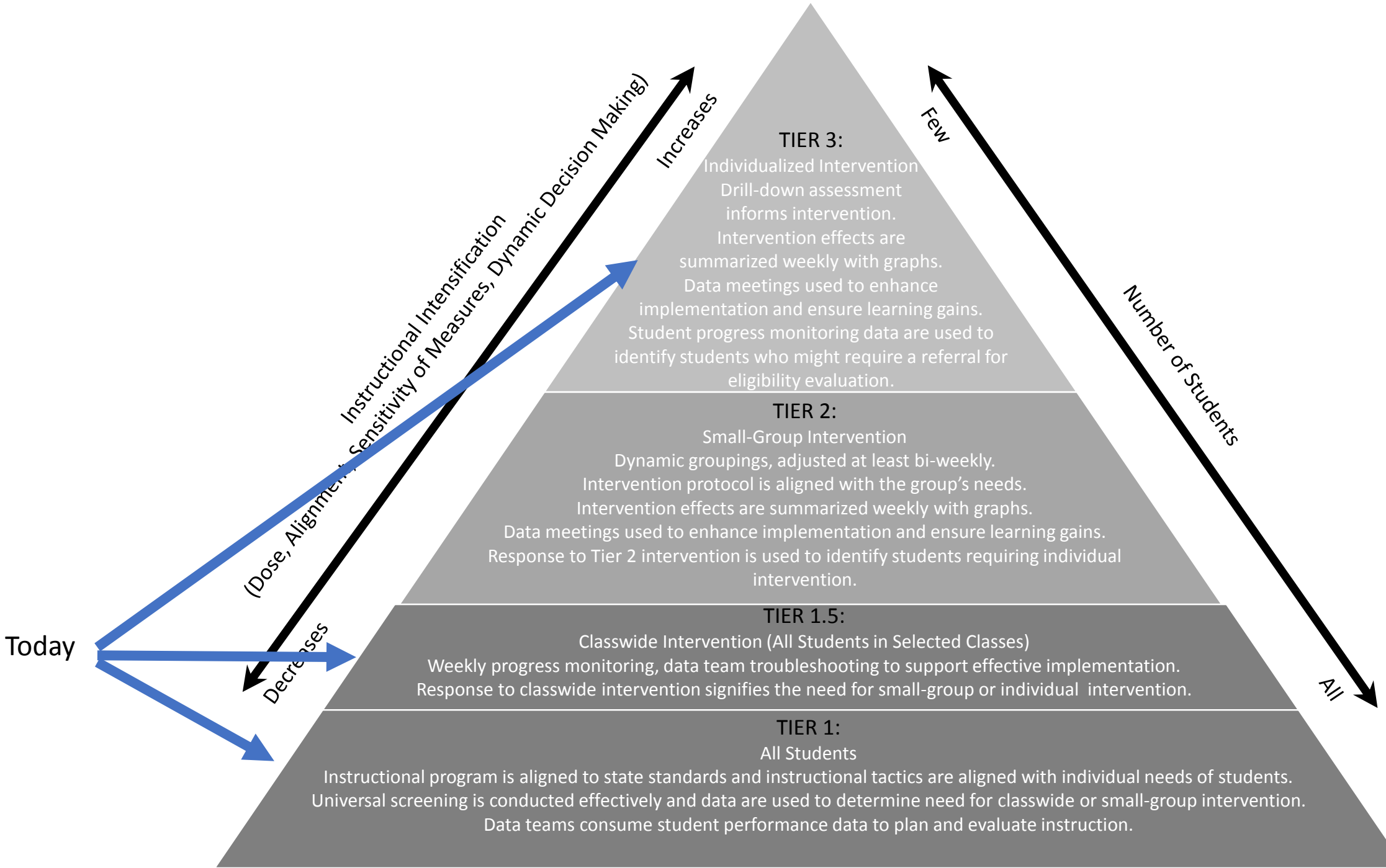
Math MTSS
I. Classwide intervention
II. Individual intervention
III. Screening Post-COVID

Amanda VanDerHeyden
www.springmath.com
@amandavande1
@springmathk8
amandavande@gmail.com

All these kids been learning Common Core math, bout to learn how to "Carry the One" from their new homeschool teachers.


Instructional Intensification
(Dose, Alignment, Sensitivity of Measures, Dynamic Decision Making)
Increases
Decreases
Today
TIER 3:
Individualized Intervention
Drill-down assessment informs intervention.
Intervention effects are summarized weekly with graphs.
Data meetings used to enhance implementation and ensure learning gains.
Student progress monitoring data are used to identify students who might require a referral for eligibility evaluation.
TIER 2:
Small-Group Intervention
Dynamic groupings, adjusted at least bi-weekly.
Intervention protocol is aligned with the group's needs.
Intervention effects are summarized weekly with graphs.
Data meetings used to enhance implementation and ensure learning gains.
Response to Tier 2 intervention is used to identify students requiring individual intervention.
TIER 1.5:
Classwide Intervention (All Students in Selected Classes)
Weekly progress monitoring, data team troubleshooting to support effective implementation.
Response to classwide intervention signifies the need for small-group or individual intervention.
TIER 1:
All Students
Instructional program is aligned to state standards and instructional tactics are aligned with individual needs of students.
Universal screening is conducted effectively and data are used to determine need for classwide or small-group intervention.
Data teams consume student performance data to plan and evaluate instruction.
Few
Number of Students
All

Meeting State Proficiency Standards is Generally Not Sufficient

Lee, 2012. College for all: Gaps between desirable and actual P-12 math achievement trajectories for college readiness. Educational Researcher, 41, 43-55.

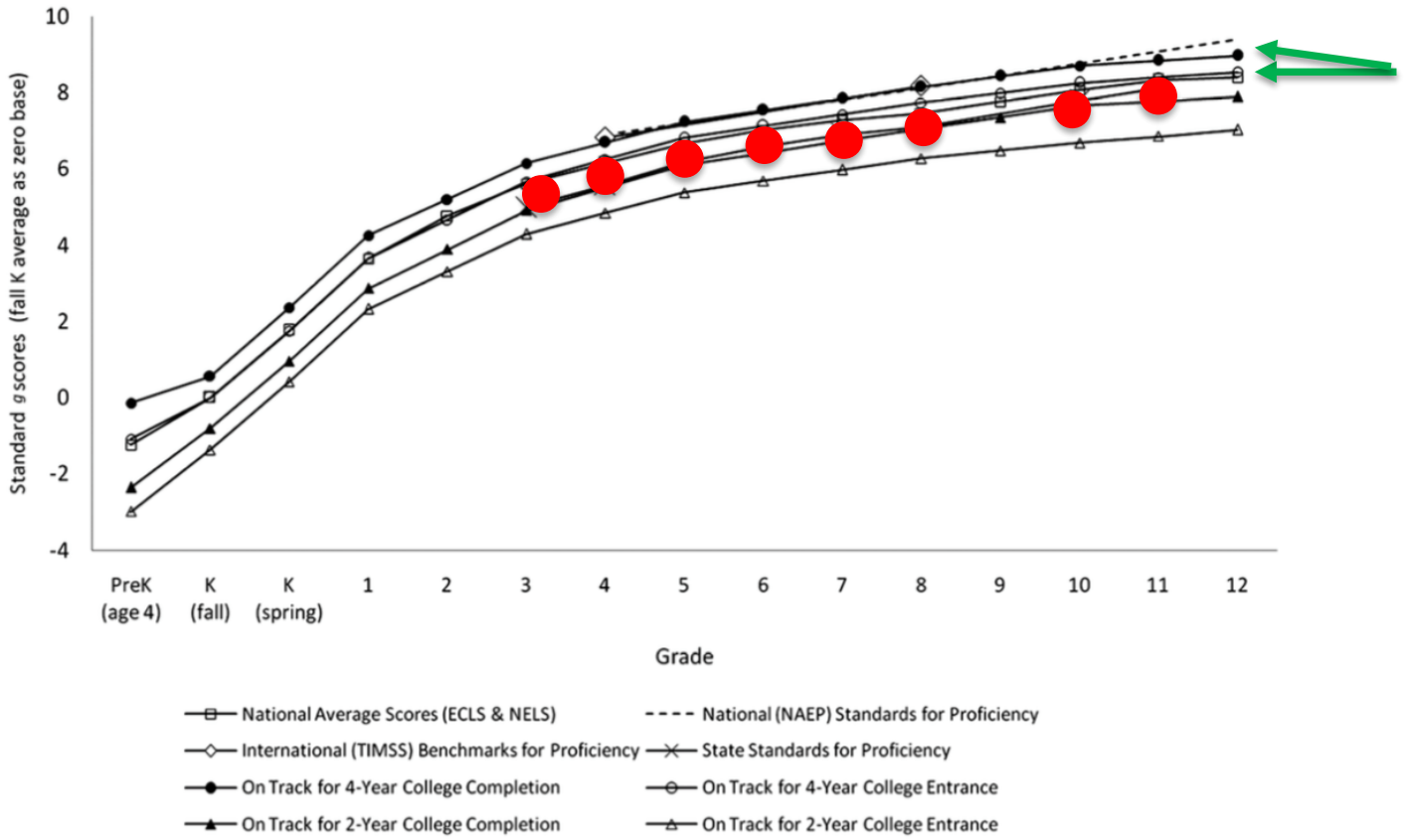
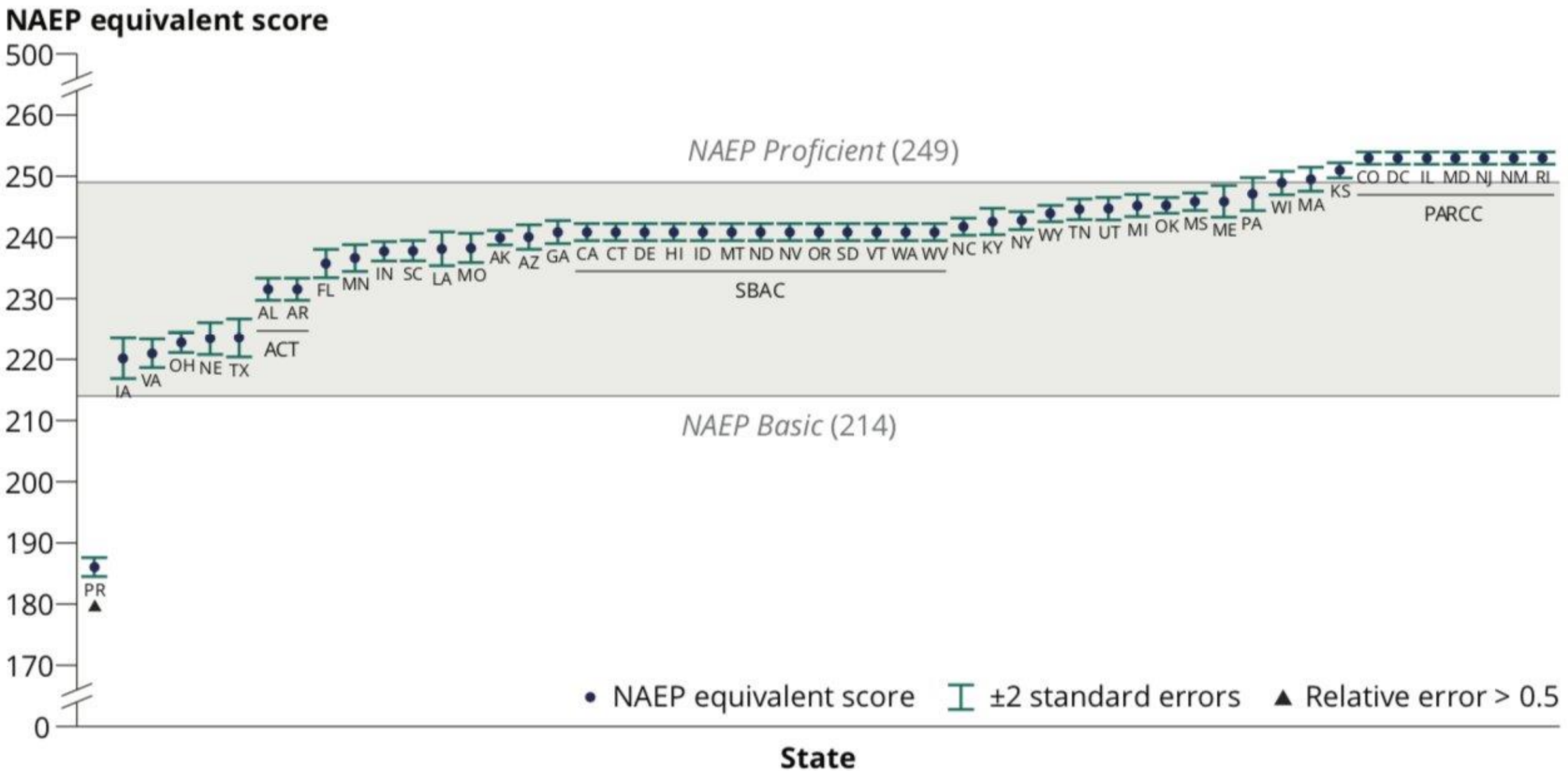


FIGURE 1. *National P–12 education math achievement trajectories for college readiness: actual (national average scores) and desirable (standards and benchmarks) levels in cross-grade g scores. ECLS = Early Childhood Longitudinal Study; NELS = National Education Longitudinal Study; TIMSS = Trends in International Math and Science Studies; NAEP = National Assessment of Educational Progress.*

NAEP equivalent scores of state grade 4 mathematics standards for proficient performance, by state: 2017



Teachers Vary in Teaching Efficacy

- "… average gains in learning across classrooms, even classrooms within the same school, are very different. Some teachers year after year produce bigger gains in student learning than other teachers. The magnitude of the differences is truly large, with some teachers producing 1.5 years of gain in acheivement in an academic year while others with equivalent students produce only ½ year of gain. In other words, two students starting at the same level of achievement can know vastly different amounts at the end of a single academic year due solely to the teacher to which they are assigned. If a bad year is compounded by other bad years, it may not be possible for the student to recover."

p. 467, Hanushek, 2011

Math Success is Highly Predictable (so is risk)

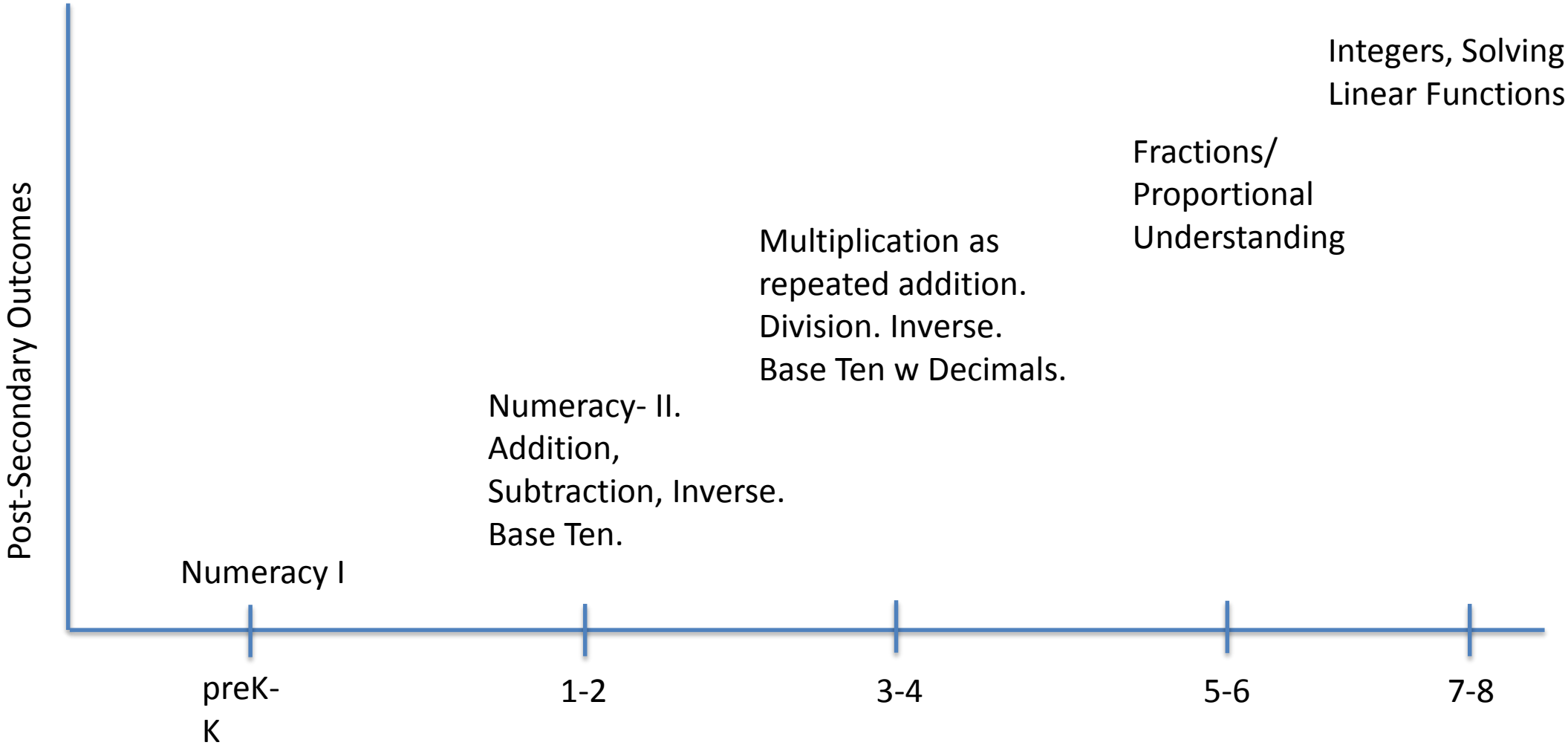
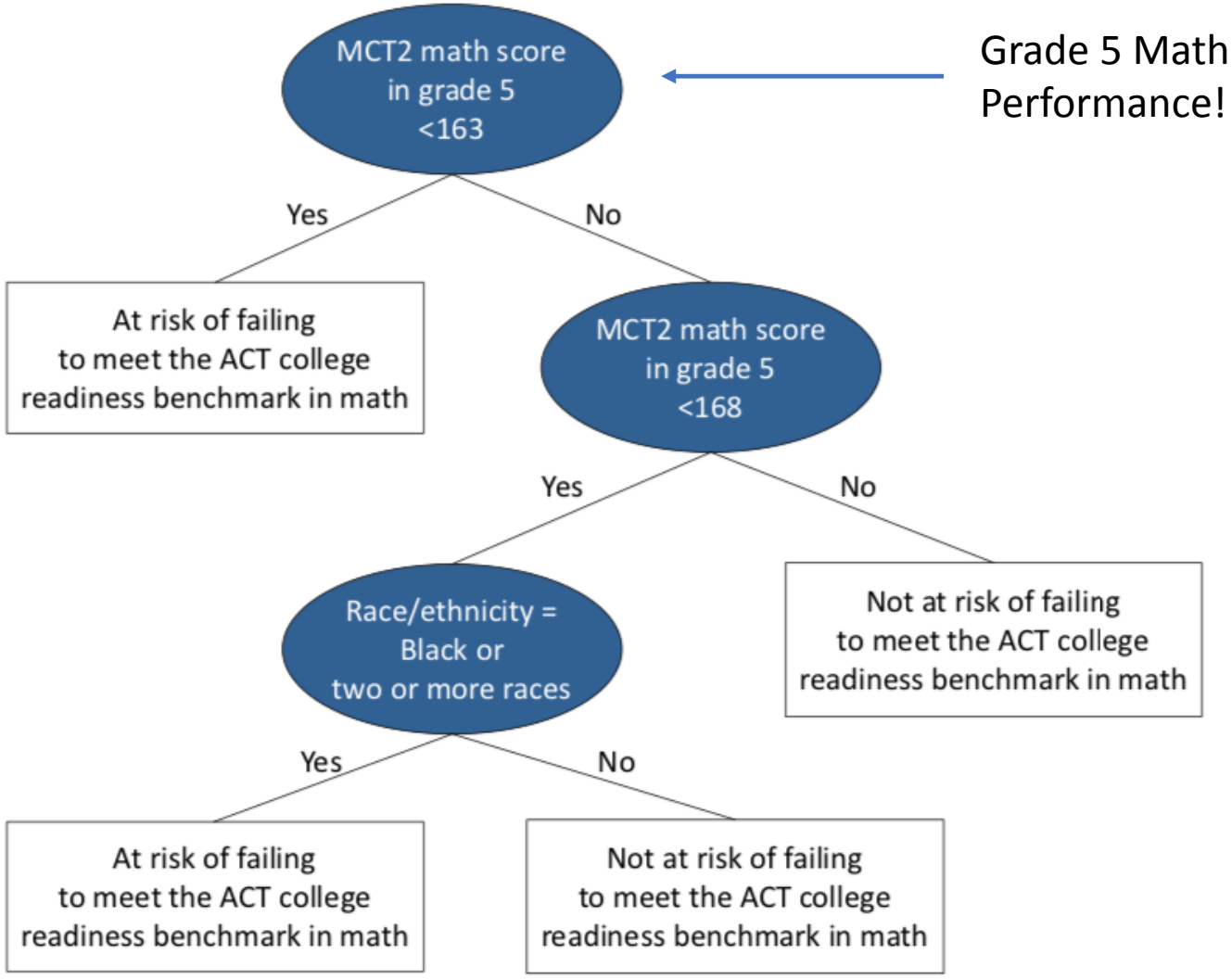


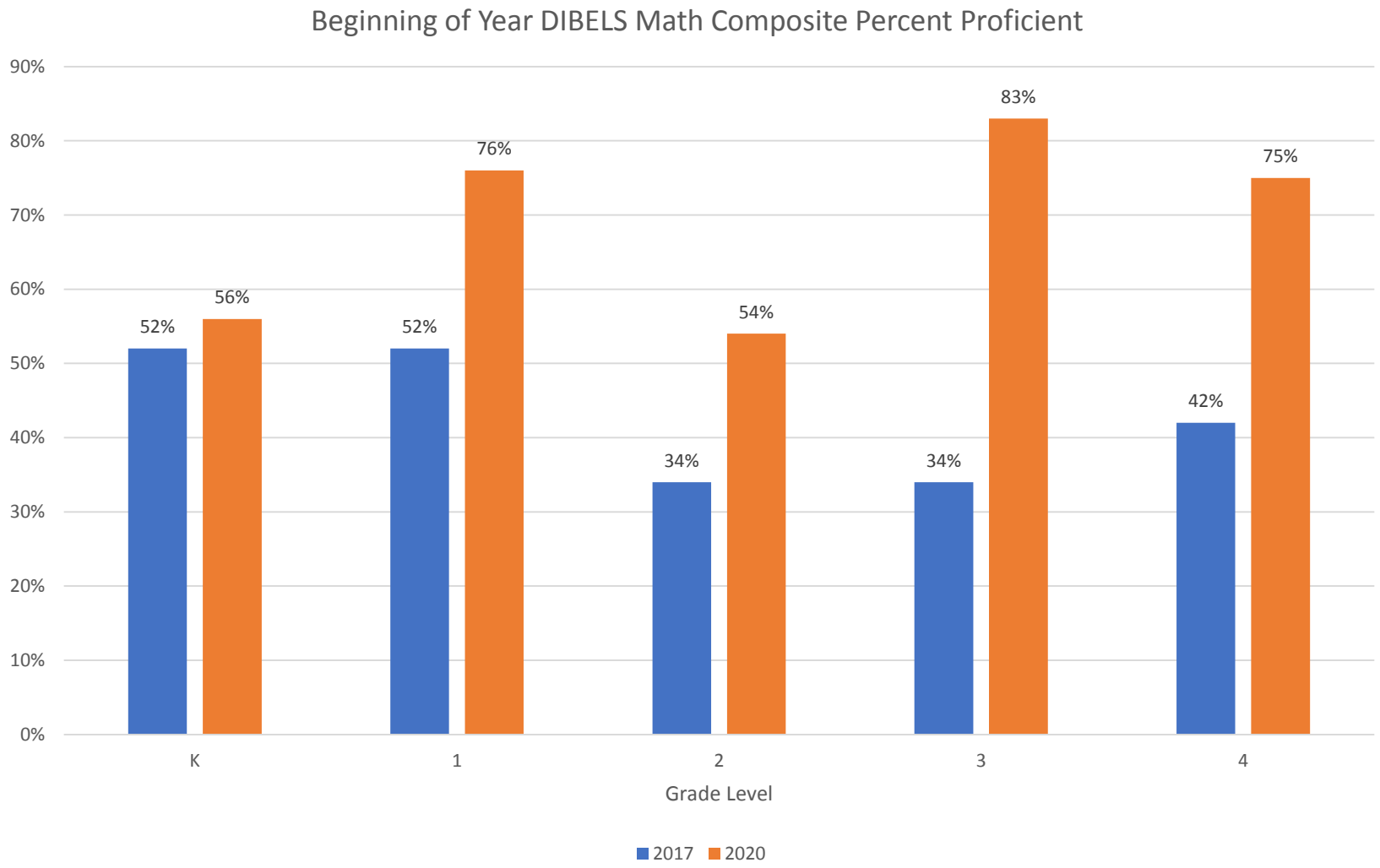
Figure 2. Classification and regression tree model decision rules for identifying Mississippi students as at risk of failing to meet the ACT college readiness benchmark in math, based on grade 5 math achievement and race/ethnicity, 2011/12–2016/17



Grade 5 Math Performance!!

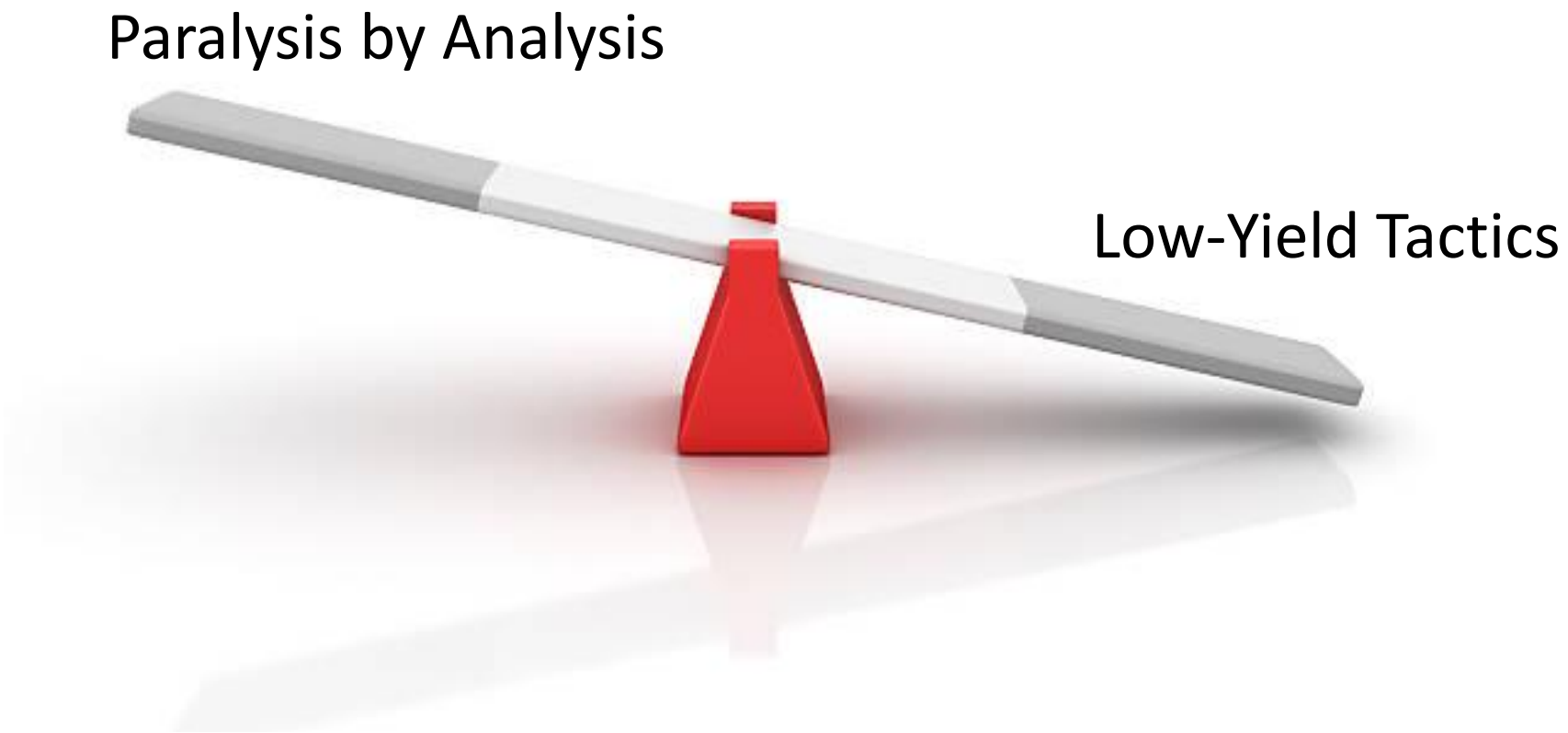
Koon, S., & Davis, M. (2019). Math course sequences in grades 6–11 and math achievement in Mississippi (REL 2019–007). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Southeast. Retrieved from http://ies.ed.gov/ncee/edlabs

Prevention Effects from Effective Instruction in Math Are Cumulative!



