has additional information on the aspects of rigor of the CCSS-M.

Effective instruction in the modern era includes engaging with technology to support deep mathematics understanding. The key to technology in the classroom is using it to increase access to the mathematics concepts. School leadership teams promote purposeful and appropriate use of technology to enhance student learning opportunities. There are a variety of in-person and remote learning resources involving varying levels of technology use. Online components of high quality instructional programs can help scaffold student learning and remove barriers to learning materials. School leaders support access to specific professional learning for development of technology skills in connection with curriculum and student engagement, with the expectation of active implementation.

School administrators and leadership teams create structures to gather and analyze student data for the purpose of making instructional decisions. It is important to gather multiple data points to better inform decision making. Data includes, but is not limited to, assessment and progress-monitoring data, insights from daily observation during student interaction, and evidence collected from student feedback and reflection. This information is used by educators and grade-level or department teams to adapt instructional strategies and modify the mathematics instructional plan or curriculum as needed to improve student outcomes.

Additionally, educators need training in various types of formative assessments and their uses to provide equitable opportunities for students to show evidence of understanding. The insight into student understanding that is gained from effective formative assessment practice is highly valuable. Educators respond to formative assessment results by targeting instruction and attending to specific student learning needs. School leaders support these formative assessment practices through access to professional learning, providing time for collaboration and data analysis with educator teams, and modeling data-informed decision making. See the Assessment for Learning section for additional information regarding formative assessment practices and a balanced assessment system.

Instructional Leadership

School leaders such as educators, department chairs and other teacher leaders, and administrators work together with school staff to maintain focus on student mathematics learning outcomes. School leadership teams promote a shift in mathematics instruction to a more student-centered approach. Educators should have access to a variety of professional learning opportunities, such as peer observations, lesson study, guidance from research-based education resources and grade-level and department-level professional learning communities (PLCs). School leadership teams support all educators in developing their craft by providing appropriate, job-embedded and ongoing opportunities for professional growth. Time should be allocated for collaborative planning and reflection among mathematics educators, including the opportunity to study the adopted curriculum and apply reasonable variation in pacing and presentation to meet students' diverse learning needs. See the Professional Learning section for additional information on the essential elements of professional learning.

It is essential for all educational leaders to express a positive attitude toward mathematics, an appreciation for the importance of mathematics in the future of every student, and high expectations for advanced mathematics learning for all students. School leaders should model and support staff and students in developing a growth mindset. This may be accomplished by creating and sustaining effective professional communities of reflective practitioners, by promoting the role of productive struggle in the learning process for students, parents, educators, and the community.

Explicitly incorporating social-emotional learning (SEL) into math instruction is a great way to both foster a growth mindset and undermine math anxiety. SEL can increase academic achievement, improve attitudes and behaviors, and reduce emotional distress for students. One powerful way to foster SEL through math is to authentically incorporate the SMPs into instruction. The SMPs are habits of mind that perfectly dovetail with SEL (Resanovich, 2020). The SEL continuum of learning continues outside the classroom, supporting a school-wide learning environment for the whole child. All educators and school leadership teams strive to develop an understanding of their own and students' mathematical identities, establishing a safe environment of shared inquiry.

Access and Equity

School leadership teams continuously advocate for equity in mathematics education. Equity does not mean that every student should receive identical instruction; instead, it demands that reasonable and appropriate accommodations be made as needed to promote access and attainment for all students (NCTM, 2014). School leadership teams should work to create the conditions, structures, and policies necessary to guarantee all students have high quality, engaging, relevant, and meaningful mathematics learning experiences. Some students may require targeted support at specific times, addressing learning challenges as soon as they occur.

School leaders embed culturally and linguistically relevant instruction (CLRI) practices into professional learning and promote opportunities for educators to deepen their understanding of CLRI. School leaders promote shared culturally sustaining practices and encourage educators to value diversity in perspectives from colleagues. Educators then apply these practices to their teaching to encourage a variety of student perspectives in learning. All educators work to maximize student learning in support of their future goals. Of utmost importance, is for school leaders to establish the belief that *all* students can learn and are capable of advanced mathematics achievement. See the Universal Instruction section, page 16, for additional information on equitable instruction for all students.

Professionalism

True professionals are lifelong learners. School leaders model lifelong learning and promote the professional growth of educators through access to professional learning that meets teaching and learning needs. As professionals, mathematics educators continually seek to improve and enhance their mathematical knowledge for teaching, their knowledge of mathematical pedagogy, and their knowledge of students as mathematical learners (NCTM, 2014). School and district leaders create a work environment that motivates educators to achieve this improvement. School leadership teams serve as a conduit for information, sharing new knowledge and research about mathematics standards,

assessments, instructional programs and high quality instructional materials.
In service to educators, students, and the school community, school leaders anchor all stakeholders in a shared vision and understanding of high quality mathematics learning experiences for all students. School leadership teams communicate regularly with support networks and resources and promote collaboration in supporting student learning. Within a culture of professionalism, school leadership teams embrace the transparency of their work, their accomplishments and challenges, share ideas, insights, and practices, and collaborate with educators to promote mathematics success for all students (NCTM, 2014).

Implementation (What do we need to do?)

To support advanced student mathematics achievement, all educators and school staff have a role to play and actions to take. For the school's mathematics plan to endure, school leaders intentionally implement and continue to adapt the plan over time, reflecting on what is (and is not) working, and how the school can do even better. It is the responsibility of the school administration to maintain professional communication with all stakeholders around potential impacts to the strategic plan. School leadership teams that include committed administrators, educators, parents, and community members will promote sustainability by effectively responding to changing conditions that affect progress. Most importantly, creating effective classrooms and learning environments for all students in every school and district will take *educators* who plan and implement effective instruction as described by the Mathematics Teaching Principles (NCTM, 2014).

Actions for Educators

Actions for Teacher Leaders

- Provide consistently high-quality mathematics instruction for all students and support colleagues to do the same through mentorship, collaboration, peer observations and sharing strategies.
- Promote a solid understanding of the Standards for Mathematical Practice, and support daily student engagement with the SMPs.
- Work with preservice and in-service educators to support research-informed and equitable instructional practices.
- Support all grade-level or PLC team members to provide on-grade-level mathematics learning opportunities for *all* students.
- Collaborate with school and district or state charter school educators to challenge and dismantle systemic and structural impediments to student success in mathematics.

Actions for Administrators

- Ensure leadership is distributed among different individuals and groups within the school and conceptualized as leadership functions, not linked to specific key individuals (i.e., Principal, Vice-Principal, Math Coach)
- Ensure that the instructional leadership is knowledgeable in evidence-based practices in elementary and secondary mathematics, as well as possessing strong communication and instructional leadership skills.
- Identify, articulate, and monitor grade-level mathematics learning goals, and prioritize the attainment of mathematics learning goals for *all* students, ensuring a targeted focus on mathematics learning goals and objectives.
- Based on grade level, schedule an uninterrupted mathematics learning block and specified time for tiered interventions.
- Ensure that subject-specific mathematics learning and mathematics instruction across the content areas is based on the *Common Core State Standards for Mathematics*, with emphasis on the *Standards for Mathematical Practice*s.
- Actively ensure that all educators provide classroom instruction that meets student needs through frequent and thorough walk-throughs with meaningful feedback and dialog with all educators; regularly observe classroom mathematics instruction to understand how instruction is being delivered and use this information

to support educators in providing effective mathematics instruction to *all* students.

- Actively model and support data-driven decision making using a variety of data points related to student mathematics learning and success.
- Ensure that there is sufficient time for planning instruction and that this time is used productively; ensure the day-to-day implementation of planned instruction and subject-specific mathematics instruction during each mathematics block and across content areas.
- Ensure that classroom educators and school-based teams have ample opportunity to work with a mathematics coach on: a) highly effective mathematics instruction, b) evidence-based interventions, including motivation strategies, for students in Layer 2 and Layer 3, and c) assessment and progress monitoring.
- Develop an environment that fosters common planning time and collaboration for instructional improvements within a Professional Learning Community.
- Develop and implement a school mathematics learning plan that is reflected in the school's *NM DASH 90-Day* Plan.
- Every 30 days, evaluate the effectiveness of the school's strategic math plan and adapt if progress is insufficient; determine which variables can be manipulated (see Table 1) and take appropriate actions to result in improved mathematics learning.

Table 1. Implementation Elements Alterable Variable Chart

Less Intense ← Specific Adjustments → More Intense					
Time for Instruction	Increase student attendance	Provide instruction daily	Increase opportunities to respond	Vary schedule of easy/hard tasks/ skills	Add another instructional period (double dose)
Program Efficacy	Pre-teach components of core program	Use extensions of the core program	Supplement core with appropriate materials	Replace current core program	Implement specially designed program
Program Implementation	Provide model lesson delivery	Monitor implementation frequently	Provide coaching and ongoing support for teacher	Provide additional professional learning	Vary program/ lesson schedule
Grouping for Instruction	Check group placement	Reduce group size	Increase teacher-led instruction	Provide individual instruction	Change instructor
Coordination of Instruction	Clarify instructional practices	Establish concurrent mathematics periods	Provide complementary mathematics instruction across periods	Establish communication across instructors	Meet frequently to examine progress

Universal Instruction Goal

Implement research-based instruction, strategies, and interventions that promote active, equitable student engagement. Meet the mathematics needs of all diverse learners in a developmentally-appropriate and culturally, linguistically relevant manner.

Foundation (Why is this important?)

Preparing New Mexico's students for their future calls for innovation in mathematics instruction. Quantitative understanding and problem-solving skills are necessary in dealing with the abundance of data available and utilized in our daily lives leading to societal engagement. The delivery of Layer 1 core instruction and the implementation of effective scaffolding strategies is the foundation upon which student achievement will rest. In New Mexico, math educators are committed to implementing a guaranteed, viable curriculum utilizing high quality instructional materials (HQIM) paired with the New Mexico Mathematics Instructional Scope (NMIS-Math) to prepare all students for career, college, and citizenship.

