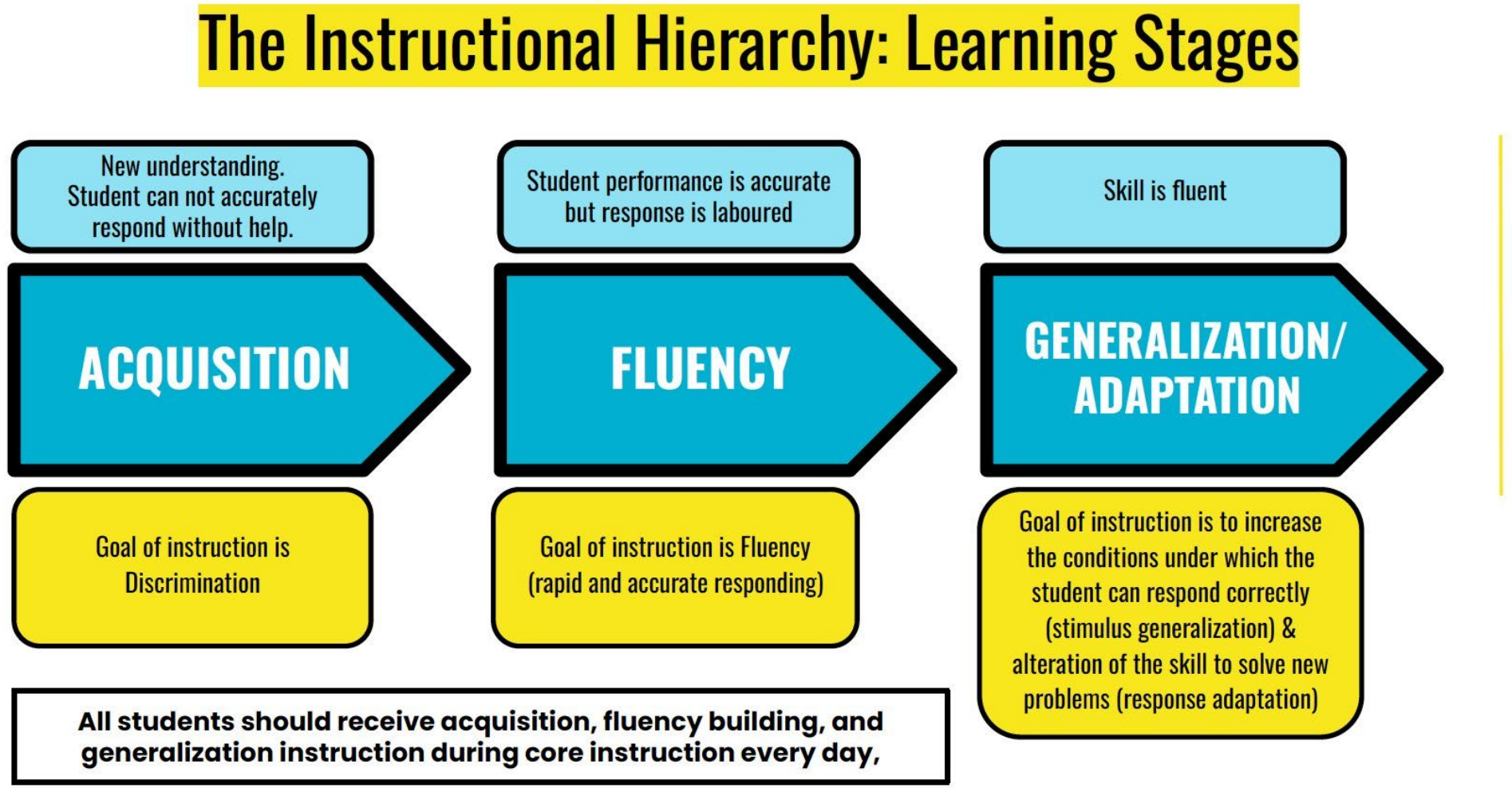
Texas Education Agency

Instructional Delivery Challenges In District Math Systems

Why is getting kids to achieve in math a challenge?

Math is relentlessly hierarchical.

