Got Math Assessments?

A Clinical Approach to Diagnosing and Monitoring Mathematical Understanding in Grades 3-6

Presented by:
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Learning Targets for Today's Presentation

- Discover how the Puyallup School District developed and implemented the use of common math assessments
- Understand the design of both the formative and diagnostic math assessments
- Learn about different tools to support the use of the common assessments

Agenda

- PSD Math Improvement Plan
- What Does the Research Say?
- Developing the Formative Assessments
- Developing Diagnostic Assessments
- Analyzing Student Work Protocol
- Intervention Resources
- PSD Mathematics Achievement Data
- Next Steps

Take Aways from Today's Session

- E-Copies of the Common Formative Assessments grades 3-6
- E-Copies of the Diagnostic Unit Assessments grades 3-6
- Electronic Excel Scoring Rosters
- Analyzing Student Work Template
- PowerPoint of presentation

A Clinical Approach

- *Clinical diagnosis* is the process of collecting information from patients and determining their problem; it is the essence of medicine. (Lee, Anthony. *The Process of Clinical Diagnosis.*)
- In the same way, *clinical diagnosis of learning* can be thought of *as* the process of collecting information from students and determining their needs; it is the essence of teaching (Our view).

The Physician's Clinical Process

1. Patient history
2. Physical examination
3. Diagnostic testing
4. Assessment
5. Treatment plan

Lee, Anthony. *The Process of Clinical Diagnosis*. (2009)

A Teacher's Clinical Approach

- Pre-assessment
- Formative assessments
- Diagnostic testing
- Analysis of student work
- Intervention plan

Various authors and works

Puyallup School District's Comprehensive Math Improvement Plan

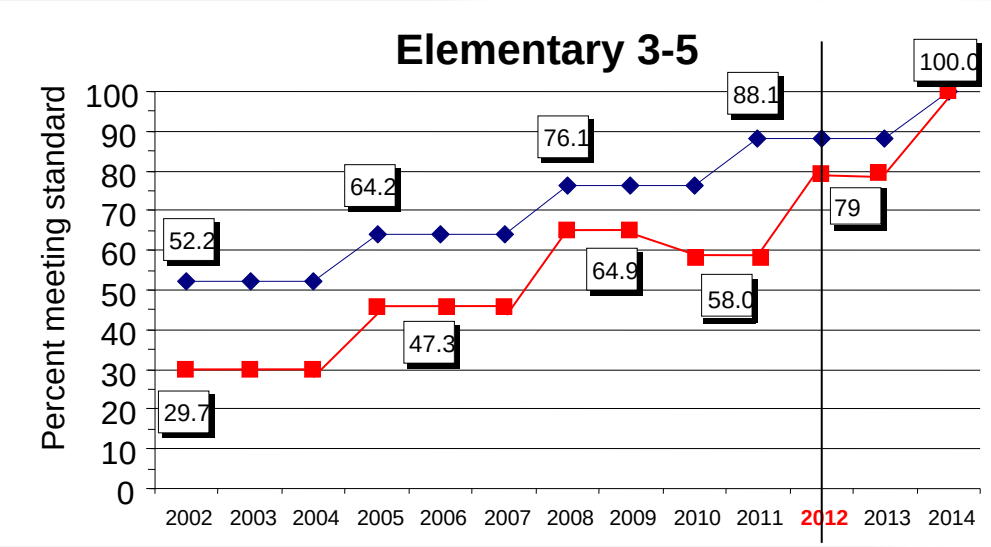
- **Our target…** successful completion of high school math so students are college-ready.

