New Mexico Instructional Scope

4th Grade Operations and Algebraic Thinking Guide

The purpose of this tool is to help educators understand each of the grade level standards and how those standards connect to the students' overall preparation for college and career readiness.

The NMIS is a teacher-influenced tool, designed to provide instructional planning support at the programmatic level for districts and instructional level for teachers. Its foundation stems from the vision and mission of the PED and came into existence to assure that students in NM will be engaged in a culturally and linguistically responsive educational system that meets the social, emotional, and academic needs of ALL students. This is also rooted in the belief that all students must have access to on-grade-level standards, focusing on acceleration. The purpose of this tool is to help educators understand each of the grade level standards and how those standards connect to the students' overall preparation for college and career readiness.

Standards are defined as the most critical prerequisite skills and knowledge. This document is color-coded to reflect both anchor and priority standards. Though previous emphasis was placed on priority standards to address lost learning due to COVID-19, New Mexico teachers should note that moving forward, while priority standards allow for acceleration of learning, all standards should be addressed in instruction throughout the school year.

In this guide you will find:

- A breakdown of each of the grade level standards within the cluster, including:
  - Standards of Mathematical Practice
  - Common Misconceptions
  - Identification of Priority Standards, as identified by NMPED.
  - Level of Rigor Identification
- Sample aligned assessment items
- Suggested Student Discourse Guide
- A multilayered system of supports (MLSS) and culturally and linguistically responsive instruction (CLR) guide

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Key		
	Priority Standard	Priority standards, as identified by NMPED, are denoted with red highlighting. Priority standards are the most critical prerequisite skills and knowledge a student needs. This does not mean that these are only standards required to be taught, just these are the standards that will allow for the acceleration the students of New Mexico need during this time.
	*Conceptual Understanding*	Conceptual Understanding standards help students build a deep understanding of the **how** and **why** of mathematics.
	*Application*	Application standards help students identify the appropriate concepts and skills to tackle **novel real-world problems.**
	*Procedural Skill and Fluency*	Procedural standards help students develop **efficiency** and **accuracy** in computations.

Standards Breakdown

- Use the four operations with whole numbers to solve problems.
  - 4.OA.A.1
  - 4.OA.A.2
  - 4.OA.A.3
- Gain familiarity with factors and multiples
  - 4.OA.B.4
- Generate and analyze patterns
  - 4.OA.C.5

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Grade	*CCSS Domain*	*CCSS Cluster*
4	**Operations and Algebraic Thinking**	**Use the four operations with whole numbers to solve problems**

Cluster Standard: 4.OA.A.1

Standard	Standards for Mathematical Practice
Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.	• **SMP 3:** Construct viable arguments and critique the reasoning of others • **SMP 7:** Look for and make use of structure
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• This standard requires students to use multiplication equations to represent verbal multiplicative comparisons. This standard also calls for students to conceptually represent multiplicative comparisons. The focus lies in understanding comparisons NOT simply identifying each factor or product without understanding the meaning. Students should relate multiplicative reasoning to iterating-that is, to making multiple copies- and partitioning sets of objects as well as to the length, area, and volume of physical space.	• Explain multiplication equations as multiplicative comparisons (28 is 7 times as many 4 and 4 times as many as 7) • Explain how multiplication can compare quantities - Interpret multiplicative comparison language within a word problem • Represent multiplicative comparisons • Identify a multiplication equation as showing two ways to describe a product • Write equations to represent multiplicative comparisons • Write word problems using multiplicative comparisons to describe a multiplication equation
DOK	**Blooms**
1-2	Apply

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Grade	*CCSS Domain*	*CCSS Cluster*
4	**Operations and Algebraic Thinking**	**Use the four operations with whole numbers to solve problems**

Cluster Standard: 4.OA.A.2

Standard	Standards for Mathematical Practice
Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.	• **SMP 4:** Model with mathematics
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• This standard requires students to use multiplication equations to represent verbal multiplicative comparisons. This standard also calls for students to conceptually represent multiplicative comparisons. The focus lies in understanding comparisons NOT simply identifying each factor or product without understanding the meaning. Students should relate multiplicative reasoning to iterating-that is, to making multiple copies- and partitioning sets of objects as well as to the length, area, and volume of physical space.	• Use drawings and equations (with symbols to represent an unknown) to solve multiplication word problems • Use drawings and equations (with symbols to represent an unknown) to solve division word problems • Contrast a multiplicative comparison from an additive comparison
DOK	**Blooms**
1-2	Apply