Math follows a hierarchy within a skill



Math is relentlessly hierarchical year over year

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Algebra I
Representing and Solving Problems with Equations and Inequalities								
(5) Algebraic reasoning. The student applies mathematical process standards to identify and apply number patterns within properties of numbers and operations in order to describe relationships. The student is expected to:	(7) Algebraic reasoning. The student applies mathematical process standards to identify and apply number patterns within properties of numbers and operations in order to describe relationships. The student is expected to:	(5) Algebraic reasoning. The student applies mathematical process standards to analyze and create patterns and relationships. The student is expected to:	(5) Algebraic reasoning. The student applies mathematical process standards to develop concepts of expressions and equations. The student is expected to:	(4) Algebraic reasoning. The student applies mathematical process standards to develop concepts of expressions and equations. The student is expected to:	(10) Expressions, equations, and relationships. The student applies mathematical process standards to use equations and inequalities to solve problems. The student is expected to:	(11) Expressions, equations, and relationships. The student applies mathematical process standards to solve one-variable equations and inequalities. The student is expected to:	(8) Expressions, equation and relationships. The st ent applies mathematical pro ess standards to use one- va ble equations or inequalities problem situations. The student is expected to:	(5) Linear functions, equations, and inequalities. The student applies the mathematical process standards to solve, with and without technology, linear equations and evaluate the reasonableness of their solutions. The student is expected to:
(F) determine the unknown whole number in an addition or subtraction equation when the unknown may be any one of the three or four terms in the equation.	(C) represent and solve addition and subtraction word problems where unknowns may be any one of the terms in the problem.	(A) represent one- and two-step problems involving addition and subtraction of whole numbers to 1,000 using pictorial models, number lines, and equations.	(A) represent multi-step problems involving the four operations with whole numbers using strip diagrams and equations with a letter standing for the unknown quantity.	(B) represent and solve multi-step problems involving the four operations with whole numbers using equations with a letter standing for the unknown quantity.	(A) model and solve one-variable, one-step equations and inequalities that represent problems, including geometric concepts.	(A) model and solve one-variable, two-step equations and inequalities.	(C) model and solve one-variable equations with variables on both sides of he equal sign that represent mathematical and real-w ld problems using rational number coefficients and constants	(A) solve linear equations in one variable, including those for which the application of the distributive property is necessary and for which variables are included on both sides.
								(B) solve linear inequalities in one variable, including those for which the application of the distributive property is necessary and for which variables are included on both sides.
(G) apply properties of operations to add and subtract two or three numbers.		(D) determine the unknown whole number in a multiplication or division equation relating three whole numbers when the unknown is either a missing factor or product.			(B) determine if the given value(s) make(s) one-variable, one-step equations or inequalities true.	(B) determine if the given value(s) make(s) one- variable, two-step equations and inequalities true.	(9) Expressions, equation and relationships. The student applies mathematical process standards to use multiple representations to develo foundational concepts of simultaneous linear equations. The student is expected to:	(3) Linear functions, equations, and inequalities. The student applies the mathematical process standards when using graphs of linear functions, key features, and related transformations to represent in multiple ways and solve, with and without technology, equations, inequalities, and systems of equations. The student is expected to:

Instructional Systems

What instructional systems need to be in place to give our kids the best chance of success in an **unforgiving**, **relentlessly hierarchical content area** where everything must go right for them to be successful?

Charge

5. Implementation Considerations

a) Identify key challenges in integrating cognitive and the science of math approaches into the revised TEKS framework, including:

i. Professional development needs for educators to effectively implement these strategies.

Texas Education Agency

Two Key Challenges

Agenda

Two Key Challenges

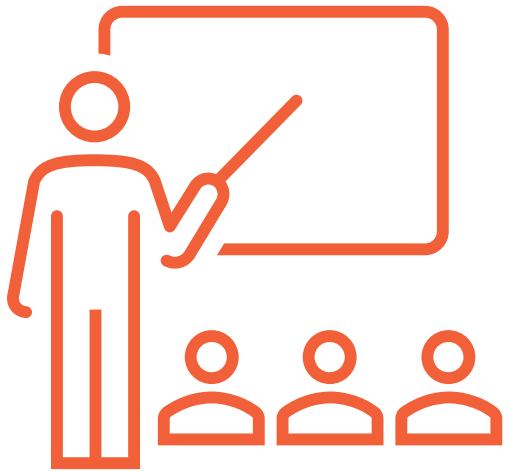
1. Instructional Approach
2. Effective Math Training

Challenge 1

Ensuring math standards are taught using a research-based instructional approach

Challenge 1: Instructional Approach

Do teachers know what the research says about differences in instructional approaches for new math content?



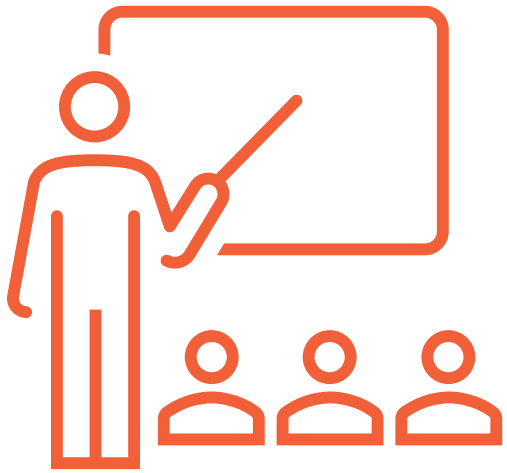
Direct Instruction
(teacher-led)

vs.

Inquiry
(student-led)

Challenge 1: Instructional Approach

Do teachers know what the research says about differences in instructional approaches for new math content?



Direct Instruction
(teacher-led)

- teacher-directed
- carefully planned lessons
- small learning increments
- intentional connections to prior learning
- modeling
- questioning and checks for understanding
- guided practice
- independent practice
- feedback
- high success rate
- scaffolds
- regular review

Rosenshine

Challenge 1: Instructional Approach

Do teachers know what the research says about differences in instructional approaches for new math content?