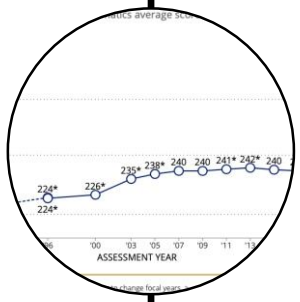
The Equity Promise of MTSS: Effective Instruction for All

The School Psychologist as Instructional Ally: Don’t Do This

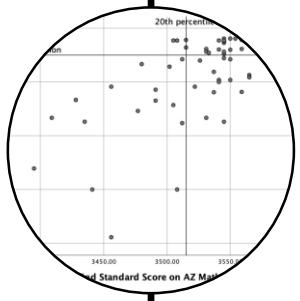


Instead, Do This

Strategic Vision



Data Sources



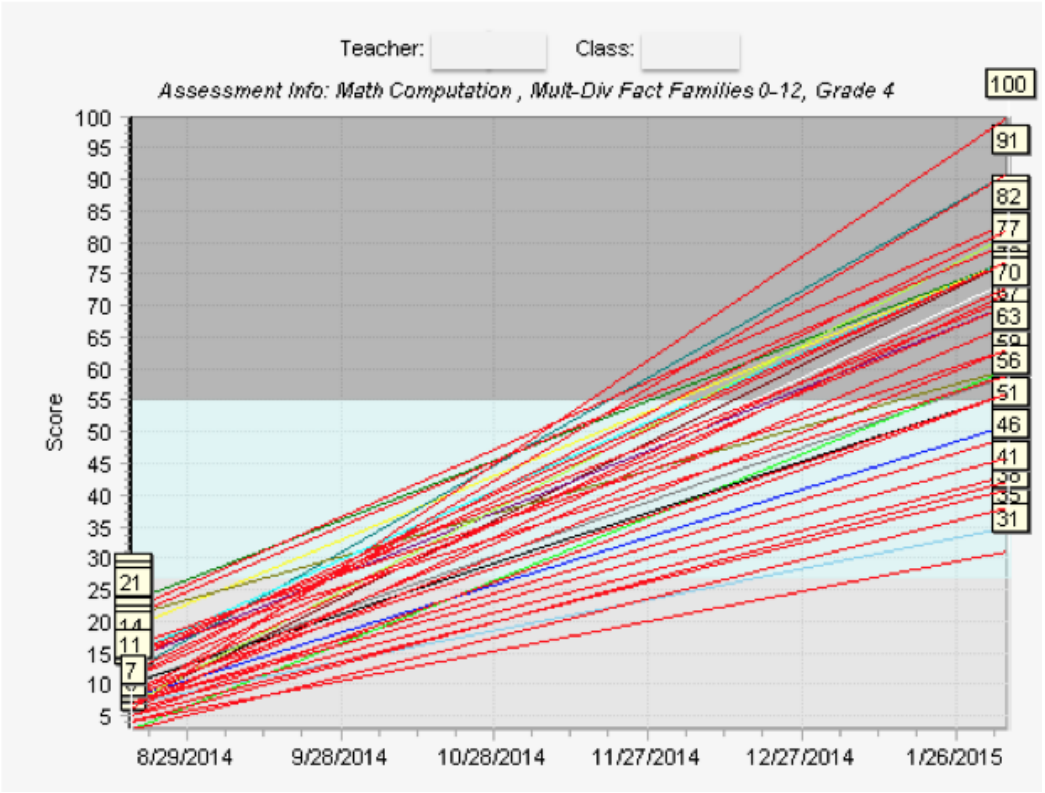
Needs

Costs/Benefits

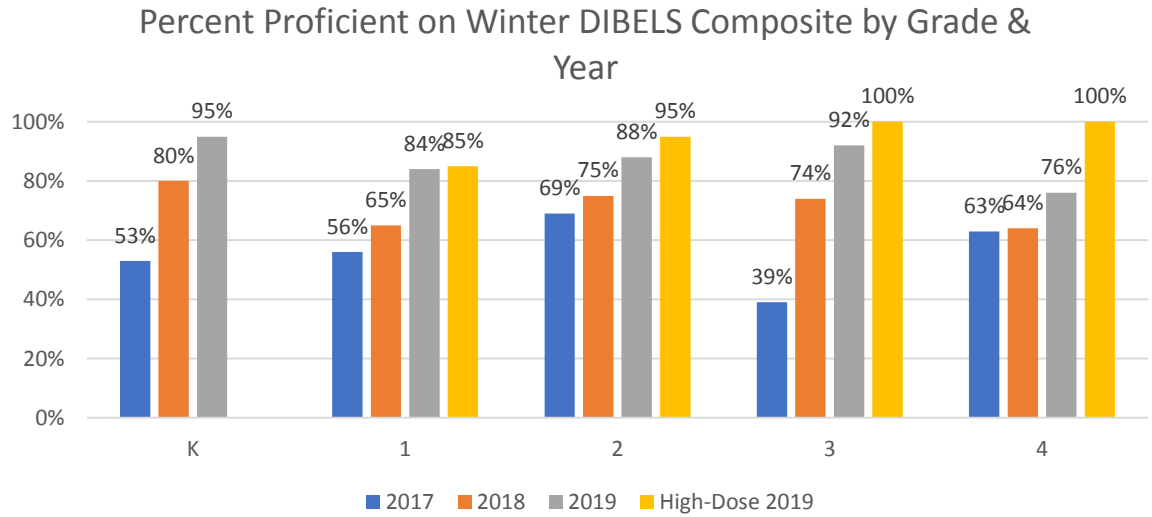
Tactics (Implementation Management)

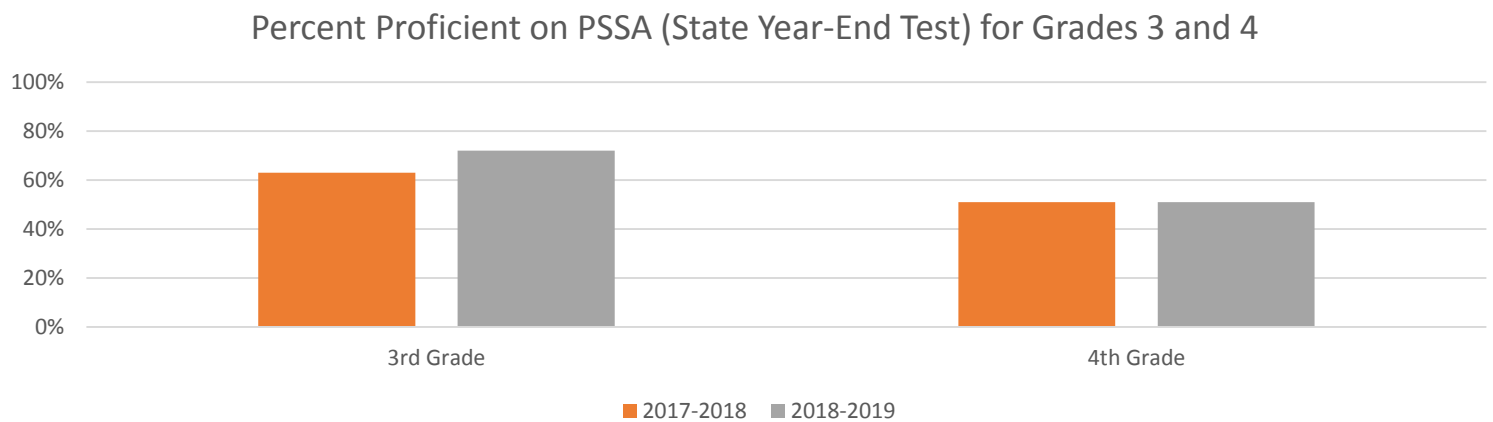
Report to Leaders

- Dose, Growth on Proximal, Growth on Distal

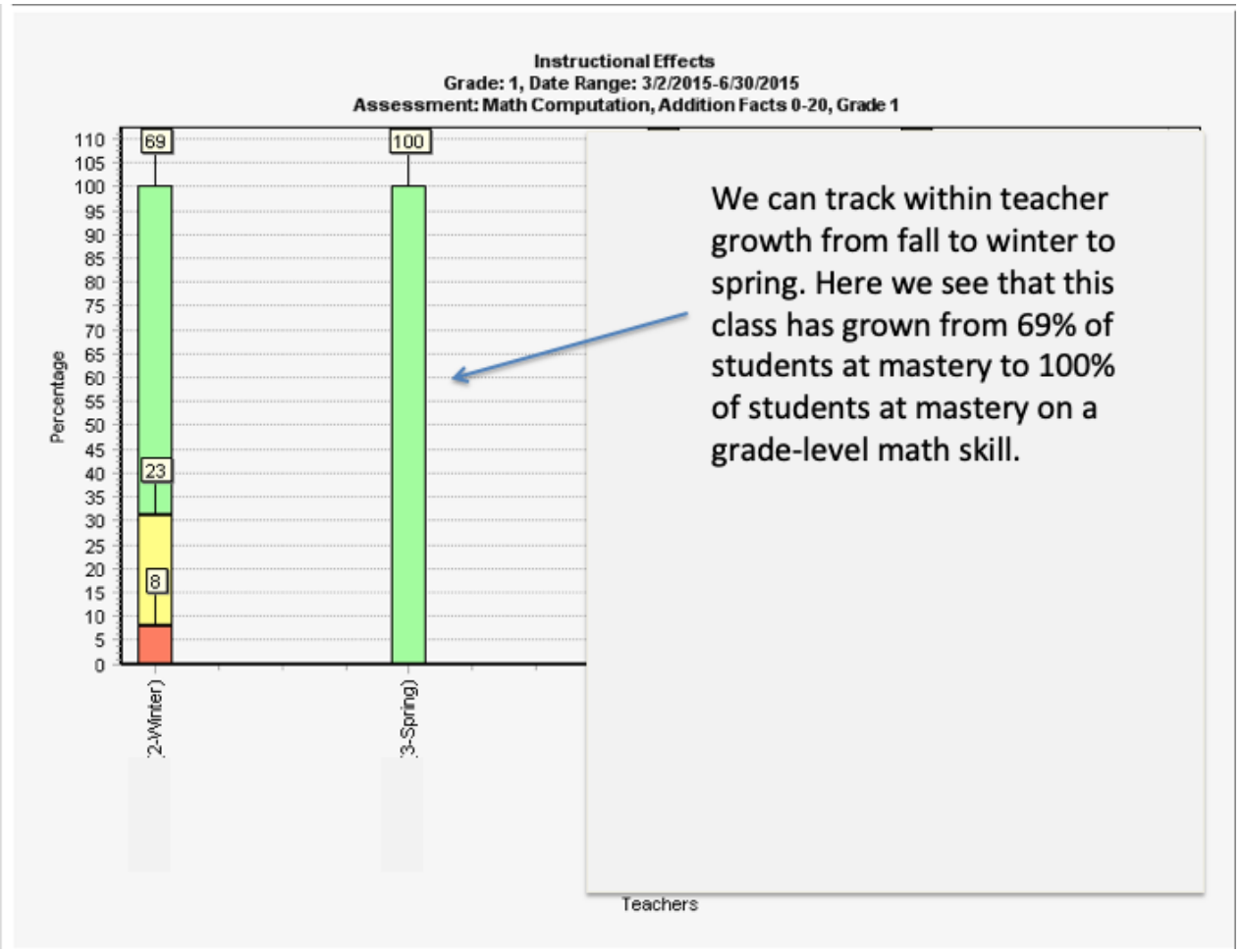


	Percentage of Skills Mastered (2017-2018)	Percentage of Skills Mastered (2018-2019)
Kindergarten	58%	100%
1st Grade	60%	80%
2nd Grade	62%	88%
3rd Grade	35%	68%
4th Grade	22%	49%

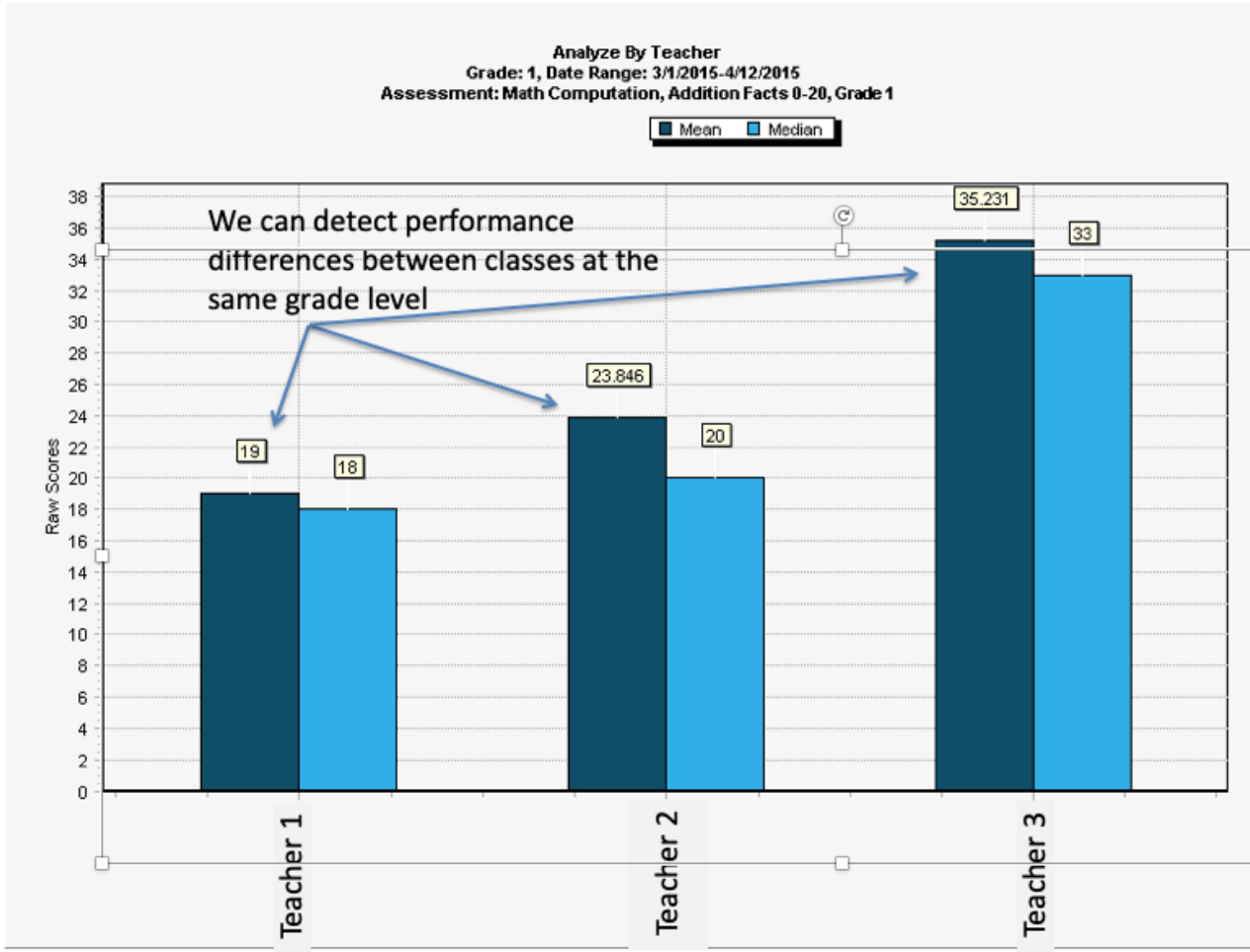




Within-Class, Within-Year Improvements

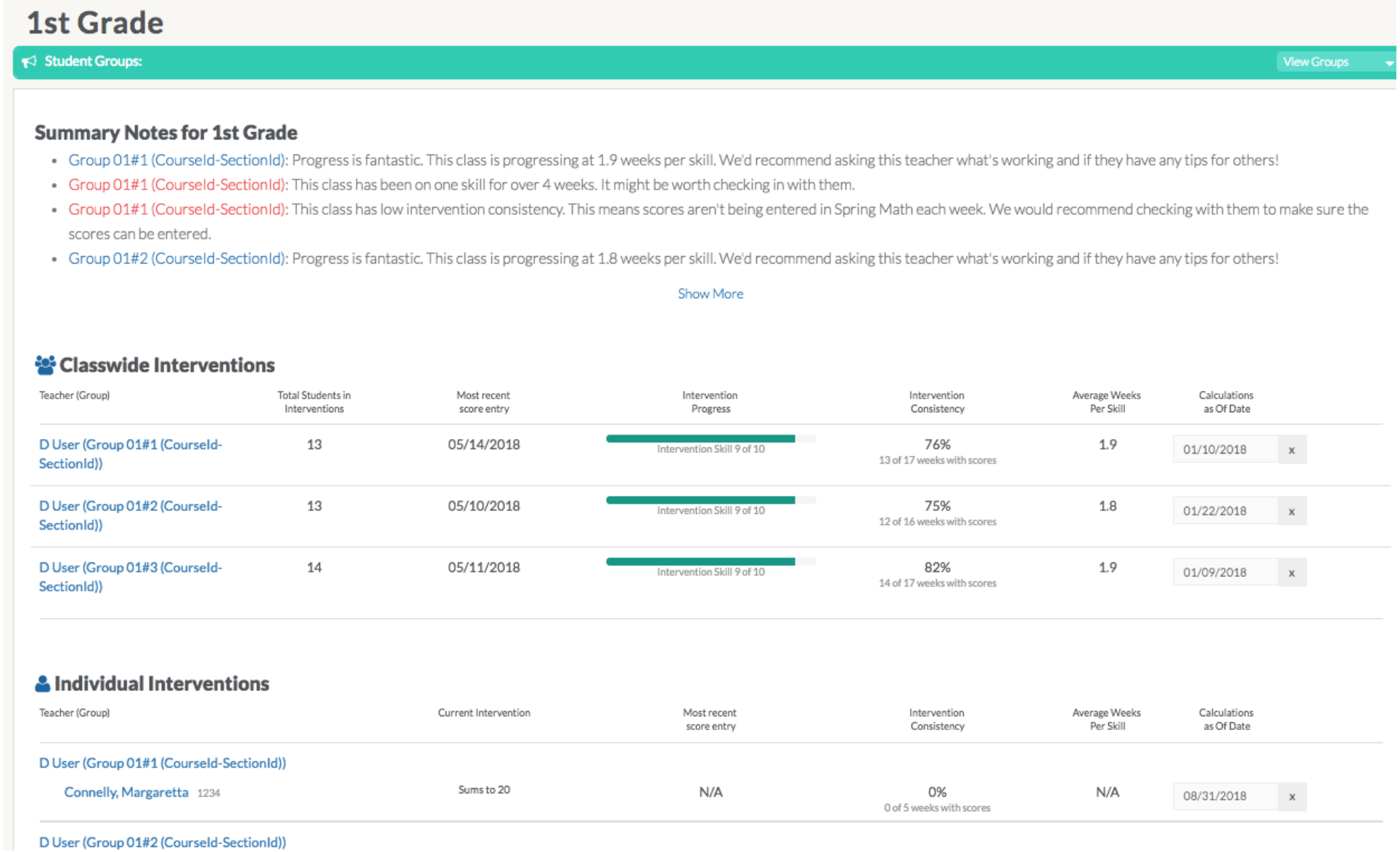


Across-Class Differences



What Must Leaders Know?

- What actions are underway?
- What are the results right now?
- Where is support needed?
- Are proximal indicators headed in the right direction?
- What are the barriers we can troubleshoot?



1st Grade

Student Groups: View Groups

Summary Notes for 1st Grade

- Group 01#1 (CourseId-SectionId): Progress is fantastic. This class is progressing at 1.9 weeks per skill. We'd recommend asking this teacher what's working and if they have any tips for others!
- Group 01#1 (CourseId-SectionId): This class has been on one skill for over 4 weeks. It might be worth checking in with them.
- Group 01#1 (CourseId-SectionId): This class has low intervention consistency. This means scores aren't being entered in Spring Math each week. We would recommend checking with them to make sure the scores can be entered.
- Group 01#2 (CourseId-SectionId): Progress is fantastic. This class is progressing at 1.8 weeks per skill. We'd recommend asking this teacher what's working and if they have any tips for others!

Show More

Classwide Interventions

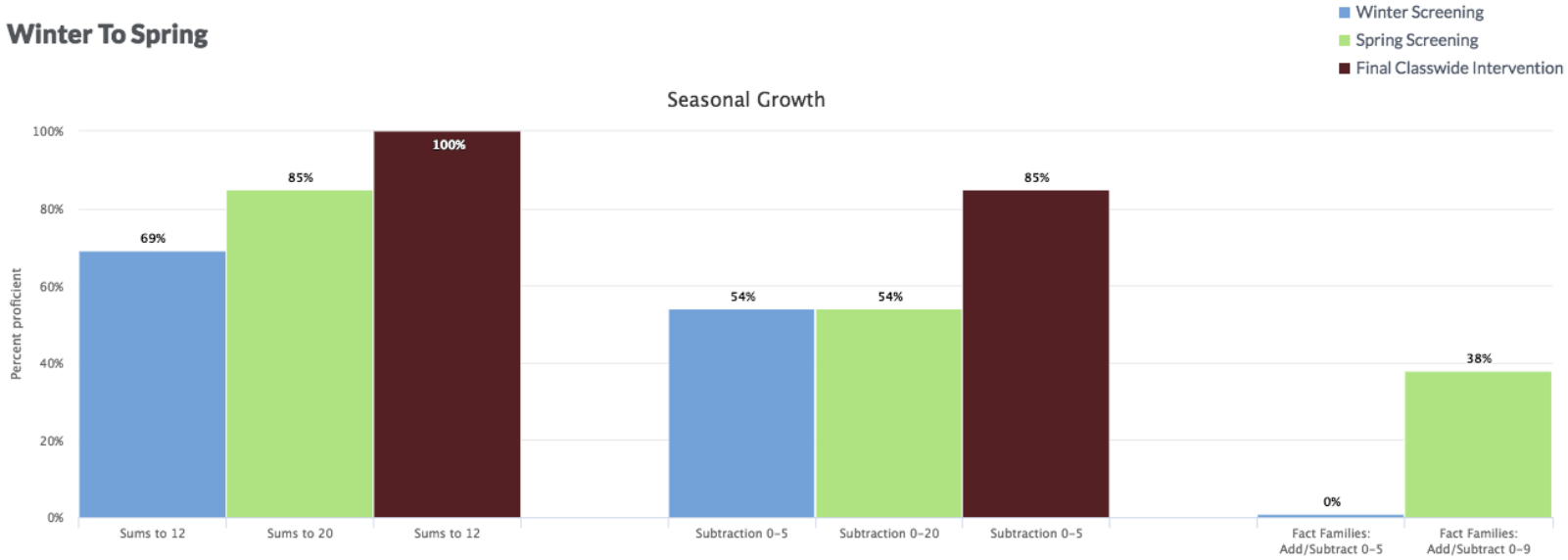
Teacher (Group)	Total Students in Interventions	Most recent score entry	Intervention Progress	Intervention Consistency	Average Weeks Per Skill	Calculations as Of Date
D User (Group 01#1 (CourseId-SectionId))	13	05/14/2018	Intervention Skill 9 of 10	76% 13 of 17 weeks with scores	1.9	01/10/2018 x
D User (Group 01#2 (CourseId-SectionId))	13	05/10/2018	Intervention Skill 9 of 10	75% 12 of 16 weeks with scores	1.8	01/22/2018 x
D User (Group 01#3 (CourseId-SectionId))	14	05/11/2018	Intervention Skill 9 of 10	82% 14 of 17 weeks with scores	1.9	01/09/2018 x

Individual Interventions

Teacher (Group)	Current Intervention	Most recent score entry	Intervention Consistency	Average Weeks Per Skill	Calculations as Of Date
D User (Group 01#1 (CourseId-SectionId))					
Connelly, Margaretta 1234	Sums to 20	N/A	0% 0 of 5 weeks with scores	N/A	08/31/2018 x
D User (Group 01#2 (CourseId-SectionId))					

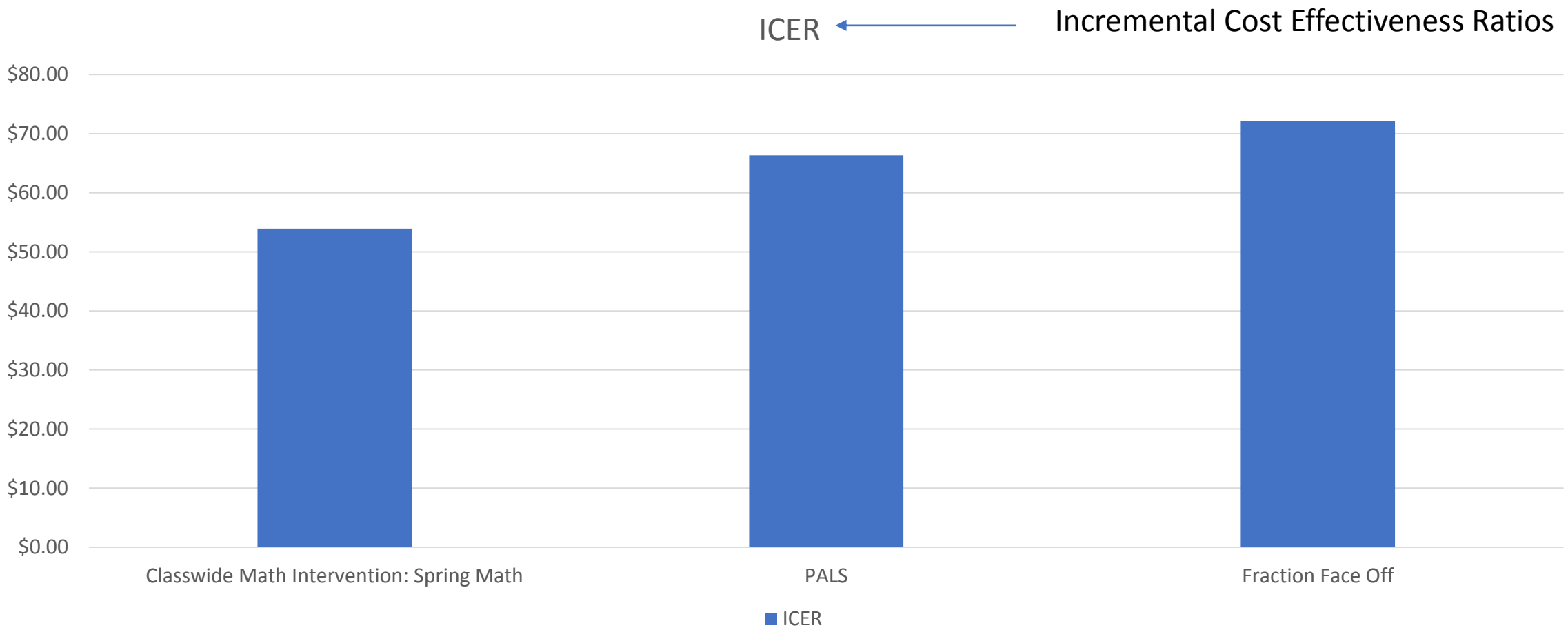
Teacher: Are Students Growing?

Teacher: Does Growth Transfer?



Think about Return on Investment

Per Student, Per 1 SD gain in outcome



"Changing math curricula as an approach for whole-school intervention when large numbers of students do not achieve proficiency is more costly than targeted, preventative math intervention" (Barrett & VanDerHeyden, in press)

Use Classwide Intervention

- It takes 15-20 min per day.

- It’s curriculum neutral and supplements.

- All students show benefits.

- It makes future risk decisions more accurate.

Use Class-wide Intervention

Classwide Intervention | Screening | Students

Classroom Performance

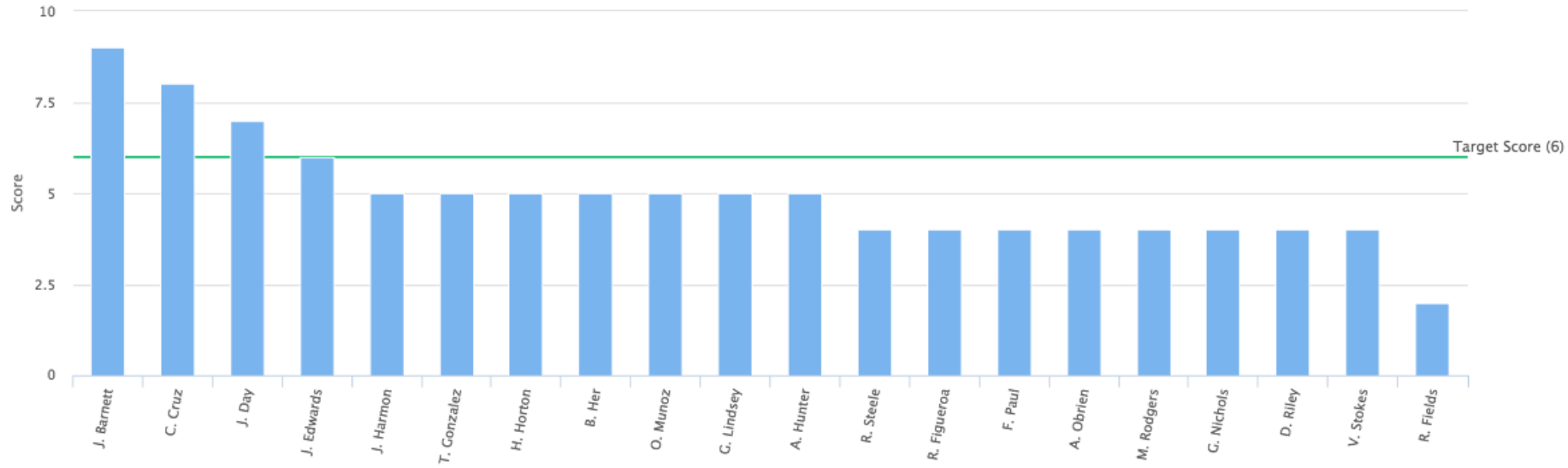
80% of your class appears to be at risk and in need of intervention to benefit from grade-level instruction.

We call this a classwide problem and *recommend a classwide intervention*.

20% !	20% !	25% !	30% !
Measure 1	*Measure 2*	*Measure 3*	*Measure 4*

Measure 1: Multiply 1 Digit by 2-3 Digit w/ & w/o Regrouping

Your students' screening scores compared to the target score.



Next Steps: Performing Class Wide Interventions

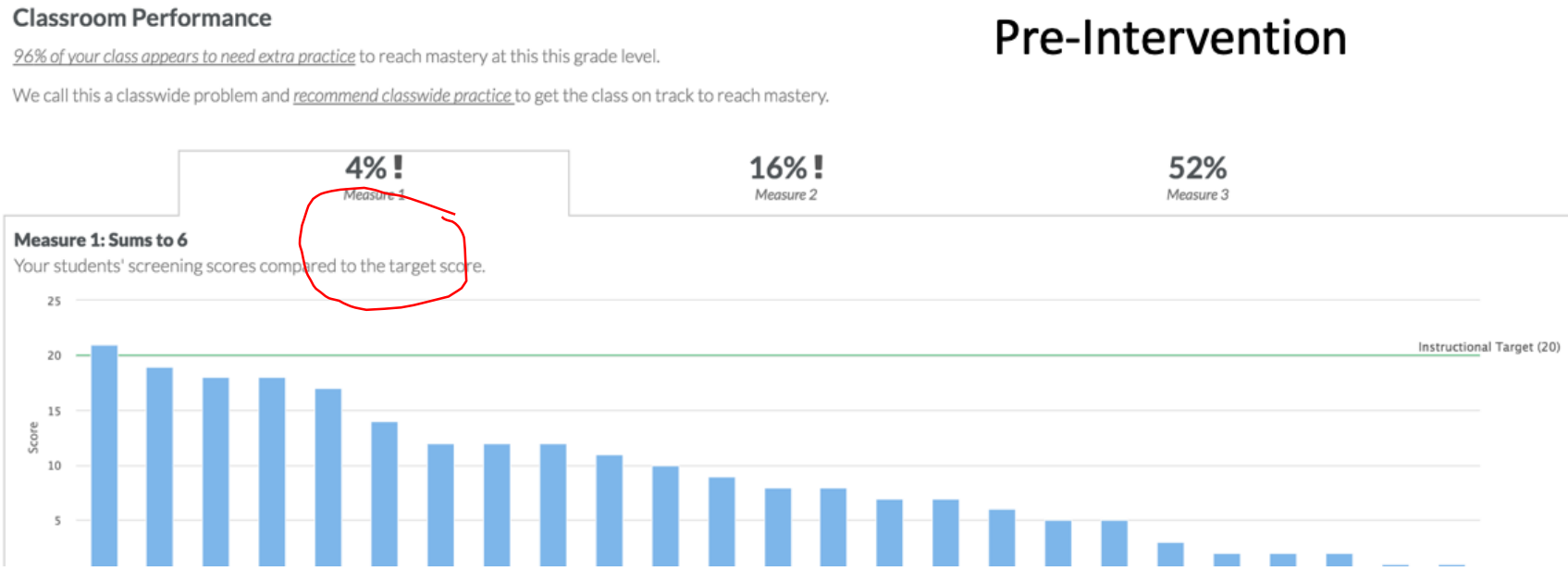
Skill packets will be provided to help practice foundational math skills.