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Grade	*CCSS Domain*	*CCSS Cluster*
4	**Operations and Algebraic Thinking**	**Use the four operations with whole numbers to solve problems**

Cluster Standard: 4.OA.A.3

Standard	Standards for Mathematical Practice
Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.	• **SMP 2:** Reason abstractly and quantitatively.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• This standard requires students to use ALL four operations to solve multi step word problems. It also requires students to interpret remainders in context of the word problem.	• Use drawings and equations (with symbols to represent an unknown) to solve multiplication word problems • Use drawings and equations (with symbols to represent an unknown) to solve division word problems • Use mental computation and estimation to check for reasonable solutions
DOK	**Blooms**
1-2	Apply

Common Misconceptions

• Students may confuse addition and	• Students may have trouble with the language in

multiplication. For example, when asked to write an equation for 7 times as many as 5, a student may write 7 + 5 instead of 7 x 5.	the word problems. For example, "3 times fewer" may be interpreted as the same as "3 less than" when solving word problems.

Grade	*CCSS Domain*	*CCSS Cluster*
4	**Operations and Algebraic Thinking**	**Gain familiarity with factors and multiples**

Cluster Standard: 4.OA.B.4

Standard	**Standards for Mathematical Practice**
Find all factor pairs for a whole number in the range 1-100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1-100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1-100 is prime or composite.	• **SMP 3:** Construct viable arguments and critique the reasoning of others • **SMP 7:** Look for and make use of structure
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• This standard requires students to find all factor pairs for whole number in the range of 1-100. It also requires students to determine whether a whole number in the range of 1-100 is prime or composite.	• Identify factor pairs for a number using basic multiplication facts. • Determine whether a number is a multiple of another number using basic multiplication facts. • Identify prime or composite numbers. • Find all factors pairs for whole numbers 1-100 • Determine if a number in the range of 1-100 is a multiple of a given one-digit number • Understand that a whole number is a multiple of its factors • Determine if a number in the range 1-100 is prime or composite number
DOK	**Blooms**
1-2	Remember

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Common Misconceptions

• A common misconception is that the number 1 is prime, when in fact; it is neither prime nor composite.	• Another common misconception is that all prime numbers are odd numbers. This is not true, since the number 2 has only 2 factors, 1 and 2, and is also an even number.

Grade	*CCSS Domain*	*CCSS Cluster*
4	**Operations and Algebraic Thinking**	**Generate and analyze patterns**

Cluster Standard: 4.OA.C.5

Standard	Standards for Mathematical Practice
Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. For example, given the rule "Add 3" and the starting number 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way.	• **SMP 8:** Look for and express regularity in repeated reasoning.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Patterns involving numbers or symbols either repeat or grow. Students need multiple opportunities creating and extending number and shape patterns. Numerical patterns allow students to reinforce facts and develop fluency with operations. Students investigate different patterns to find rules, identify features in the patterns, and justify the reason for those features. After students have identified rules and features from patterns, they need to generate a numerical or shape pattern from a given rule.	• Describe rules in number and shape patterns. • Identify features of a pattern when given a rule. • Make observations about a resulting sequence given a rule, such as noticing that the terms alternate between even and odd numbers. • Model and solve multi-step word problems using equations.
DOK	**Blooms**

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2-3	Evaluate, Create

Common Misconceptions

• Students may not think a number is a multiple of itself.	• Students may think that numbers with a greater value have more factors than numbers with a lesser value.

Student Discourse Guide

- **Purposeful, rich classroom discourse offers students the opportunity to express their ideas, thinking, and to critique the reasoning of others in a variety of ways (writing, drawing, verbal). Purposeful implementation of classroom discourse allows students to activate funds of knowledge and to refine their mathematical understanding. When students have frequent opportunities for discourse they find various paths to solutions and reveal knowledge or misunderstandings to educators. The process also allows educators to honor students' culture, lived experiences and evolving math identities.**
- **Discourse that focuses on tasks that promote reasoning and problem solving is a primary mechanism for developing conceptual understanding and meaningful learning of mathematics (Michaels, O'Connor, and Resnick, 2008)**

Domain: **Operations and Algebraic Thinking**	Strand: **Use the four operations with whole numbers to solve problems**

Suggested Student Discourse Questions

• What key words in the word problem help you decide which operation(s) to use? • Compare and contrast the two different strategies?	• If a statement says 5 times more what does that mean? • Explain the process of building your model to a partner? • Do you agree with your partner's model? Why or why not?