- process focused
- constructivist
- investigative
- exploratory
- teacher as facilitator
- real-life context
- based on guiding questions
- “reverses the order of learning”
- starts with a range of scenarios
- focus on “21st Century Skills”

Inquiry
(student-led)

Inquiry-based learning

Challenge 1: Instructional Approach

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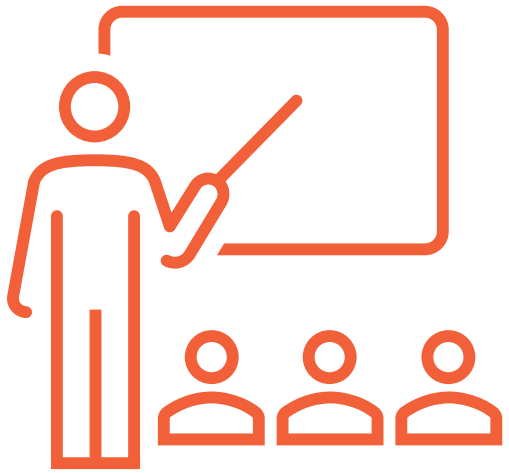

Direct Instruction
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What does the research tell us?

Challenge 1: Instructional Approach

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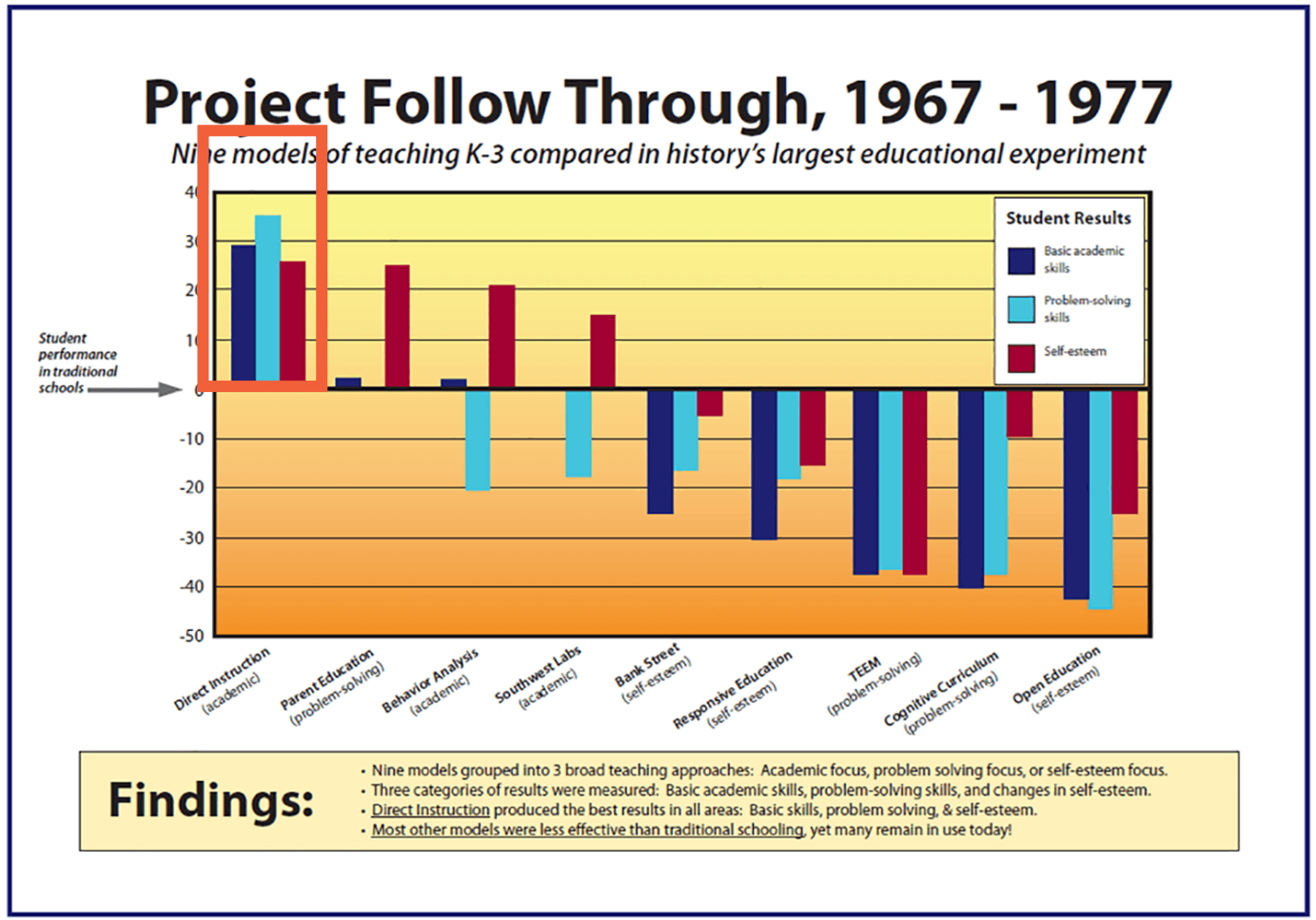