As you complete skills you will receive new packets and be able to view your class' skill progress.

Use Classwide Intervention

High-Yield Action: Use Class-wide Intervention

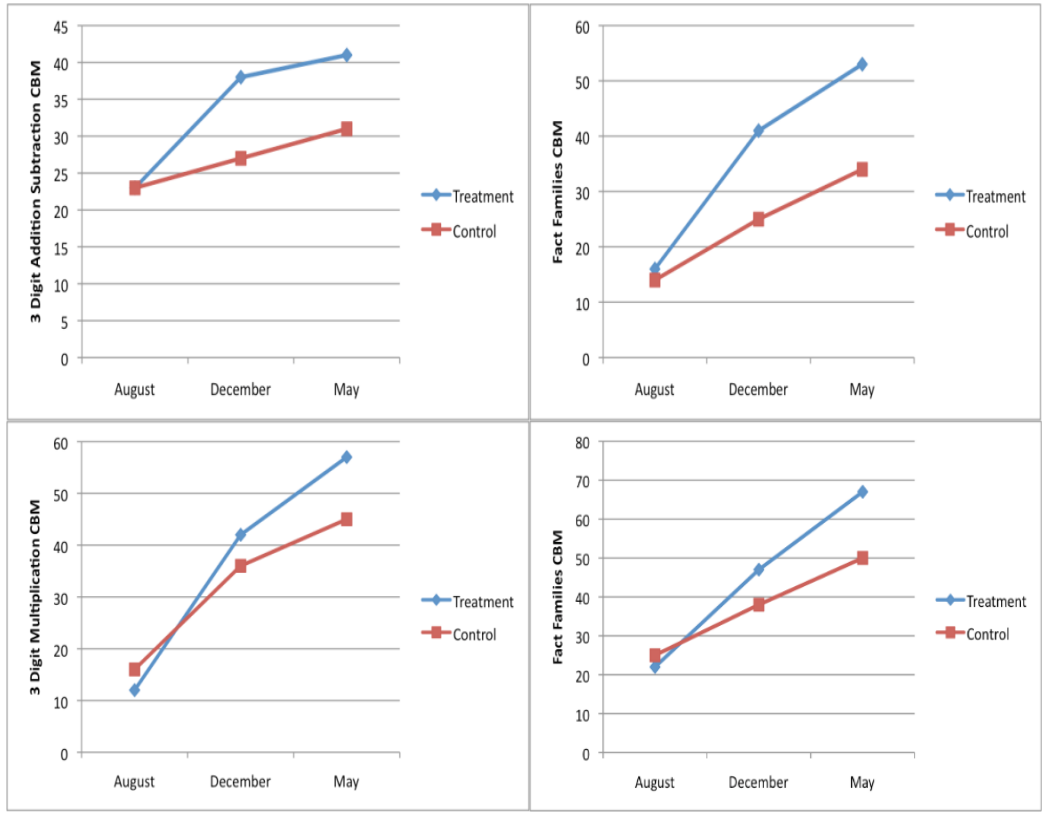
Pre

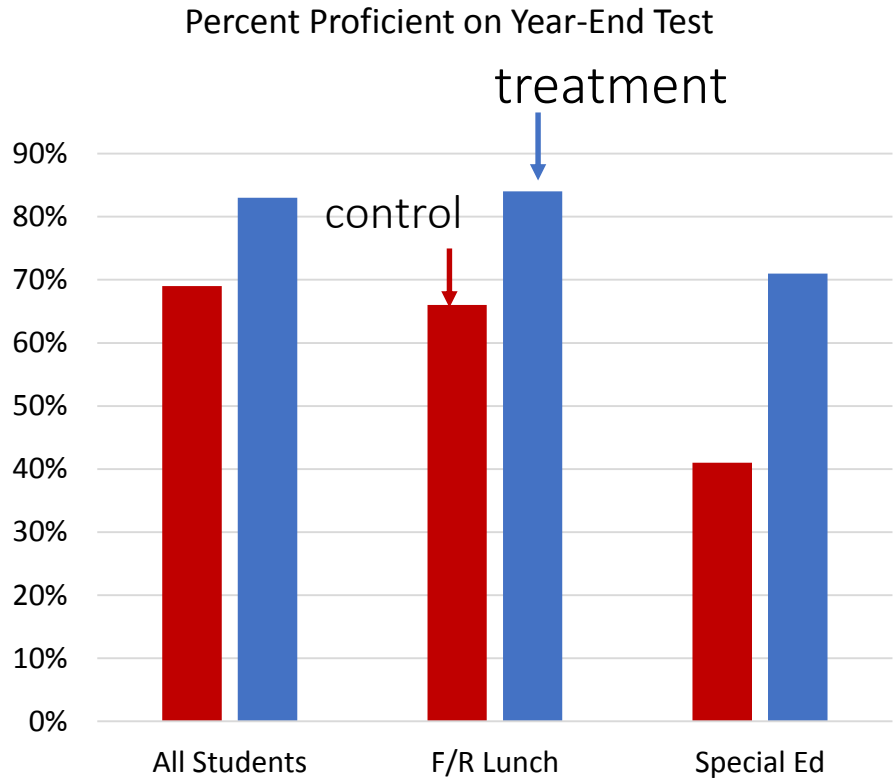


Post

Use Classwide Intervention

Classwide Intervention Works (when used well)





All	Title	Study	Study Type	Participants	Design	Fidelity of Impl.	Measures (Targeted)	Measures (Broader)
☐	Spring Math	Codding, VanDerHeyden, Martin, & Perrault (2016)	Group Design	●	◒	●	●	●
☐	Spring Math	VanDerHeyden, McLaughlin, Algina, & Snyder (2012)	Group Design	●	●	●	●	●

ES = .68 CBMs
ES = .18 Gr 4
ES = .79 for at-risk

http://www.intensiveintervention.org/chart/instructional-intervention-tools (NCII)

Use Classwide Intervention

When Managed, Classwide Intervention Works!

	Absolute Risk Reduction	Number Needed to Treat
All Students	15%	7
Students receiving F/R Lunch	18%	6
Students receiving Special Education Services	39%	3
Low-Performing Students	44%	2

Source: VanDerHeyden, McLaughlin, Algina, & Snyder, 2012; VanDerHeyden & Codding, 2015

How-To For Classwide Intervention in Math

To Get Started:

- Intervention protocol.
  - Here is one to try: https://static1.squarespace.com/static/57ab866cf7e0ab5cbba29721/t/5d67ed2a390a160001c5b4ac/1567092010232/Spring+Math+Classwide+IP.pdf
- Sequence of skills
- Daily practice materials
- Weekly assessment materials
- Criteria for decision making, a way to graph progress, and implementation support structures

Suggested Student Pairings

Adams, Maximus	Goyette, Dangelo
Homenick, Darrin	Rolfson, Keegan
Lehner, Salvador	Blick, Jerald
Collins, Lamont	Waelchi, Jacinthe
Reichert, Marlen	Skiles, Daphnee
Greenholt, Clovis	Kozey, Monserrat
Kreiger, Selena	Turcotte, Kayleigh
Larson, Kobe	Champlin, Gertrude

Close

Use Classwide Intervention

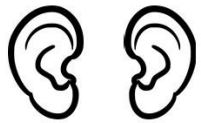
Workers

We use our **brains** to **think**.

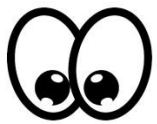
We use our **mouths** to **explain**.

We use our **hands** to **write**.

Helpers



We use our **ears** to **listen**.



We use our **eyes** to **watch**.

We use our **mouths** to **help**.

Intervention Protocol

Classwide Fact Families: Add/Subtract 0-9

Student:

Grade: 01

Teacher: Paul Muyskens

Class name: 1 Mathematics (-Hayden-)

Date: 1/22/2019

Classwide Math Intervention

Preparation:

- This is your master set of materials for the week.
- Make 1.5 copies of the practice sheets Day 1-5 for each student in your class (ex. if you have 20 students make 30 copies). Each student will have one copy for independent practice, while each pair of students will have one copy for paired practice.
- If you are using flashcards to practice, you can make only 1 copy per student.
- To set up your student pairs click on "Students" in your dashboard, then "Suggested Student Pairs."
- Identify the first "Worker," which should be the higher-performing student. This student will always work first.

☐ Say, **It's time for Spring Math. Please get together with your math partner. Please take out your practice materials, have your colored pen and pencil out, and show me you are ready.**

☐ Say, **Workers, your job is to work as many problems correctly as you can. As you work, be sure to talk through the problem so your partner can HEAR and SEE you solve the problem. Use a quiet voice while you work.**

☐ Say, **Helpers, your job is to follow along, listen and watch as the worker is working problems. If you see an error, speak up! Say, "Stop, Let's check this one."**

You should give the worker a hint, point to the exact error, but don't give them the answer. See if the worker can fix the error.

If the worker is stuck, give the answer but solve it aloud so the worker knows how you got that answer. If you get really stuck, circle the problem and ask me for help.

☐ Set the timer for 3 minutes.

☐ Say, **Remember, your goal is to work as many problems as possible with 100% accuracy. Ready? Begin!**Start the timer when you say Begin.

Use Classwide Intervention

Active Ingredients

- Modeling
- Practice for the right level of difficulty (opps to respond, complete learning trials)
- Corrective feedback & repetition loop
- Goal setting
- Delayed error correction w verbal rehearsal component
- Reward
- Advances difficulty based on proficiency

Use Classwide Intervention

Use Classwide Intervention

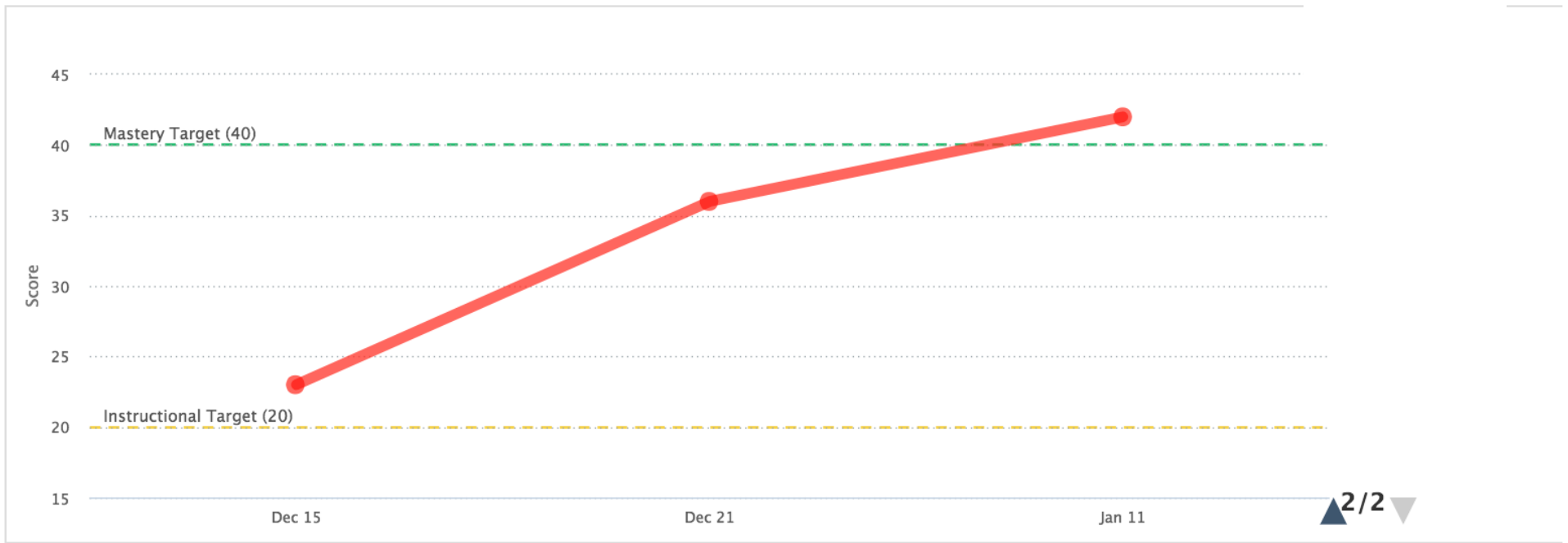
It's time to start Winter screening!

Start Screeni

Classwide Intervention Progress

Subtraction 0-9

Classwide Rate of Improvement: 4.1

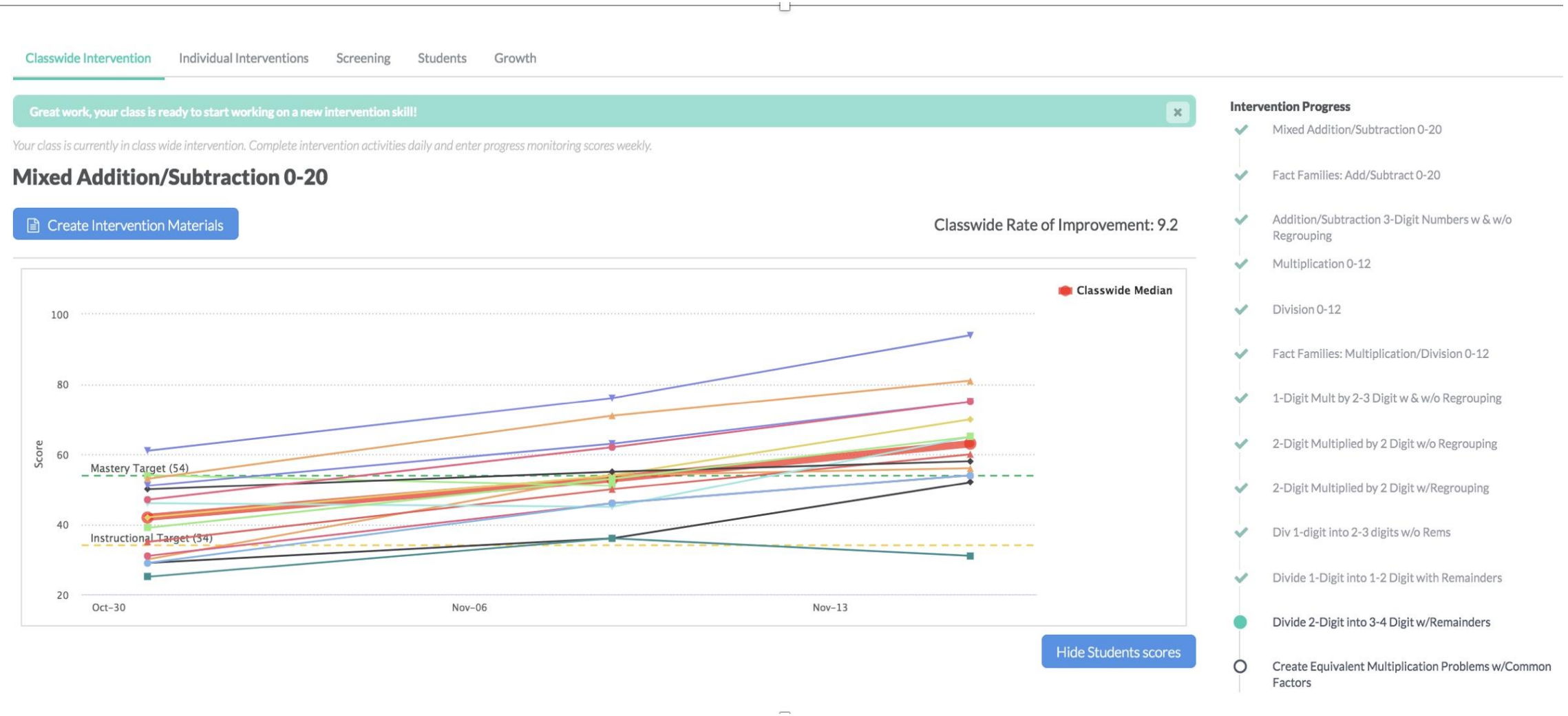


Skill Tree Progress

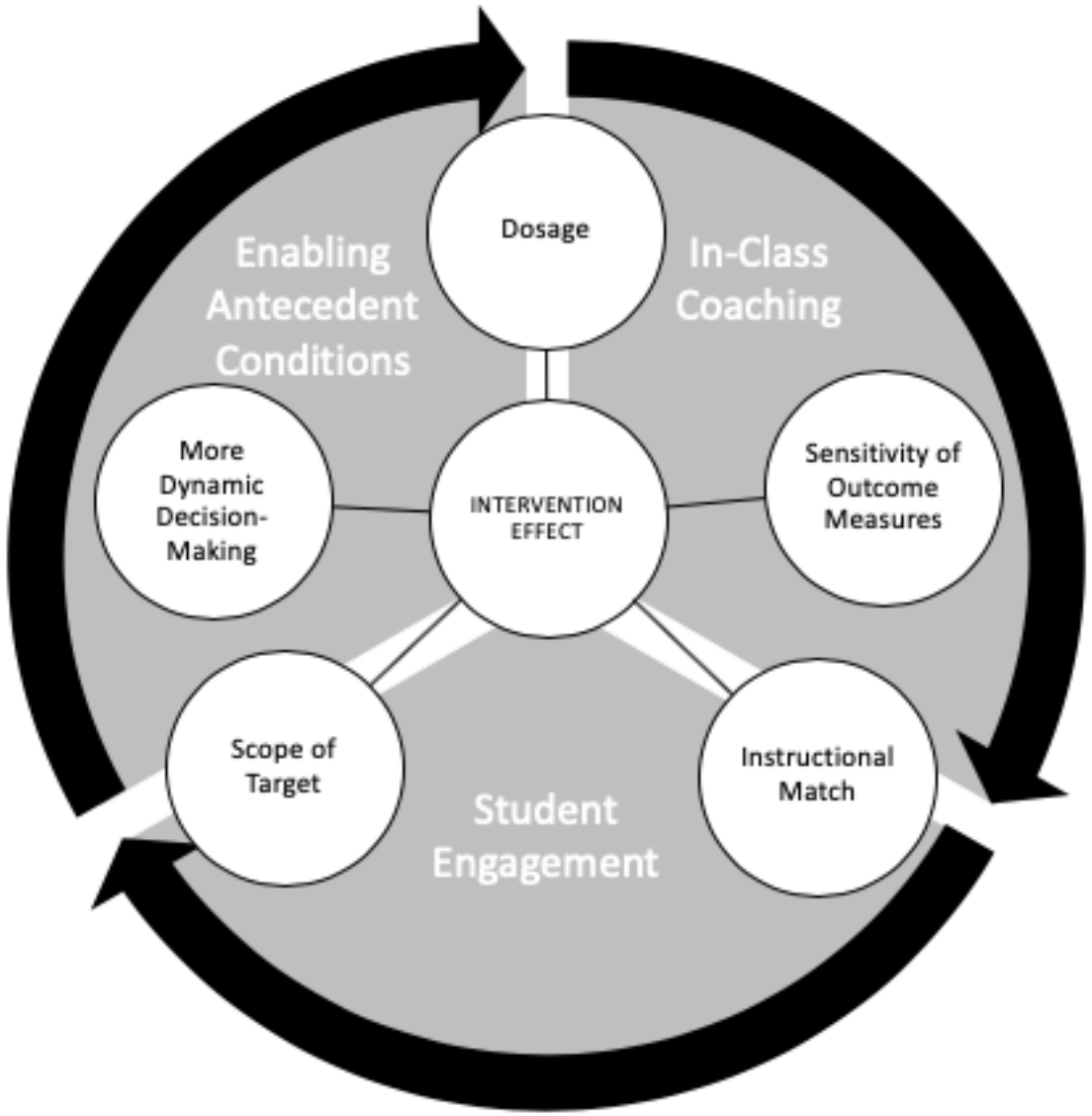
- Sums to 6
- Sums to 12
- Subtraction 0-5
- Sums to 20
- Subtraction 0-9
- Fact Families: Add/Subtract 0-9
- Subtraction 0-12
- Subtraction 0-15
- Subtraction 0-20

Use Classwide Intervention

Improves Learning, but Makes it Clear Who Needs More



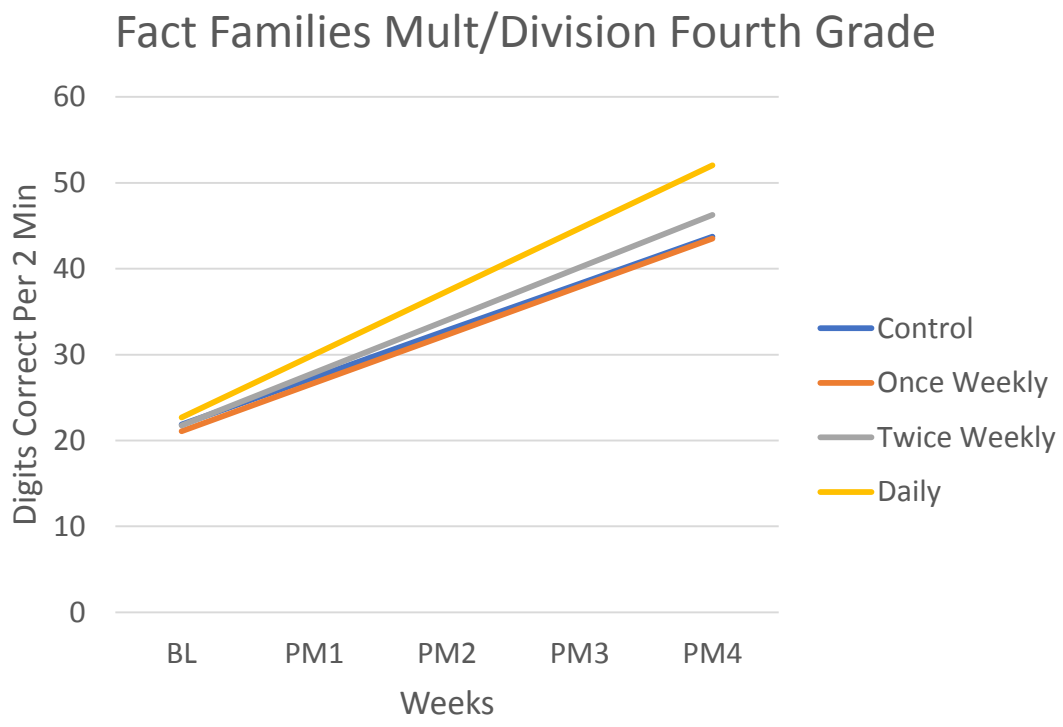
Use Classwide Intervention



Manage the Intervention

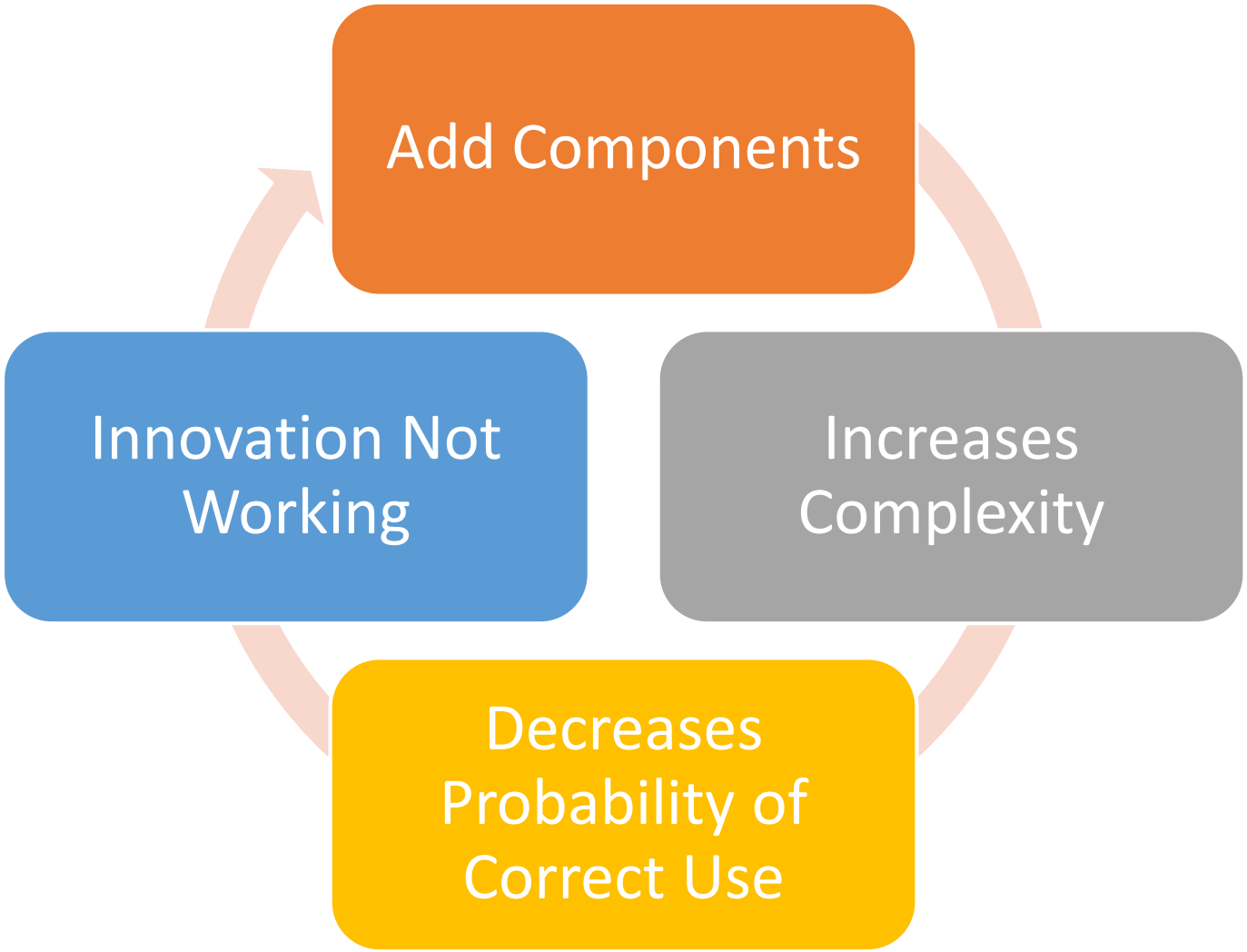
Recent survey findings reported by:
Silva, M.R., Collier-Meek, M.A., Codding, R.S. et al. (2020). Data Collection and Analysis in Response-to-Intervention: a Survey of School Psychologists. Contemporary School Psychology. https://doi.org/10.1007/s40688-020-00280-2

Dose What is Needed, Not What Fits Schedule



Codding, R., VanDerHeyden, Martin, R. J., & Perrault, L. (2016). Manipulating Treatment Dose: Evaluating the Frequency of a Small Group Intervention Targeting Whole Number Operations. *Learning Disabilities Research & Practice, 31*, 208-220.

Don’t Do This


Add Components
Increases Complexity
Decreases Probability of Correct Use
Innovation Not Working

Use Implementation Science

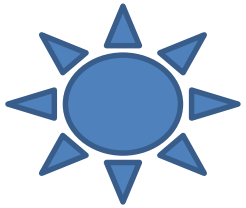
Plan to be present when intervention is started.

Track intervention effects weekly.

When growth is weak, check-in with teacher by watching intervention being implemented.

Help troubleshoot any barriers and say that you will check in again next week.

Wash, Rinse, Repeat.



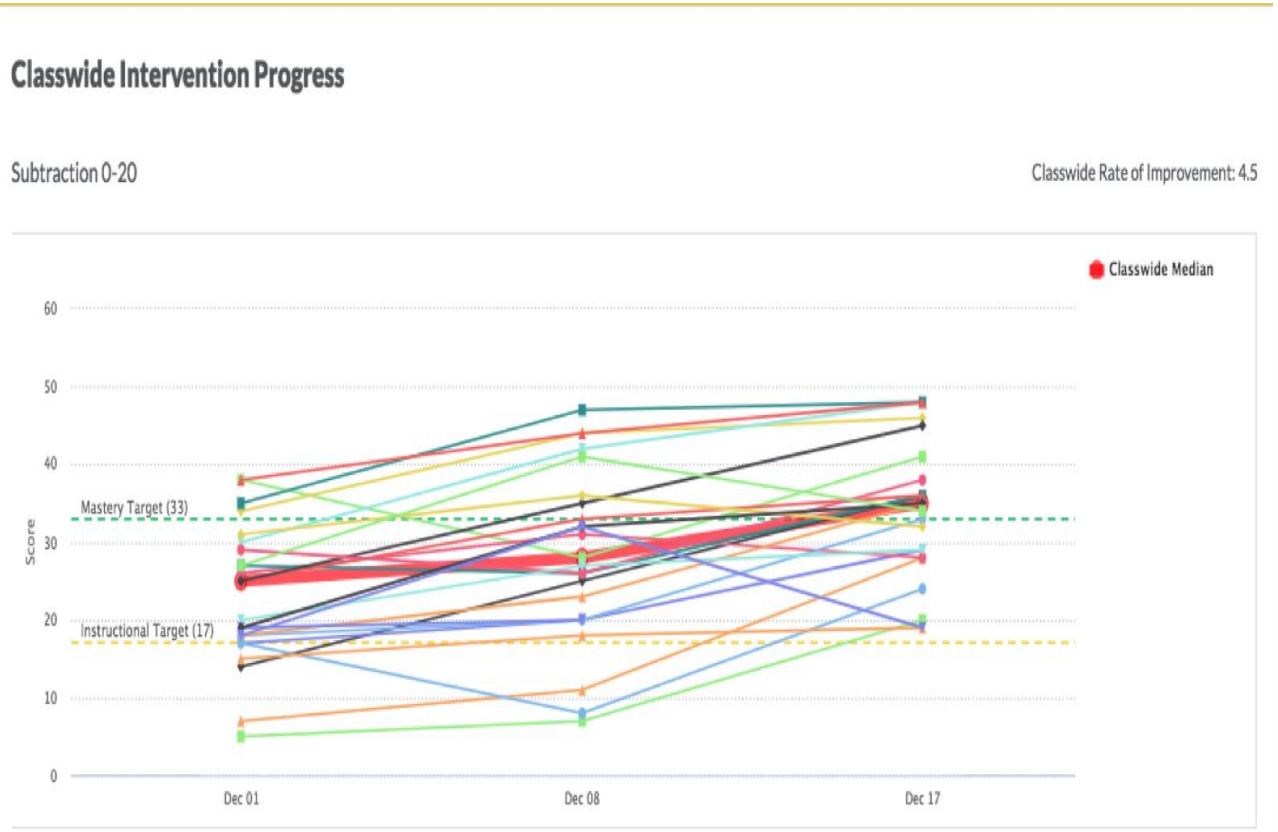
Signs of an Effective Intervention

- Scores available for each week.
- Median increases each week within instructional groupings.
- Most students grow week over week.
- Very few students remain in the frustrational range.
- Few students require more intensive intervention.