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ASSESSMENT GUIDE

- Use the four operations with whole numbers to solve problems
- Gain familiarity with factors and multiples
- Generate and analyze patterns

Grade	*CCSS Domain*	*CCSS Strand*
4	**Operations and Algebraic Thinking**	**Use the four operations with whole numbers to solve problems**
	Sample Task #1 (Constructed Response)	
	Amy is baking muffins. Each baking tray can hold 6 muffins. a. If Amy bakes 4 trays of muffins, how many muffins will she have in all? b. The corner bakery produced 10 times as many muffins as Amy baked. How many muffins did the bakery produce? Explain your thinking.	
	Sample Task #2 (Multiple Choice)	
	Heather is going to a fair. The cost to enter the fair is $7, and each ride costs $3. Heather has $40 to spend to enter the fair and go on rides. What is the greatest number of rides Heather can go on? A. 4 B. 5 C. 11 D. 13	

Grade	*CCSS Domain*	*CCSS Strand*
4	**Operations and Algebraic Thinking**	**Gain familiarity with factors and multiples**
	Sample Task #1 (Constructed Response)	
	Sarah made a list of all of the whole numbers from 40 to 50. a. What is the greatest prime number on Sarah's list? Explain your thinking.	

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	Sample Task #2 (Multiple Choice)
	Which of these expressions are factor pairs of 56? Select the four correct answers. A. 1 x 56 B. 2 x 28 C. 3 x 18 D. 4 x 14 E. 6 x 8 F. 7 x 8

Grade	*CCSS Domain*	*CCSS Strand*
4	**Operations and Algebraic Thinking**	**Generate and analyze patterns**
	Sample Task #1 (Constructed Response)	
	Marco wrote a number pattern that followed the rule “Multiply by 3, subtract 5.” The first number in his pattern is 4. What is the fourth number in Marco’s pattern? Explain your thinking.	
	Sample Task #2 (Multiple Choice)	
	A number pattern starts with 7. Which rule for this number pattern would result in switching between odd and even numbers? A. Add 2. B. Add 3. C. Multiply by 2. D. Multiply by 3.	

MLSS AND CLR GUIDE

- Use the four operations with whole numbers to solve problems
- Gain familiarity with factors and multiples
- Generate and analyze patterns

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4th Grade Operations and Algebraic Thinking Guide

CCSS Domain	*CCSS Cluster*
Operations and Algebraic Thinking	**Use the four operations with whole numbers to solve problems**

Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on using the four operations with whole numbers to solve problems, consider options for learning from your families and communities the cultural and linguistic ways this mathematics exists outside of school to create stronger home to school connections for students, for example teachers can encourage students to write a word problem about something at home. This could be written in conjunction with family members. This gets the family talking about the math and different examples brought back into the classroom.	
Cross-Curricular Connections	Science: In fourth grade the NGSS recommends that students will study energy. Teachers should give students opportunities to use the four operations with whole numbers to solve problems. Students will also study Earth and human activity. Teachers should give students opportunities to be quantitative in descriptions. Consider providing a connection for students to be quantitative when discussing environmental effects.	
Validate/Affirm/Build/Bridge	• *How can you design your mathematics classroom to intentionally and purposefully legitimize the home culture and languages of students and reverse the negative stereotypes regarding the mathematical abilities of students of marginalized cultures and languages?* • *How can you create connections between the cultural and linguistic behaviors of your students' home culture and language, the culture and language of school mathematics to support students in creating mathematical identities as capable*	• Equity Based Practice (Posing Purposeful Questions): CLRI requires intentional planning around the questions posed in a mathematics classroom. It is critical to consider "who is being positioned as competent, and whose ideas are featured and privileged" within the classroom through both the types of questioning and who is being questioned. Mathematics classrooms traditionally ask short answer questions and reward students that can respond quickly and correctly. When questioning seeks to understand students' thinking by taking their ideas seriously and asking the community to build upon one another's ideas a greater sense of belonging in mathematics is created for students from marginalized cultures and languages. For example, when studying four operations with whole numbers to solve problems, the pattern of questions within the classroom is critical because it is important to include every student in no particular order. When grouped appropriately, students can share prior knowledge and support each other's strengths and weaknesses. Students set group norms in respect of their cultures. This enables the development of a

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	mathematicians that can use mathematics within school and society?	culture of productive discourse/discussion. Encourages questioning and validation among students' groups, the use of sentence frames and positive reinforcement. The teacher can facilitate conversations through strategic questioning.