https://www.nifdi.org/what-is-di/project-follow-through.html

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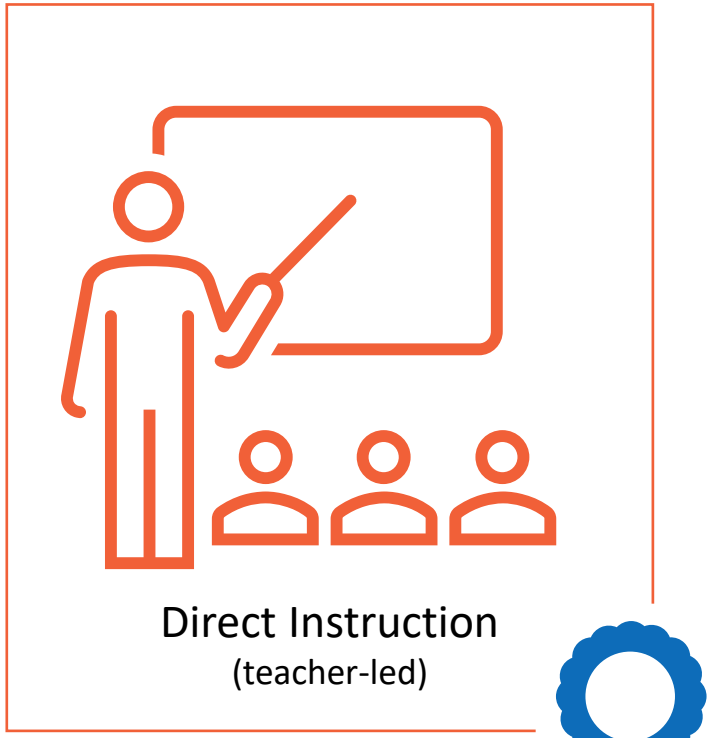


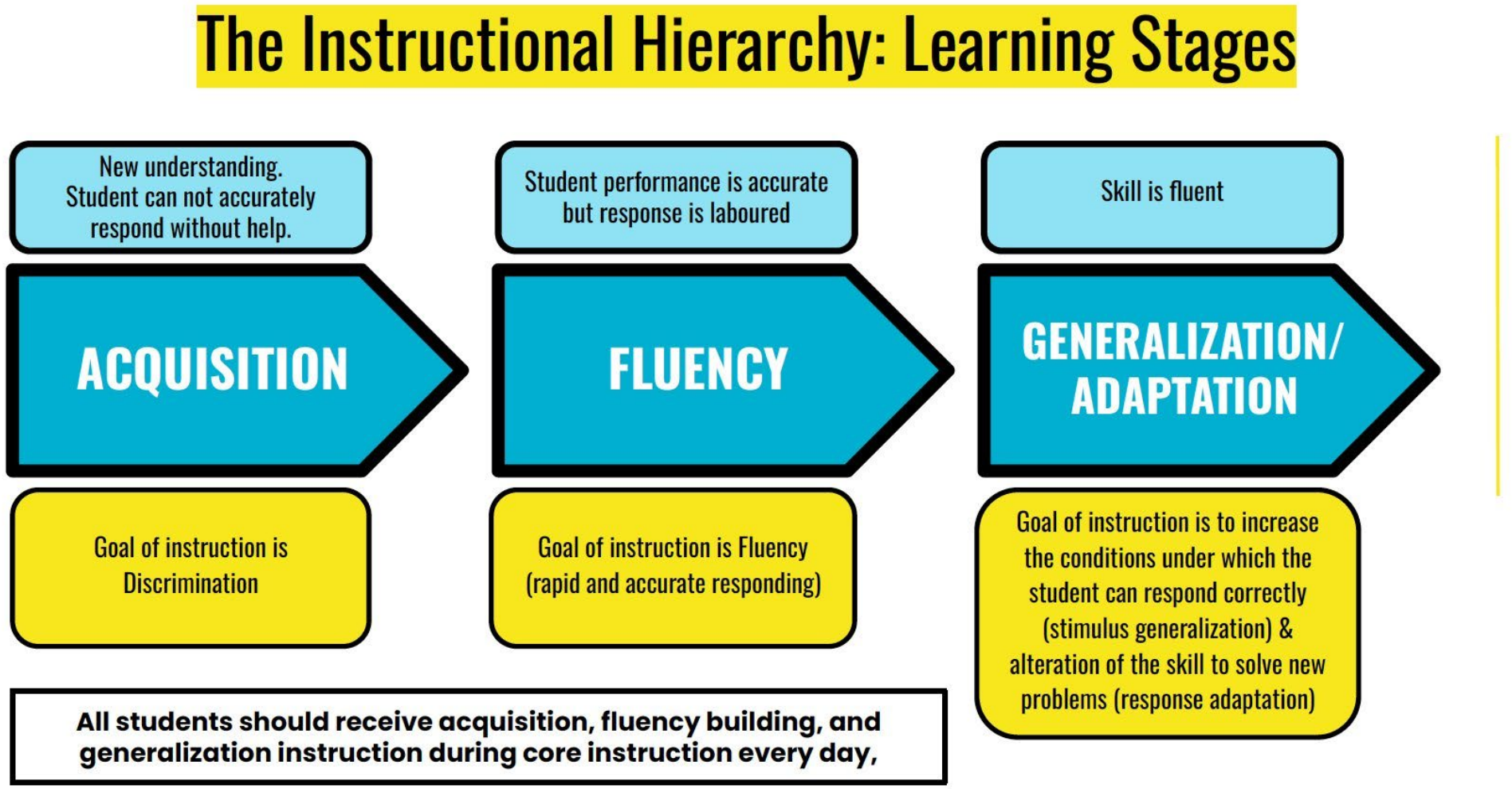
Direct Instruction
(teacher-led)

vs.