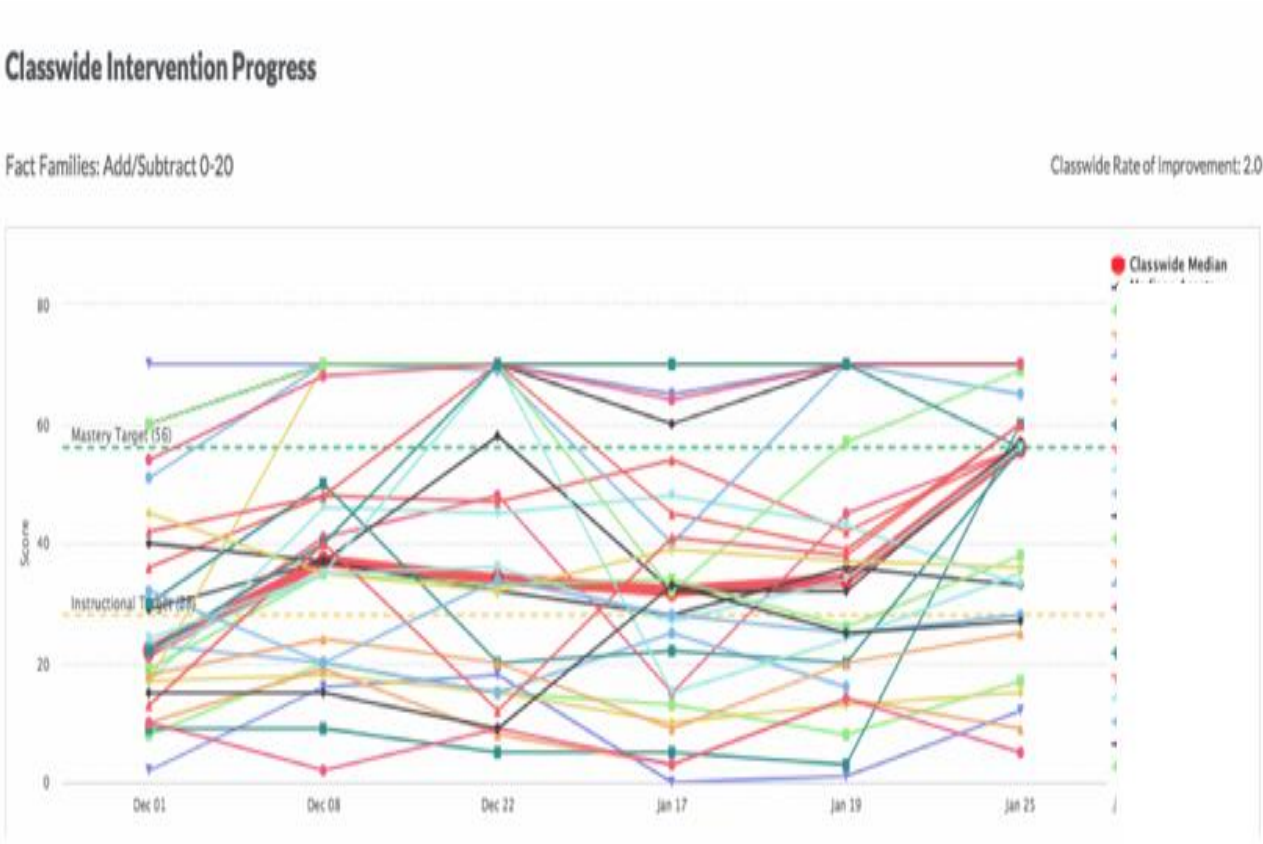
Activity: NCII DBI Implementation Rubric

https://intensiveintervention.org/resource/dbi-implementation-rubric-and-interview

This is a High-Integrity Intervention



This is a Low-Integrity Intervention



Manage Intervention

It's time to start Winter screening!

Classwide Intervention Progress

Sums to 6

Classwide Rate of Improvement: 1.8

Skill Tree Progress

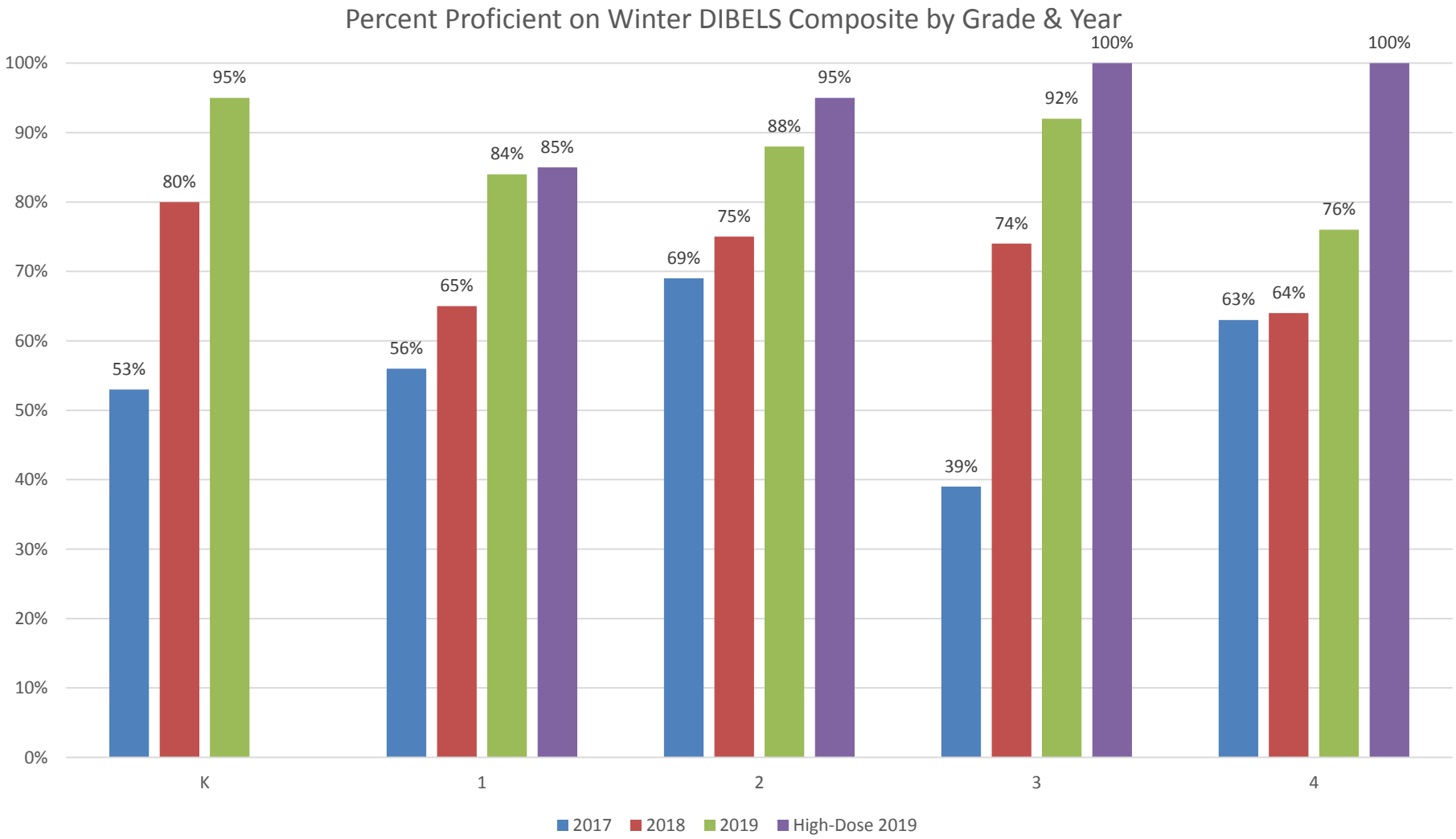
- Sums to 6
- Sums to 12
- Subtraction 0-5
- Sums to 20
- Subtraction 0-9
- Fact Families: Add/Subtract 0-9
- Subtraction 0-12
- Subtraction 0-15
- Subtraction 0-20

Manage Intervention

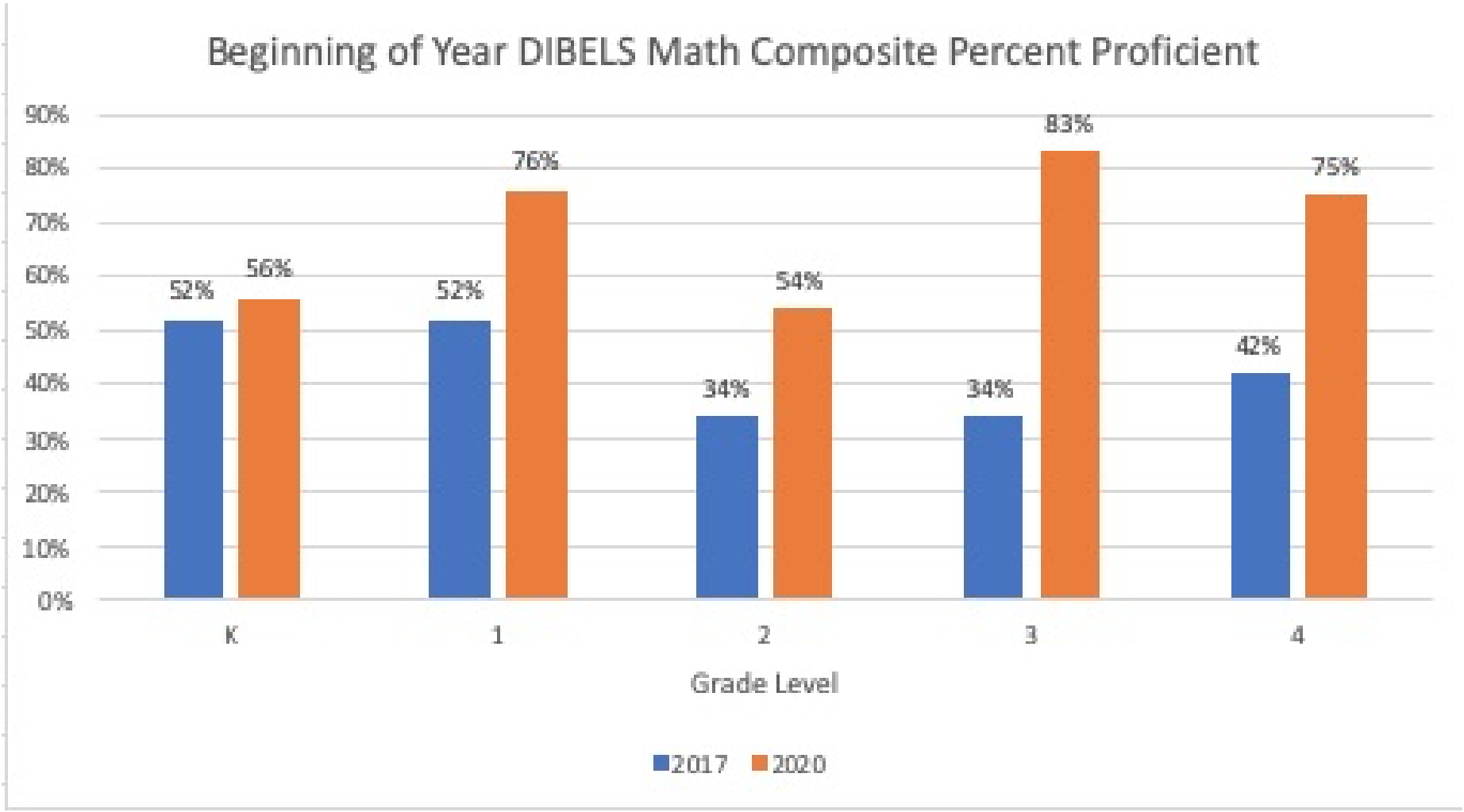
Manage Intervention

Not doing the intervention.	Make intervention use fail-proof: Make sure you have materials. Make sure you know HOW to implement. Make sure there is a scheduled time for intervention.
Students do not know how to follow the classwide intervention routine.	Re-train the students. Show the students how to get into working pairs, how to use the materials, how to provide high-quality feedback, and how to be engaged.
Teacher is not completing all steps of the intervention.	Review missed steps and understand rationale. Papers must be scored during the intervention because that provides feedback to the student, provides the error correction opportunity, and provides goal attainment opportunity. The error correction component is important because it improves student accuracy for the next session.
Children seem bored with the intervention.	Include rewards to motivate students. Display the median graph on dashboard for the class to see their growth. Be sure to set daily goals with the students!

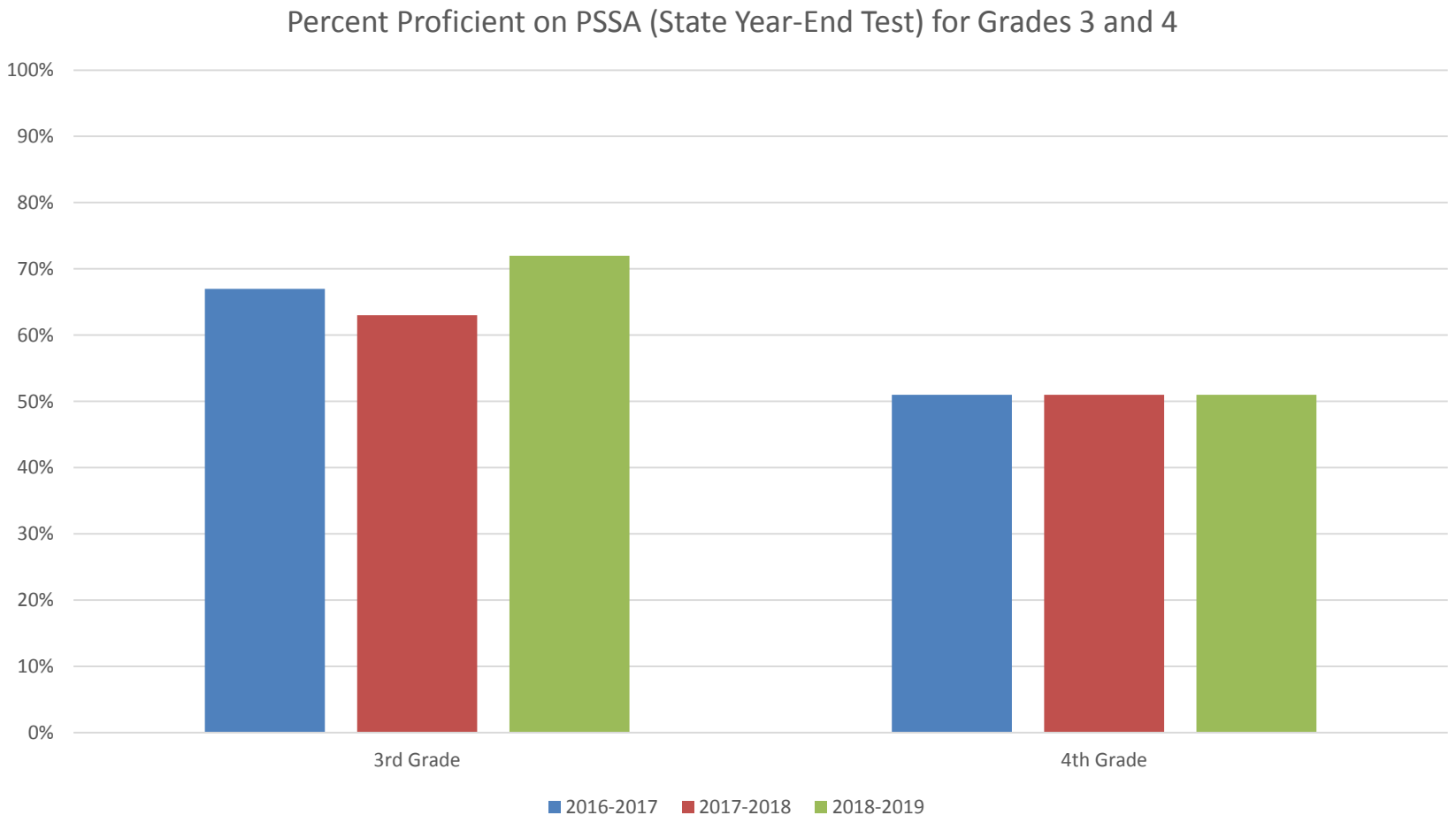
Gains Across Years and By Dosage



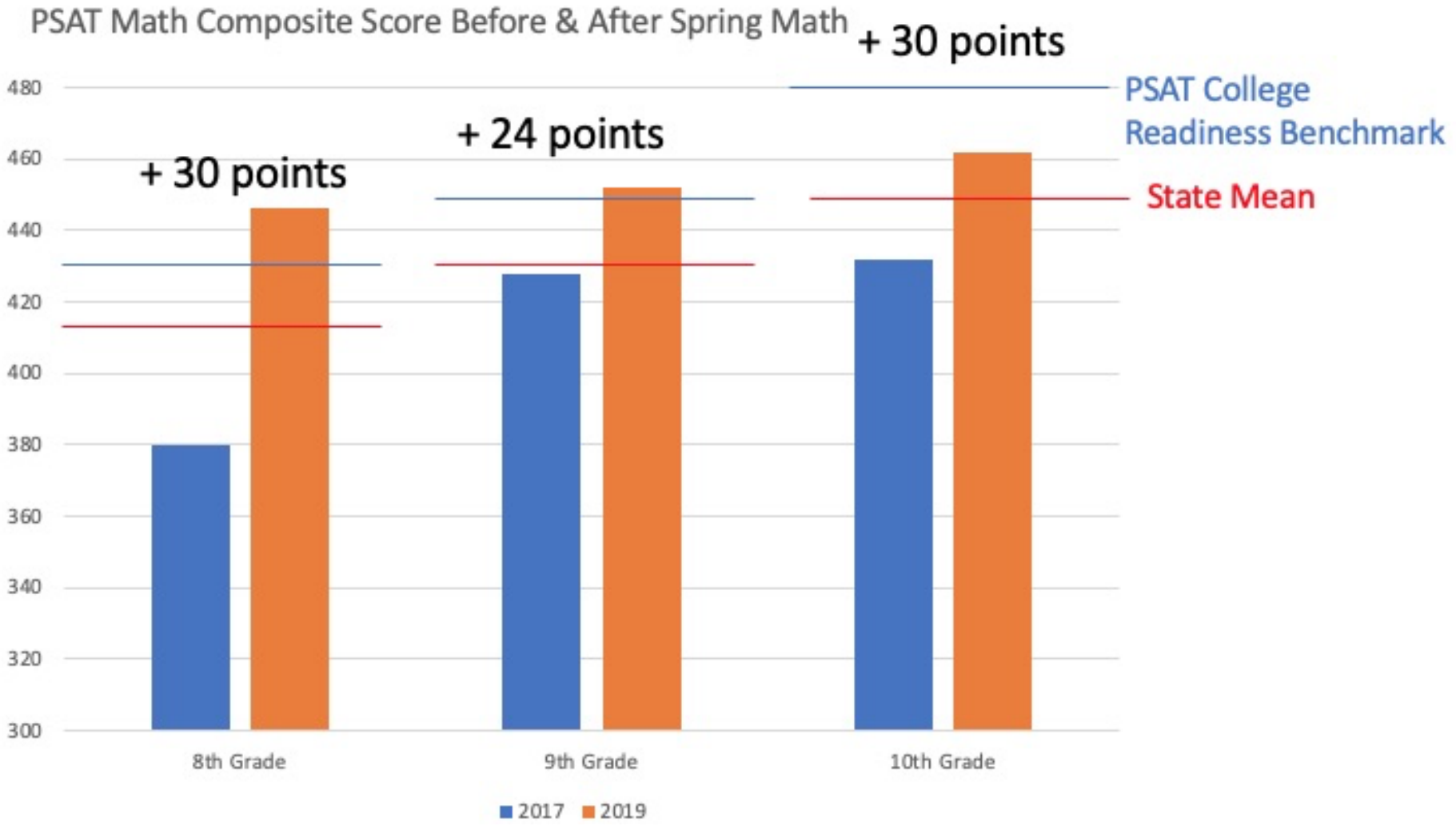
Cumulative Protective Benefit Can Be Seen



It Takes Time to Move the “Big” Indicators



But After Year 2, they Move



Delivering Intensive Individual Intervention

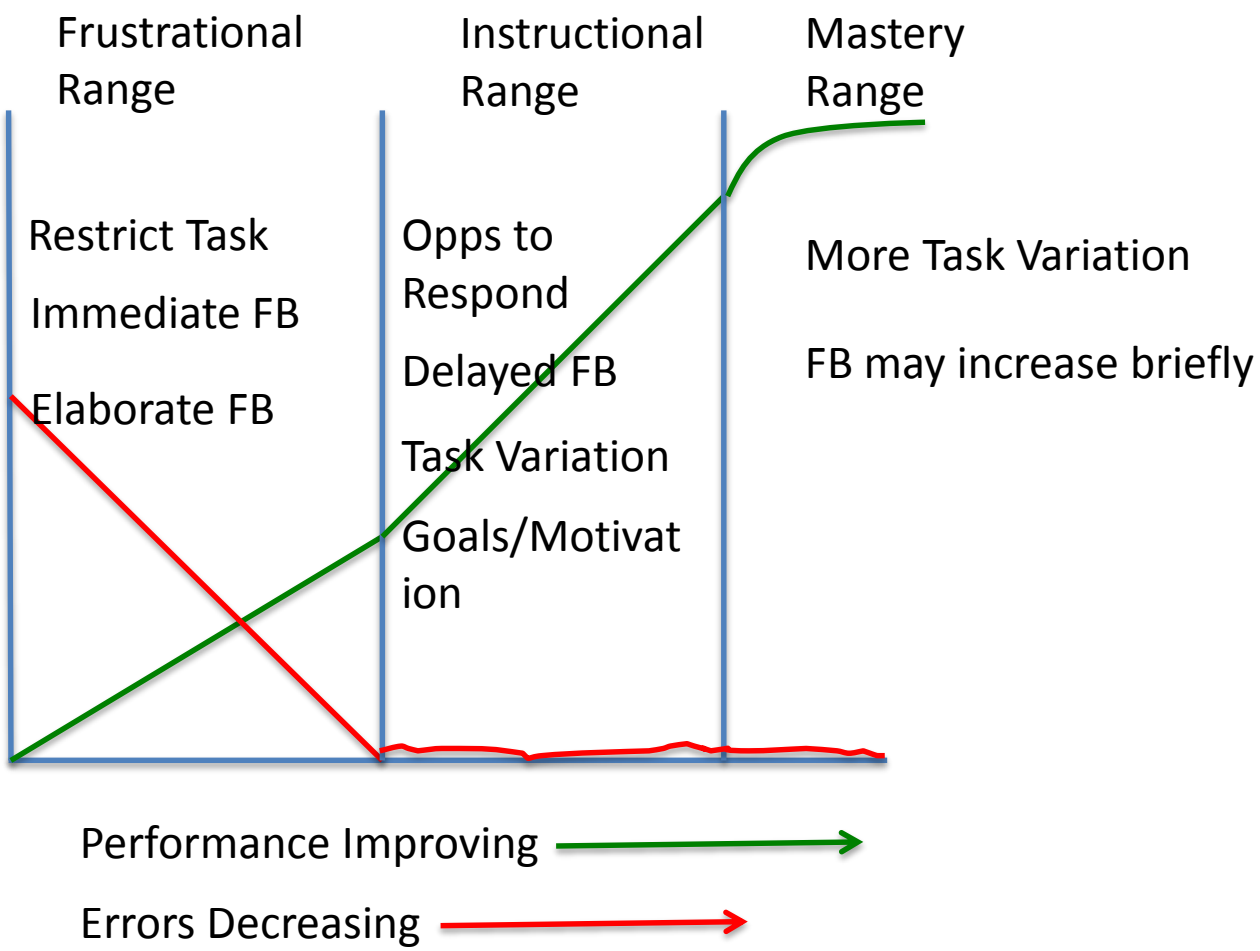
Learning Process

All learning is a product of the interaction between the learner and the environment.

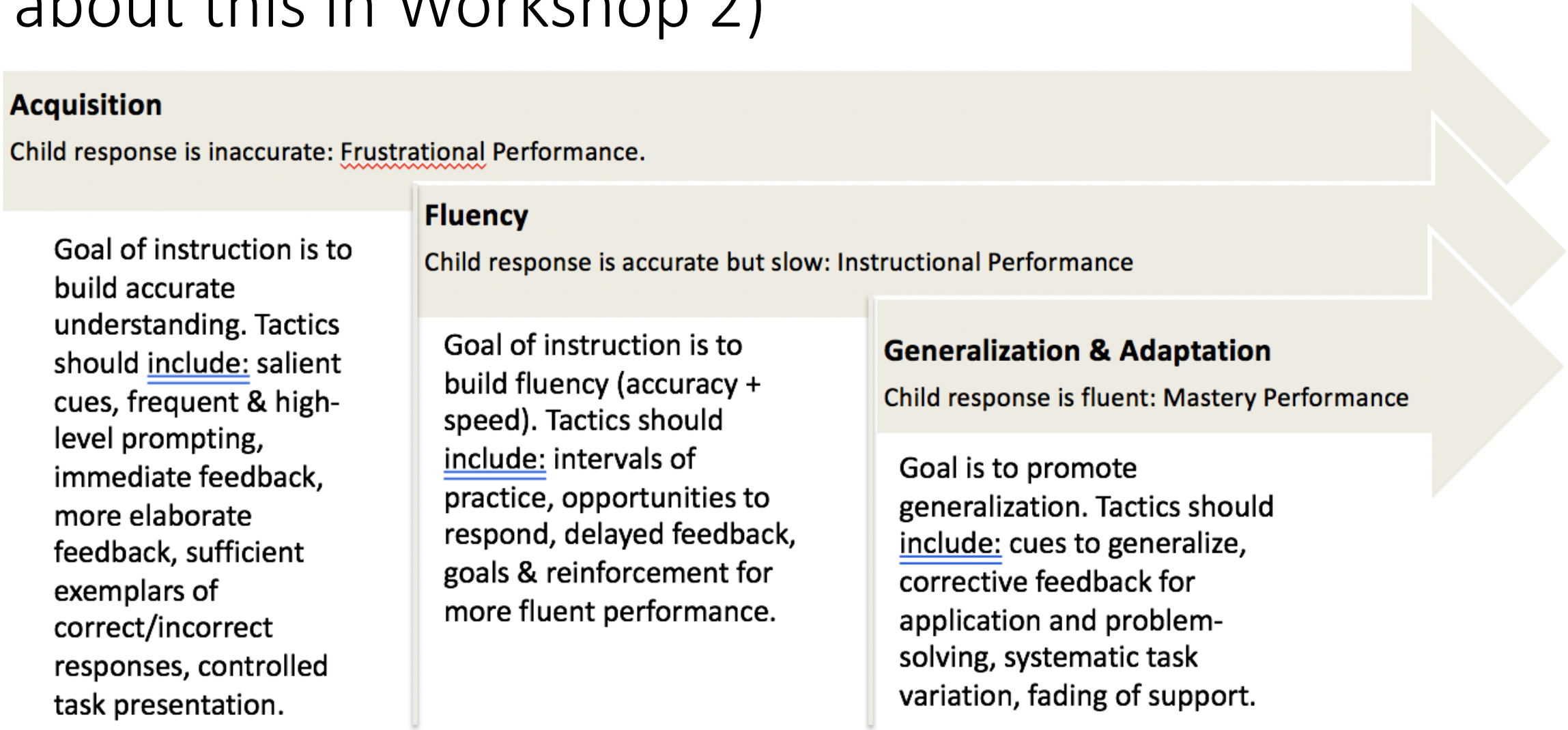
Functional academic assessment recognizes that the environment can be assessed and optimized to create a better child-environment fit to optimize learning (Lentz & Shapiro, 1986).

To be successful interventions have to be selected based on their fit and installed into adequate host environments (Witt, VanDerHeyden, Gilbertson, 2004).

The Instructional Hierarchy



How to Plan Instruction Using Science (We will talk about this in Workshop 2)



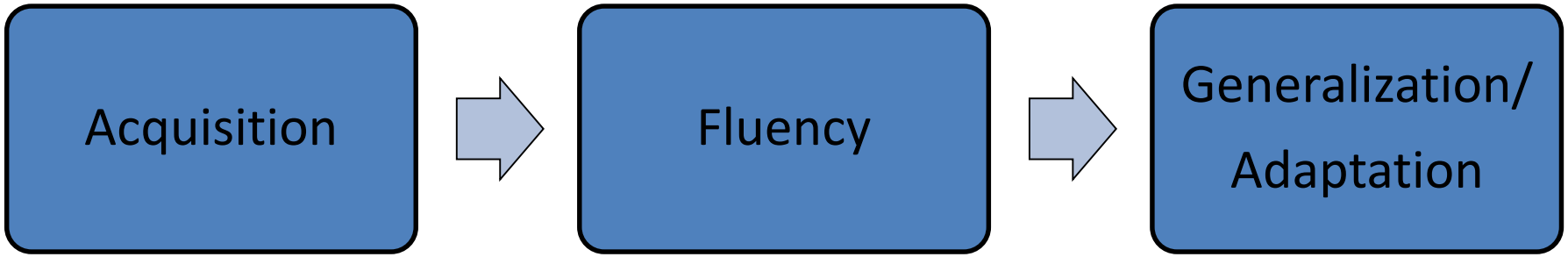
Haring, N. G., & Eaton, M. D. (1978). Systematic instructional procedures: An instructional hierarchy. In N. G. Haring, T. C. Lovitt, M. D. Eaton, & C. L. Hansen (Eds.), *The fourth R: Research in the classroom* (pp. 23–40). Columbus, OH: Merrill.

Stages of Learning

New understanding. Child cannot accurately respond without help.

Child performance is accurate, but response is labored.

Skill is fluent.