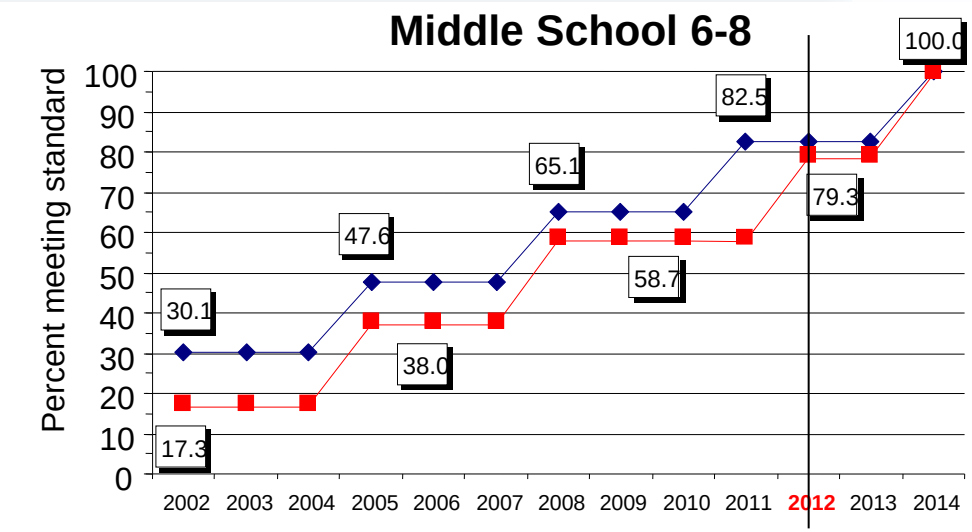
- **Students will…**
  - Develop a deep conceptual understanding of core concepts in mathematics through research-based curricula delivered with fidelity
  - Receive appropriate instructional intervention for concepts not yet mastered
  - Take math courses sequenced to master Algebra and Geometry concepts

9 Core Objectives

1. Plan is consistent with approach to learning math
2. Coherent K-12 sequence
3. Curriculum aligned to standards
4. Common assessments
5. Complementary interventions
6. Professional development for administrators
7. Professional development for teachers
8. Math courses for every career pathway
9. Partnership with parents

Impetus for Change





Red – Math

Blue – Reading

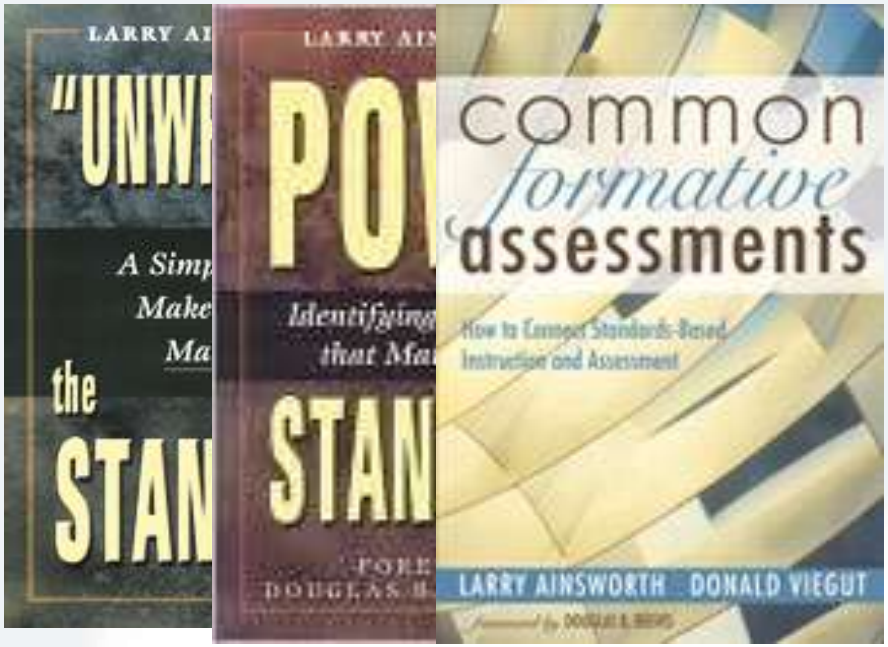
- AYP: The bar continues to rise

Math MSP 2012:

- 79% in grades 3-5
- 79.3% in grades 6-8

2009 WERA Conference

- Larry Ainsworth spoke on Common Formative Assessments



What *are* effective schools doing to achieve dramatic results in student learning?