Planning for Multi-Layered System of Supports

Vertical Alignment

Previous Learning	*Current Learning*	*Future Learning*
• Connect to interpreting products of whole numbers as the total number of objects in a set of groups **(3.OA.A1)** • Connect to using addition to find the total number of objects arranged in a rectangular array **(2.OA.C4)**	• Connect to process of generating a number or shape pattern that follows a given rule **(4.OA.C5)**	• Connect multiplying and dividing whole numbers to future work of multiplying and dividing fractions **(5.NF.B3)**

Suggested Instructional Strategies

Pre-Teach

Level of Intensity	*Essential Question*	*Examples*
Targeted	*What pre-teaching will prepare students to productively struggle with the mathematics for this cluster within your HQIM?*	For example, some learners may benefit from targeted pre-teaching that rehearses prior learning when studying using the four operations with whole numbers to solve problems because students need to represent verbal statements of multiplicative comparisons as multiplication equations.
Intensive	*What critical understandings will prepare students to access the mathematics for this cluster?*	3.OA.D.8 This standard provides a foundation for working with the four operations with whole numbers to solve problems because this standard works on two step problems using the four operations. It also asks students to create an equation using a letter for unknown. If students have unfinished learning within this standard, based on assessment data, consider ways to provide

		intensive pre-teaching support prior to the start of the unit to ensure students are ready to access grade level instruction and assignments.
Universal Support Framework		
A student should know/understand...	A student should be able to do...	***Potential Scaffolds***

• A multiplicative comparison is a situation in which one quantity is described as a multiple of another.
• How to interpret a comparison word problem as multiplication or division.
• Which operations are needed when solving multi-step word problems.
• The meaning of the remainder in a story problem.
	• Use symbols for unknown numbers to determine comparisons in multiplication and division.
	• Use numbers and symbols to represent word problems, including a letter for the unknown.
	• Solve multi-step word problems using contextual situations and reason and reflect on solutions.
	• Determine what to do with the remainder in division situations with remainders.
		• Build on students' experience with the following skills:
		  ○ Solving multi-step word problems by identifying key words to help them decide which operation to use
		  ○ Multiplying and dividing single-digit numbers within 100
		  ○ Adding and subtracting with regrouping
		• Cognitive Strategies
		  ○ Repeatedly model the strategies
		  ○ Monitor the students' use of the strategies
		  ○ Provide feedback to students
		  ○ Teach self-questioning and self-monitoring strategies
		  ○ Introduce multiple means of representation for mathematical ideas
		• Encourage students to use alternative tools to better access the grade level content. Examples include:
		  ○ Counting tiles
		  ○ Problem-solving strategies

Re-Teach		
Level of Intensity	***Essential Question***	***Examples***
Targeted	What formative assessment data (e.g., tasks, exit tickets, observations) will help identify content needing to	For example, students may benefit from re-engaging with content during a unit on using the four operations with whole numbers to solve problems by examining tasks from a different perspective through a short mini-lesson

	be revisited during a unit?	because students need support in discovering different ways to solve problems. This can be through group work or small groups.
Intensive	What assessment data will help identify content needing to be revisited for intensive interventions?	For example, some students may benefit from intensive extra time during and after a unit using the four operations with whole numbers to solve problems by confronting student misconceptions because students will need clear understanding to solve multi-step problems using the four operations. Students need practice and support when they don't understand word problems. Students need direct instruction using manipulatives.
Extension		
Essential Question		***Examples***
What type of extension will offer additional challenges to 'broaden' your student's knowledge of the mathematics developed within your HQIM?		For example, some learners may benefit from the opportunity to understand concepts more quickly and explore them in greater depth than other students when studying using the four operations with whole numbers to solve problems because word problems are seen through the students' academic careers and will be found in a variety of places. Working on different real world problems or creating problems help students understand different situations and help with understanding of complex problems.

CCSS Domain	***CCSS Cluster***
Operations and Algebraic Thinking	**Gain familiarity with factors and multiples**
Culturally and Linguistically Responsive Instruction	
Relevance to Families and Communities	During a unit focused on gaining familiarity with factors and multiples, consider options for learning from your families and communities the cultural and linguistic ways this mathematics exists outside of school to create stronger home to school connections for students, for example, students can discover different patterns that lend to factors and multiples in their home. They can further mathematical discourse with family about