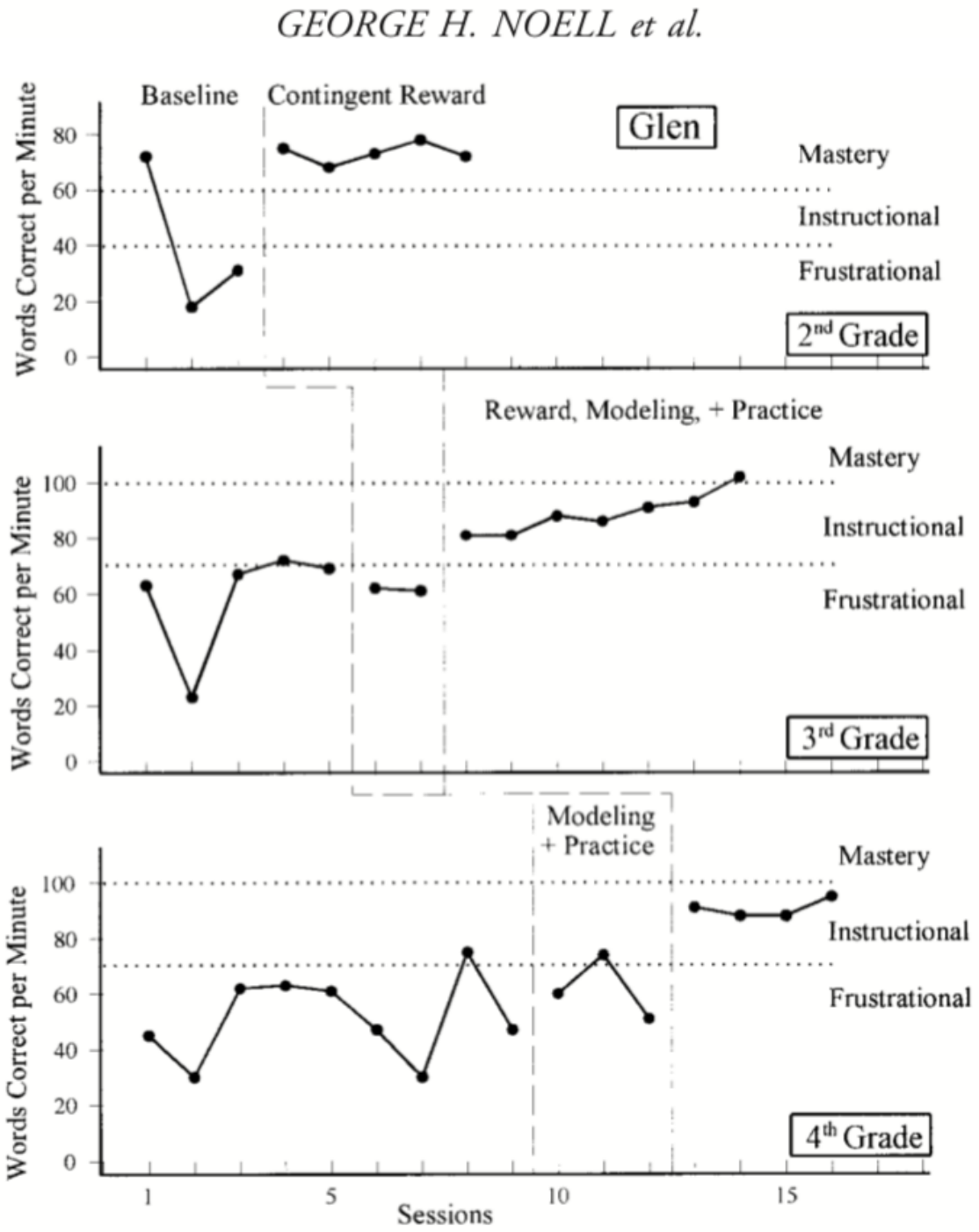
Goal of instruction is Discrimination.

Goal of instruction is Fluency (rapid and accurate responding).

Goal of instruction is to increase the conditions under which the child can respond correctly (stimulus generalization) & alteration of the skill to solve new problems (response adaptation)

Test the Effects of Reward & Instructional Supports in Tandem with Task Difficulty

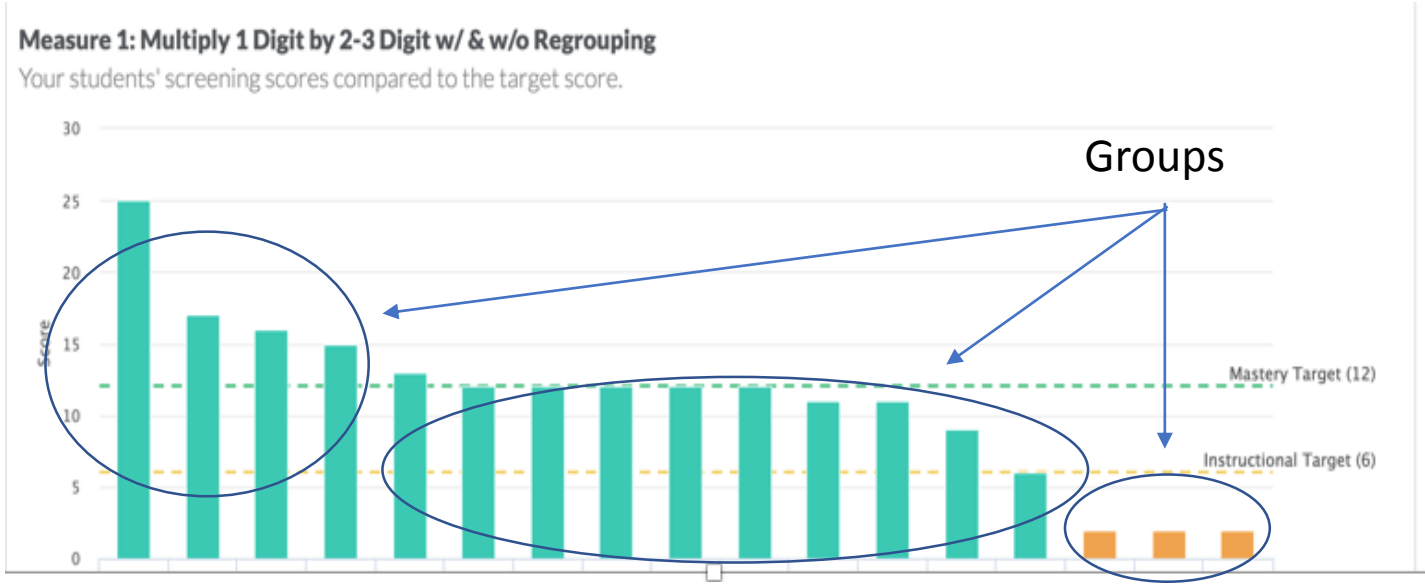
Noell, G. H., Gansle, K. A., Witt, J. C., Whitmarsh, E. L., Freeland, J. T., LaFleur, L. H., et al. (1998). Effects of contingent reward and instruction on oral reading performance at differing levels of passage difficulty. Journal of Applied Behavior Analysis, 31, 659–663.



Features to Adjust & Align for Successful Intervention

- Learner
  - Sensitivity to contingencies/rewards for performance
  - Level of skill proficiency/understanding
  - Presence at school
  - Motivation, attention, engagement
  - Rapport with the teacher
- Environment
  - Task difficulty
  - Explicit clarity of antecedent support for correct responding (materials, cues, guided instruction)
  - Opportunities to respond
  - Corrective feedback
  - Rapport with the teacher
  - Whole-class engagement
  - Whole-class skill proficiency

Tier 2 Take-Aways



- Group size can vary (larger groups not associated with weakened efficacy
- Groupings must be flexible (they should change based on learner growth & need– in math this means every 1-2 weeks)
- Sessions can be brief, but more frequent is better (dosage).
- Students can work in pairs (like a mini-classwide intervention) to maximize opps to respond & feedback
- Can be used for Acquisition and Fluency-Building interventions

For Math: Use Screening Data

Classwide Intervention | Individual Interventions | Screening | Students | Growth

Spring 2017-18 Screening Results

The results are in. Let's take a look...

Classroom Performance

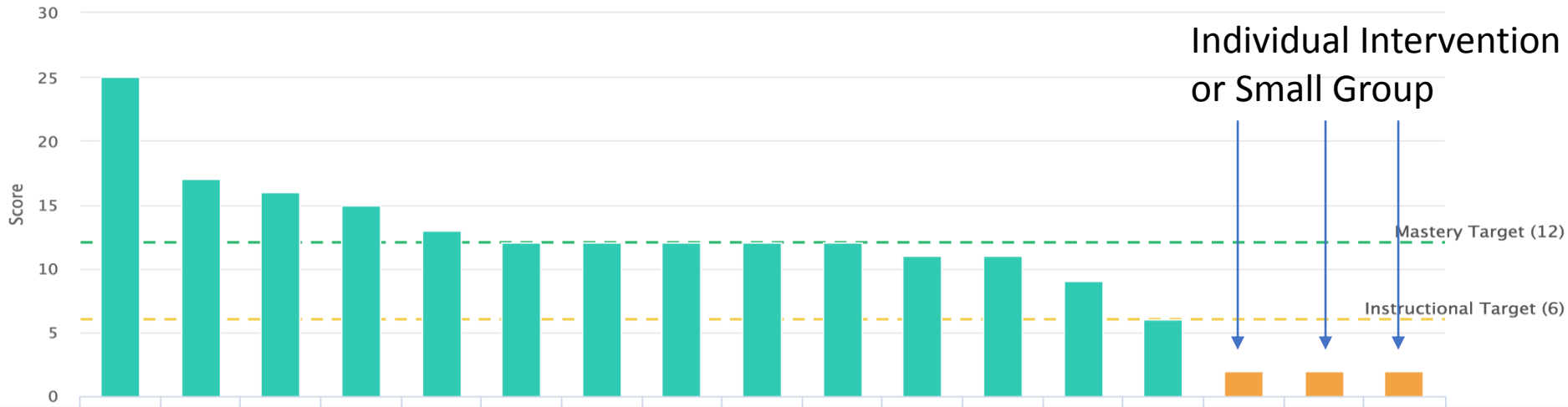
6% of your class reached the target on all of the screening assessments. Extra practice will help you reach mastery at this grade level.

The classwide intervention has already been started.

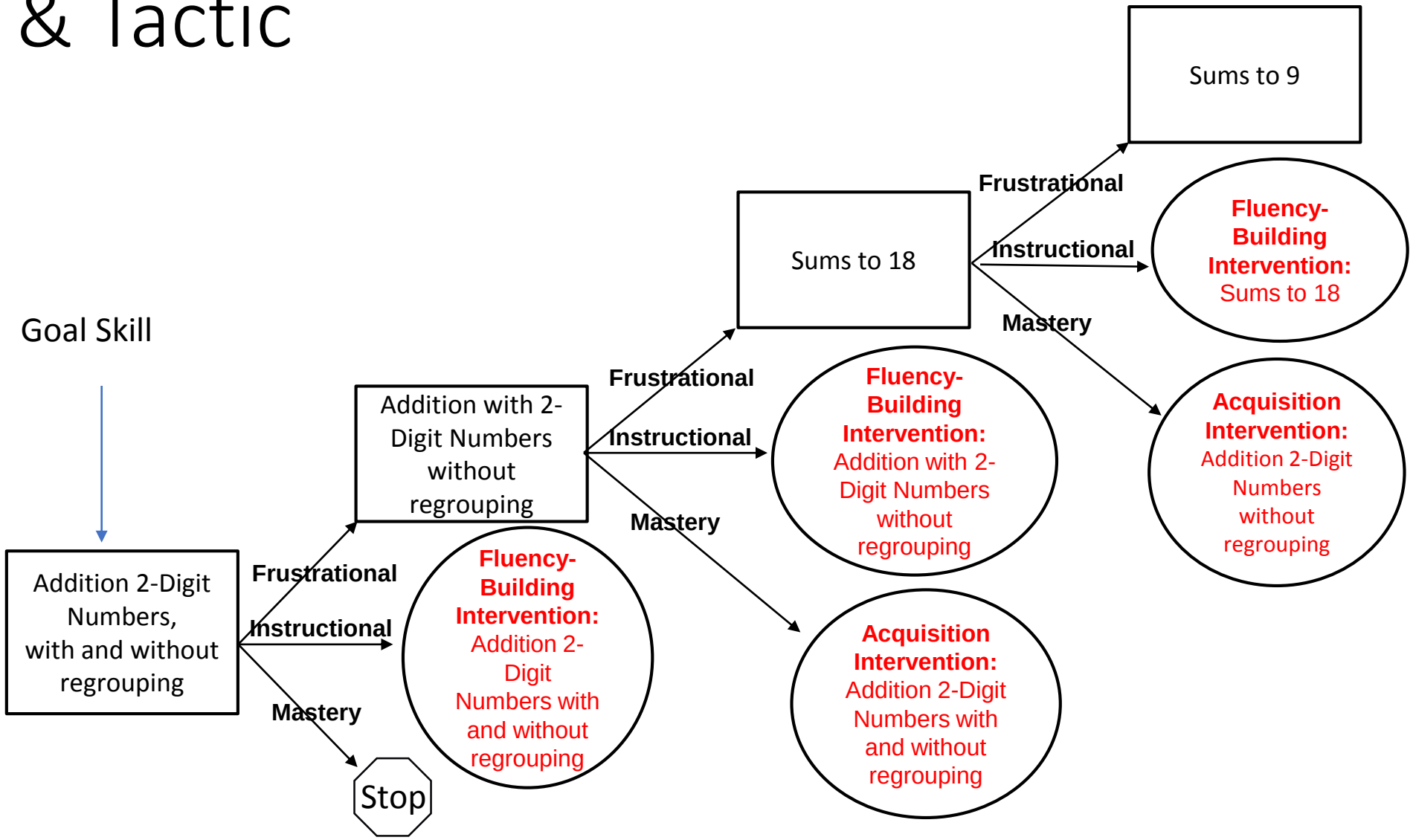
82%	12%	94%	24%
Measure 1	Measure 2	Measure 3	Measure 4

Measure 1: Multiply 1 Digit by 2-3 Digit w/ & w/o Regrouping

Your students' screening scores compared to the target score.



Sample Back to Find Starting Level & Tactic



You will Need a Range of Interventions & Data to Connect them to the Student

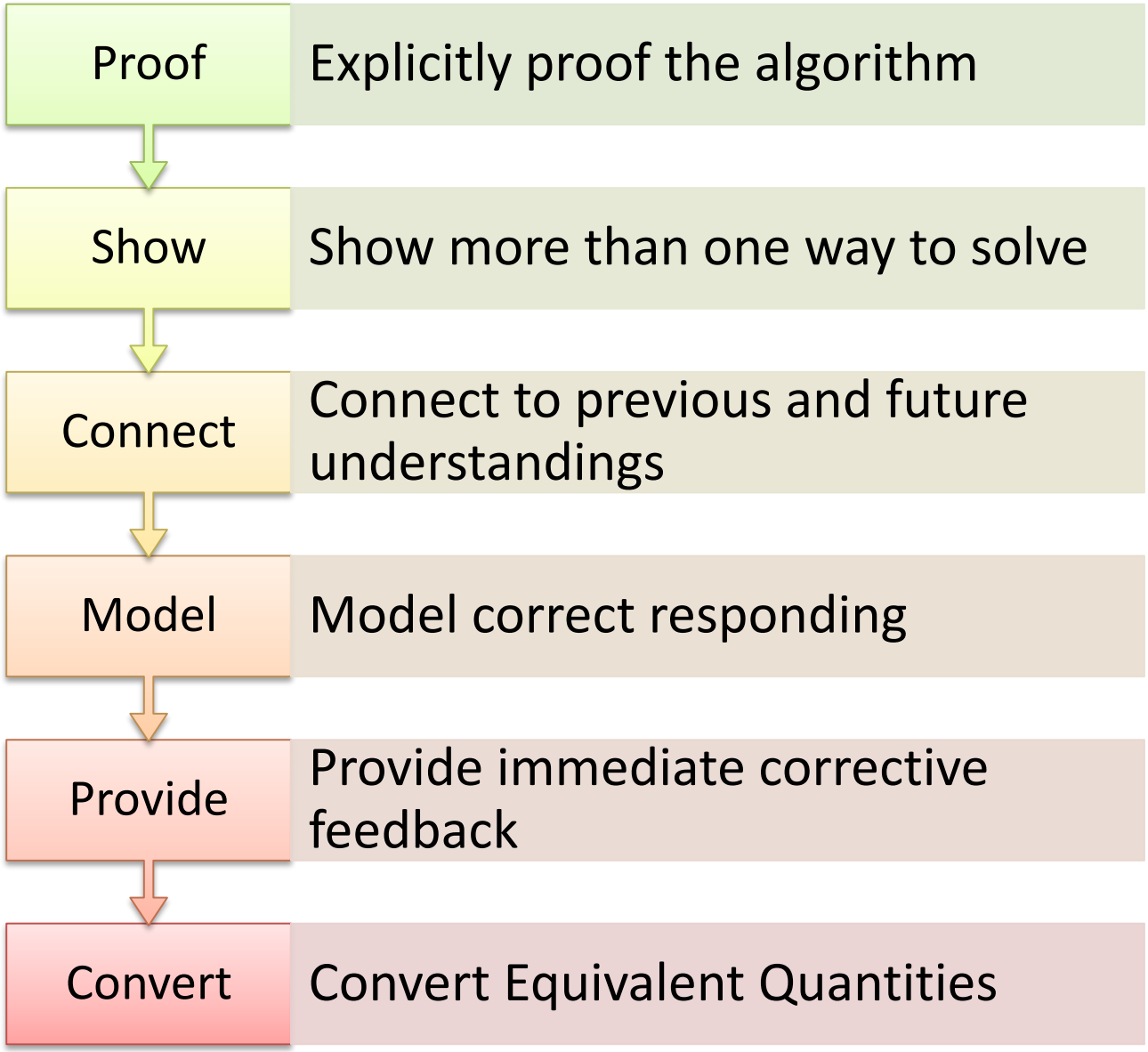
Procedural & Conceptual Understanding for Middle School Math						
Fluency-Building →			Acquisition →			
Classwide Math Intervention	Timed Trial	Response Cards	Cover Copy Compare	Guided Practice	Incremental Rehearsal	Bingo

Stage of Learning	Student Performance	Goal of Intervention	Intervention Example
Acquisition	Frustrational: inaccurate	Establish 100% correct responding. Discrimination	Cover, copy, and compare; Guided Practice
Fluency-Building	Instructional: accurate but not rapid.	Build fluency	Flashcards, timed performance with incentives, response cards
Generalization & Adaptation	Mastery: Fluent (i.e., accuracy + speed)	Establish robust application	Guided practice intervention

To Find the “Right” Intervention

- Step 1: Identify the “Goal” skill or understanding.
- Step 2: Specify the necessary pre-requisite understandings.
- Step 3: Survey-level assessment to sample back or “drill down” to find the right intervention target.
- Step 4: If performance is frustrational => Give acquisition intervention. If performance is instructional => Give fluency-building intervention. If performance is mastery => Give generalization opportunities

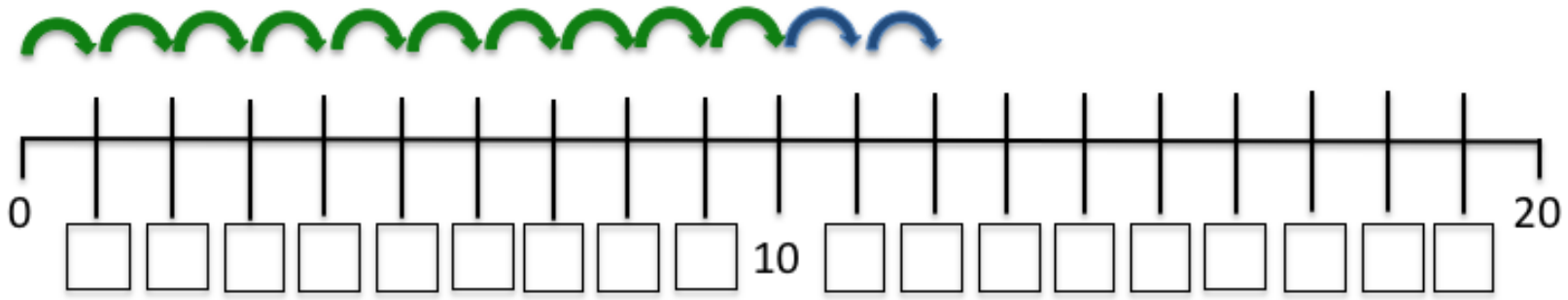
Effective Acquisition Interventions in Math



Show the child a number line and say, **Let's find 10 + 2.** Say, **This number line goes from zero to 20. Ten is here** (point to the 10). **Let's count how many copies of "1" 10 is.** Guide the child to count the units to 10. Show the child that 10 can be written as 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1. **Let's fill in the boxes for the units on the number line.** Guide the child to fill in the missing number for each unlabled unit on the number line.

Can you find another way to write 10? If the child cannot answer, prompt, **Here is the 5. How many must we add to 5 to get 10? Let's count and check. Can you find another way?**

Now let's solve 10 + 2. Let's find the 10 on the number line. If we count up 2 units from 10, what is the sum? Show the child how to count from zero to 12. Then show the child how to start with 10 and count up 2 units.

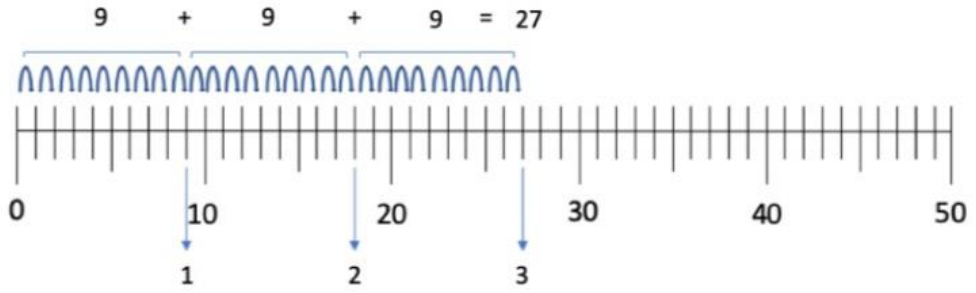


Explicitly proof the algorithm

Show More than One Way to Solve

		9											
		1	2	3	4	5	6	7	8	9	10	11	12
3 Sets of	1												
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
	11												
	12												

Let's find the solution to 3 x 9 on a number line. We can think of 3 x 9 as 3 sets of 9. Let's count out each set and then find the product or answer of 3 x 9.



9 + 9 + 9 = 27

How many sets of 9 are in 27?

3 x _____ = 27

We have learned that when we divide with whole numbers, it is the same as solving for an unknown factor. In other words, 8 divided by 4 is the same as asking 4 times what number will equal 8? We could write this as '4 x ? = 8'. We can solve this in our heads because we know our multiplication facts. But we can also solve it procedurally.

You already know that any number can be multiplied by 1 without changing the quantity. Let's check and see.

8 x 4 = 32

8 (1) x 4 (1) = 32

This is useful to you because when you need to create an equivalent fraction with a different denominator (for example, when you want to compare close fraction quantities or when you want to add or subtract with fractions), you can multiply the fraction by a value of 1 to change the denominator.

Connection to Previous Understanding

Now let's find 10's inside these problems to find the sums. Fill in the missing number and remember, you must make a 10.

12 = _____ + _____

14 = _____ + _____

13 = _____ + _____

8 + 8 + 2 = 10 + _____

5 + 5 + 8 = 10 + _____

4 + 4 + 6 = 10 + _____

13 + 3 = _____ + _____ + _____

14 + 4 = _____ + _____ + _____

Connects Addition Facts to Place value understanding

Connection to Future Understanding

Convert Quantities

Let's find the "doubles" inside these problems.

6 = _____ + _____

8 = _____ + _____

12 = _____ + _____

16 = _____ + _____

20 = _____ + _____

Now we are warmed up. Fill in the blanks for each problem below. You must include a double.

5 = 2 + _____ + _____

9 = 4 + _____ + _____

17 = 8 + _____ + _____

3 = 1 + _____ + _____

7 = 3 + _____ + _____

11 = 5 + _____ + _____

15 = 1 + _____ + _____

19 = 3 + _____ + _____

19 = 1 + _____ + _____

Now let's find 10's inside these problems to find the sums. Fill in the missing number and remember, you must make a 10.

---

12 = _____ + _____

14 = _____ + _____

13 = _____ + _____

8 + 8 + 2 = 10 + _____

5 + 5 + 8 = 10 + _____

4 + 4 + 6 = 10 + _____

13 + 3 = _____ + _____ + _____

14 + 4 = _____ + _____ + _____

Explicit Modeling: Common Denominators

If we want to add 3/8 and 3/5, however, we must convert the fractions to the same base unit. In other words, we have to find a common denominator. First, let's write the multiples of each denominator. Guide the student to fill in each cell of the table. What is the common multiple? 40, that's right. But our work is not done. We have to convert each fraction to a 1/40 unit fraction. We know we can multiply any fraction quantity by 1 and it won't change the quantity. To convert the first fraction 3/8 to a 1/40 unit fraction, we can multiply 3/8 by 5/5 and that gives us 15/40. What must we multiply 3/5 by to get a 1/40 unit fraction that's equivalent to 3/5? 8/8, that's right. So 3/5 x 8/8 = 24/40.

Let's do some more.

Find the Common Multiple

x 1	x 2	x 3	x 4	x 5	x 6	x 7	x 8	x 9
8	16	24	32	(40)	48	56	64	72
5	10	15	20	25	30	35	(40)	45

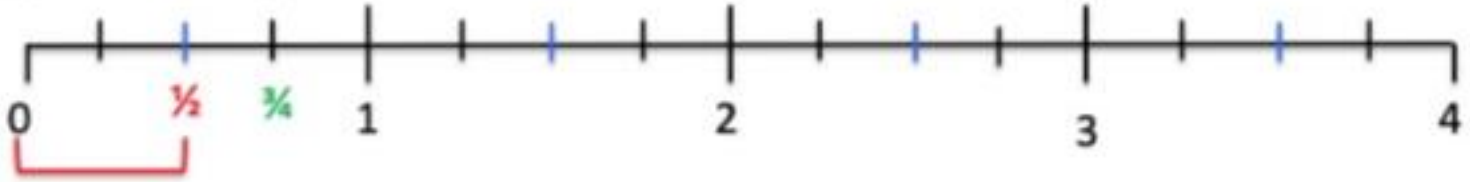
Now Convert the Fractions

x 1	x 2/2	x 3/3	x 4/4	x 5/5	x 6/6	x 7/7	x 8/8	x 9/9
3/8				15/40				
3/5							24/40	

Dividing with Fractions

Let's think about 1/2 ÷ 3/4.

½ ÷ ¾



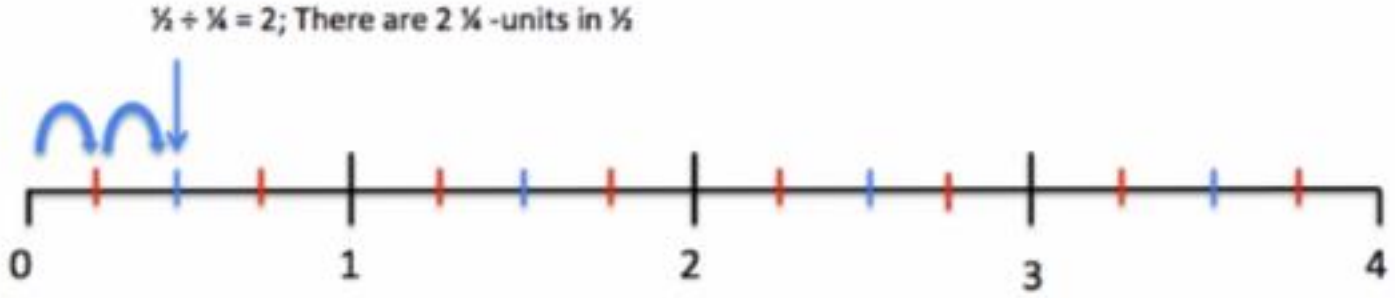
How many ¾ parts are in ½? There is less than one ¾ part in ½. How do we know?

½ = ¼ + ¼.

¾ = ¼ + ¼ + ¼. There are less than three ¼-parts in two-¼ parts.

Let's try 1/2 divided by 1/4.

½ ÷ ¼ = 2; There are 2 ¼ -units in ½



- ☐ Ensure that the child answers each problem correctly. Ensure that the child writes the number in the box without peeking at the answer box. Ensure that the child lifts the cover to check his or her answer.
- ☐ Ensure that the child makes a check mark in the "Match" box for correct answers.
- ☐ If there is not a match (the child's response was incorrect), guide the student to count again and assist as needed to ensure correct counting/adding.

Troubleshoot

Children should be able to fluently read numbers, be able to count fluently from 1-20, be able to count sets of objects and specify the number of objects, and understand that counting up from 0 to 20 indicates greater quantities to benefit maximally from this intervention.

Once the child can fluently draw and count both sets of hash marks to obtain the sum, guide the child to identify the larger number and count up.

If the child cannot readily identify the larger number, have the child circle the larger number in the problems on the practice page.

If the child continues to struggle to identify the greater number in the set, then consider adding the "Establish Quantity Discrimination" intervention to this intervention.

The purpose of timing the intervention period is to contain the intervention to a focused and productive 10-minute period.

This intervention requires direct assistance from the teacher. The teacher should sit beside the child and actively monitor each response to ensure the student is completing each problem accurately.

If a mistake is made, the teacher should guide the student to "try again" and provide prompts as needed to ensure correct responding.

For example, the teacher might say, **Stop. 12 + 7 does not equal 18, let's try again.**

If the child does not respond correctly, the teacher might say, **Which number is larger? 12, that's right. So let's count seven up from 12.**

If the child does not respond correctly the teacher might model, saying, "12" then holding one finger up at a time, **13, 14, 15, 16, 17, 18, 19. So what is 12 + 7? 19, that's right. Let's do the next one.**

Immediate Corrective Feedback

When we convert improper fractions to mixed numbers, we will take a whole number quantity out of the fraction. When we do this, the numerator will be less than the denominator because the remaining fractional value will be less than 1.

To convert the improper fraction to a mixed number, we:

Divide the numerator by the denominator, asking how many times the denominator can be divided into the numerator, and identify any remainder

Write the remainder as the new numerator

Copy the denominator from the original fraction.

Day 1

Acquisition Convert Improper Fractions to Mixed Numbers Student: _____

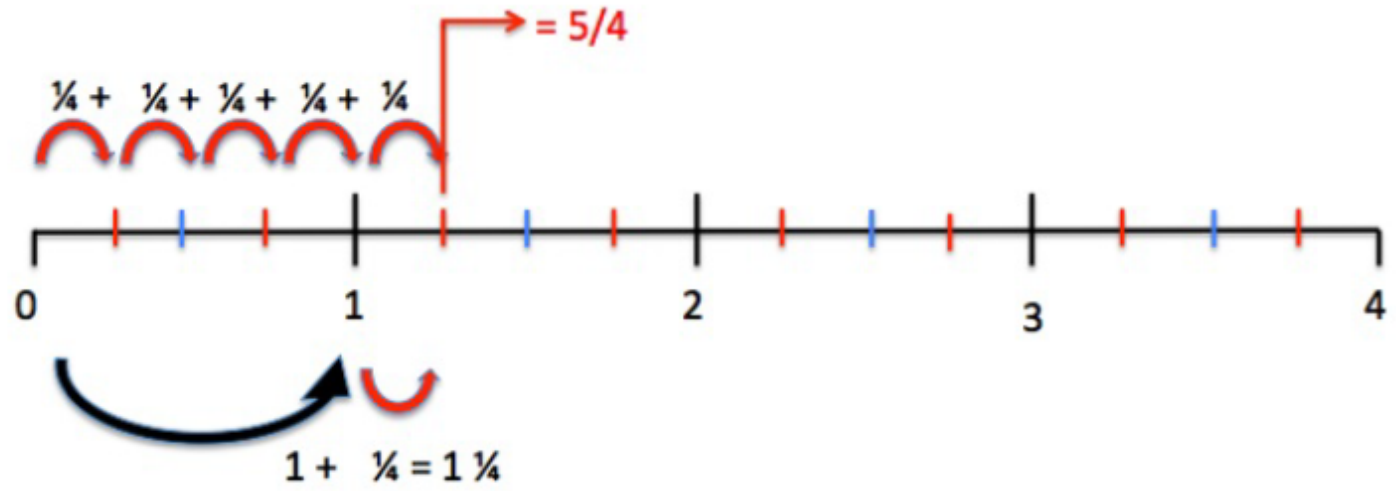
Work Problem	Check Answer	Match?	Work Problem	Check Answer	Match?
$\frac{75}{7} =$	$\frac{75}{7} = 10\frac{5}{7}$		$\frac{95}{9} =$	$\frac{95}{9} = 10\frac{5}{9}$	
$\frac{25}{4} =$	$\frac{25}{4} = 6\frac{1}{4}$		$\frac{109}{10} =$	$\frac{109}{10} = 10\frac{9}{10}$	
$\frac{35}{4} =$	$\frac{35}{4} = 8\frac{3}{4}$		$\frac{13}{3} =$	$\frac{13}{3} = 4\frac{1}{3}$	

Build Conceptual Understanding

Complete several of these each day with the child, encouraging the child to solve each problem aloud:

Play War: Make 20 cards with mixed numbers (2 copies of each for a total of 40 playing cards). Each player turns over a card and the player with the greater quantity wins both cards. If the values are tied, then each player places three cards face-down and turns over the fourth card. The player with the higher value card to all the cards. The object of the game is to win all the cards.