To accomplish high quality Layer 1 instruction, all math educators actively engage in these critical domains: knowledge of mathematics, ambitious teaching, mindsets (Van de Walle et al., 2019; DeAnn, Bill, & Smith, 2017) and New Mexico math resources.

Knowledge of Mathematics

Elementary math educators need a working knowledge of their assigned content area—defined in the Common Core State Standards for Mathematics (CCSS-M)—and an understanding of the learning progressions not only in previous grades leading up to the assigned grade level but also what students will encounter in later courses. Effective elementary math educators feel confident and fluent in the fundamental concepts and skills.

At the secondary level, effective math educators possess an exceptional grasp of their assigned content areas and an understanding of the learning progressions for Grades K–12. Secondary math educators support the learning of students who perform above and below grade-level or course-specific proficiency levels and so require a deep knowledge of K–12 mathematics.

Ambitious Teaching

In the *Taking Action* series, DeAnn, Bill, & Smith (2017) define ambitious teaching as:

> Viewing students as capable of making sense of mathematical ideas, using their understanding to solve authentic problems and values students' thinking, including emergent understanding and errors, and attends to student thinking equitably and responsively (pg.4).

Math educators in New Mexico ensure all diverse learners can equitably access meaningful mathematics. Educators build on students' lived experiences and culture, leveraging their strengths and challenging spaces of marginality (DeAnn, Bill, & Smith, 2017). To create a learning community that positions students as doers of mathematics, educators keep these ideas at the forefront:

- Assessment of student mathematics proficiency and learning needs (Formative, Interim, Summative) as a means for focusing universal instruction.
- Scaffolding techniques based upon universal design principles and cognitive science findings relevant to the student mastery of mathematical concepts and practices.
- Research-based strategies to effectively respond to linguistic and cultural diversity in student populations
- Instructional techniques demonstrated to support the three aspects of rigor; 1. Application to real-world problems, 2. Conceptual understanding, and 3. Procedural skill and fluency.

- An array of teaching strategies that strike a balance between explicit and implicit instruction appropriate for the mathematical learning goal and student needs.
- Ability to critically assess and select materials, equipment, and resources demonstrated to effectively support student learning in mathematics

Mindsets

Mathematics brings out different attitudes and mindsets students have regarding their growth in math. Two dominant thoughts prevail in the literature around mindsets. Students with a **fixed mindset**—those who believe intelligence is innate and they are as smart as they ever will be—are more likely to give up when they encounter any challenging tasks or concepts. In contrast, students with a **growth mindset**—those who believe intelligence is developed through life experiences and perseverance—are more likely to engage in productive struggle, learn and grow as they arrive at a solution (NCTM, 2014; Seeley, 2016).

Principles to Action (2014) continues to elaborate on mindsets:

> Fixed mindsets (i.e., the attitude that levels of mathematics ability are fixed and cannot be changed), when coupled with societal stereotypes about academic ability that are based on student characteristics, perpetuate the unproductive practices described below (Dweck 2008). In contrast, a growth mindset, which emphasizes mathematics teaching and learning as processes that cultivate mathematical abilities, stresses that success and learning are a reflection of effort and not intelligence alone, and thus promotes a belief that all students are capable of participating and achieving in mathematics (Boaler 2011; Dweck 2006). (pg. 64)

The emerging belief for mathematics instruction centers on students and engaging them in approaching and discussing tasks that promote reasoning and problem solving (NCTM, 2014; Van De Walle et al., 2019). To ensure that all students have access to an equitable, culturally and linguistically relevant mathematics program, educators need to identify, acknowledge, and discuss the mindsets and beliefs that they have about students' abilities. Understanding mindsets can change how educators plan and implement mathematics instruction.

Table 2 compares some productive and unproductive mindsets that influence instruction. Educators embracing productive mindsets view students as active participants in learning while unproductive mindset limits students accessing content and practices.

Table 2. Comparing mindsets about mathematics instruction.

Unproductive Mindsets	Productive Mindsets
Mathematics learning should focus on practicing procedures and memorizing basic number combinations	Mathematics learning should focus on developing understanding of concepts and procedures through problem solving, reasoning and discourse
Students need only to learn and use the same standard computational algorithms and prescribed methods to solve algebraic problems	All students need to multiple strategies and entry points to approach problems, including but not limited to, general methods, standard algorithms and procedures
Students can learn to apply mathematics only after they have master basic skills	Students can learn mathematics through exploring and solving contextual and mathematical problems
The educator's role is to tell students exactly what definitions, formulas, and rules they should know and demonstrate how to use this information to solves mathematics problems	The educator's role is to engage students in tasks that promote reasoning, problem solving and facilitating discourse, moving students toward shared understanding of mathematics

Table 2. Comparing mindsets about mathematics instruction.

Unproductive Mindsets	Productive Mindsets
The student's role is to memorize information that is presenta and then use it to solve routine problems on homework, quizzes and tests	The student's role is to be actively involved in making sense of mathematics tasks by using varied strategies and representations, justifying solutions, making connections to prior knowledge or familiar contexts/ experiences and considering other's reasoning
An effective educator makes the mathematics easy for students by guiding them through problem solving to ensure low levels of frustration or confusion	An effective educator provides appropriate scaffolds, encourages perseverance in solving problems and supports productive struggle in learning mathematics

Adapted from Principles to Action (2014)

New Mexico Math Resource

The CCSS-M establishes the foundation for planning, implementing, and evaluating mathematics instruction in New Mexico. To succeed in helping students to master the aspects of rigor embedded in the standards, educators possess a working knowledge of:

- Instructional standards specifically relevant to their teaching assignments
- Integrating CCSS-M learning progressions across grade levels, particularly those adjacent to the grade-level(s) or content area(s) assigned in the NMIS-M.
- Layering interventions based on data-driven and data-informed students needs identified in the New Mexico Multi-Layered System of Supports (MLSS) manual.
- The principles and guidelines included in the NM High Quality Instructional Materials manual and the application to the task of selecting and implementing a mathematics curriculum using materials supported by educational research and cognitive science

Essential Elements (What do I need to know?)

Teaching all students how to interpret and apply mathematical concepts correctly is an essential school responsibility. It plays a central role in education throughout grades PreK–12, not just in the first few years of school.

High-quality mathematics instruction in grades PreK–12 involves the integration of **eight essential elements** (NMPED, 2020a):

1. **Instruction aligned to CCSS-M**
2. **Equitable math instruction for *all* students**
3. **Sufficient and effective use of time for math instruction**
4. **Using formative assessment data to formulate instructional goals and strategies**
5. **Focused instruction to address the key components of mathematical proficiency**
6. **Progress monitoring to deliver a range of layered supports**
7. **Implementation of high quality instructional materials with a high level of fidelity**
8. **Effective instructional program delivery and administration**

Instruction aligned to CCSS-M

Educators become familiar with the content standards through reading and reflecting on the main ideas of the standards and the learning progressions that students follow. The standards also inform the accepted models of student mathematical proficiency, which is the foundation upon which a student-focused math curriculum is situated.

Every step in facilitating instruction is informed by the standards. Key findings from TNTP's The Opportunity Myth (2018) revealed students need the following experiences daily:

1. **Consistent opportunities** to work on grade-appropriate assignments,
2. **Strong instruction**, where students do most of the thinking in a lesson,
3. **Deep engagement**, in what they are learning, and
4. Teachers hold **high expectations** for students and believe students can meet grade-level expectations.

Equitable Mathematics Instruction for ***All*** Students

All NM students bring unique cultural and linguistic diversity into classrooms. All students deserve access to the best math education that NM teachers can provide. *Principles to Actions* (2014) summarizes the components of equitable instruction to include

> high expectations, access to high-quality mathematics curriculum and instruction, adequate time for students to learn, appropriate emphasis on differentiated processes that broaden students' productive engagement with mathematics, and human and material resources. (p. 60)

Universal Design for Learning

Equitable instruction is culturally responsive, keeping the learner at the center of instruction. One way of centering instruction on the learner is to adopt the principles of Universal Design for Learning (UDL). UDL is grounded in the idea that teachers can anticipate individual student needs and plans for strategies to meet those needs, then all students benefit (NCTM, 2020).

Hunt and Andreasen (2011) describe UDL as:

> a process that maximizes learning for all students, minimizes the needs for individual accommodations, and eventually benefits every learner by considering different ways that students' minds are activated. It is somewhat comparable to Differentiated Instruction, which involves a framework for modifying or adapting curriculum in response to learner needs or preferences as identified during instruction. However, UDL differs from these approaches in that its use—
>
> - addresses learner diversity at the beginning of curriculum and lesson design;
> - builds the tools and methods of differentiation directly into the curriculum; and
> - provides students with mechanisms so as to become more self-aware of how to take charge of their learning rather than relying on the teacher to make modifications. (p. 168)

As educators approach planning their instruction, they recognize the strengths of learners and provide multiple means of engagement, representation, and expression. Educators utilize the NMIS-M when planning with their HQIM math materials to ensure on grade-level instruction.