Inquiry
(student-led)

Why minimal guidance during instruction does not work…

Math follows a hierarchy within a skill

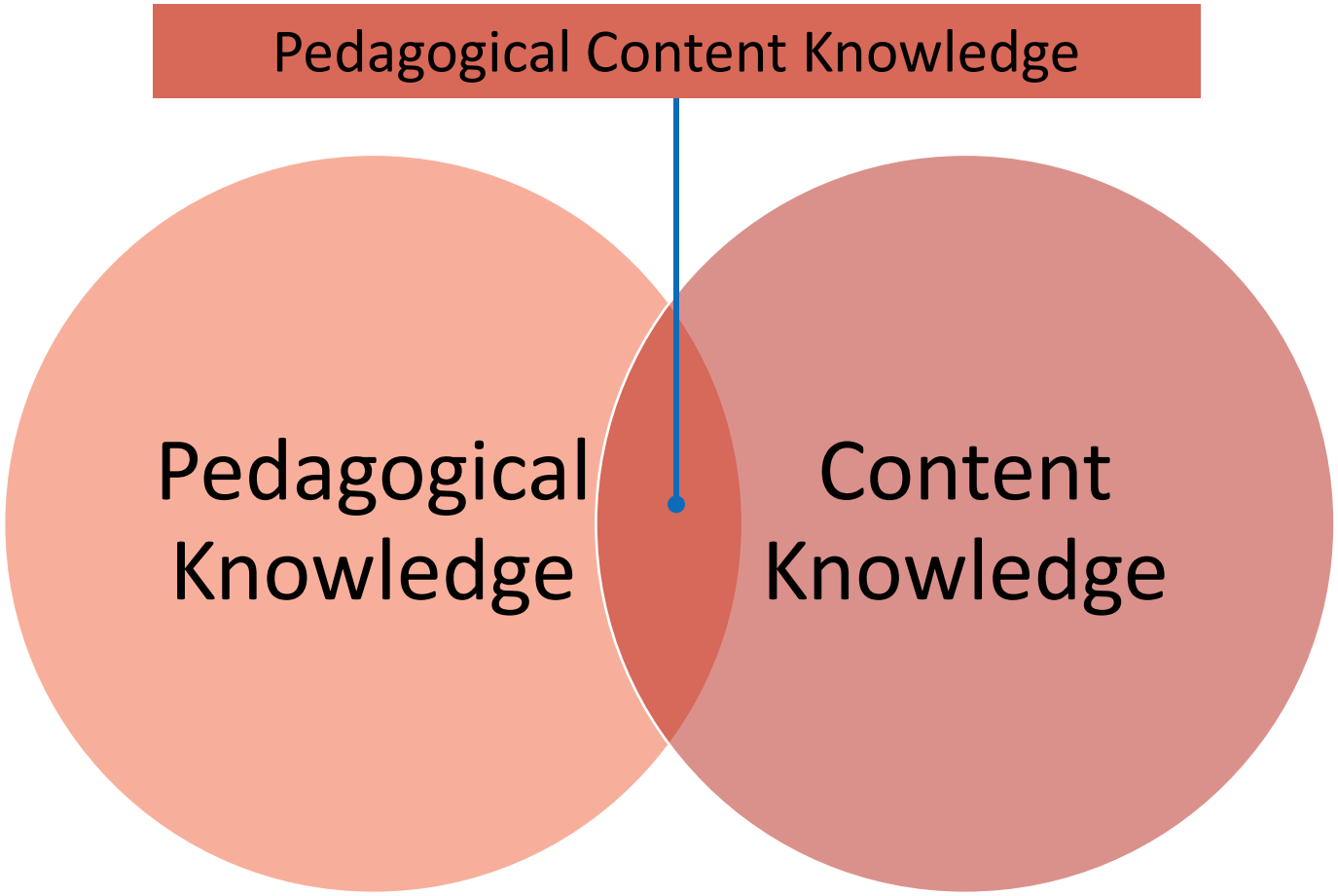


Challenge 2

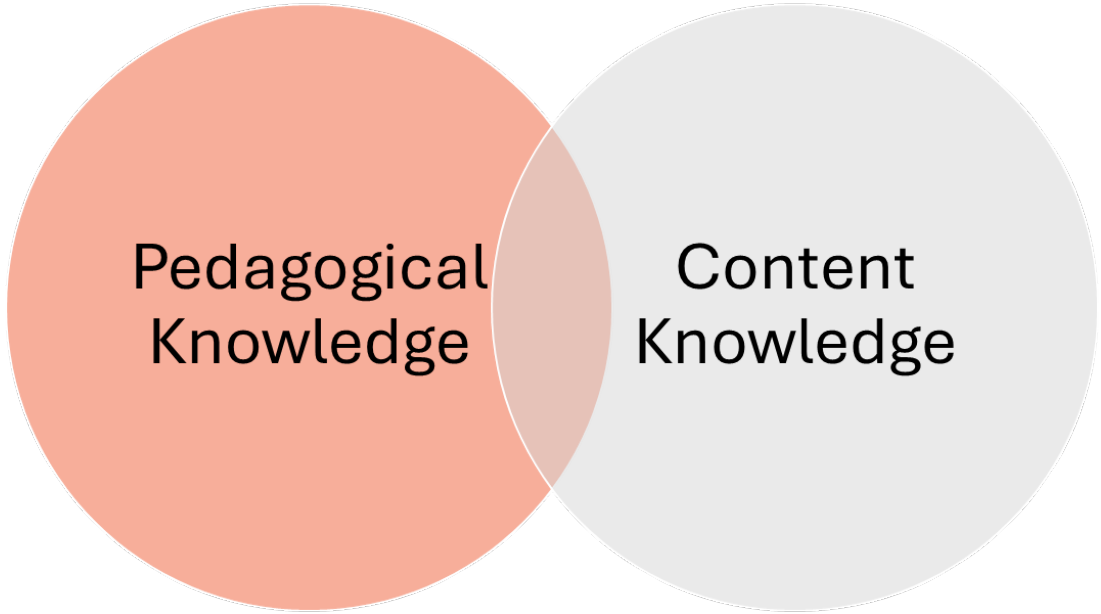
Ensuring teachers have effective training to developed pedagogical content knowledge grounded in HQIM