Using the day's practice problems, have the student draw each mixed number on a number line. Several number lines are provided below the sample problem. Help the student choose the best one.



This one shows 1/4 units.

This one shows 1/3 units.

$\frac{55}{7} = \frac{7}{\_} \times \frac{\_}{\_} = \frac{49}{\_}$ This one is not enough. How much more is needed?

$\frac{7}{\_} \times \frac{\_}{\_} = \frac{56}{\_}$ This one is too much. How much too much is this one?

$\frac{7}{\_} \times \frac{7}{\_} + \frac{\_}{\_} = \frac{55}{\_}$

$\frac{7}{\_} \times \frac{8}{\_} - \frac{\_}{\_} = \frac{55}{\_}$

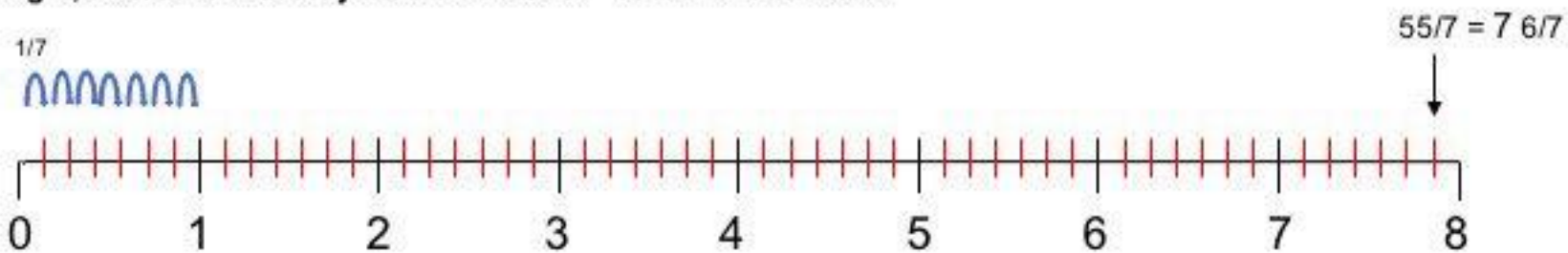
Answer will be between these two factors

Let's find the answer on a number line. We can ask, **How many 1/7 units are in 55/7. There are 7, 1/7th units in each increment of 1. Let's count and check (1/7 + 1/7 + 1/7 + 1/7 + 1/7 + 1/7 + 1/7 = 7/7 or 1).**

So we want to multiply 7 x (7/7) which gives us 49/7. How many more 1/7th units do we need to get to 55? That's right, 6 more 1/7th units will get us to 55/7 or 55 1/7th units. We can count and check if we want.

Can you see another way to get to 55/7 that's easier and faster to find on the number line (hint, look above)?

Right, 8 x 7/7 is 56/7 so just one more 1/7th unit than we need.



Let's practice converting whole numbers into fraction base unit quantities. We've just learned how to convert 7 into 1/7 units. We multiplied 7/1 x 7/7 to get 49/7. This makes sense because we know, 49 ÷ 7 = 7.

Let's try some more. Write the equation and then solve.

Change 5 into 1/4 units: _____ x _____ = _____

Change 3 into 1/6 units: _____ x _____ = _____

Change 4 into 1/8 units: _____ x _____ = _____

Change 2 into 1/10 units: _____ x _____ = _____

Change 8 into 1/5 units: _____ x _____ = _____

Change 3 into 1/7 units: _____ x _____ = _____

Let's think more about improper fraction quantities. A few moments ago, we looked at 55/7 on the number line. We can see that 55/7 is between 7 and 8 on the number line. 55/7 is more than 7 but less than 8. Let's complete the following statements to make them true. There are several answers that can be correct for these questions, but for today, I want you to choose the closest whole number on either side of the improper fraction quantity. If you want, you can draw a number line next to each statement to prove your conclusion.

10/8 is more than _____ but less than _____.

14/5 is more than _____ but less than _____.

10/3 is more than _____ but less than _____.

17/5 is more than _____ but less than _____.

19/4 is more than _____ but less than _____.

26/5 is more than _____ but less than _____.

Fill in the missing number to solve. Try to solve these by thinking of each quantity on a number line.

44/9 + _____ = 5

14/5 + _____ = 3

19/5 + _____ = 4

9/5 + _____ = 2

13/7 + _____ = 2

10/8 - _____ = 1

14/3 - _____ = 4

16/5 - _____ = 3

Why is the numerator larger than the denominator when a mixed number is converted to a fraction? Is the numerator always greater than the denominator when a mixed number is converted to a fraction?

Can the numerator ever be greater than the denominator if the fraction is in its simplest form?

Using problems from the day's practice materials, ask the student to check to see that an improper fraction was correctly converted to a mixed number by asking the student to convert the improper fraction back to a mixed number.

Ask, **Why is it useful to convert an improper fraction to a mixed number?** (Hint: easier to understand quantity).

If it Feels Like a Trick, It Is

Acquisition Intervention Protocol to Try

- An acquisition intervention for establishing understanding of how to divide fractions: https://static1.squarespace.com/static/57ab866cf7e0ab5cbba29721/t/5dfbce55f74ce17bca99ffd7/1576783445988/Spring+Math+-+Sample+Individual+Intervention.pdf

Acquisition Tactics to Look For

Use manipulatives with K & 1

Use expanded notation

Convert to equivalent quantities

Solve for missing value/unknown

Graphics- number lines, area models, graphs

Find & Fix problems

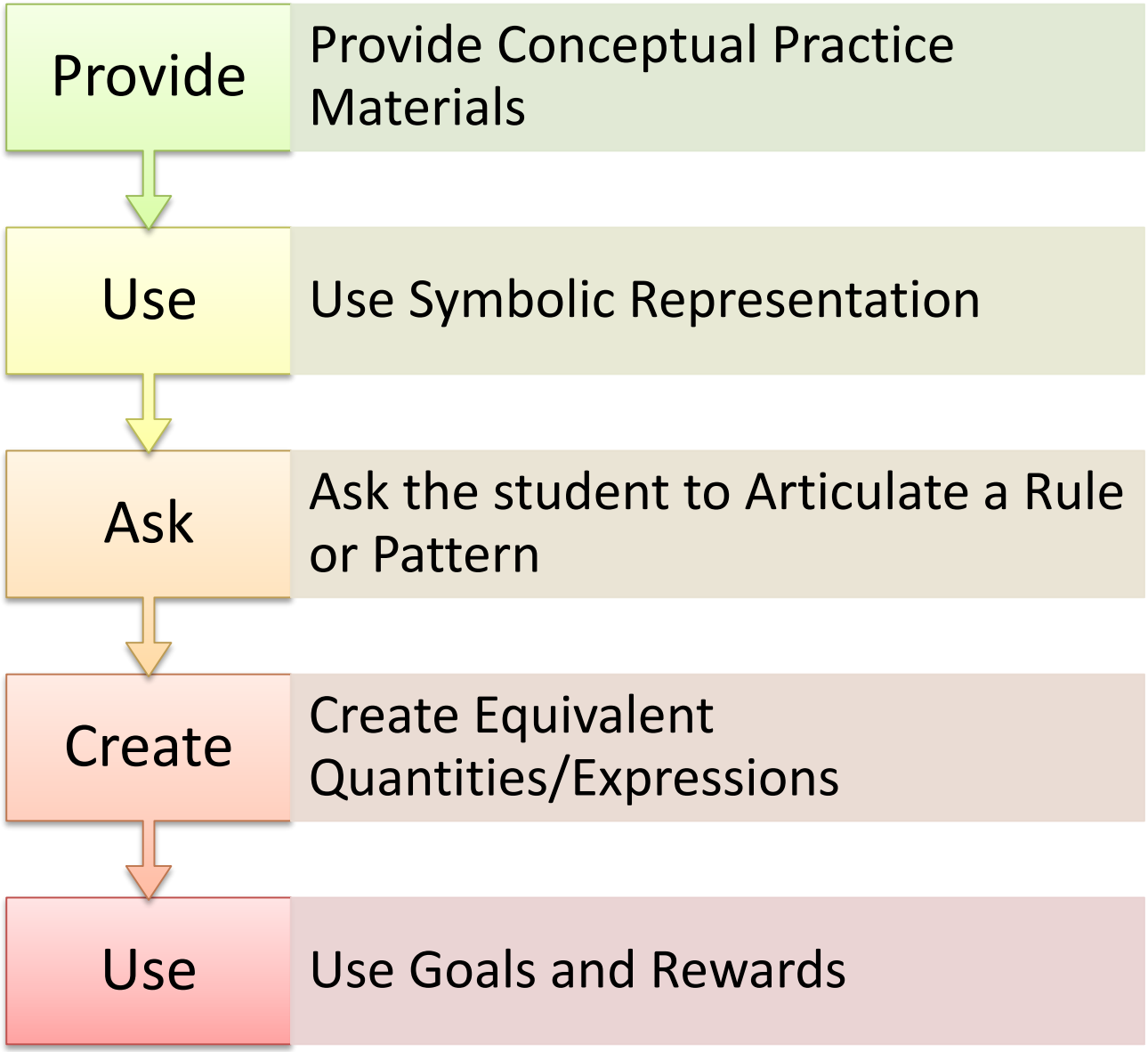
True or False. Change to make true.

Excellent Fluency-Building Interventions Are

- Easily done in small groups.
  - Group size can be flexible
  - Key is active responding of all children
  - Groups must be dynamic (children should change groups based on skill mastery)
- Dosage has to be 4 days per week, but short sessions are fine.
- Emphasize high OTRs, delayed corrective feedback, use of goals and rewards.


Oo Pp Qqq Rr Ss Tt Uu Vv

In Math, look for fluency-building Interventions that



Day 1
Acquisition Sums to 20

Student: _____

Work Problem	Check Answer	Match?	Work Problem	Check Answer	Match?
14 + 3 =	14 + 3 = 17		3 + 1 =	3 + 1 = 4	
15 + 0 =	15 + 0 = 15		1 + 17 =	1 + 17 = 18	
16 +	16		19	19	

Symbolic Representation

Ask the child, **When we add two numbers that are greater than zero, will the answer be greater than or less than this number**(point to the top number)?

Will the answer be greater than or less than this number(point to the bottom number)**?**

When we add zero to another number, what will the answer be? Can you explain why?

Write an addition problem with a sum of 10, using the greatest number of addends possible(Answer: 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1).

Write an addition problem with a sum of 10, using the greatest number possible as one of the two numbers you are adding(Answer 10 + 0)

Find two doubles in the problem 6 + 1 (Answer: 2 + 2 + 3 and 3 + 3 + 1).

Write an addition problem to show 10, using only the number 2.

Asks Student to Articulate Rule or Pattern

Create Equivalent Quantities

Let's find the "doubles" inside these problems.

6 = _____ + _____

8 = _____ + _____

12 = _____ + _____

16 = _____ + _____

20 = _____ + _____

Now we are warmed up. Fill in the blanks for each problem below. You must include a double.

5 = 2 + _____ + _____

9 = 4 + _____ + _____

17 = 8 + _____ + _____

3 = 1 + _____ + _____

7 = 3 + _____ + _____

11 = 5 + _____ + _____

15 = 1 + _____ + _____

19 = 3 + _____ + _____

19 = 1 + _____ + _____

Now let's find 10's inside these problems to find the sums. Fill in the missing number and remember, you must make a 10.

---

12 = _____ + _____

14 = _____ + _____

13 = _____ + _____

8 + 8 + 2 = 10 + _____

5 + 5 + 8 = 10 + _____

4 + 4 + 6 = 10 + _____

13 + 3 = _____ + _____ + _____

14 + 4 = _____ + _____ + _____

- ☐ Count the number of correctly completed problems. Write this number on the Progress Monitoring Chart.
- ☐ Allow the child to select a small reward from the treasure chest for beating his or her last best score.

Monitor Progress
Establish Sums to 20
6/10/2018

Monitoring Student Progress

CHART FOR _____

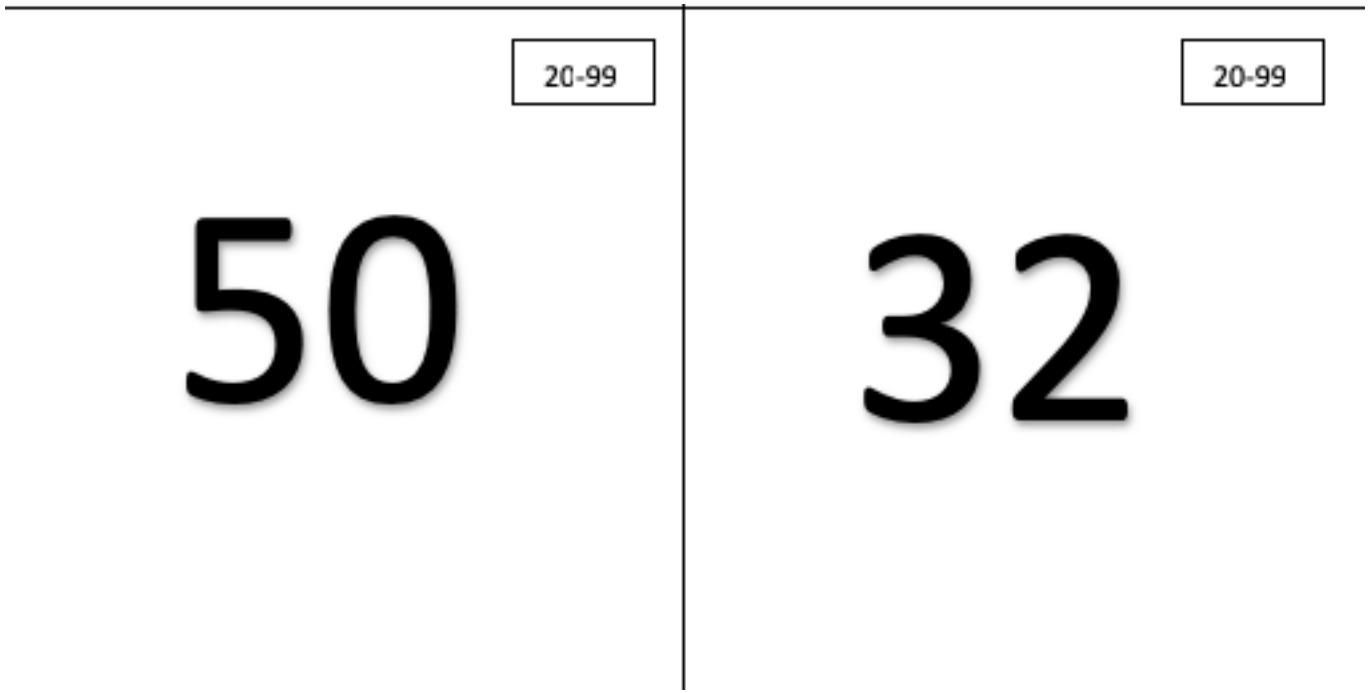
Weekly Goal: _____

DAY 1	My best score is:	_____
	My score on the timed test is:	_____
	Did I beat my score?	_____

Use of Goals and Rewards

Use Games to Build Fluency!

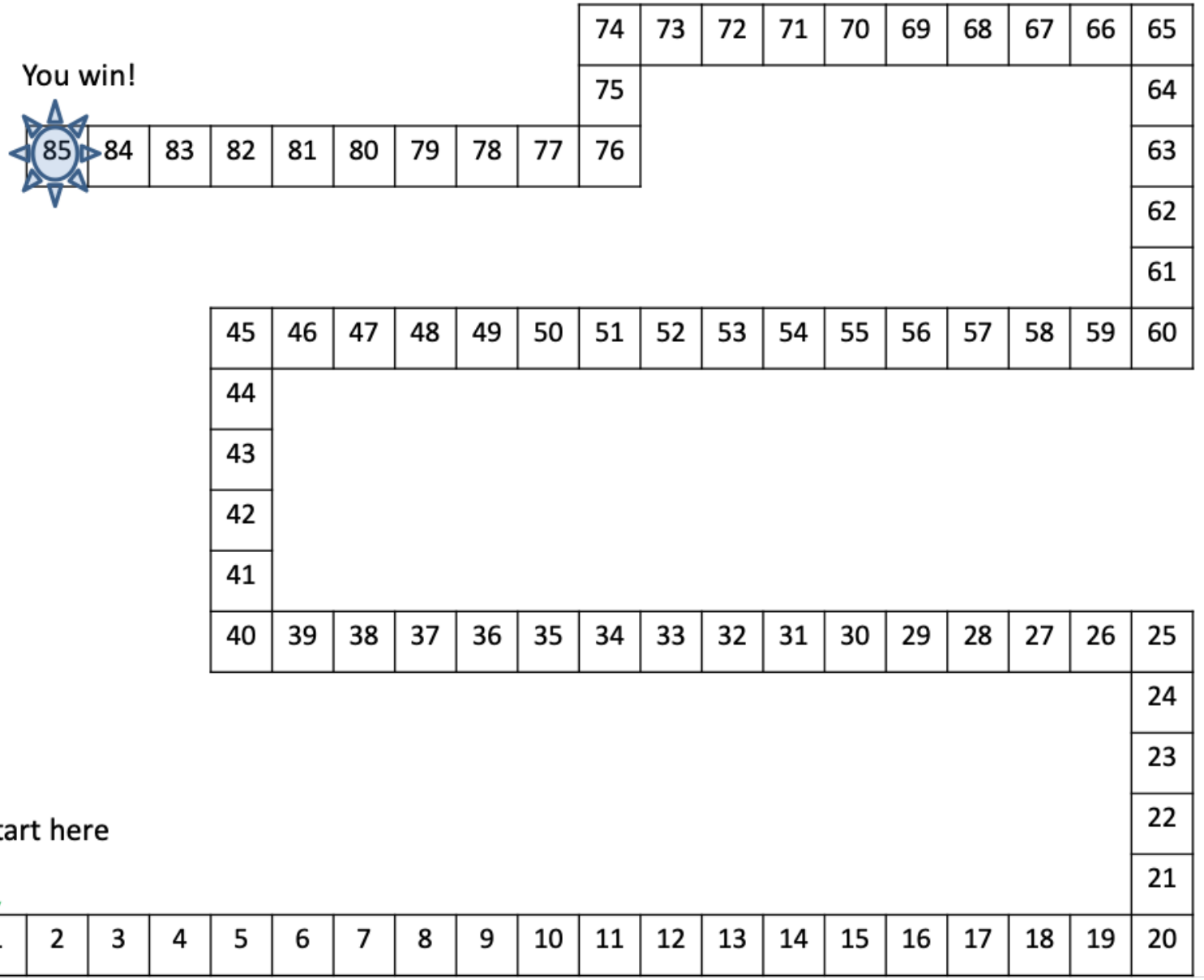
Play War: Make a stack of cards with 20 randomly selected numbers between 20 and 99 (2 of each) and play "war." Each player turns over a card and the player with the higher-value number wins both cards. If the values are tied, then each player places three cards face-down and turns over the fourth card. The player with the higher value card takes all the cards. The object of the game is to win all the cards.



Play 3-in-a-row bingo: Here is another game that can be played as a single player or with multiple players. Each player needs a number grid (see below). Using the day's practice problems and answer key (don't show the student the answer key), just call out a problem and the student will try to answer verbally and make an X over the number on their grid. The object is to get three in a row in any direction to win the game. If needed, the student can write the problem to solve it. If the student makes an error solving the problem, then the he or she may not place an X on the grid for that turn.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
15	16	17	18	19	20	21	22	23	24	25	26	27	28
29	30	31	32	33	34	35	36	37	38	39	40	41	42
43	44	45	46	47	48	49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80	81	82	83	84
85	86	87	88	89	90	91	92	93	94	95	96	97	98
99	100	101	102	103	104	105	106	107	108	109	110	111	112
113	114	115	116	117	118	119	120	121	122	123	124	125	126
127	128	129	130	131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150	151	152	153	154
155	156	157	158	159	160	161	162	163	164	165	166	167	168
169	170	171	172	173	174	175	176	177	178	179	180	181	182
183	184	185	186	187	188	189	190	191	192	193	194	195	196

Play Add & Take ten: Make a stack of 8 cards. Write, Add 10, Add 20, Add 30, Add 40 on the first four cards. Then write Add 10, Add 20, Add 30, Add 40 on the next four cards. Shuffle the cards. If you are playing single player, then pull a card and have the student start moving on the path to get to the winning space. If you draw a take card early in the game and there are not enough spaces to go back, just return to the start position of 1. This game is fun to play with two players. If you play with two players, print two copies of the board and take turns drawing cards to see who can get to the winning position first.



Translate Verbal Expressions into Math Equations Matching Game

Directions: This game can be played with 2-4 players. Each of the numerical expression cards below has a matching verbal expression card. To play the game:

- Cut out the cards below.
- Shuffle all the numerical and verbal expression cards together.
- Deal each player a hand of 7 cards.
- When it is their turn the player draws one card.
- If the player has two cards that match (numerical and verbal expressions) they place the pair face up on the table.
- The first player to lay down all of their cards wins the game.

6 greater than a number is twice the number.

$x + 6 = 2x$

Fluency-Building Tactics to Look for in Math

Convert to equivalent quantities

Solve for missing value/unknown

Solve a more challenging problem type, application opportunities.

Games for fluency building.

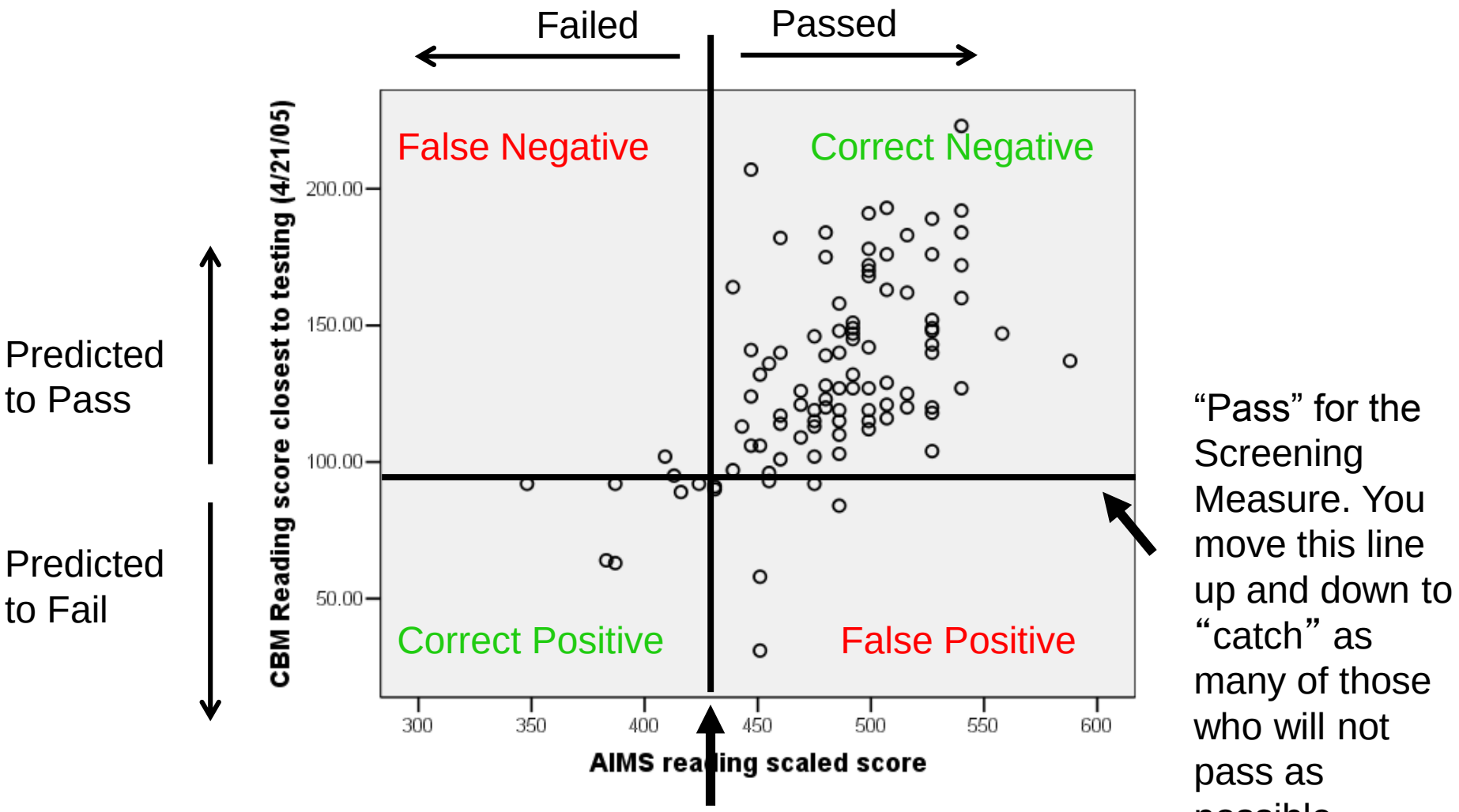
Generalization Opportunities: Subtraction 0-20 Word Problem Examples

- **We have $12.00 to buy treats at the concession stand. Each treat costs $1.00. How many treats can we buy if we use all our dollars?**
- **On the way to the concession stand, we lost $3.00. How many treats can we buy now?**
- **The concession stand is now selling an extra special double-size scoop of ice cream for $2.00. If we have $12.00 and we buy the double-scoop at $2.00, how much money will we have left? How many regular $1.00 treats can we buy?**
- **You are playing a board game. You have moved forward 10 spaces from the start. Your opponent is ahead of you by 6 spaces. What space is your opponent on? How many spaces ahead is your opponent?**

Screening

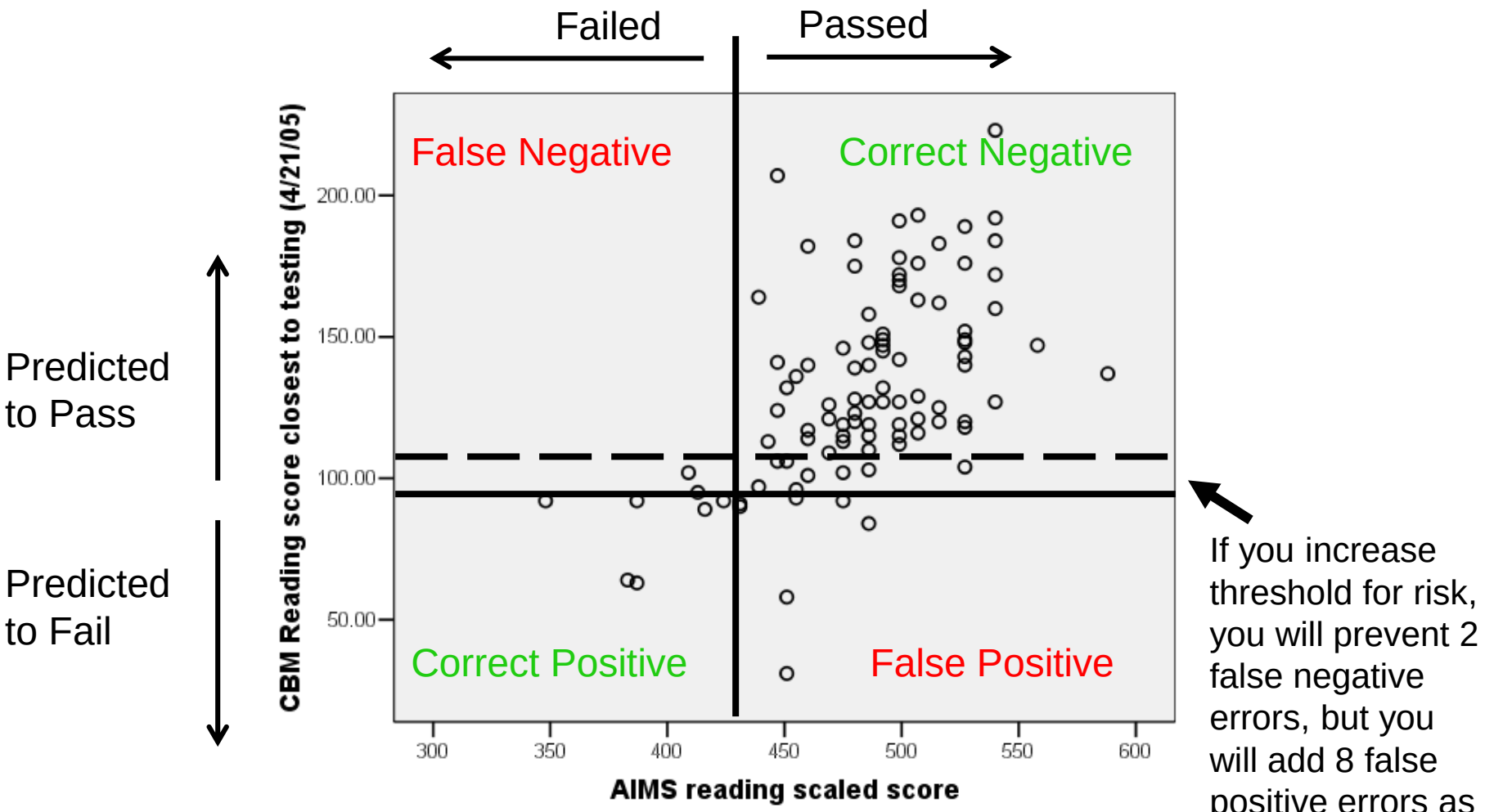
Quick review of best practices for academic screening

Post-COVID implications

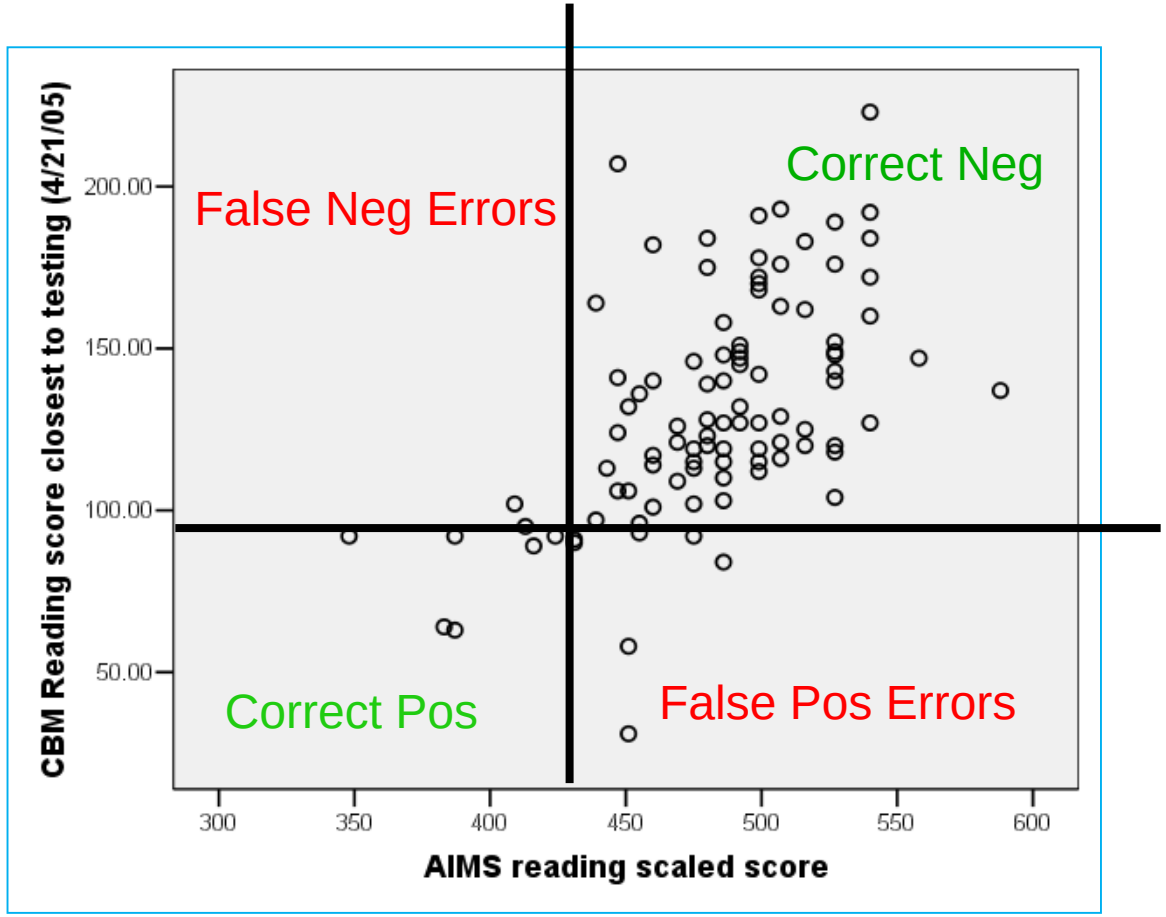


431 = “Pass” for Year-End Measure. This line does not move.