Culturally and Linguistically Responsive Instruction (CLRI)

Addressing the unique strengths and learning styles of students purposefully promotes equity for all students regardless of their ability, family, or sociocultural circumstances. Darling (2019) and Van de Walle et al., (2019) outline key components of shifting classrooms to be more culturally and linguistically responsive, encouraging all diverse learners in exploring and accessing mathematics:

1. **Take an asset-based approach and recognize multilingualism as a power** (promote the development of a growth mindset among students)
2. **Ensure shared power** (develop socially, emotionally, and academically safe environments for mathematics teaching and learning environments in which students feel safe to engage with one another and with teachers)
3. **Communicate high expectations** (plan mathematics around big ideas in the CCSS-M; model high expectations for each student's success in problem solving, reasoning, and understanding)
4. **Make mathematics content relevant** (math ideas are interrelated and utilize student familiar contexts)
5. **Include group work** (strategically grouping for language development)
6. **Make work visual** (include graphic organizers, visual examples, encourage visual communication)
7. **Build on students' lived experiences and cultures** (allow native and home language use; access students' funds of knowledge)
8. **Scaffold learning and language development** (scaffold with sentence frames and/or sentence starters)
9. **Give opportunities for pre-learning** (opportunities to learn prerequisite material ahead of time)

CLRI, around mathematics, prompts educators to think about mathematical thinking, language and culture for all students in classrooms. It includes considerations for content, relationships, cultural knowledge, flexibility in approaches, use of familiar or interesting learning contexts, and a responsive learning community (Aguirre, del Roasrio Zavala, & Katanyoutanant, 2012).

Sufficient and Effective Use of Time for Mathematics Instruction

It is critical that enough time is scheduled during the school day for explicit mathematics instruction. This time commitment should be of the highest priority and considered non-negotiable. At the elementary level, it is important that assemblies, fire drills, class parties, class pictures, or other special events are routinely scheduled outside of the mathematics instruction block. At the secondary level, it is important that instruction time in every instructional area be protected to provide sufficient time for students to master the course content and skills.

How much time is "enough" time to effectively cultivate student math proficiency? Unlike reading instruction, which does have established and widely recognized recommendations for instructional time commitment, the guidance for mathematics instruction is more focused upon the quality of the time vs. the quantity. Brown-Chidsey & Bickford (2016) provide a general recommendation of 60 minutes of instruction at the elementary level and 70 minutes at the middle- and high-school levels.

Table 3 provides guidelines on how the instructional time should be focused (CCSS-M, Introductions).

Table 3. Recommended time allocations for math instruction for all students.

Grade/Course	Time Commitment Per Day	Purpose
Preschool	Numeracy instruction should be embedded in multiple activities throughout the day	Students should become familiar with the counting numbers and should have multiple opportunities to explore counting and grouping using manipulatives. Students should understand how numbers are used to describe groups of things and changes in grouping based on adding or removing members. Preschool students should begin to develop a basic number and math operation vocabulary. Students should recognize and construct simple geometrical shapes and have opportunities to explore measurement with tangible materials.
Kindergarten	60 minutes	In Kindergarten, instructional time should focus on two critical areas: (1) representing and comparing whole numbers, initially with sets of objects; (2) describing shapes and space. More learning time in Kindergarten should be devoted to number than to other topics.

Grade/Course	Time Commitment Per Day	Purpose
First Grade	60 minutes	In Grade 1, instructional time should focus on four critical areas: (1) developing understanding of addition, subtraction, and strategies for addition and subtraction within 20; (2) developing understanding of whole number relationships and place value, including grouping in tens and ones; (3) developing understanding of linear measurement and measuring lengths as iterating length units; and (4) reasoning about attributes of, and composing and decomposing geometric shapes.
Second Grade	60 minutes	In Grade 2, instructional time should focus on four critical areas: (1) extending understanding of base-ten notation; (2) building fluency with addition and subtraction; (3) using standard units of measure; and (4) describing and analyzing shapes.
Third Grade	60 minutes	In Grade 3 students instructional time should focus on four critical areas: (1) developing understanding of multiplication and division and strategies for multiplication and division within 100; (2) developing understanding of fractions, especially unit fractions (fractions with numerator 1); (3) developing understanding of the structure of rectangular arrays and of area; and (4) describing and analyzing two-dimensional shapes. Students should be provided with abundant opportunities to explore these concepts using both manipulatives and mathematical symbols.
Fourth Grade	60 minutes	In Grade 4, instructional time should focus on three critical areas: (1) developing understanding and fluency with multi-digit multiplication, and developing understanding of dividing to find quotients involving multi-digit dividends; (2) developing an understanding of fraction equivalence, addition and subtraction of fractions with like denominators, and multiplication of fractions by whole numbers; (3) understanding that geometric figures can be analyzed and classified based on their properties, such as having parallel sides, perpendicular sides, particular angle measures, and symmetry.
Fifth Grade	60 minutes	By 5th grade, instructional time should focus on three critical areas: (1) developing fluency with addition and subtraction of fractions, and developing understanding of the multiplication of fractions and of division of fractions in limited cases (unit fractions divided by whole numbers and whole numbers divided by unit fractions); (2) extending division to 2-digit divisors, integrating decimal fractions into the place value system and developing understanding of operations with decimals to hundredths, and developing fluency with whole number and decimal operations; and (3) developing understanding of volume.

Grade/Course	Time Commitment Per Day	Purpose
Sixth Grade	70 minutes	In Grade 6, instructional time should focus on four critical areas: (1) connecting ratio and rate to whole number multiplication and division and using concepts of ratio and rate to solve problems; (2) completing understanding of division of fractions and extending the notion of number to the system of rational numbers, which includes negative numbers; (3) writing, interpreting, and using expressions and equations; and (4) developing understanding of statistical thinking.
Seventh Grade	70 minutes	In Grade 7, instructional time should focus on four critical areas: (1) developing understanding of and applying proportional relationships; (2) developing understanding of operations with rational numbers and working with expressions and linear equations; (3) solving problems involving scale drawings and informal geometric constructions, and working with two- and three-dimensional shapes to solve problems involving area, surface area, and volume; and (4) drawing inferences about populations based on samples.
Eighth Grade	70 minute	In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.
High School	70 minutes	High school instructional time should continue to focus upon the six major mathematical topic areas: (1) number & quantity, (2) algebra, (3) geometry, (4) functions, (5) modeling, and (6) statistics & probability. The degree of focus upon any specific topical area should correspond to the specific high school math course and the standards established for that subject area.

Adapted from Brown-Chidsey & Bickford, (2016)

Using Formative Assessment Data to Formulate Instructional Goals and Strategies

Formative assessment plays an essential role in designing universal math instruction. Keep in mind, as highlighted in the Assessment section, formative assessment is an intentionally planned process that aligns with the standards, objectives and learning targets (Greenstein, 2010). Formative assessments provide data that allow teachers to more precisely address the learning needs of individual students. The effective integration of assessment into the day-to-day flow of instructional events allows teachers to track the learning of students in the key component areas of math learning.

Formative assessment data is collected throughout instruction through a variety of formal and informal ways including:

- Before Instruction: Entrance slips requiring a quick written explanation; Corners or Gallery which provides a quick visual way to preview what students know or believe before starting instruction
- During Instruction: Thumbs-Up/Fingers-Up as a quick way to assess a whole class; graphic organizers show how students are organizing information; math journal entries allow students to write and explain student's thinking
- After Instruction: Exit ticket with a task or short quiz; nutshelling where students craft a brief summary statement capturing their learning; one-on-one interviews to understand a student's work and thought process (Greenstein, 2010)

Focused Instruction to Address the Key Components of Mathematical Proficiency

In NM, math educators adopt a student-centered perspective when making their instructional design and delivery decisions. This means that all math instruction is focused upon the key components of mathematical proficiency outlined in Figure 3.

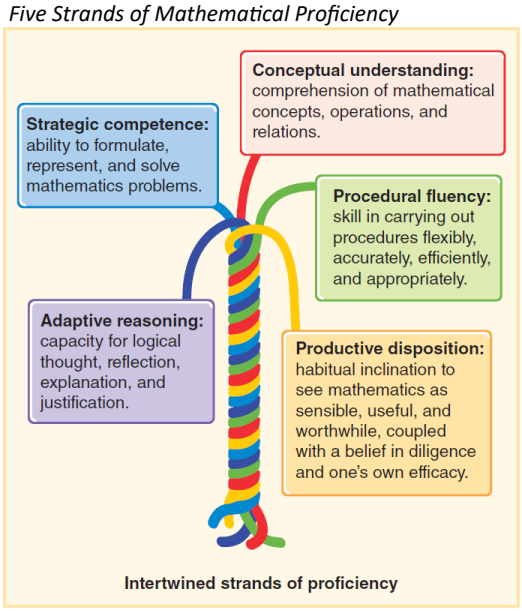
Building upon this mathematics proficiency model, the CCSS-M proposes eight mathematical practices that all students should master in order to be considered proficient. These eight mathematical practices include.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

The five proficiency strands and eight mathematical practices serve to establish a comprehensive set of knowledge, skill, and attitudinal targets towards which all math instruction should be aimed. Formative assessment data should be used to determine the degree to which students show mastery or need in these specific areas. Lessons should then be specifically focused upon helping students to cultivate these knowledge, skill, and attitudinal attributes. It is through the iteration of formative assessment, instructional design and lesson delivery that students may be taught what they need most for mathematics success.

Figure 3

Five Strands of Mathematical Proficiency



Note this figure was produced by the National Research Council. (2001). *Adding it up: Helping children learn mathematics.* J. Kilpatrick, J. Swafford, and B. Findell (Eds.). Mathematics Study Learning Committee, Center for Education, Division of Behavioral and Social Science and Education. Washington, DC: National Academy Press.

Progress Monitoring to Deliver a Range of Layered Interventions

The Multi-Layered System of Supports (MLSS) is a comprehensive framework to organize schools and school systems in supporting student learning (NMPED, 2020b). The MLSS framework ensures all students

access high quality differentiated core instruction aligned to the CCSS-M as identified in Layer 1 (Figure 4). Educators implementing Layer 1
instruction use the principles of the UDL guidelines that provide students with multiple forms of engagement, presentation and expression.