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	patterns and different ways factors and multiples are used in everyday life.	
Cross-Curricular Connections	Social Studies: Connect students to the history behind the Sieve of Eratosthenes, the ancient algorithm that helps us to determine factors, multiples, primes, and composites for all numbers. Study the life and accomplishments of the Greek astronomer Eratosthenes of Cyrene and teach students how to use the Sieve.	
Validate/Affirm/Build/Bridge	• *How can you design your mathematics classroom to intentionally and purposefully legitimize the home culture and languages of students and reverse the negative stereotypes regarding the mathematical abilities of students of marginalized cultures and languages?* • *How can you create connections between the cultural and linguistic behaviors of your students' home culture and language, the culture and language of school mathematics to support students in creating mathematical identities as capable mathematicians that can use mathematics within school and society?*	• Facilitating Meaningful Mathematical Discourse: Mathematics discourse requires intentional planning to ensure all students feel comfortable to share, consider, build upon and critique the mathematical ideas under consideration. When student ideas serve as the basis for discussion, we position them as knowers and doers of mathematics by using equitable talk moves students and attending to the way students talk about who is and isn't capable of mathematics, we can disrupt the negative images and stereotypes around mathematics of marginalized cultures and languages. "A discourse-based mathematics classroom provides stronger access for every student — those who have an immediate answer or approach to share, those who have begun to formulate a mathematical approach to a task but have not fully developed their thoughts, and those who may not have an approach but can provide feedback to others." For example, when studying, gaining familiarity with factors and multiples facilitating meaningful mathematical discourse is critical because factors and multiples can be interpreted in many different ways. These are types of patterns that are seen in different areas of academic and life. Supporting mathematical discourse around tasks or problems with factors and multiples allows the teacher to determine misconceptions and helps the classroom develop different strategies for determining answers. A teacher can use questioning to guide and further students thinking through discourse. In the same way, the teacher can ask guiding questions about misconceptions and lead students to understanding.

Planning for Multi-Layered System of Supports

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Vertical Alignment		
Previous Learning	***Current Learning***	***Future Learning***
• Connect to determining the unknown value in a multiplication or division equation **(3.OA.A.4)** • Connect to fluently multiplying and dividing numbers within 100 **(3.OA.C7)** • Connect to learning about representing unknown quantities with a letter **(3.OA. D8)**	• Connect factor pairs to multiplicative comparisons **(4.OA. A1)**	• Connect to representing expressions with whole number exponents **(6.EE.A1)** • Connect to determining the greatest common factor and least common multiple of two whole numbers **(6.NS.B4)**

Suggested Instructional Strategies		
Pre-Teach		
Level of Intensity	***Essential Question***	***Examples***
Targeted	*What pre-teaching will prepare students to productively struggle with the mathematics for this cluster within your HQIM?*	For example, some learners may benefit from targeted pre-teaching that uses images/resources (especially those being used the first time) when studying gaining familiarity with factors and multiples because it helps students with conceptual understanding and being able to visually see patterns within factors and multiples. This can be connected to different standards in previous grades such as skip counting.
Intensive	*What critical understandings will prepare students to access the mathematics for this cluster?*	3.OA.C.7 This standard provides a foundation for work with gaining familiarity with factors and multiples because students will need to fluently multiply and divide within 100 and know from memory all products of two one-digit numbers. If students have unfinished learning within this standard, based on assessment data, consider ways to provide intensive pre-teaching support prior to the start of the unit to ensure students are ready to access grade level instruction and assignments.
Re-Teach		
Level of Intensity	***Essential Question***	***Examples***

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Targeted	What formative assessment data (e.g., tasks, exit tickets, observations) will help identify content needing to be revisited during a unit?	For example, students may benefit from re-engaging with content during a unit on gaining familiarity finding factor pairs of whole numbers by revisiting student thinking through a short mini-lesson because students that are struggling need support where they are having difficulty. Can they multiply or divide within 100? Do they need support for determining factors? Are they confused with the vocabulary? These are student thoughts that the teacher can work on in small groups.
Intensive	What assessment data will help identify content needing to be revisited for intensive interventions?	For example, some students may benefit from intensive extra time during and after a unit gaining familiarity finding factor pairs of whole numbers by addressing conceptual understanding because students who have trouble with coming up with factors quickly will need additional support with conceptual understanding. This includes manipulatives or visual models. It also might include the use of mathematical tools such as a hundreds chart.