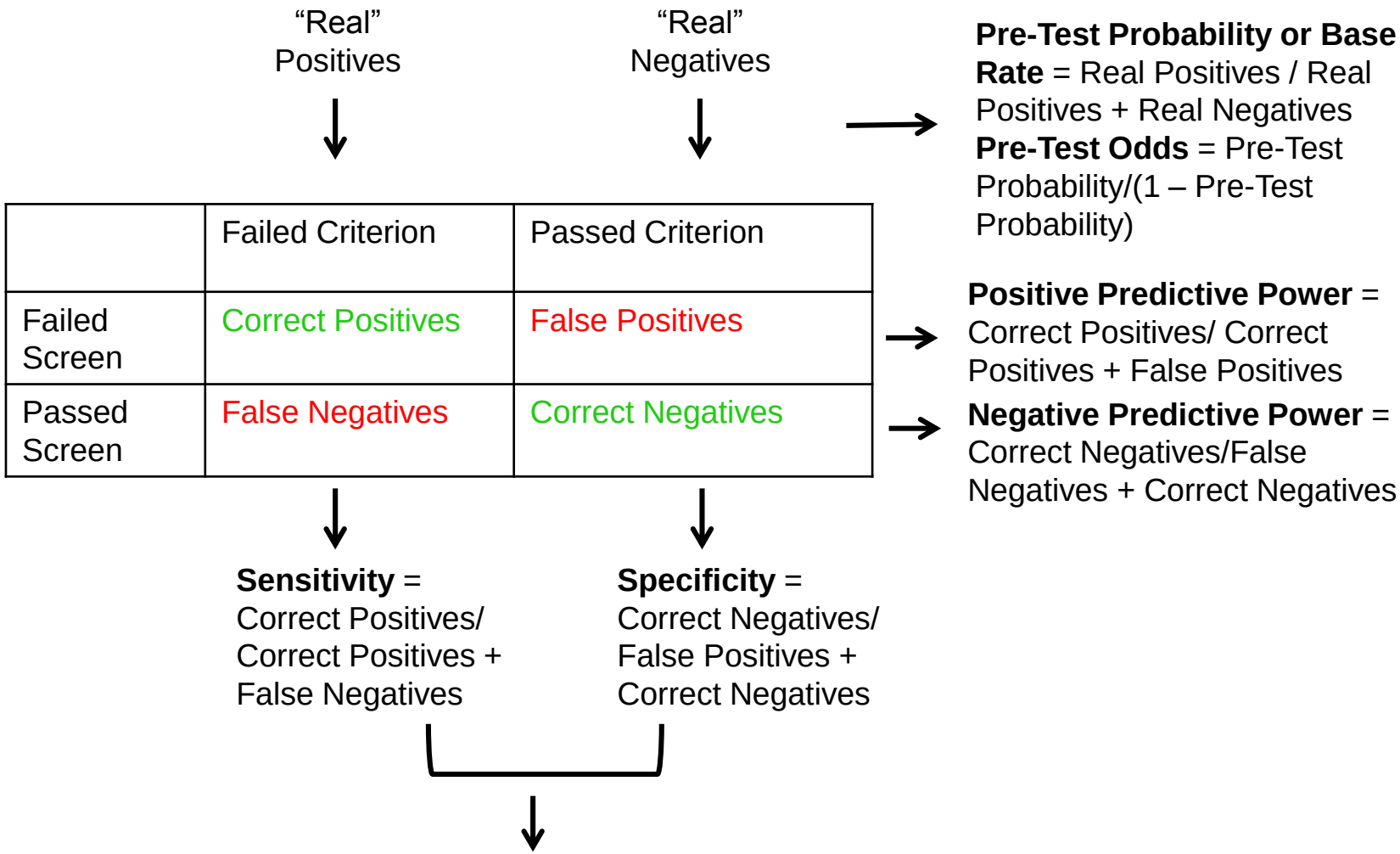
“Pass” for the Screening Measure. You move this line up and down to “catch” as many of those who will not pass as possible.



If you increase threshold for risk, you will prevent 2 false negative errors, but you will add 8 false positive errors as a result.



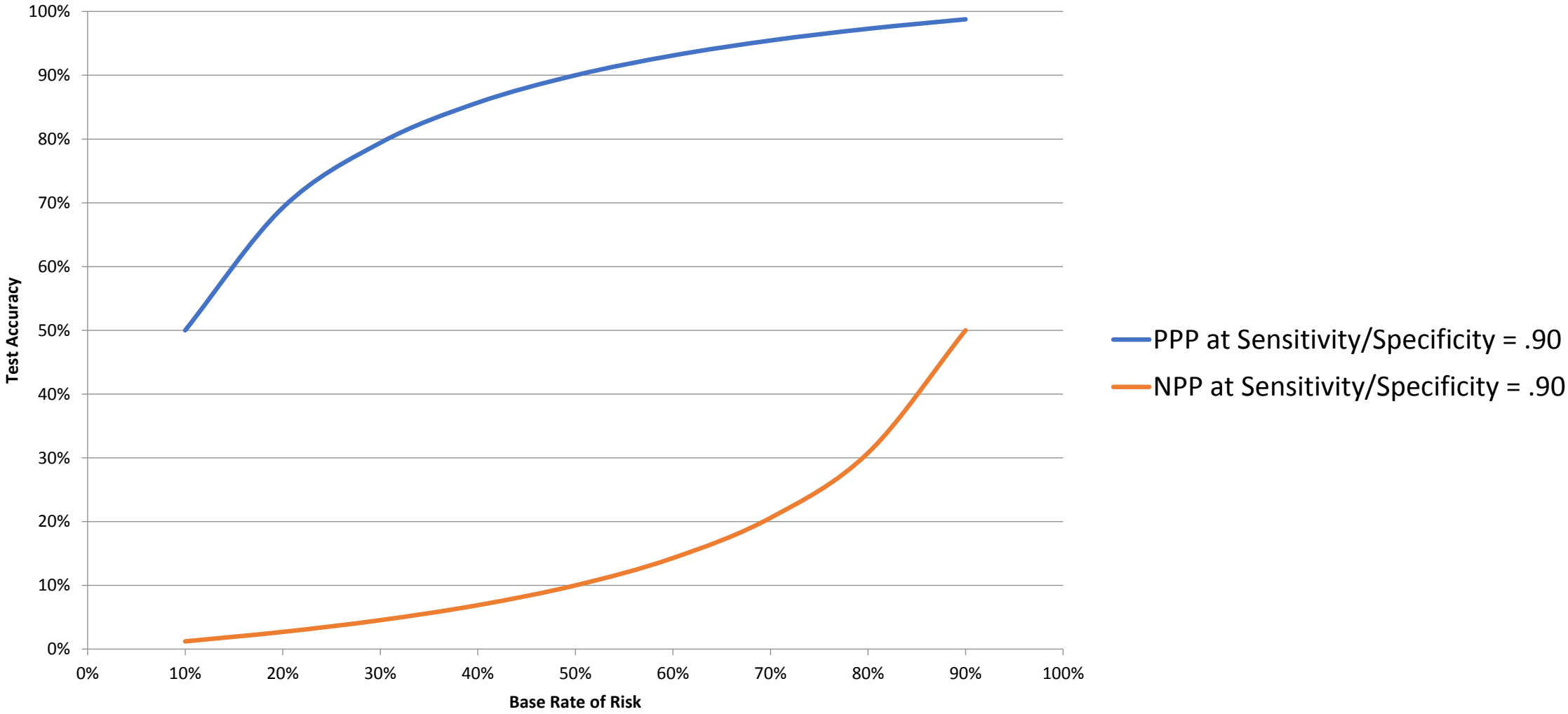
	Failed Criterion	Passed Criterion
Failed Screen		
Passed Screen		



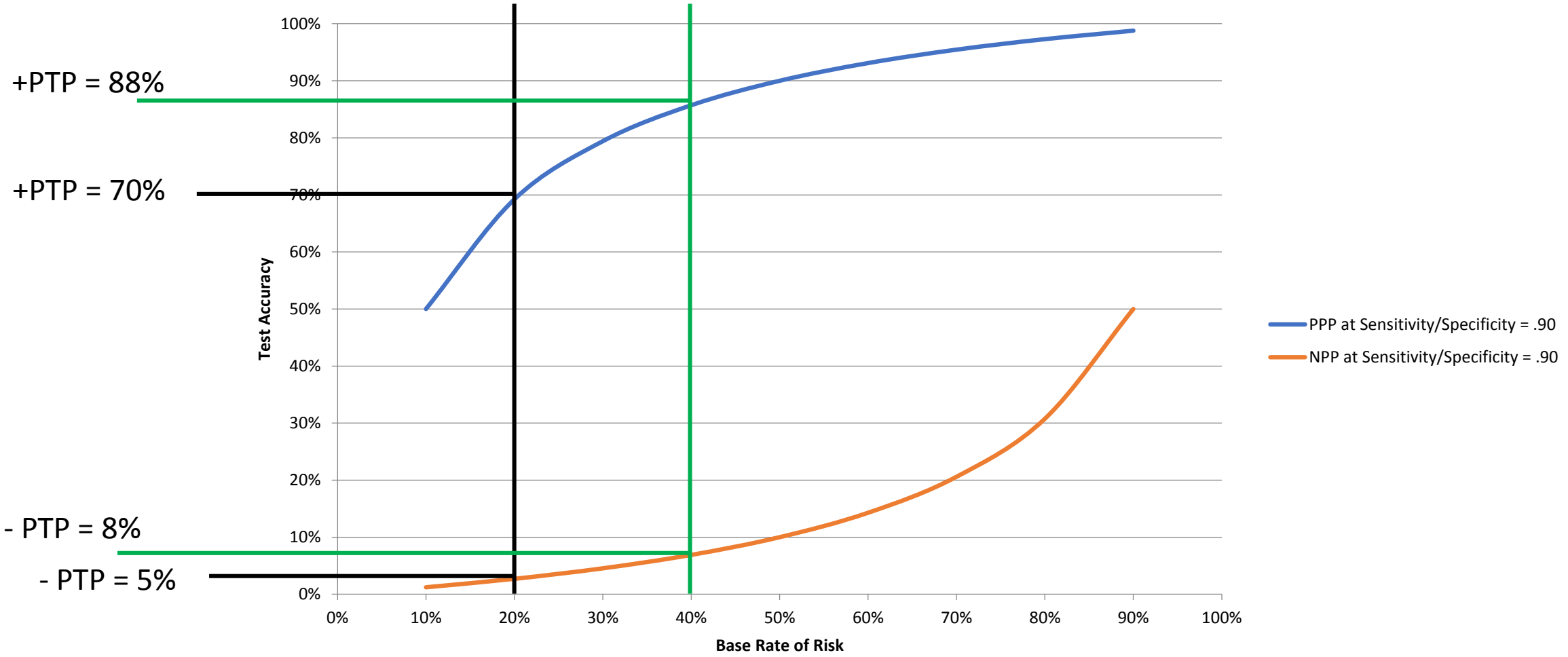
Positive Likelihood Ratio = sensitivity/ (1-specificity).
Positive Post-Test Odds = Pre-test odds x Positive Likelihood Ratio
Negative Likelihood Ratio = (1-sensitivity)/specificity.
Negative Post-Test Odds = Pre-test odds x Negative Likelihood Ratio

Positive Post-Test Probability = Positive Post-Test Odds/ (1 + Positive Post-Test Odds)
Negative Post-Test Probability = Negative Post-Test Odds/ (1 + Negative Post-Test Odds)

Risk (& Prediction) Varies with Base Rate



New Goal of Screening: Change the Base Rate



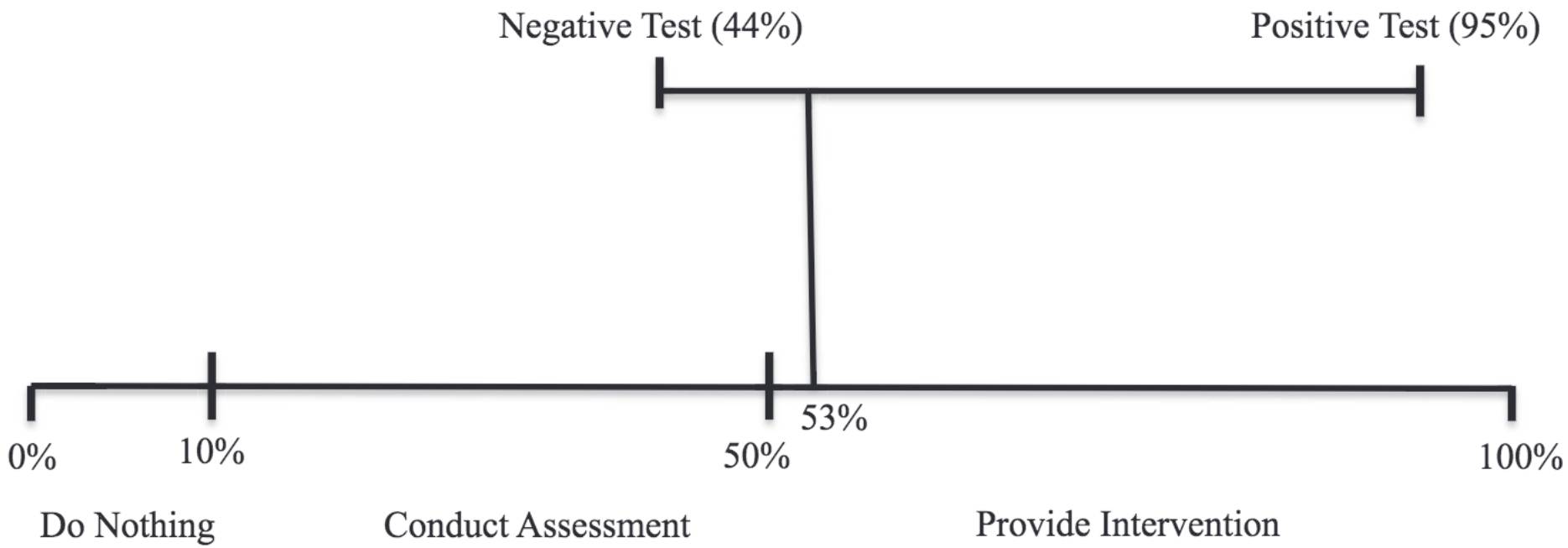
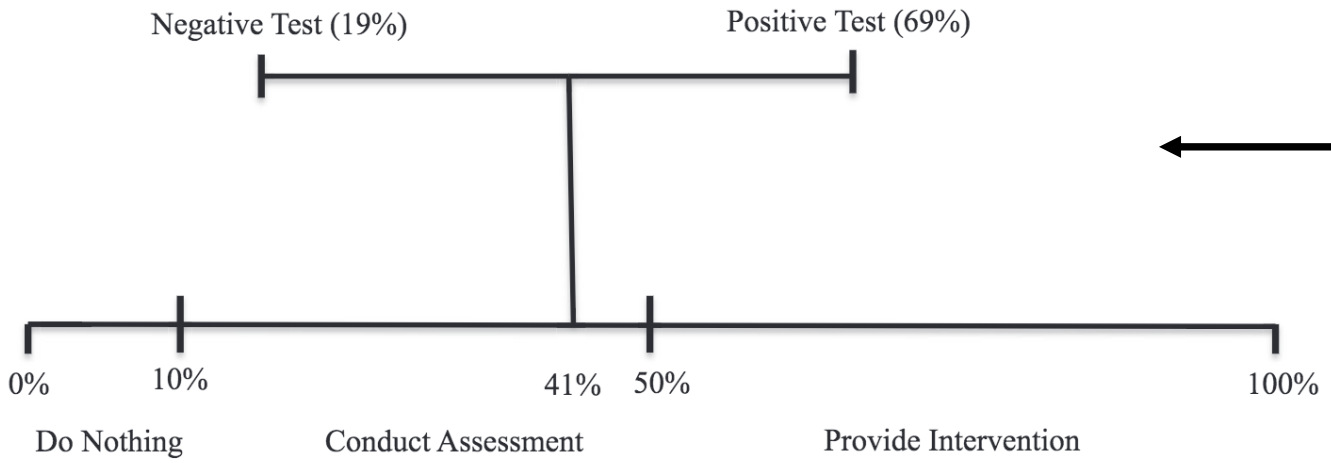
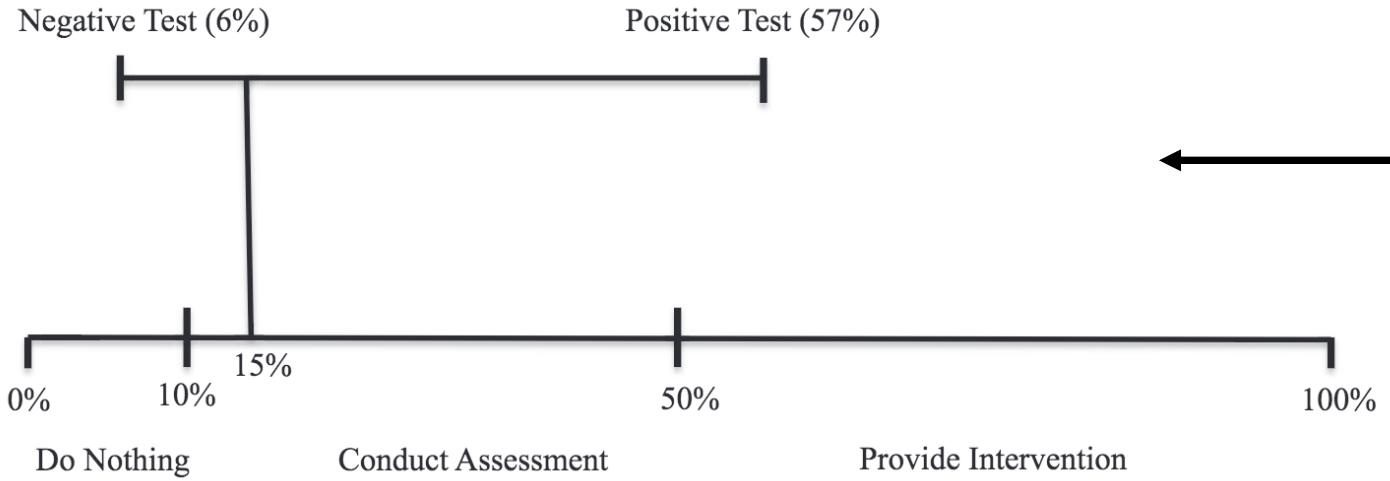


Figure 3. Accuracy of the preceding year's accountability scores in mathematics in predicting proficient performance on current end-of-year test for mathematics.



Before Intervention

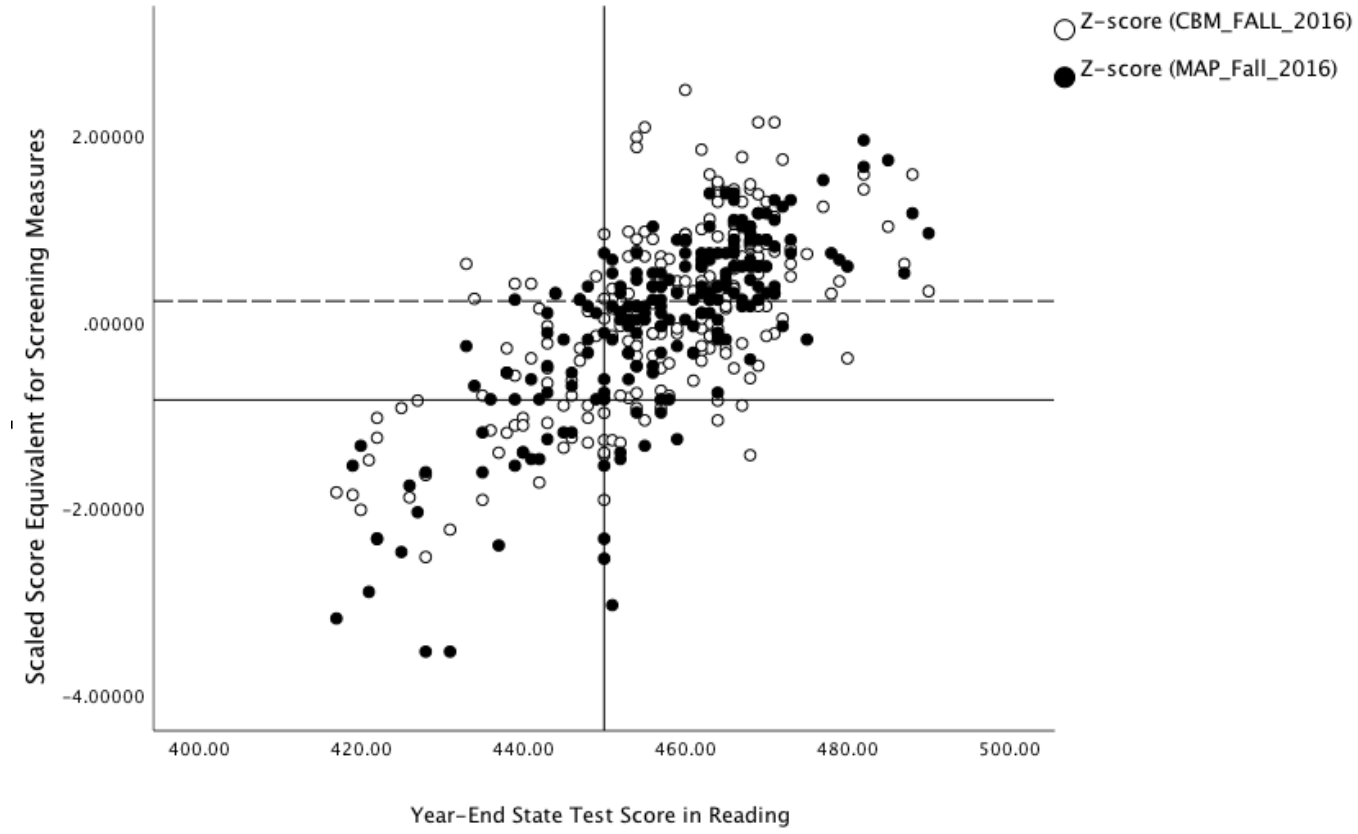
Figure 4. Accuracy of the mathematics screener for students who receive a free or reduced-price lunch.



After Intervention

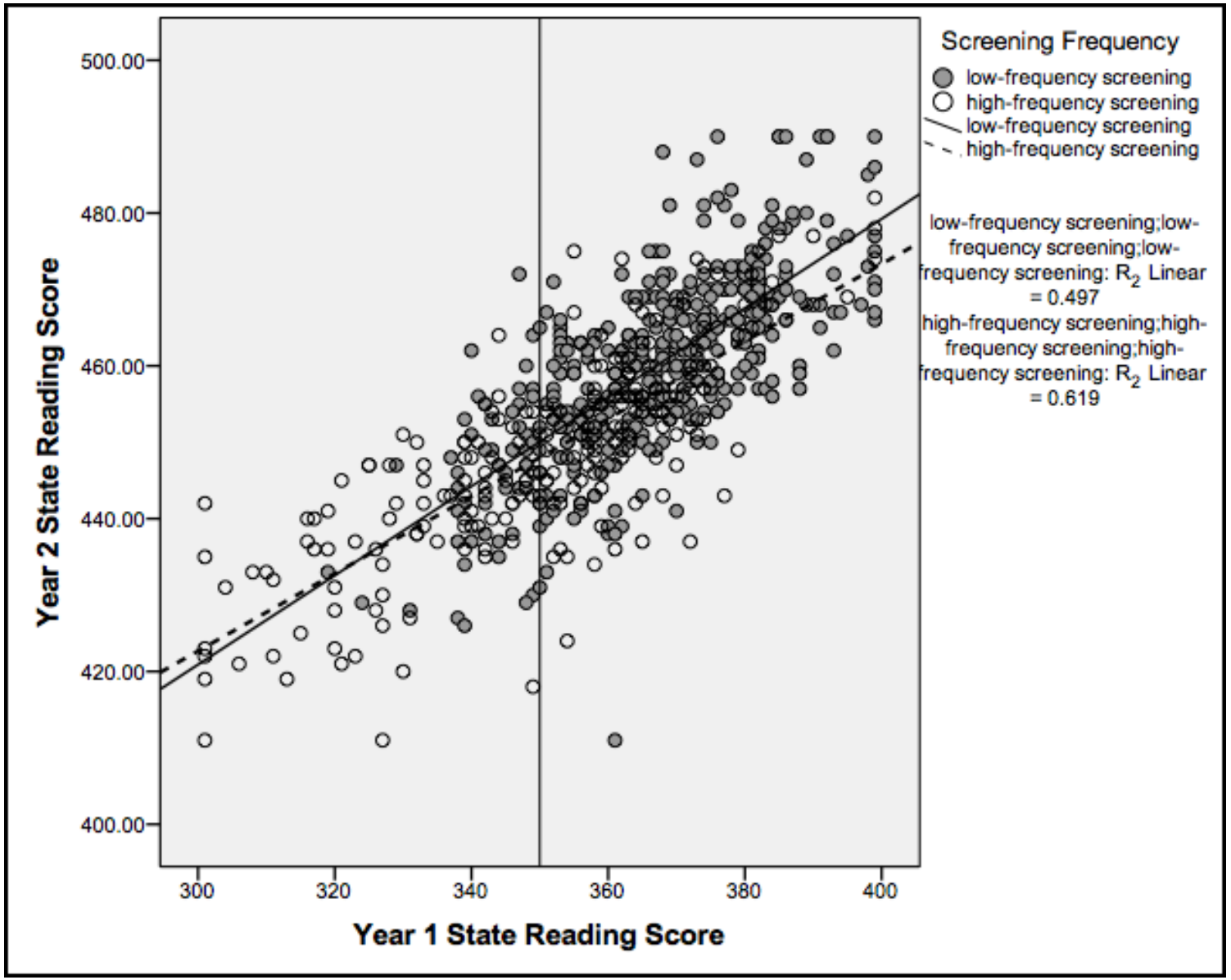
Figure 5. Illustration of the use of intervention to reduce overall risk and permit more accurate screening decisions.

Adding Additional Measures at the Same Screening Generally Does Not Improve Accuracy



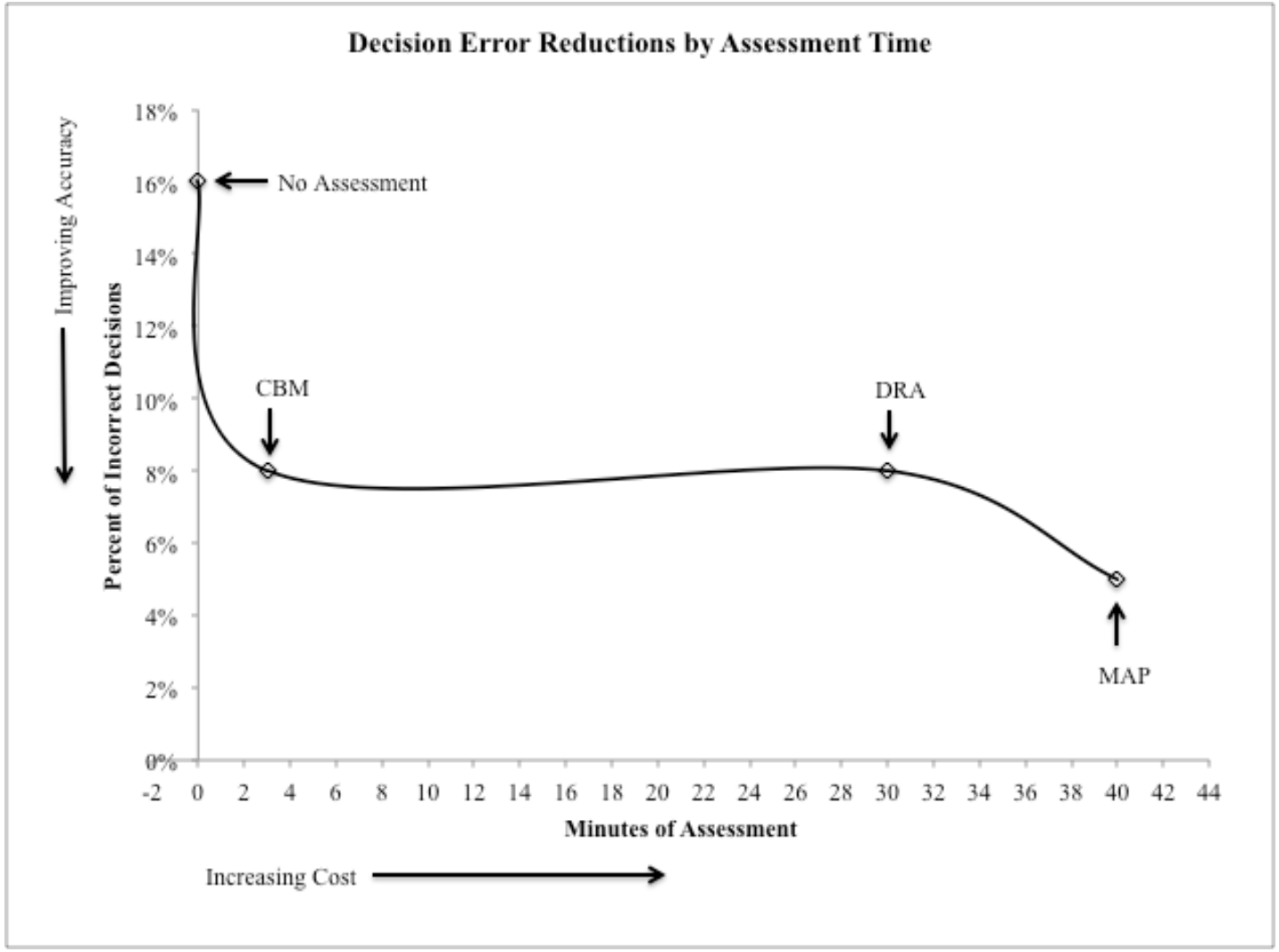
VanDerHeyden, A. M., & Burns, M. K., (2019). Commentary: Improving decision making in school psychology: Making a difference in the lives of students, not just a prediction about their lives. School Psychology Review, 47, 385-395.