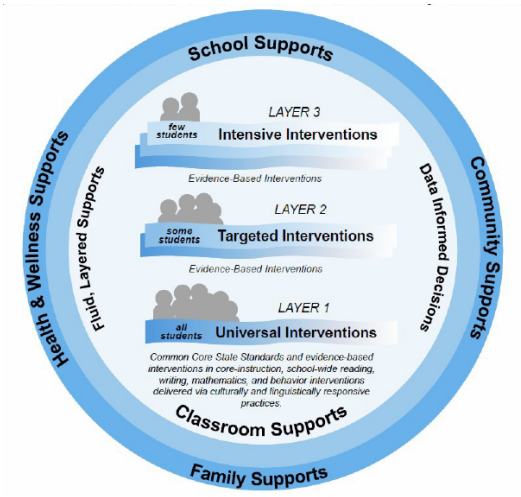
If students are not making progress in learning through Layer 1, they may need additional academic interventions in Layer 2. Layer 2 is student-driven through continued access to Layer 1 instruction with targeted evidence-based interventions. Progress monitoring is on-going as students engage in Layer 2 interventions.

Layer 3 provides intensive interventions for students. Layer 3 evidence-based interventions are provided for a longer duration and with more frequency than Layer 2 (NMPED, 2020b).

The MLSS website has more information on the components, evidence-based interventions or to access New Mexico's MLSS manual.

Figure 4

Major Components of the MLSS Framework



Note. This figure graphically organize each important features of layered interventions based on data-driven and data-informed students needs.From NMPED. (2020b). *Multi-Layered System of Supports (MLSS) 2020.* Santa Fe: NMPED. Retrieve from https://webnew.ped.state.nm.us/bureaus/multi-layered-system-of-supports-mlss/

Implementation of High Quality Instructional Materials with a High Level of Fidelity

Mathematics instructional strategies, programs, and materials should be supported by evidence from experimental research that clearly demonstrates their effectiveness. Alignment with the CCSS-M standards is a key factor in selecting HQIM or programming.

The review and selection of instructional materials and resources is the starting point for shaping what happens in the mathematics classroom. The New Mexico High Quality Instructional Materials Manual describes the process whereby instructional materials are evaluated to ensure they meet the learning needs of NM students. Questions teachers and instructional leaders should consider when reviewing possible resources for adoption include:

- Will it be engaging or interesting to my students?
- Can it be differentiated to meet the needs of my students?
- Are the materials culturally and linguistically relevant for my student population?
- Does it focus upon the established elements of mathematics proficiency?
- Does this address all the standards to their full intent?
- Does it make contributions to my instructional strategies that help prepare my students to be college and career ready, secure in their identity, community, and life?
- Can I customize it?
- Are the results measurable?
- Is the material supported by ongoing professional learning?
- Are there others using these materials I can gain best practices from?
- Is this evidence-based, meaning the materials demonstrate strong or moderate evidence of effectiveness of positive student outcomes?
- Is there any independent research that shows that students are learning?

The need for a thoughtful and research-based approach to curriculum adoption and implementation also applies to the selection and integration of technology in the mathematics classroom. To effectively integrate technology into mathematics instruction teachers:

- Implement lessons that make use of technological investigations that precede or accompany the development of

paper-and-pencil skills.

- Ensure that students see both the power and limitations of technology, and expect them to examine answers for reasonableness and applicability to the context and to choose appropriate tools for the task at hand.
- Incorporate mathematical tools and technology as an everyday part of the mathematics classroom, recognizing that students should experience "mathematical action technologies" and physical or virtual manipulatives to explore important mathematics.
- Plan carefully for the use of classroom technology to ensure that it builds student understanding and reasoning. (NCTM, 2014)

Using HQIM paired with the NMIS-M, educators can proceed with the task of implementing a guaranteed, viable mathematics curriculum that meets the learning needs of all students.

Effective instructional program delivery and administration

NCTM (2014) identified eight effective mathematics teaching practices that provide a framework for strengthening the teaching and learning of mathematics. This research-informed framework of teaching and learning reflects the current body of knowledge of mathematics instruction that has accumulated over the past twenty-five years. These practices establish a set of specific attributes all math teachers should strive to cultivate including:

1. Establish goals to focus learning. Effective math teachers establish clear goals for the mathematics that students are learning, situate goals within learning progressions, and use the goals to guide instructional decisions.
2. Implement tasks that promote reasoning and problem solving. Effective math teachers engage students in solving and discussing tasks that promote mathematical reasoning and problem solving and allow multiple entry points and varied solution strategies.
3. Use and connect mathematical representations. Effective math teachers engage students in making connections among mathematical representations to deepen understanding of mathematics concepts and procedures and as tools for problem solving.
4. Facilitate meaningful mathematical discourse. Effective math teachers facilitate discourse among students to build shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments.
5. Pose purposeful questions. Effective math teachers use purposeful questions to assess and advance students' reasoning and sense making about important mathematical ideas and relationships.
6. Build procedural fluency from conceptual understanding. Effective math teachers cultivate student fluency with procedures based upon a foundation of conceptual understanding so that students, over time, become skillful in using procedures flexibly as they solve mathematical problems in real world applications.
7. Support productive struggle in learning mathematics. Effective math teachers consistently provide students, individually and collectively, with opportunities and support to engage in productive struggle as they grapple with new mathematical ideas and relationships.
8. Elicit and use evidence of student thinking (formative assessment). Effective math teachers use evidence of student thinking to assess progress toward mathematical understanding and to adjust instruction continually in ways that support and extend learning.

Teachers, instructional leaders and school administrators should keep these teaching practices in mind when making decisions regarding teacher professional development. The success of the mathematics curriculum at a school will depend upon the extent to which these practices prevail in the classroom. Teachers should be provided with ample opportunities to engage in dialogue with colleagues who teach other mathematics courses or grade levels to share best practices in the classroom application of these eight practices. Such collaboration will also promote a common understanding of the intended curriculum from both horizontal and vertical perspectives.

Implementation (What do we need to do?)

Action Steps for Educators

Action Steps for Teachers

- Utilize the *New Mexico Instructional Scope* alongside high quality instructional materials when planning.
- Consistently implement the eight Mathematics Teaching Practices.
- Elicit, value, and celebrate varied approaches and solution paths that students take to solve mathematics problems.
- Give priority to the mathematical practices, including problem solving, reasoning, and constructing viable arguments in every aspect of classroom practice - including teaching, assessment, curriculum decisions, and the use of tools and technology.
- Plan and implement units and lessons that promote positive dispositions toward the study of mathematics, including curiosity, self-confidence, flexibility, and perseverance.
- Make ongoing professional learning that supports the implementation of the eight Mathematics Teaching Practices a priority.
- Communicate the value of the Mathematics Teaching Practices to parents and the community and all educational stakeholders.
- Observe lessons or engage in classroom walkthroughs, using the Mathematics Teaching Practices as the focus.

Action Steps for Administrators

- Consider teacher assignment practices to ensure that struggling students have access to effective mathematics teaching that incorporates the Mathematics Teaching Practices.
- Maintain a schoolwide culture with high expectations and a growth mindset.
- Allocate time for collaborative interactions among mathematics teachers to study the school's curriculum - at, above, and below the intended grade level or course.
- Observe lessons or engage in classroom walkthroughs, using the Mathematics Teaching Practices as the focus.

Assessment for Learning Goal

Use the balanced assessment system to support educators in continuously monitoring students' mathematical development and proficiency. Coherently link formative, interim, and summative measurements to improve standards-aligned classroom instruction.

Foundation (Why is this important?)

Assessment is an essential component of effective mathematics instruction. The primary purpose of assessments is collecting evidence to enhance student learning and supporting students' development of positive mathematics identities (Aguirre, Mayfield-Ingram, & Martin, 2013). The assessment results are necessary to support understanding of what is happening with mathematics instruction at multiple levels. Educators can use individual student assessment results to provide appropriate scaffolds for all students to access the materials or analyze class results to help them guide their instructional strategies moving forward. At the highest level, policymakers rely on assessment data to understand mathematics learning achievement across the state and the nation. The functions of assessment recognized by the NCTM (2014) address this multilevel spectrum and include:

- Evaluating students' learning needs and progress to promote student achievement
- Making instructional decisions to modify instruction to facilitate student learning
- Evaluating students' achievement to summarize and report students' demonstrated understanding at a particular moment in time
- Enable collaboration and communication between teachers, administrators, and community stakeholders
- Evaluating programs to make decisions about the performance of entire instructional programs

Providing an accurate picture of student performance requires multiple data points. Assessments can help determine how educators are doing in meeting students' needs. These results provide pieces of information to share with parents about their children's progress in school, in addition to report cards, and present an opportunity to build partnerships with families.

Essential Elements (What do I need to know?)

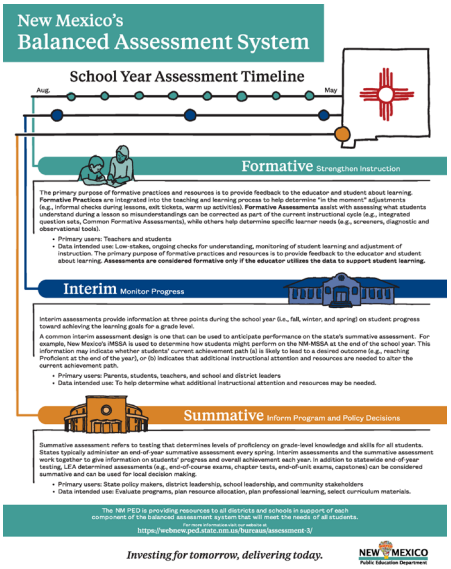
Ultimately, the value of assessments is reflected in the extent to which the resulting data are used to shape instructional delivery decisions. **One essential element** required is assessment strategies that address the full cognitive span of mathematics learning. Assessment activities should yield data regarding student learning at three distinct cognitive dimensions, including:

- Application of concepts and procedures to successfully engage problems in somewhat novel contexts (application)
- Concepts that connect procedures to deeper understanding (conceptual understanding)
- Skills used to solve math problems and manipulate symbols (procedural fluency)

A second essential element required is the interaction of the various components in a balanced assessment system: formative, interim, and summative (Figure 5). This interaction provides useful data to educators supporting students in identifying their current understanding and preparing for subsequent instruction and learning.