Challenge 2: Math Teacher Training

Does teacher training develop pedagogical content knowledge?



Challenge 2: Math Teacher Training



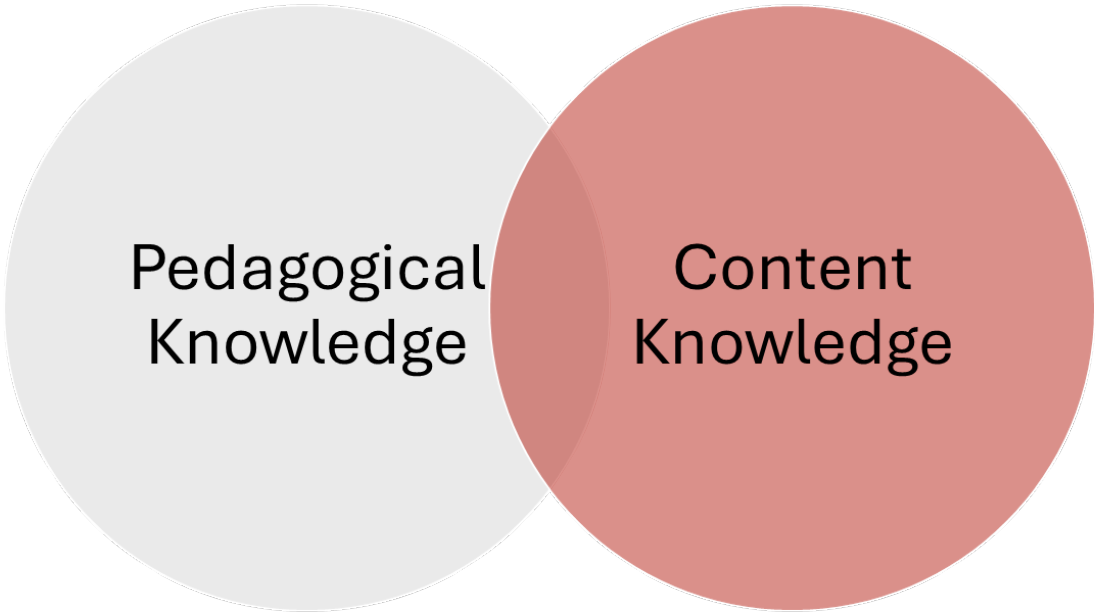
In a classroom with a teacher with just **pedagogical knowledge:**

- Students are engaged and on-task
- The teacher uses effective teaching strategies like questioning, cold calling, and Turn-and-Talks to make sure all students participate in and process the learning

However, because **content knowledge** is low:

- Students may learn incorrect information
- Students may learn correct information but not to the depth and rigor of the standard
- The teacher may teach math “tricks” without conceptual understanding