The POWER of Common Assessments

"Schools with the greatest improvements in student achievement consistently used common assessments."

Douglas Reeves, *Accountability In Action* (2004)

L. Ainsworth, 2009 WERA Conference

The POTENTIAL of Common Assessments

"There is a body of firm evidence that formative assessment is an essential component of classroom work and that its development can raise standards of achievement. **We know of no other way of raising standards for which such a strong prima facie case can be made**."

-Black, P., & Wiliam, D. (1998, October 1). Inside the black box: Raising standards through classroom assessment. *Phi Delta Kappan*

-L. Ainsworth, 2009 WERA Conference

How Much of a Difference Can Formative Assessments Make?

- Black and Wiliam (1998) examined 250 research studies on classroom assessment that focused on the question, *does formative assessment improve learning?*
- Through this examination, they discovered that the **achievement gains are "among the largest ever reported for education interventions."**
- Typical effect sizes were measured ranging from 0.4 to 0.7.
- Black and Wiliam concluded that **if mathematics teachers were to focus their efforts on formative classroom assessment, student learning gains would be significant.**

L. Ainsworth, 2009 WERA Conference

John Hattie “Visible Learning”

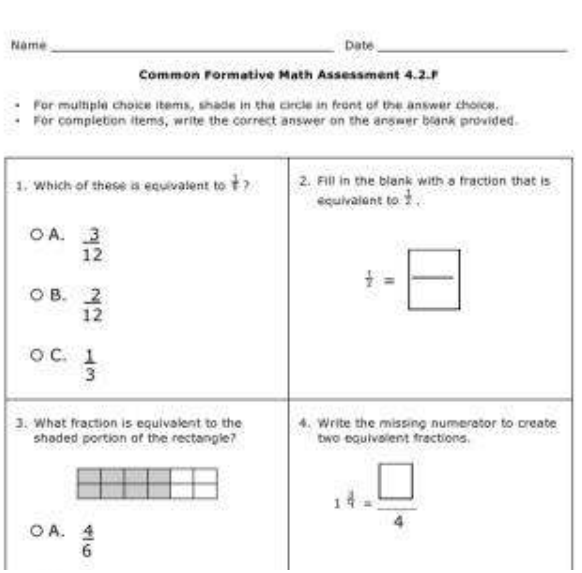
- Fifteen years of research
- Synthesis of 800+ meta-analyses of teaching practices
- Providing Formative Assessment had an effect size of 0.9

“When teachers were required to use data and evidence based models, effect sizes were higher than when data were evaluated by teacher judgment.”

Hattie, John (2008) *Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement*.

Two Types of Assessments

- **Common Formative Assessments**
  - Can be used throughout a unit of instruction to monitor learning
  - Used to inform a teacher of their students' progress towards mastery of each PE


Name _____ Date _____

Common Formative Math Assessment 4.2.F

- For multiple choice items, shade in the circle in front of the answer choice.
- For completion items, write the correct answer on the answer blank provided.

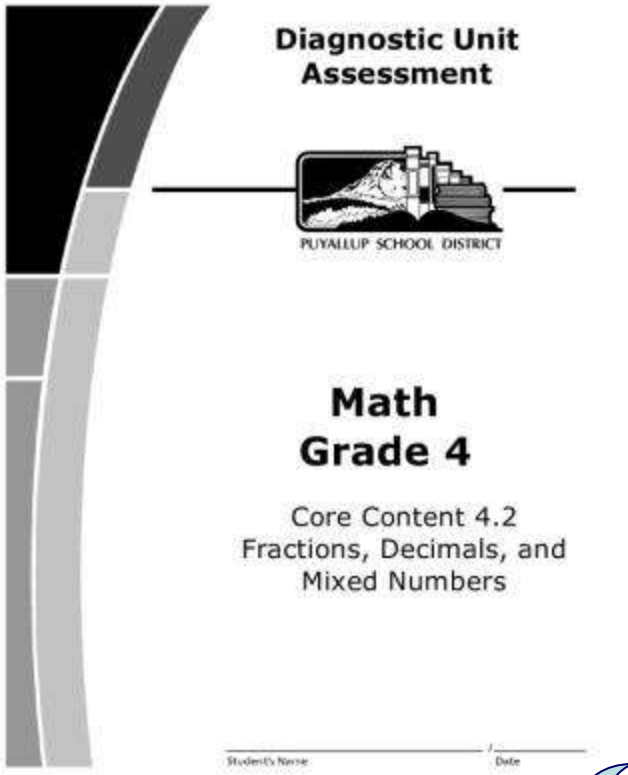
1. Which of these is equivalent to $\frac{1}{4}$?
   - A. $\frac{3}{12}$
   - B. $\frac{2}{12}$
   - C. $\frac{1}{3}$