Figure 5

New Mexico's Balanced Assessment System



Note: This figure outlines the layers and school year assessment timeline. Retrieved from https://webnew.ped.state.nm.us/wp-content/uploads/2020/07/The-Balanced-Assessment-System-Quick-Infographic.pdf

Table 4 identifies the interactions and relationships between the various assessments in a balanced assessment system.

Table 4. Interactions and relationships between assessments.

Purpose (Classroom)	Explanation	Frequency	Examples
Formative	A planned, ongoing process to elicit and use evidence of student learning to improve student understanding of intended disciplinary learning outcomes and to support students in becoming self-directed learners (CCSSO, 2018) Formative assessments can be formal or informal. Can go beyond paper/pencil Examples and guidance for formative assessments Used to identify strengths and areas of growth or developmental milestones so teachers can adjust their instructional strategy, determine appropriate tasks.	Administered by teachers during the normal flow of instruction to quickly measure student progress minute by minute; Results provide frequent and timely feedback on teaching effectiveness and students' evolving understanding of essential concepts;	Purposefully planned assessment techniques that occur during the course of instruction: exit cards, muddiest point, checking for understanding questions; More formal, intentionally planned assessments such as classroom observations, exit tasks and student interviews, that are integrated into instructional units.
Interim	Medium scale assessments are particularly valuable in providing data to adjust instruction that addresses student needs at the trimester, semester or school year timeframe. The results can be used by school leaders and teachers to better prepare students for the future summative assessment.	Administered periodically (~ 6–8 weeks) separately from the process of instructing students	Results can be aggregated across classrooms and are reported locally to influence grade level/department, school-, or district-level decisions regarding mathematics instructional delivery priorities and strategies; Interim MSSA (iMSSA); K–2 Istation Math; District/School Common Formative Assessments (CFAs)
Summative	In the case of state-required, standardized tests, the data are aggregated and reported at the school, district, and state levels and influence policy decisions aimed at better serving the needs of all NM students	Administered at the end of the school year.	Results are used for identifying opportunities for improvement and to inform future instructional delivery strategies Compare performance between schools and/or districts New Mexico Measures of Student Success and Achievement (NM-MSSA) (Grades 3–8); SAT (High School)

Implementation (What do we need to do?)

Principles to Actions (2014) describes the student at the center of the assessment process.

> An important goal of assessment should be to make students effective self-assessors, teaching them how to recognize the strengths and weaknesses of past performance and use them to provide their future work. (p. 95)

Critical to this work is the role of the educator. Classroom educators determine what goes on in the classroom, deciding what topics are addressed, creating an equitable learning environment to facilitate learning. One key factor in improving student achievement starts with classroom educators beliefs and their willingness to share the learning responsibility with students.

Table 5 compares some productive and unproductive beliefs that influence assessment practices. Educators embracing productive beliefs view assessments to inform learning and prompt student self-awareness while unproductive beliefs limit students accessing content and practices.

Table 5. Comparing beliefs about mathematics assessment.

Unproductive Beliefs	Productive Beliefs
The purpose of assessments is to hold teachers accountable for student learning	Assessments provides information and improves the teaching and learning of mathematics
Classroom assessments interrupt the instructional flow	Assessments are embedded, planned, and part of the ongoing process to support student learning and make adjustments in instruction
A single assessment can be used to make important decisions about students and teachers	Multiple data sources are needed to provide an accurate picture of teacher and student performance
Assessment is something done to students	Assessment is a process that should help students reflect on their own learning and take charge of that learning, assists in recognizing when they produce high quality work and provide evidence to advance their own learning
Stopping instruction to review and take practice tests leads to improving student performance on high-stakes tests	Ongoing review and distributing practice within effective instruction is productive

Adapted from Principles to Action (2014)

Assessments require educators to elicit students' existing ideas as students make their thinking visible. When student thinking is made visible, educators examine the progression of learning towards the goals of the standards and adjust instruction as necessary. By including students in the assessment and analysis process, students become strategic a goal-directed about their learning.

Formative Assessments

Formative assessments cross traditional boundaries, involving both the teacher ***and*** the student, and evidence from the assessment has a direct impact on what comes next in the learning process (Box, 2019). Assessment is *not* a tool or an event, nor a bank of test items or performance tasks. Well-supported by research evidence, formative assessments improve students' learning in time to achieve intended instructional outcomes. Linquanti (2014) identifies these key features to include:

1. Clear lesson-learning goals and success criteria, so students understand what they're aiming for;
2. Evidence of learning gathered during lessons to determine where students are relative to goals;
3. A pedagogical response to evidence, including descriptive feedback that supports learning by helping students answer: Where am I going? Where am I now? What are my next steps?
4. Peer- and self-assessment to strengthen students' learning, efficacy, confidence, and autonomy;
5. A collaborative classroom culture where students and teachers are partners in learning.

The following table (Table 6), taken from *Principles to Actions* (2014, p. 56), provides helpful insight into specific teacher and student actions in a formative assessment setting.

Table 6. Elicit and Use Evidence of Student Thinking – Teacher and Student Actions.

What are teachers doing?	What are students doing?
• Identifying what counts as evidence of student progress toward mathematics learning goals. • Eliciting and gathering evidence of student understanding at strategic points during instruction. • Interpreting student thinking to assess mathematical understanding, reasoning, and methods. • Making in-the-moment decisions on how to respond to students with questions and prompts that probe, scaffold, and extend. • Reflecting on evidence of student learning to inform the planning of next instructional steps.	• Revealing their mathematical understanding, reasoning, and methods in written work and classroom discourse. • Reflecting on mistakes and misconceptions to improve their mathematical understanding. • Asking questions, responding to, and giving suggestions to support the learning of their classmates. • Assessing and monitoring their own progress toward mathematics learning goals and identifying areas in which they need to improve.

Adapted from Principles to Action (2014)

Arter (2010) drew this conclusion regarding assessments:

> Currently, there is stronger evidence supporting the large impact of classroom-level formative assessment practices than supporting the use of interim or summative assessments, so, if we are going to use scarce resources wisely, we should focus on what the preponderance of evidence indicates is the best use of assessment in the service of student learning. (p.2)

Self Assessments

Assessments also support students with their own learning and giving and receiving feedback from peers. Self-assessments provide students with opportunities to reflect upon their learning and growth in the classroom and learning communities. It is not a skill that comes naturally to students and must be taught. Moss and Brookhart (2009) stated:

> The educator needs to be skilled not only at teaching a skill (self-assessment) but also at interpreting student progress. Educators who understand learning progressions with the materials in question—how students typically do with this learning goal, how understanding typically developed, and what meaningful ways there are to chunk the task into smaller bits, if needed—will be better facilitators of student self assessment than those who do not. (p.79).

Students can provide great evidence of their opportunity to learn, thus taking control of their own learning. Students think about what they learned and where they need to grow based on the clear lesson learning goals, provided by or co-developed with the teacher.

Assessment for Learning

Students are given clear statements of the mathematical content and practices they are learning, which they use to think about what they have learned and what they still need to work on. The statements could communicate mathematics content such as, "I understand the difference between mean and median and when each should be used," as well as mathematical practices, such as, "I have learned to persist with problems and keep going even when they are difficult."

Usually students use a rubric with the criteria for successful achievement of the learning target set forth by the educator. As students start each unit of work with clear statements about the mathematics they are going to learn, they begin to focus on the bigger landscape of their learning journeys; they learn what is important, as well as what they need to work on to improve. Studies have found that when students are asked to rate their understanding of their work through self-assessment, they are incredibly accurate at assessing their own understanding, and they do not over-or underestimate it (Black et al., 2002).

Assessing Student Work

Students review their own work and identify strengths and weaknesses for the purpose of improving performance by comparing their work against a rubric. It is better to engage students in co-developing the assessment targets and the rubric, allowing students' voice equal weight (Topping, 2018). Co-constructing the rubric provides students additional opportunities to become aware of the mathematics they are learning and need to learn. They identify their own strengths and weaknesses, decide how they are progressing towards a learning target and plan for improvement (Moss & Brookhart, 2009).

Peer Assessments

Similar to self-assessment, it also involves students developing the ability to reflect and assess progress in reaching the learning target set forth by the educator. Students utilize the co-constructed rubric to measure their peer's work in meeting the assessment target. Peer assessment has been shown to be highly effective, in part because students are often much more open to hearing criticism or a suggestion for change from another student, and peers usually communicate in ways that are easily understood by each other (Black et al., 2002 and Topping, 2018). This kind of collaboration allows the students to internalize the evaluative criteria, and engage in a learning process that relies on speaking and thinking like a mathematician.

Interim Assessments

Interim assessments provide opportunities for educators to measure students' progress at mastering specific concepts during the instructional year. Educators use this information to inform their instruction moving forward. Although

sometimes confusingly referred to as "formative assessments," interim assessments are neither specific nor timely enough to guide teaching and learning, and so cannot serve the formative assessment process (Linquanti, 2014). Interim assessments must provide comparable evidence of student collected throughout the year to reveal patterns of achievement within and across teachers, grades and subjects. In order to accurately provide this data, interim assessments must measure standards addresses within the learning period and align to the scope and sequence utilized in classrooms, i.e. the objectives tested should match those taught in the preceding time period (Shepard, 2005).

Summative Assessments

Summative assessments help determine whether students have attained a certain level of competency after a more or less extended period of instruction and learning (National Research Council [NRC] 2001). Summative assessments determine levels of proficiency on grade-level knowledge and skills and support evaluative judgements on the overall impact and effectiveness of educational programs at the end of the school year. These assessments are the most distant from the classroom and the least able to inform teaching and learning directly because they are made to provide information over a large range, i.e. state or national level.