Challenge 2: Math Teacher Training



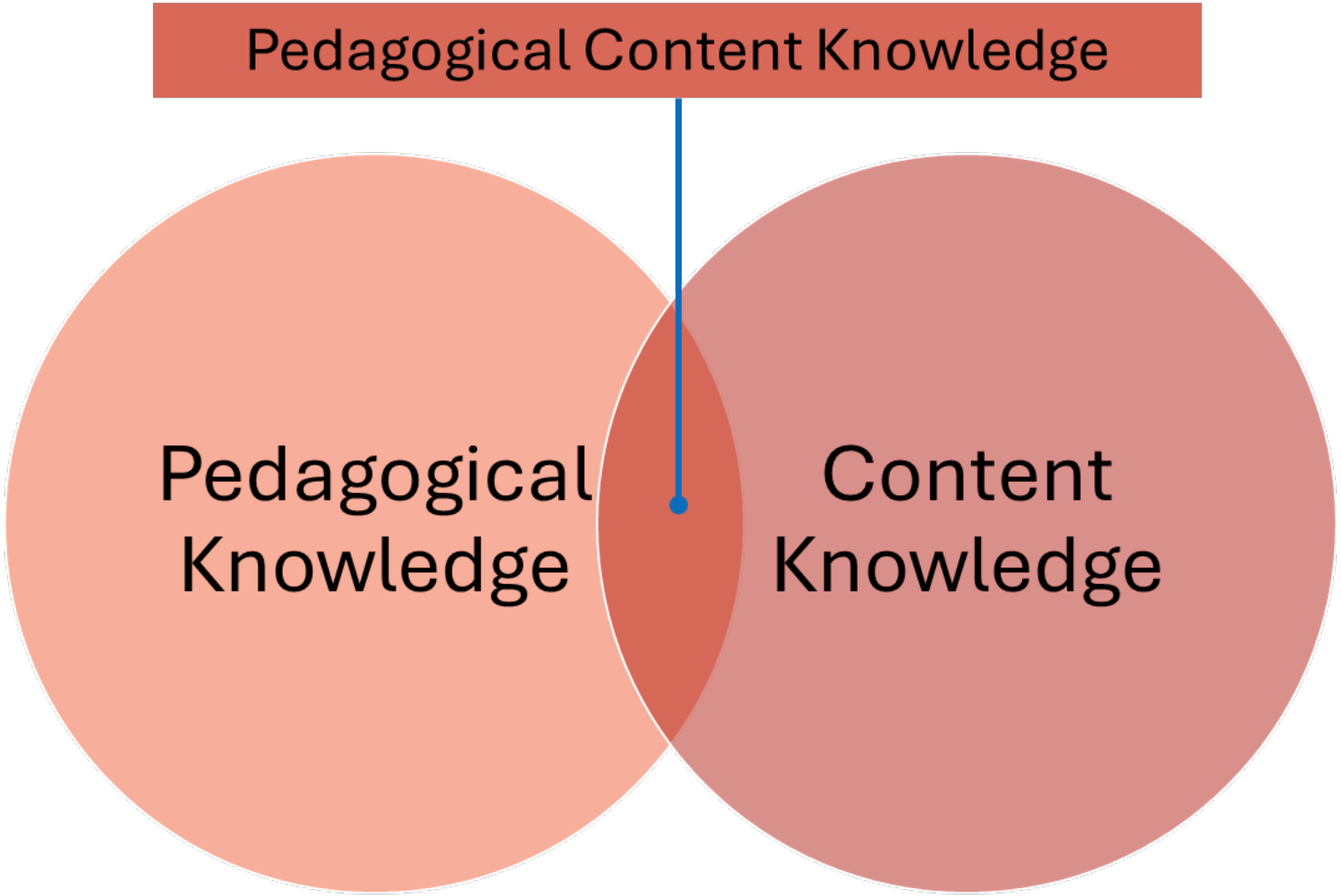
In a classroom with a teacher with just **content knowledge:**

- Math content is accurate and precise
- Teacher uses appropriate vocabulary and terminology
- Students are exposed to correct mathematical information

However, because **pedagogical knowledge** is low:

- Few students are engaged in the lesson through the use of instructional strategies
- The teacher doesn't identify misconceptions so doesn't carefully select examples to address them
- The teacher is not aware of students' prior knowledge, so doesn't properly engineer the learning progression
- The teacher doesn't thinkaloud, model, or question students

Challenge 2: Math Teacher Training



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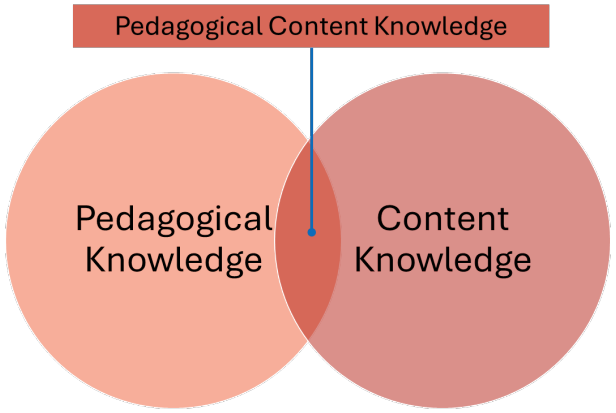


Scenario (PK = pedagogical knowledge / CK = content knowledge / PCK = pedagogical content knowledge)

Objective: 3rd graders learning standard algorithm for multiplication of two-digit by one-digit numbers.