2. Fill in the blank with a fraction that is equivalent to $\frac{1}{2}$.
   $\frac{1}{2} = \frac{\square}{\square}$

3. What fraction is equivalent to the shaded portion of the rectangle?
   - A. $\frac{4}{6}$

4. Write the missing numerator to create two equivalent fractions.
   $1\frac{1}{4} = \frac{\square}{4}$

- **Diagnostic Unit Assessments**
  - Aligned to the Washington State Core Content Standards in Math
  - Used to identify students needing intervention and inform teacher's instruction



Formative Assessment – Quick Checks for Understanding

Teacher Development in the Test and Item Specifications

- Provided Professional Development with the goal of increasing teachers' knowledge of the math standards and test/item specifications for the MSP
  - Understand the design of the MSP and Test Map
  - Identify which performance expectations will be assessed on the Measurements of Student Progress (MSP)
  - Discuss instructional implications of the Test and Item Specifications

Collaborative Item Writing Process

- Pope and Edgerton Elementary teachers in grades 3-6
- Teachers worked in grade level teams
- Stimulus, Stem, and Prompt Rules were used during item writing
- Wrote 4-point assessments
  - Multiple Choice, Completion, or Short Answer
- Question formats to mirror test item question formats for the MSP
- Used district adopted and supplemental curriculum to assist in item writing process

Stimulus, Stem and Prompt Rules

Item Specifications: Grade 3

3.1 Core Content: Addition, subtraction, and place value
(Numbers, Operations)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Stimulus may include number words through ten thousand, e.g., one, twelve, thirty-five.
- Answer choices may be symbolic or pictorial.
- Items may include illustrations of base-ten blocks, tally marks, cubes, sticks, number lines, or other counting manipulatives.
- Number lines may be used when asking students to order and compare the magnitude of whole numbers.
- Number lines will have the necessary reference points labeled using whole numbers.
- Computation items may appear either in a vertical or horizontal format.
- Item assessing 3.1.A may use the symbols <, >, or =.
- Items assessing 3.1.C. will use whole numbers and sums less than or equal to ten thousand. The number of addends will be five or fewer.