Action Steps for Educators

Action Steps for Teachers (NCTM, 2014)

- Work in collaborative grade-level or subject-based teams to develop common assessments to be used formatively; commit to their use, and analyze and apply the results to advance student learning and improve instruction.
- Evaluate students' mathematics learning with multiple measures to make more reliable and valid judgments about what students know and are able to do.
- Provide students with descriptive, accurate, and timely feedback on assessments, including strengths, weaknesses, and next steps for progress toward the learning targets.
- Recognize that effective instruction and ongoing review are the best high-stakes "test prep" strategies.
- View assessment results as supplying part of the picture of instructional effectiveness and use them to drive instructional decision making, focus personal professional growth, and make programmatic improvements.
- Allow student involvement in the formative assessment process; empowering and encouraging them to monitor their own learning, even though it takes time to incorporate into a lesson.

Action Steps for Administrators (NCTM, 2014)

- Align assessments with the goals of the mathematics program by measuring students' conceptual understanding and proficiency in the mathematical practices.
- Aligns and supports goals in the school/district's NM DASH plans to support students meeting those expectations.
- Create structures to ensure that the results of all assessments are used to strengthen teaching, curriculum, and support for students.
- Make collaborative design and implementation of common formative assessment processes a norm, and allocate the necessary time for grade-level or subject-based teacher teams to complete this work.
- Provide teachers with the professional development support that they need to develop their assessment expertise.
- Ensure that collaborative teams use assessment results appropriately to guide and modify instructional practices and make program improvement.

Professional Learning Goal:

Support multiple opportunities for professional learning and growth to enhance mathematics learning experiences, refine mathematics classroom instruction, and promote educator collaboration and reflection.

Foundation (Why is this important?)

Research indicates a strong correlation between educator professional learning, teaching practices used in instruction, and positive student outcomes. Professional learning provides educators with an opportunity to explore teaching practices and strategies and how they impact student learning. Educators hold themselves and their colleagues accountable for the mathematical success of every student and for personal and collective professional growth toward effective teaching and learning of mathematics (NCTM, 2014). Effective professional learning for educators leads to:

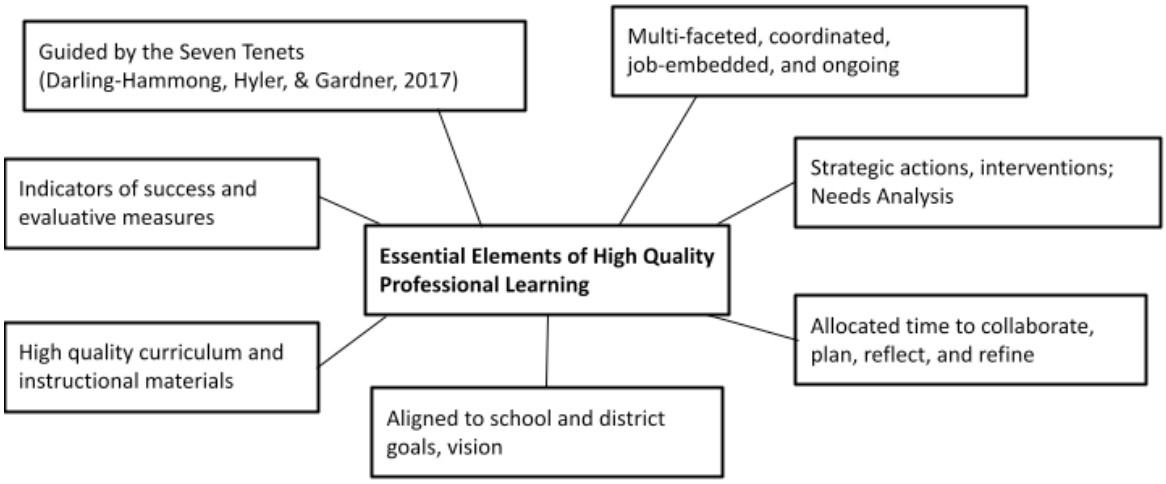
- increased mathematical knowledge and capacity to use it in practice
- enhanced ability to notice, analyze, and respond to student learning needs
- reflection on beliefs and dispositions about mathematics teaching and learning
- opportunity to develop collegial relationships and learning communities that support and sustain educator professional growth.

Essential Elements (What do I need to know?)

The role of professional learning is deeply connected to the work educators do each day in their classrooms, driven by the needs of their students, and measured in terms of results for students. These seven essential elements (Figure 6) highlight criteria that make professional learning effective and impactful for student learning. Adhering to these elements will increase the likelihood that investments in professional learning will be implemented in meaningful ways, with clear, positive results in student achievement data.

Figure 6

Essential Elements of High Quality Professional Learning



Guided by the Seven Tenets of Effective Professional Learning

Effective professional learning is guided by the need to change instructional practice that supports student learning. The approach must include a range of experiences sustained over time. Structured professional learning that results in changes to instructional practice and improvements in student learning outcomes tends to incorporate most or all of the elements below (Darling-Hammond, Hyler, & Gardner, 2017).

Darling-Hammond, Hyler and Gardner (2017) describe seven tenets of professional learning. Professional learning:

- Is content focused
- Incorporates active learning utilizing adult learning theory
- Supports collaboration, typically in job-embedded contexts
- Uses models and modeling of effective practice
- Provides coaching and expert support
- Offers opportunities for feedback and reflection
- Maintain a sustained focus and duration

Well-designed professional learning communities integrate these elements to support educator learning results in student learning gains. Professional learning that focuses on teaching strategies and content associated with high quality curriculum content supports educator learning within their classroom contexts. Active learning provides educators with opportunities to get hands-on experience designing and practicing new teaching strategies and participate in the same style of learning they are designing for their students. Working collaboratively, educators create communities that positively change the culture and instruction of a grade level, department, school/district, which has important implications for improving the equity of whole systems.

Curricular models and modeling of instruction provide educators with a clear vision of what best practices look like. Coaching and expert support involve sharing of expertise around content and practice, focused directly on educators' individual needs. High-quality professional learning frequently provides time for feedback and reflection, opportunity to think about, receive input on, and make changes to their practice. This can include modeling best practices or instructional strategies via video or demonstration, analyzing lesson plans, or walk-through observations with reflective follow-up and constructive feedback. Educators require adequate time to learn, practice, implement, and reflect upon new strategies. Strong professional learning initiatives typically engage educators in learning over weeks, months, or even academic years. In the process of making their work public and critiquing others, educators learn to make rules implicit and expectations explicit, and how to give and receive constructive feedback as students (Darling-Hammond, Hyler, & Gardner, 2017).

Multi-faceted, coordinated, job-embedded and ongoing

In the same manner that we approach diverse student learning needs, educators also require professional learning that works well with their situation, meets their needs, and allows for variety in the type of sessions and support. Multi-faceted and coordinated support, including reflective coaching, not only introduces new instructional strategies but can also refine current instructional strategies, both of which increase student achievement. Job-embedded and ongoing opportunities for professional growth link the professional learning to on-the-spot and real-life challenges faced by educators in supporting all students to understand and enjoy mathematics.

Table 7. Mathematics Professional Learning Types, Advantages and Considerations.

Types of Professional Learning	Potential Advantages	Considerations for Effective Professional Learning
Training *Presenters or teams of presenters share knowledge through a variety of group-based activities. Training format may include large group presentations, webinars and seminars.*	Builds knowledge and awareness of school/district vision. Common message delivered to all participants to create a shared knowledge base and common vocabulary. Efficient and cost effective.	Participants need time to discuss and consider how new concepts or strategies will be enacted at school sites. Follow-up activities are needed to support implementation of new practices in the classroom, including planning implementation, modeling instruction, providing feedback, and coaching.
Content-based Workshops *Teachers engage in mathematics learning as students to experience rich conceptual learning of mathematics concepts to develop a deep understanding of the math they teach.*	Improve participant conceptual knowledge of mathematics needed for teaching and connections between mathematics concepts. Strengthen participants' understanding of CCSS-M standards and connections between standards.	Participants math experiences should include multiple entry points for teachers to enhance content discussions and provide an image for replicating in the classroom. Participants can reflect consciously on the design of a lesson they experience in order to consider how to replicate engaging experiences and discourse for students.
School-based study groups *Professional learning is conducted through school-based communities of practice and situated in classrooms where student learning occurs to address authentic problems of student learning.* .	Study problems of practice related to student understanding of mathematics concepts. Begin with analysis of student work to identify current understanding, learning gaps, and misconception. Study research on strategies for addressing common mathematics gaps or misconception. Plan interventions to build student understanding and address learning gaps or misconceptions. Study student learning (using student work) to reflect on effectiveness of intervention and plan next steps.	Participants need uninterrupted/ sacred time built into the schedule that is structured in regular intervals (e.g, weekly or bi-weekly) Time to build team norms and relationships is the foundation of sustainable school groups. Teachers need time to consider how to implement their learning practically in the classroom, and then have opportunities to revise and refine that vision based on personal practice. This can extend to collaborative practice.

Types of Professional Learning	Potential Advantages	Considerations for Effective Professional Learning
Action Research Groups *Educators engage in a) selecting a problem or question of common interest; b) collecting, organizing, and interpreting information related to the problem; c) studying the professional literature and research; d) determining possible actions, and e) taking actions and documenting results to share with others.*	Collaboration around a common goal or dilemma in mathematics learning. Helps educators become more reflective practitioners, more systematic problem solvers, and more thoughtful decision makers.	Requires significant initiative and commitment of participants. Participants need uninterrupted/ sacred time built into the schedule that is structured in regular intervals (e.g, weekly or bi-weekly). Time to build team norms and relationships is the foundation of sustainable school groups.
Individually Guided Activities *Educators determine their own individual professional development goals and select the activities they believe will result in the achievement of these goals.*	Flexibility and opportunities for choice and individualization. Designed for self-analysis, reflection, and thoughtful decision-making.	Requires significant self-starting initiative and commitment of participant. Structured time for sharing of professional learning should be built into the school structure.
Individually Guided Activities *Educators determine their own individual professional development goals and select the activities they believe will result in the achievement of these goals.*	Flexibility and opportunities for choice and individualization. Designed for self-analysis, reflection, and thoughtful decision-making.	Requires significant self-starting initiative and commitment of participant. Structured time for sharing of professional learning should be built into the school structure.
Mentoring *Pairing an experienced and highly successful educator with a less experienced colleague.*	Collaboratively set personal goals for learning. Collaboratively plan, reflect, and refine instruction. The process can foster lifelong, highly productive professional relationships. Strengthens sharing of expertise within the school.	Participants need uninterrupted and dedicated time built into the schedule that is structured in regular intervals (e.g, weekly or bi-weekly).