Extension	
Essential Question	***Examples***
What type of extension will offer additional challenges to 'broaden' your student's knowledge of the mathematics developed within your HQIM?	For example, some learners may benefit from an extension such as the opportunity to explore links between various topics when studying gaining familiarity, finding factor pairs of whole numbers because students can look for factor relations through different curriculum data or real-world examples. This will help with work into 5th (fractions) and 6th (ratios)

CCSS Domain	***CCSS Cluster***
Operations and Algebraic Thinking	**Generate and analyze patterns**

Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on generating and analyzing patterns, consider options for learning from your families and communities the cultural and linguistic ways this mathematics

	exists outside of school to create stronger home to school connections for students, for example, learning can be expanded to home. Students can ask questions or gather data that pertains to their home unit or culture.	
Cross-Curricular Connections	Art: Patterns are prevalent in artistic compositions. Have students generate a rule to create a mosaic pattern. For example: Given the rule "add three" and the starting point "one" create a mosaic or other artistic composition using two different colors that follows the pattern. Increase the complexity of the pattern to result in a more complex color scheme. This could also be used with notes in music.	
Validate/Affirm/Build/Bridge	• *How can you design your mathematics classroom to intentionally and purposefully legitimize the home culture and languages of students and reverse the negative stereotypes regarding the mathematical abilities of students of marginalized cultures and languages?* • *How can you create connections between the cultural and linguistic behaviors of your students' home culture and language, the culture and language of school mathematics to support students in creating mathematical identities as capable mathematicians that can use mathematics within school and society?*	• Using and Connecting Mathematical Representations: The standard for mathematical practice, use appropriate tools strategically, provides a strong foundation to validate and bridge for students. Mathematical representations are mathematical tools. The linguistic and cultural experiences of students provide different and varied types of representations for solving mathematical problems. By explicitly encouraging students to use multiple mathematical representations students can draw on their "mathematical, social, and cultural competence". By valuing these representations and discussing them we can connect student representations to the representations of school mathematics and build a bridge for students to position them as competent and capable mathematicians. For example, when studying generating and analyzing patterns the use of mathematical representations within the classroom is critical because students need to understand patterns, create tables that accurately represent the mathematics, and answer questions based on the data. These representations are seen in many different areas of academics, but in everyday life and can be related to home cultures.

Planning for Multi-Layered System of Supports

Vertical Alignment		
Previous Learning	***Current Learning***	***Future Learning***

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• Connect to arithmetic patterns and properties of operations **(3.OA.D.9)**	• Connect to solving problems using a letter to stand in for an unknown quantity **(4.OA.A2)** • Connect patterns to multiples and the multiplication table.	• Connect to future learning of generating two numerical patterns given two rules **(5.OA.B 3)**

Suggested Instructional Strategies

Pre-Teach

Level of Intensity	***Essential Question***	***Examples***
Targeted	*What pre-teaching will prepare students to productively struggle with the mathematics for this cluster within your HQIM?*	For example, some learners may benefit from targeted pre-teaching that rehearses prior learning when studying, generating and analyzing patterns because students will be building on arithmetic that was built in previous grades. This standard in 4th grade will build on working with patterns, which began in previous grades.
Intensive	*What critical understandings will prepare students to access the mathematics for this cluster?*	3.OA.D.9: This standard provides a foundation for work with generating and analyzing patterns because students are reasoning about operations and begin identifying patterns in addition and multiplication. If students have unfinished learning within this standard, based on assessment data, consider ways to provide intensive pre-teaching support prior to the start of the unit to ensure students are ready to access grade level instruction and assignments.

Re-Teach

Level of Intensity	***Essential Question***	***Examples***
Targeted	What formative assessment data (e.g., tasks, exit tickets, observations) will help identify content needing to be revisited during a unit?	For example, students may benefit from re-engaging with content during a unit on generating and analyzing patterns by revisiting student thinking through a short mini-lesson because students can usually identify patterns, but may not know how to put them into a rule or statement. Reviewing student thinking will help students identify patterns and put them into mathematical representation or tables.

Intensive	What assessment data will help identify content needing to be revisited for intensive interventions?	For example, some students may benefit from intensive extra time during and after a unit generating and analyzing patterns by addressing conceptual understanding because students will be able to see patterns better with conceptual understanding (examples: manipulatives or concrete models). Looking at a list of numbers is an abstract skill that struggling students need to work towards. The teacher will need to support conceptual work and move students to more abstract work (example: manipulatives to data table).

Extension	
Essential Question	***Examples***
What type of extension will offer additional challenges to 'broaden' your student's knowledge of the mathematics developed within your HQIM?	For example, some learners may benefit from an extension such as open ended tasks linking multiple disciplines when studying generating and analyzing patterns because data is accessible in many different subjects. Students can explore data in social studies, science, or independent investigations. In this way, students learn more about practical or real-world applications.