And May Do Harm for Students who Perform Above the 16th Percentile

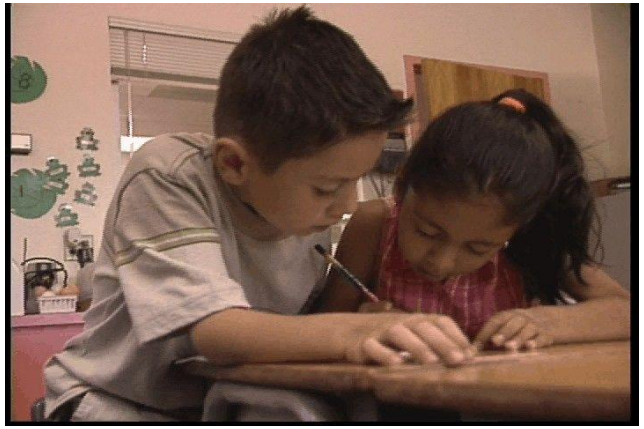


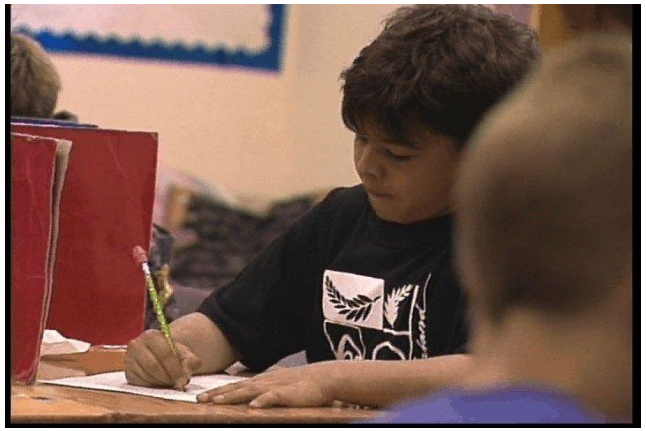
VanDerHeyden, A. M., & Burns, M. K. (2018). Is More Screening Better? The Relationship Between Frequent Screening, Accurate Decisions, and Reading Proficiency. School Psychology Review, 47, 62-82.

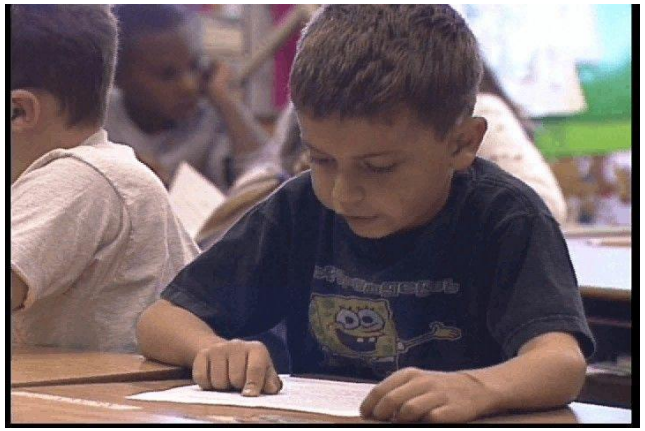
Choose the Most Efficient Assessment

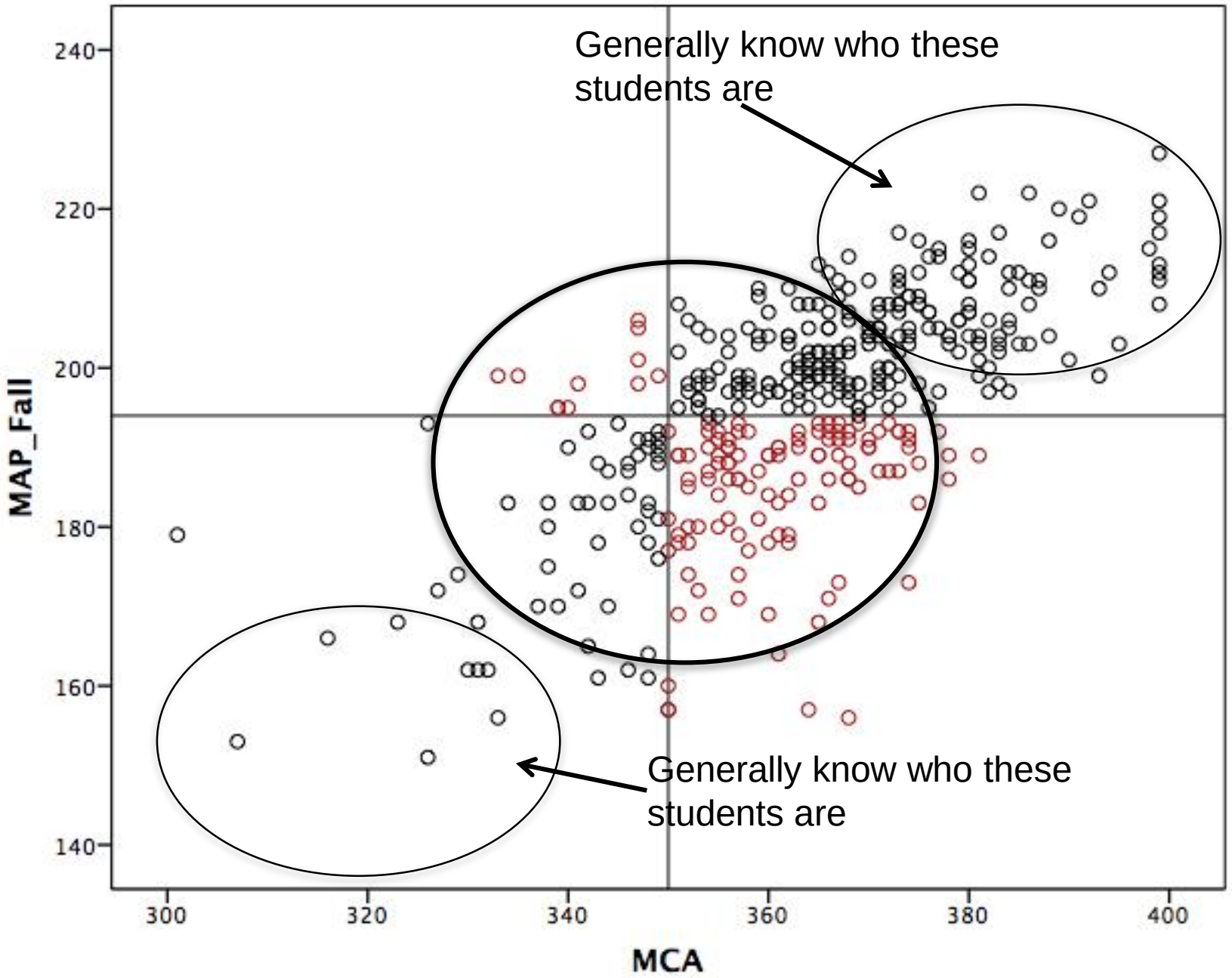


Middle Bands of Risk Create Confusion and Inflate Accuracies!





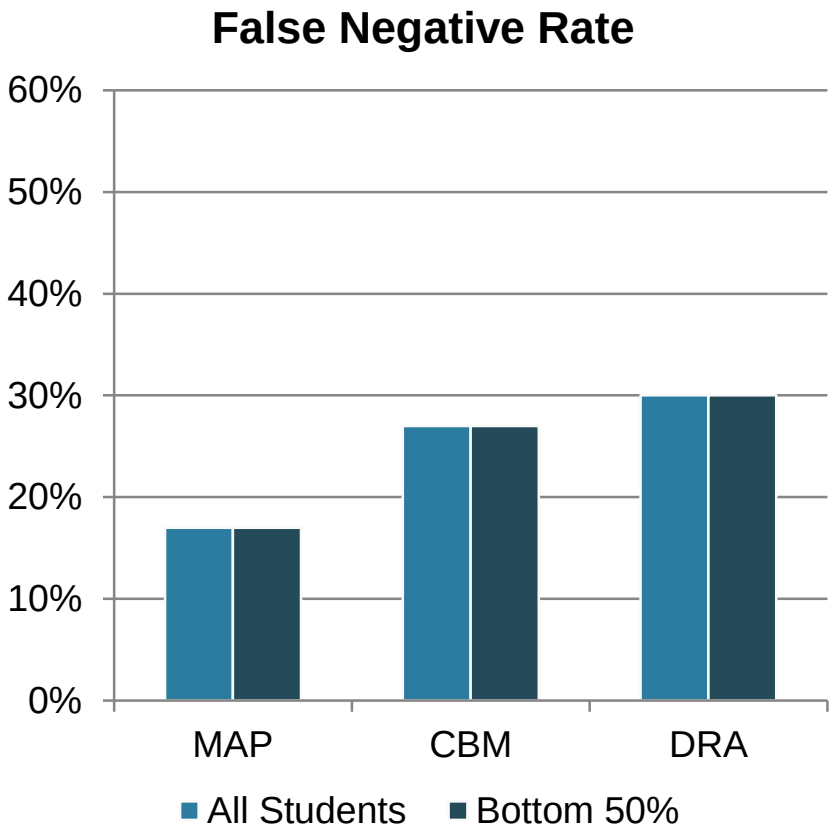


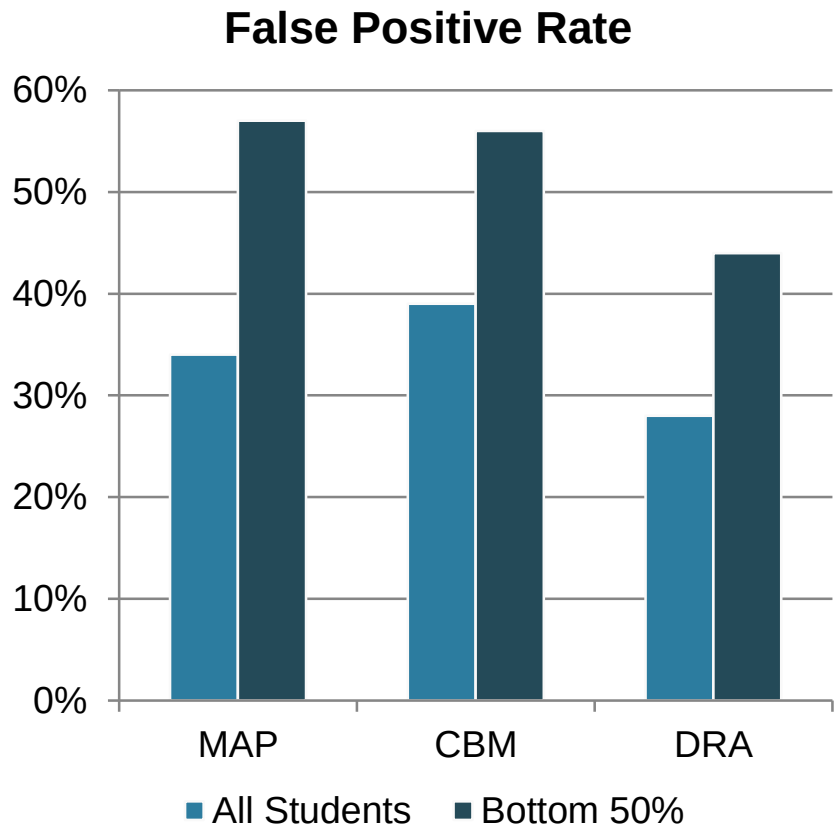

Generally know who these students are
Generally know who these students are
MAP_Fall
MCA
240
220
200
180
160
140
300
320
340
360
380
400

False Negative Rate = False Negatives/ total Criterion-Positive Cases

False Positive Rate = False Positives/ total Criterion-Negative Cases

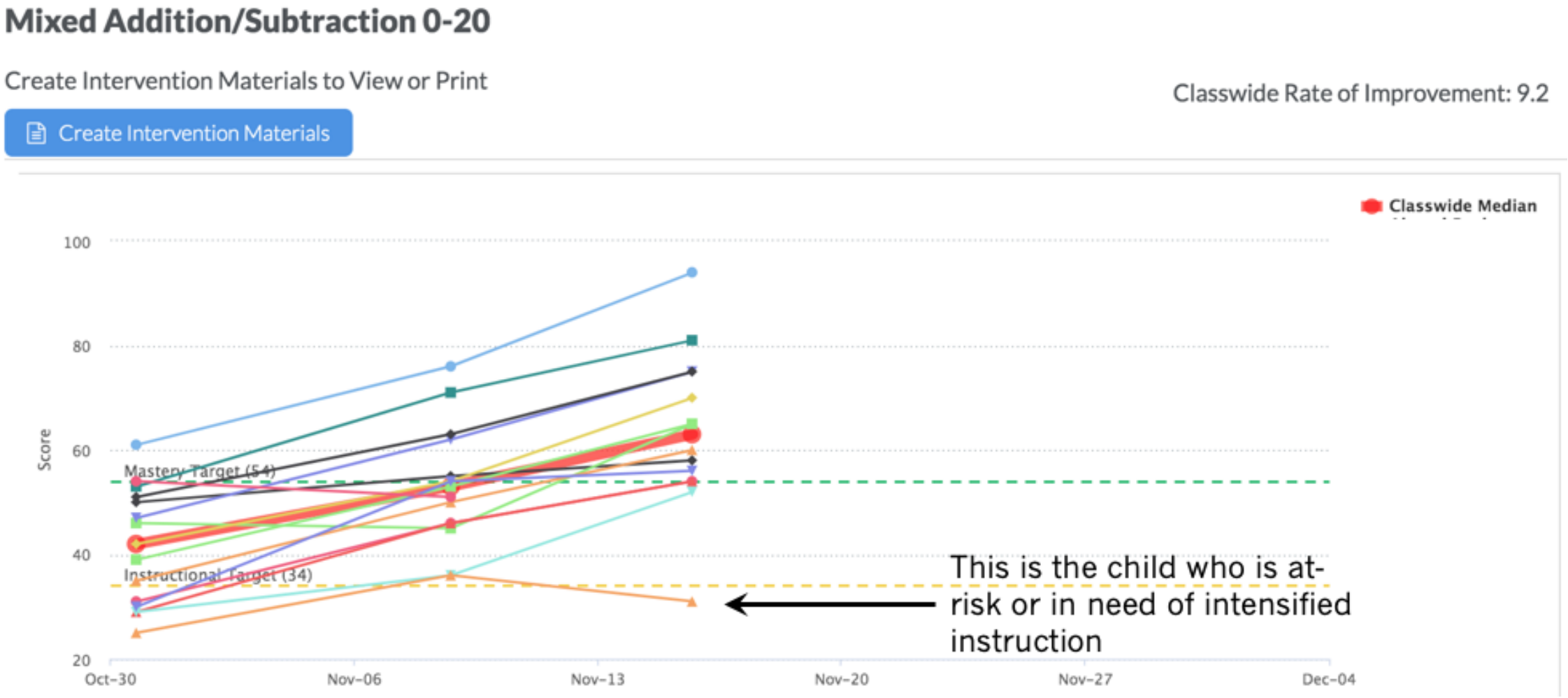
False-Positive Errors Increase Substantially





	Sens	Spec	LR +	LR-	PPTP	NPTP	
MAP (*n* = 178)	0.83	0.43	1.46	0.40	29%	10%	Bottom 50%
MAP Fall (*n* = 399)**	0.83	0.66	2.44	0.26	41%	7%	All Students
DRA (*n* = 171)	0.70	0.56	1.59	0.54	31%	13%	Bottom 50%
DRA Fall (*n* = 385)	0.70	0.72	2.5	0.42	41%	12%	All Students
CBM (*n* = 176)	0.73	0.44	1.30	0.61	27%	15%	Bottom 50%
CBM Fall (*n* = 394)	0.73	0.61	1.87	0.44	35%	12%	All Students

Use Classwide Intervention as Gate in Screening



Use Classwide Intervention

Classwide Intervention | Screening | Students | Growth

Fall 2019-20 Screening Results

The results are in. Let's take a look...

Classroom Performance

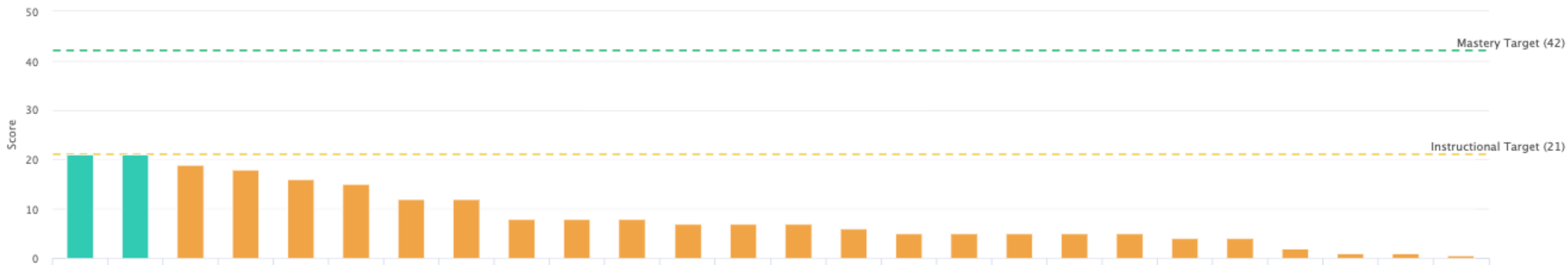
4% of your class reached the target on all of the screening assessments. Extra practice will help you reach mastery at this grade level.

The classwide intervention has already been started.

8%	19%	19%
Measure 1	*Measure 2*	*Measure 3*

Measure 1: Fact Families: Addition/Subtraction 0-20

Your students' screening scores compared to the target score.



Use Classwide Intervention

Classwide Intervention | Screening | Students | Growth

Your class is currently in class wide intervention. Complete intervention activities daily and enter progress monitoring scores weekly.

Mixed Addition/Subtraction 0-20

Create Intervention Materials to View or Print

Create Intervention Materials

Classwide Rate of Improvement: 3.8

Show Students scores

Intervention Progress

- ✓ Mixed Addition/Subtraction 0-20
- ● Fact Families: Add/Subtract 0-9
- ○ Fact Families: Addition/Subtraction 0-20
- ○ Addition 3-Digit Numbers with & without Regrouping
- ○ Subtraction 3-Digit Number with & without Regrouping
- ○ Add/Subtract 3-Digit Numbers with & without Regrouping
- ○ Multiplication 0-9
- ○ Multiplication 5-9
- ○ Division 0-9
- ○ Fact Families: Multiplication/Division 0-9
- ○ Multiplication 0-12
- ○ Division 0-12
- ○ Fact Families: Multiplication/Division 0-12
- ○ Multiply 1-Digit by 2-3-Digit without Regrouping

Use Classwide Intervention

Classwide Intervention | Screening | Students | Growth

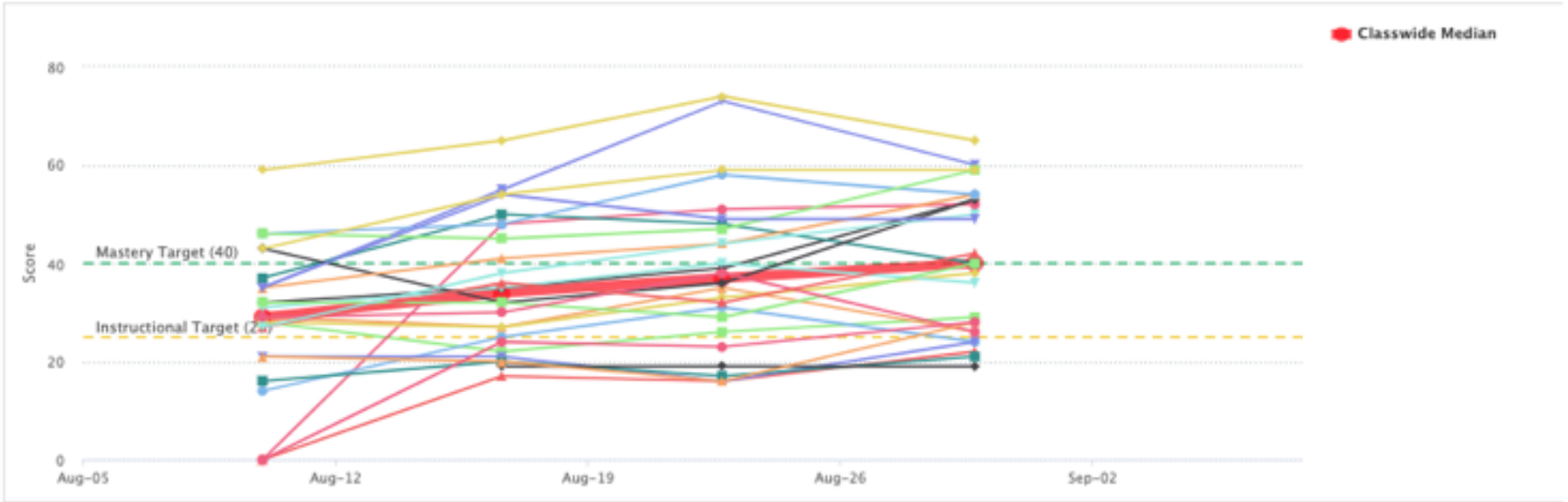
Your class is currently in class wide intervention. Complete intervention activities daily and enter progress monitoring scores weekly.

Mixed Addition/Subtraction 0-20

Create Intervention Materials to View or Print

Create Intervention Materials

Classwide Rate of Improvement: 3.8



Hide Students scores

Intervention Progress

- ✓ Mixed Addition/Subtraction 0-20
- ● Fact Families: Add/Subtract 0-9
- ○ Fact Families: Addition/Subtraction 0-20
- ○ Addition 3-Digit Numbers with & without Regrouping
- ○ Subtraction 3-Digit Number with & without Regrouping
- ○ Add/Subtract 3-Digit Numbers with & without Regrouping
- ○ Multiplication 0-9
- ○ Multiplication 5-9
- ○ Division 0-9
- ○ Fact Families: Multiplication/Division 0-9
- ○ Multiplication 0-12
- ○ Division 0-12
- ○ Fact Families: Multiplication/Division 0-12

Use Classwide Intervention

Classwide Intervention | Screening | Students | Growth

Fall 2019-20 Screening Results

The results are in. Let's take a look...

Classroom Performance

4% of your class reached the target on all of the screening assessments. Extra practice will help you reach mastery at this grade level.

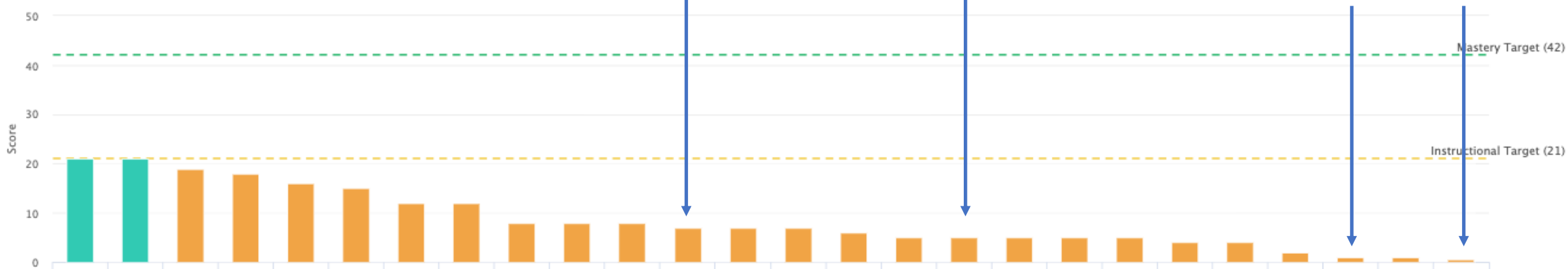
The classwide intervention has already been started.

8%	19%	19%
Measure 1	*Measure 2*	*Measure 3*

Individual Intervention Based on Classwide Screening Data

Measure 1: Fact Families: Addition/Subtraction 0-20

Your students' screening scores compared to the target score.



Use Classwide Intervention

Classwide Intervention | Screening | Students | Growth

Classwide Intervention

	Intervention Progress	Intervention Consistency	Average Weeks per Skill	Calculations as of Date
1 Mathematics	Intervention Skill 5 of 10	57% 8 of 14 weeks with scores	2.8	Start of interventions

Eligible for Individual Intervention

The following students would benefit from individual interventions. If you have additional capacity, you may choose to begin interventions with some of these students. Intervention takes 10-15 minutes a day per student, so we recommend selecting 1 or 2 students to work with.

Amanda

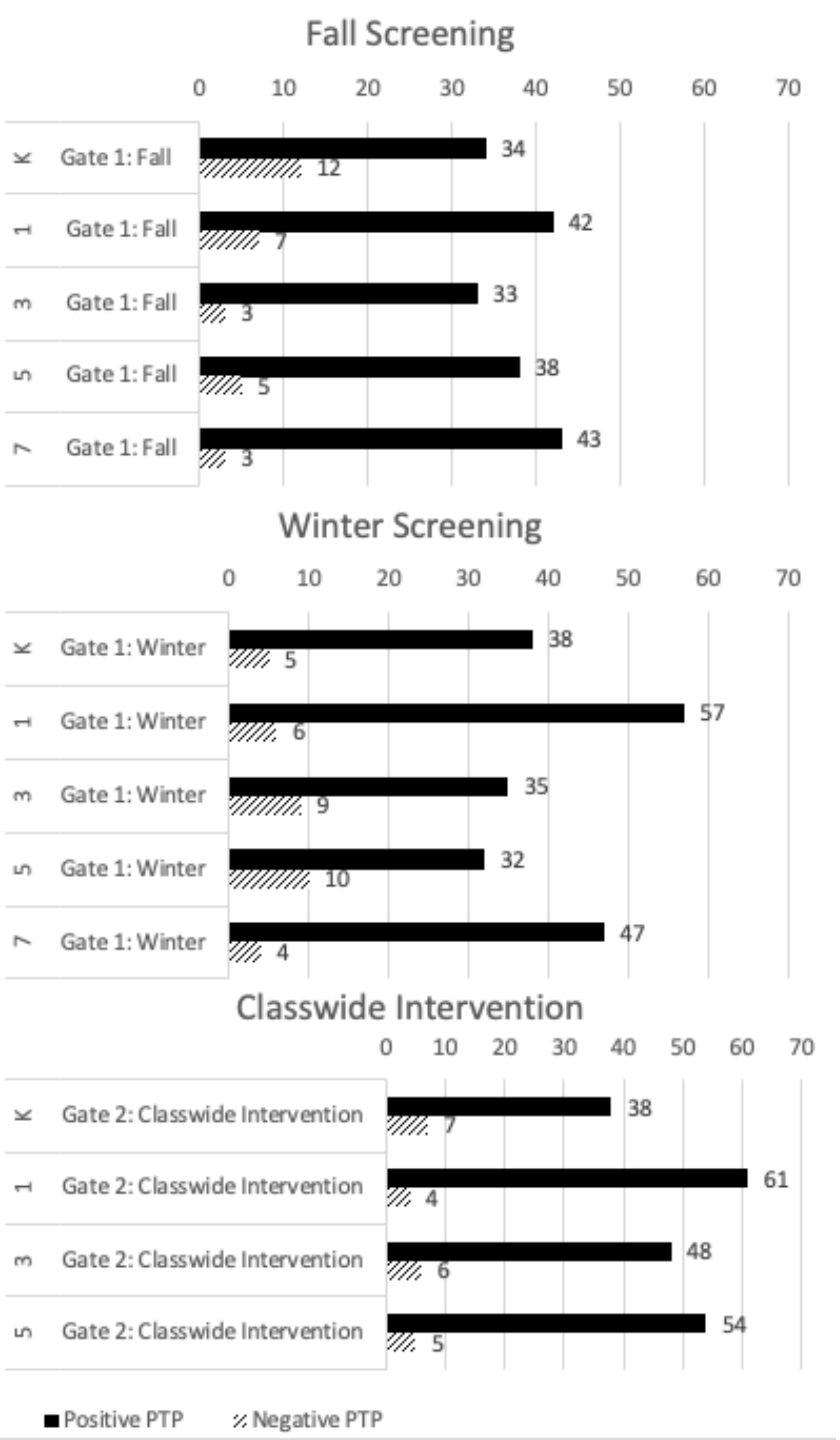
	Score	Target
Measure 1	28	13
Measure 2	41	20
Measure 3	18	20
Measure 4	18	20

Paul

	Score	Target
Measure 1	31	13
Measure 2	26	20
Measure 3	11	20
Measure 4	24	20

Vicki

	Score	Target
Measure 1	31	13
Measure 2	49	20
Measure 3	18	20
Measure 4	15	20



Classwide Intervention Lowers Base Rate of Risk & Improves Decision Accuracy

VanDerHeyden, Broussard, & Burns (2019). Classification Agreement for Gated Screening in Mathematics: Subskill Mastery Measurement and Classwide Intervention. Assessment for Effective Intervention.

https://www.researchgate.net/publication/336702020_Classification_Agreement_for_Gated_Screening_in_Mathematics_Subskill_Mastery_Measurement_and_Classwide_Intervention

Use Classwide Intervention

Final Questions, Discussion

Amanda VanDerHeyden
Fairhope, Alabama
@amandavande1
www.springmath.com
amandavande@gmail.com