Adapted from the NM Statewide Literacy Framework (NMPED, 2020)

Strategic Actions and Interventions Driven by Needs Analysis

A needs assessment is a systematic set of procedures that are used to determine needs, examine their nature and causes, and set priorities for future action. A needs assessment should lead to action that will improve systems, services, processes and operations. School teams are encouraged to utilize a needs assessment to determine the best professional learning for educators and administrators to enhance student learning experiences. With limited teacher time and financial resources, districts and schools should focus on providing professional learning opportunities that directly impact students' learning needs, based on identified trends in data analysis. School or district priorities and professional learning plans should continually be refined by identifying instructional practices and specific curriculum enhancements that have demonstrated impact on addressing student learning gaps, in contexts similar to those where the needs exist.

1. Analyze student, teacher, school, and district data; trends and patterns
2. Identify strategic actions and interventions that support advanced mathematics understanding for all students
3. Identify appropriate professional learning for educators differentiated by position and need

Allocated Time to Collaborate, Plan, Reflect and Refine

As educators seek to improve their practice by participating in professional learning, they need individual time to reflect on current instructional practices and plan how to implement new learning. Sufficient time is needed to prepare for high quality instruction that incorporates best practices identified in professional learning, and time after instruction is needed for reflection, change, and continued planning. In addition,allocating time to establish a school level support system will reinforce collaborative practices focused on meeting student needs and reflecting on how to best meet those needs. This support can be developed through professional learning communities, school-based communities of practice, instructional coaching, or a combination of these. Without collegial support, new knowledge may increase teacher skill but will not lead to sustained change in classroom practice (Joyce & Showers, 2002).

Needs Assessment for Professional Learning

1. Analyze student achievement data to develop goals for student achievement to know the specific knowledge and skill areas in which students are underperforming and which students are most often underperforming.
2. Understand the context, including cultural and linguistic diversity, in which those needs exist so that teacher, principal, school, and district factors that influence successful change initiatives based on professional learning are identified and ready to be addressed.
3. Develop clear educator learning goals that specify changes in knowledge, attitude, skill, aspiration, and behavior to ensure attainment of the student achievement goals.
4. Research professional learning designs, programs, and/or content to identify ones that have successfully achieved similar goals in similar contexts to identify core components to include in our program.
5. Plan professional learning, the implementation of professional learning, and its evaluation to ensure success not only in implementation but also in results for educators and students.
6. Support, monitor, and evaluate implementation of professional learning.
7. Assess student progress and reflect on educator practice to assess the effectiveness of professional learning before implementing the process again.

*Based on documents from the National Staff Development Council, www.nsdc.org

In professional learning communities or school-based communities of practice, educators construct knowledge and grow as professionals collaboratively studying and developing solution strategies to address important issues of student learning. Schools should work to identify instructional leaders who can support others in professional growth. Tapping into the strengths of the staff builds school capacity and supports a culture of collaboration and leadership. Some characteristics of effective school professional learning communities include the following:

a. focused on improving educator effectiveness in raising student achievement;
b. conducted among educators and facilitated by well-prepared and knowledgeable educators; and
c. lead to effective teaching practices, supportive leadership, and improved student learning (Learning Forward, 2021).

Through instructional coaching, educators are encouraged to generate and implement new ideas in a safe and supportive relationship,related to educators' specific instructional needs. Coaching can "go where no other professional development has gone before: into the intellect, behaviors, practices, and beliefs, values and feelings of an educator." (Aguilar, 2013, p. 8). Research has shown that coaching increases teachers' use of data to inform their teaching practices

and elevates their status as professional decision-makers (Felux & Snowdy, 2006). Coaching has the potential to develop greater communication that leads to changes in pedagogy, content knowledge and behaviors. It also promotes leadership development and support for teachers that focus on improving student learning (Aguilar, 2013).

Aligned to Districts/Charter Schools Goals and Vision

Enhanced learning for students depends on detailed, thoughtful professional learning for adults. To sustain consistently high quality learning opportunities for all students, professional learning must align with school and district goals and objectives. When schools approach professional learning through the lens of their instructional priorities, teacher improvement becomes a continuous cycle of learning, and progress can be gauged over time. Schools and districts must ensure educators and leaders share a vision for what great instruction looks like, and the success of this priority is determined by how it is pursued. Schools that advance educators toward this vision at every opportunity, through observation and feedback, during planning or data meetings, or in professional learning sessions, improvement feels cohesive and relevant, and becomes an invaluable part of what it means to be a teacher in New Mexico.

The PED supports districts and charter schools to achieve alignment of priorities and actions through the NM DASH (Data, Accountability, Sustainability, and High Achievement), a web-based action-planning tool identified for developing school improvement plans and identifying research-informed and evidence-based interventions and professional learning being put into place within schools. The NM DASH Portal is accessible at no cost to all local education agencies in New Mexico and is required by statute.

High Quality Curriculum and Instructional Materials

> Across New Mexico, it is critical that all students must have access to High-Quality Instructional Materials (HQIM). High-quality instructional materials are content-rich, fully accessible, culturally and linguistically relevant, free from bias, evidence-based, and aligned to New Mexico state standards. They are written with clear purpose, effective lesson structure, and pacing to provide flexibility for teachers to best suit the learning styles of all students, encouraging inquiry and curiosity.
> (NMPED, 2018)

Professional learning aligned to locally adopted high-quality instructional materials (HQIM), which includes support for implementation and development of pedagogical content knowledge, results in high quality mathematics instruction. With frequent, ongoing professional learning based in understanding, internalizing, and effectively using the adopted HQIM, educators will increase content knowledge and knowledge of effective instructional practices. Professional learning directly tied to HQIM supports schools and educators in meeting the diverse learning needs of all students, creating engaged, culturally relevant, and academically competitive learning environments.

Sufficient time is needed for educators to become familiar with materials. Tabe 8 outlines some strategies to support implementation, including but not limited to new materials, multicultural education and structures for professional learning.

Table 8. Some suggestions for HQIM professional learning

New Materials	Multicultural Education	Structures for Professional Learning
● Summer training with publishers prior to the start of the school year ● District or school summer professional learning for using materials in the classroom ● On-going, cyclical professional learning conducted throughout the year, provided by high-quality facilitators or district/school instructional coaches/personnel ● Collaboration between schools or districts/charter schools when using the same instructional materials ● Review of HQIM to determine if supplementation is needed to enhance alignment with the content standards ● Development of guides and suggested scheduling of units/ modules	● Reflection of culturally and linguistically relevant experiences and perspectives in materials and professional learning ● Development of a knowledge base to ○ identify cultural rings and belief systems ○ affirm and validate the cultural characteristics, perspectives, and experiences of culturally and linguistically diverse students ○ build and bridge academic content to lived experiences	● Determination of professional learning needs based on content, district or charter school supports in place, curriculum to be implemented and needs of students ● Unified vision of great instruction and expectations for students and how HQIM can serve that vision ● Development of meeting structures to share ongoing strategies, challenges, and successes ● Creation of an Implementation Team: representatives from each campus and grade level in a train-the-trainer model ● Protocol for gathering feedback to inform continued improvement ● Provision of professional learning opportunities at the state, district and school levels ● Plan for year-long process of implementation based on cycles of inquiry - collecting and interpreting information, enabling reflection that leads to decisions and actions for next steps ● Considerations for follow-up, first-steps and continued support for new and level I educators, as well as those that join later in the school year

Adapted from the NMPED HQIM Resource Manual (2021)

Indicators of Success and Evaluative Measures

Evaluation of professional learning is necessary to ensure the coherence and impact of a professional learning plan. Other reasons include: an increased understanding and recognition of professional learning as both a dynamic and intentional process, successful reform efforts must be guided by accurate and detailed information, and the ever increasing pressure for greater accountability (Guskey, 2000).

Table 9 provides a model for evaluating professional learning that is hierarchically arranged from simple to complex (Guskey, 2000). Each of these five levels is important and success at one level is necessary for success at the next level. In planning professional learning to improve student learning, the order of these levels must be reversed. First consider student outcomes (Level 5), then what practices and policies will achieve those outcomes (Level 4). Next, what supports would need to be in place to implement those practices and policies (Level 3). Followed by, the knowledge and skills participating professionals would need (Level 2), and the set of experiences that will help participants learn those (Level 1).

Table 9. Five Levels of Professional Learning Evaluation.