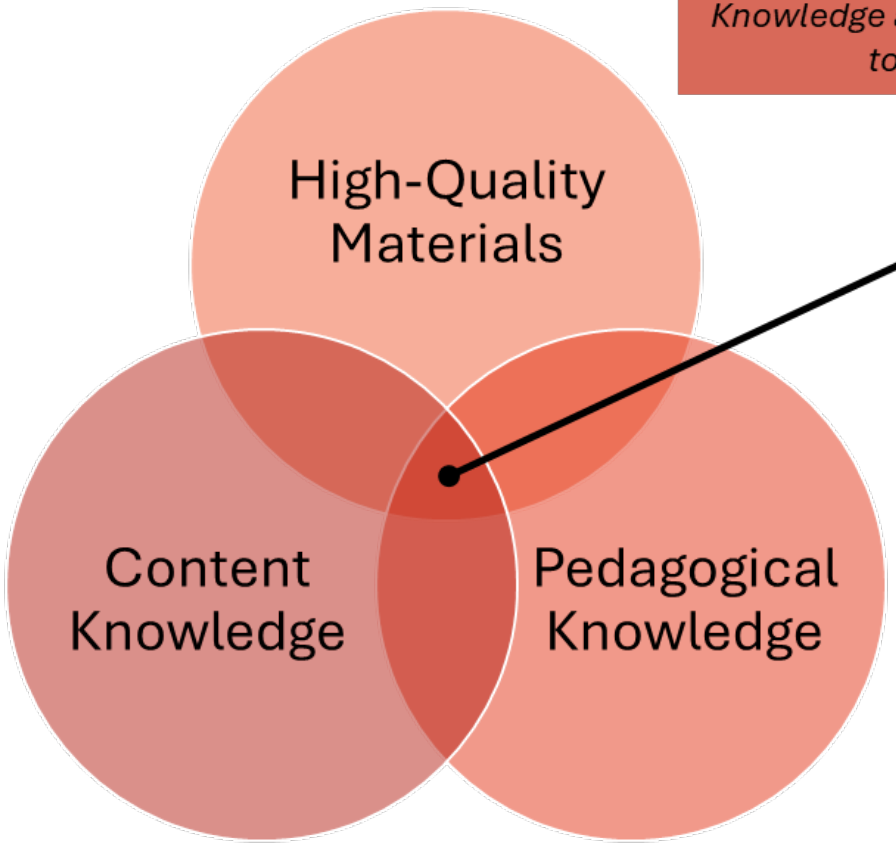
Teacher has introduced multiplication facts to 9 over the previous 40 days and students have practiced them daily to build fluency in a cycle based on spaced practice and retrieval (PK/CK/PCK). Teacher began teaching this concept two lessons ago with multiplying 1-digit numbers by multiples of 10 using place value disks and place value charts, then pictorial representations that connected to place value models (CK, PCK). All students have been engaged in these models as they work with a partner, but the teacher directs individual questions to each student, which requires them to reflect on the math, not just move disks around (PK).

After checking for understanding at the start of today's lesson with a quick, informal assessment (PK), the teacher introduces multiplying 1-digit numbers by 2-digit numbers that are *not* multiples of 10 (CK). The teacher models "3 x 23" using place value disks by creating 3 copies of 2 tens and 3 ones (CK). She thinks aloud to demonstrate her thought process as she connects the model to the standard algorithm (PCK). Students connect this to the work they did with multiplying by multiples of 10, use similar models with teacher support (place value disks, drawings), and then connect the work they did with models to the standard algorithm (PK/CK/PCK).

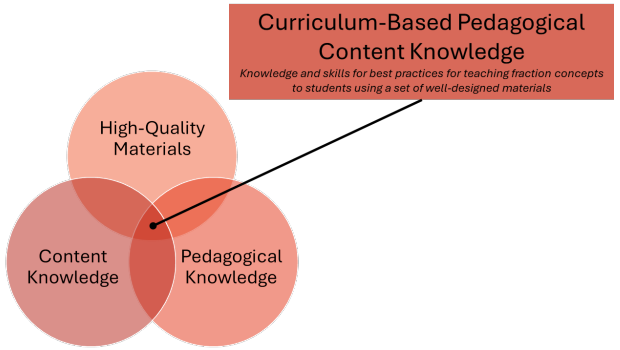
Challenge 2: Math Teacher Training

Curriculum-Based Pedagogical Content Knowledge

Knowledge and skills for best practices for teaching fraction concepts to students using a set of well-designed materials



Challenge 2: Math Teacher Training



Scenario (PK = pedagogical knowledge / CK = content knowledge / PCK = pedagogical content knowledge)
Objective: 3rd graders learning standard algorithm for multiplication of two-digit by one-digit numbers.

Teacher has introduced multiplication facts to 9 over the previous 40 days and students have practiced them daily to build fluency in a cycle based on spaced practice and retrieval **as sequenced in the HQIM's Fluency component** (PK/CK/PCK). The teacher began teaching this concept two lessons ago with multiplying 1-digit numbers by multiples of 10 using place value disks and place value charts, then pictorial representations that connected to place value models **according to the lessons in the HQIM** (CK, PCK). All students have been engaged in these models as they work with a partner, but the teacher directs individual questions to each student, which requires them to reflect on the math, not just move disks around (PK). **Examples of these questions and activities are provided in the HQIM, and the teacher added additional questions based her knowledge of her students during internalization (PCK).**

After checking for understanding at the start of today's lesson with a quick, informal assessment **(from the HQIM)** (PK), the teacher introduces multiplying 1-digit numbers by 2-digit numbers that are *not* multiples of 10 (CK). The teacher models "3 x 23" using place value disks by creating 3 copies of 2 tens and 3 ones**, an activity illustrated in the HQIM** (CK). She thinks aloud to demonstrate her thought process as she connects the model to the standard algorithm **using teacher prompts from the HQIM** (PCK). Students connect this to the work they did with multiplying by multiples of 10, use similar models with teacher support (place value disks, drawings), and then connect the work they did with models to the standard algorithm (PK/CK/PCK). **Students complete structured, scaffolded problem sets provided with the district's HQIM. The teacher directs students of varying ability levels to start on-grade-level or begin with the more challenging questions in the HQIM's Problem Set.**

Responding to Instructional Delivery Challenges

Supporting Foundational Literacy and Numeracy

84th Legislature (2015)

SB 934 Development of Math Academies

SB 925 Development of Reading Academies

86th Legislature (2019)

HB 3 K-3 Reading Academies Requirement

87th Legislature (2021)

SB 1267 Expansion of Reading and Math Academies

89th Legislature (2025)

HB 2 Math Academies Requirement