Evaluation Level	What Questions Are Addressed?	How Will Information Be Gathered?	What is Measured or Assessed?	How Will Information Be Used?
1. Participants' Reactions	Did they like it? Was their time well spent? Did the material make sense? Will it be useful? Was the leader knowledgeable and helpful? Were the refreshments fresh and tasty? Was the room the right temperature? Were the chairs comfortable?	Questionnaires administered at the end of the session	Initial satisfaction with the experience	To improve program design and delivery
2. Participants' Learning	Did participants acquire the intended knowledge and skills?	Paper-and-pencil instruments Simulations Demonstrations Participant reflections (oral and/or written) Participant portfolios	New knowledge and skills of participants	To improve program content, format, and organization

Evaluation Level	What Questions Are Addressed?	How Will Information Be Gathered?	What is Measured or Assessed?	How Will Information Be Used?
3. Organization Support & Change	Was implementation advocated, facilitated, and supported? Was the support public and overt? Were problems addressed quickly and efficiently? Were sufficient resources made available? Were successes recognized and shared? What was the impact on the organization? Did it affect the organization's climate and procedures?	District and school records Minutes from follow-up meetings Questionnaires Structured interviews with participants and district or school administrators Participant portfolios	The organization's advocacy, support, accommodation, facilitation, and recognition	To document and improve organization support To inform future change efforts
4. Participants' Use of New Knowledge & Skills	Did participants effectively apply the new knowledge and skills?	Questionnaires Structured interviews with participants and their supervisors Participant reflections (oral and/or written) Participant portfolios Direct observations Video or audio tapes	Degree and quality of implementation	To document and improve the implementation of program content

Evaluation Level	What Questions Are Addressed?	How Will Information Be Gathered?	What is Measured or Assessed?	How Will Information Be Used?
5. Student Learning Outcomes	What was the impact on students? Did it affect student performance or achievement? Did it influence students' physical or emotional well-being? Are students more confident as learners? Is student attendance improving? Are dropouts decreasing?	Student records School records Questionnaires Structured interviews with students, parents, teachers, and/or administrators Participant portfolios	Student learning outcomes: -Cognitive (Performance & Achievement) -Affective (Attitudes & Dispositions) -Psychomotor (Skills & Behaviors)	To focus and improve all aspects of program design, implementation, and follow-up To demonstrate the overall impact of professional development

Adapted from source: Guskey, (2000).

Implementation (What do we need to do?)

These Essential Elements are only as beneficial for students in so far as the actions they compel educators, administrators, schools, districts and charter schools, and state education leaders to take. Everyone has a role to play in ensuring high quality mathematics instruction for all students in New Mexico.

Principles to Actions (NCTM, 2014) states:

> We need to take action to ensure that all students become confident in their ability to learn and use mathematics...We need to take action to create classrooms and learning environments where students are actively engaged with worthwhile tasks that promote mathematical understanding, problem solving, and reasoning...We need to take action to create classrooms where all students become mathematical problem solvers, making sense of problems and discussing their solutions...What will it take to create such classrooms in every school and district? (pg. 109)

Action Steps for Educators

Action Steps for Teachers

- Ensure that instruction and pedagogy are consistent with research-informed, evidence-based equitable teaching practices.
- Consider practices or procedures in your classroom that restrict student access to and success in math, and takes stakes to remove these barriers through professional learning.
- Collaborate wtih other educators within your school, district and across the state to share strategies, successes and challenges, especially when related to pedagogy and instructional materials

- Advocate for time and space to work with professional learning communities, instructional coaches, administrators, and other education experts to further develop your craft.
- Seek out opportunities for high quality professional learning that supports deep pedagogical content knowledge and use of research-informed instructional practices, especially those that are culturally and linguistically relevant and support teacher and student mathematical identities.
- Consistently implement and link research-informed instructional practices and equity-based instructional practices.

Action Steps for Administrators

- Provide professional learning and training that makes the implementation of the Mathematics Teaching Practices a priority (NCTM, 2014).
- Engage in classroom walkthroughs that provide meaningful feedback and opportunities for professional learning and growth.
- Consider school-wide structures, systems, or policies that restrict student access to and success in mathematics, and take steps to address these with educators and school staff through professional learning.
- Provide appropriate opportunities that support on-going professional learning and promote professional growth and development, including targeted professional learning and collaborative planning time for educator teams.
  Maintain a schoolwide culture of continual improvement, learning and collaboration for all, supported by sustained professional learning around mathematical knowledge, pedagogical content knowledge, and knowledge of students as learners of mathematics.

Family and Community Engagement Goals

The goals of family engagement in math learning closely mirror those for family and caregiver engagement in general and include:

- To foster authentic school-home relationships, rooted in mutual trust and reciprocal accountability;
- To cultivate academic partnership opportunities that support student growth and equip and empower families and caregivers to monitor and support numeracy and mathematical development at home;
- To provide culturally relevant and linguistically accessible resources for families to
  - Set and communicate high expectations,
  - Cultivate a culture of math learning and habits of mind in the home
  - Support children in identifying as math learners, and
  - Advocate for individual children's needs.

Foundation (Why is this important?)

There are tremendous benefits for students and children when their families and caregivers are involved in their mathematics learning, particularly during the early grades. These children often earn higher mathematics grades and test scores, are more likely to pass their courses and move on to the next grade, have better school attendance, and are more likely to graduate from high school and go on to post-secondary education (Henderson & Mapp, 2002). When families and caregivers take an active role in their child's education, children have an increased likelihood of going into STEM-related majors in college and pursuing STEM-related careers after graduation. These children are also more likely to have better social skills, fewer behavioral problems, and better adaptation to the school environment. Family and caregiver involvement has also been shown to reduce mathematics-related achievement gaps between students regardless of economic background (Henderson & Mapp, 2002).

Teachers and administrators play a key role in promoting family engagement in the mathematics learning of their children, including:

- Communicating the impact of setting high expectations in children's mathematics learning
- Encouraging parents and families to monitor their child's academic progress
- Promoting the importance of family support and encouragement of their children's mathematics learning
- Emphasizing the need to foster positive and healthy attitudes and beliefs about the importance of mathematics learning in the home
- Underscoring the importance of family advocacy for their child's academic success

Essential Elements (What do I need to know?)

Educators must encourage families to communicate positive beliefs and attitudes about mathematics learning to help families foster a positive and productive mathematics identity in their children. Teachers and administrators must encourage the learning of mathematics outside the school environment. Families are partners in helping children learn mathematics and should be encouraged to include mathematics "talk" in their everyday life, especially in the years before children enter school and in the early grades. Using math "talk" is important in providing children with exposure to mathematics in a relaxed way. This may include things like finding shapes in the environment, counting objects, understanding how many objects are in a set, etc. It is also important to encourage families and caregivers to draw upon their culture, heritage, and daily routines to make mathematics more relevant for their children. Teachers and administrators need to find ways of teaching mathematics in culturally responsive ways by drawing upon and utilizing the culture and heritage of the families of their students. Growth mindset can also play an important role for family engagement in mathematics learning. Families and caregivers should be provided the tools and foundation to promote a growth mindset about math learning. For example, families might be provided a growth mindset phrases handout, etc...

Implementation (What do we need to do?)

The work of engaging families in the numeracy of their children is a joint effort of equal responsibility between school administrations, classroom teachers, and families. The work of each of these stakeholders is critical in the formation of a robust family-school partnership that supports math teaching and learning. New Mexico Engaged offers a general framework for building effective school-family partnerships. This framework provides guidance pertaining to engaging families in math learning and offers various resources for schools to assess and improve their engagement practices. In addition, there are resources available on this site that educators may utilize for academic partnering events, such as parent-teacher conferences.

All stakeholder groups should be encouraged to consider their own personal relationship to math and math learning and address their biases related to math. These attitudes and beliefs are transferred from caregivers, teachers, and other adults to students (Boaler, 2015). Districts, schools, and educators should collectively make a plan to address these, as they are counterproductive to numeracy development.

Administrators and educators should foster an environment of enthusiasm for learning math. Implemented strategies should be culturally relevant and linguistically accessible for all families. This can be accomplished by:

- Embracing and supporting staff, students, and family development of a growth mindset concerning math learning throughout the school
- Supporting events and activities that involve families in math learning
- Highlighting student and family contributions to math learning at their school (i.e. display and/or promote student work, family projects, etc)
- Supporting school-teacher-family relationships that are authentic, sustain trust, and build partnership (see New Mexico Engaged for guidance)
- Communicating and setting high expectations for family involvement in the school.
- Taking an inventory of the school/district's engagement of all families and making a plan to move forward
- Empowering families to advocate for their child's math development
    - Establishing varied communication methods as needed (phone, tex, apps, email, websites, folders, etc)
    - Providing families regular, timely and specific information about their child's mathematical development
    - identifying student strengths and working with families to co-create solutions to address challenges or areas of growth
- Promoting a growth mindset about learning math
- Providing opportunities for learning that promote mathematical thinking while honoring the child's home language, culture, and routines (i.e. culturally responsive math teaching practices) (Bonner, 2021)
- Finding ways to promote mathematical concept development throughout daily routines at home

Outside of the school, families and caregivers provide the physical environment and culture of learning. Characteristics of engaged families include:

- Engaging in activities that emphasize a growth mindset and are linked to in-class learning.
- Embracing new ways of learning and understanding math.
- Fostering enthusiasm for learning within the home and community
- Engaging in "math talk" at home during regular routines and activities, highlighting math in the everyday settings.
- Setting and communicating high expectations for learning.
- Celebrating the learning accomplishments of children.

The work of nurturing robust school-teacher-family/caregiver partnerships is critical in the early grades to establish family habits conducive to math learning and success. The nature of family engagement evolves as children progress through school, but the importance of the collaboration of school, teacher, family and caregivers for the advancement of the math learning of the student remains essential.

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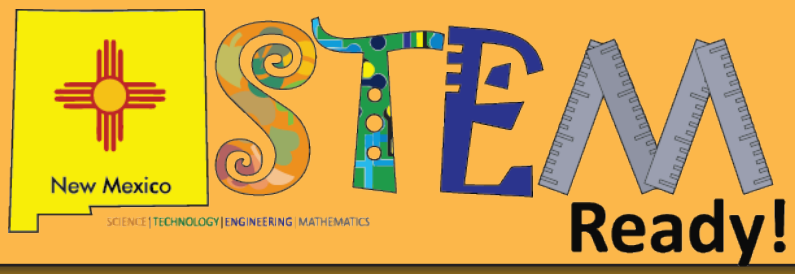
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