Cognitive Complexity, Question Format and Context

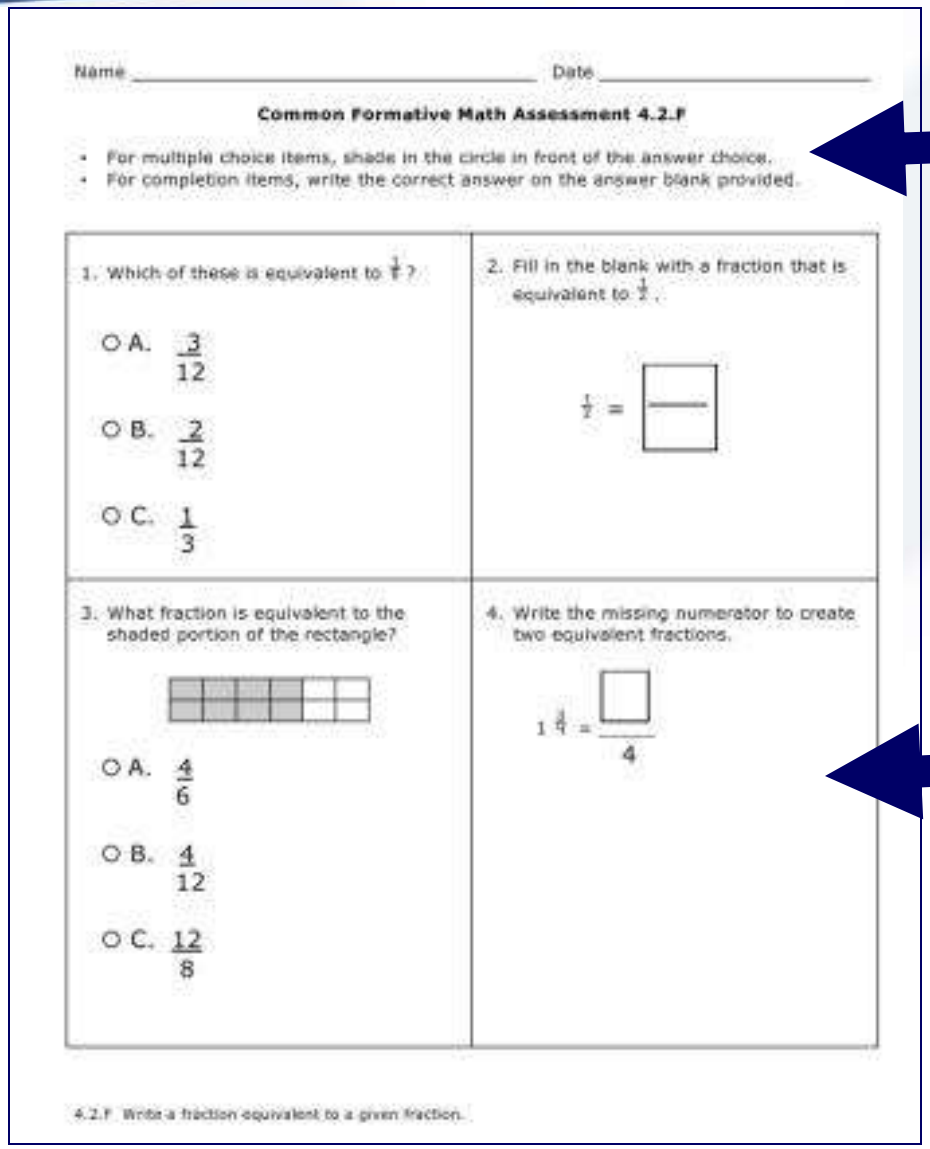
Performance Expectations

Items may ask students to:		C.C.	Format	Ctxt
3.1.A	*Read,* write, compare, order, and represent numbers to 10,000 using numbers, *words,* and symbols.	1	MC,CP	I
3.1.B	Round whole numbers through 10,000 to the nearest ten, hundred, and thousand.	1	MC,CP	I
3.1.C	*Fluently and* accurately add and subtract whole numbers using the standard regrouping algorithms.	1	MC,CP	N
3.1.D	Estimate sums and differences to approximate solutions to problems and determine reasonableness of answers.	2	*	*
3.1.E	Solve single- and multi-step word problems involving addition and subtraction of whole numbers and verify the solutions.	2	MC,SA	Y

* This performance expectation may be included in items assessing core process performance expectations.

Key:
Format = Multiple-Choice (MC), Completion (CP), Short-Answer (SA), or Not Assessed (NA)
CC – Cognitive Complexity
Ctxt = Contextual Situation
I = Item dependent
Y = Yes
N = No

The Common Formative Math Assessments



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$\frac{1}{2} = \frac{\square}{\square}$

3. What fraction is equivalent to the shaded portion of the rectangle?

○ A. $\frac{4}{6}$

○ B. $\frac{4}{12}$

○ C. $\frac{12}{8}$

4. Write the missing numerator to create two equivalent fractions.

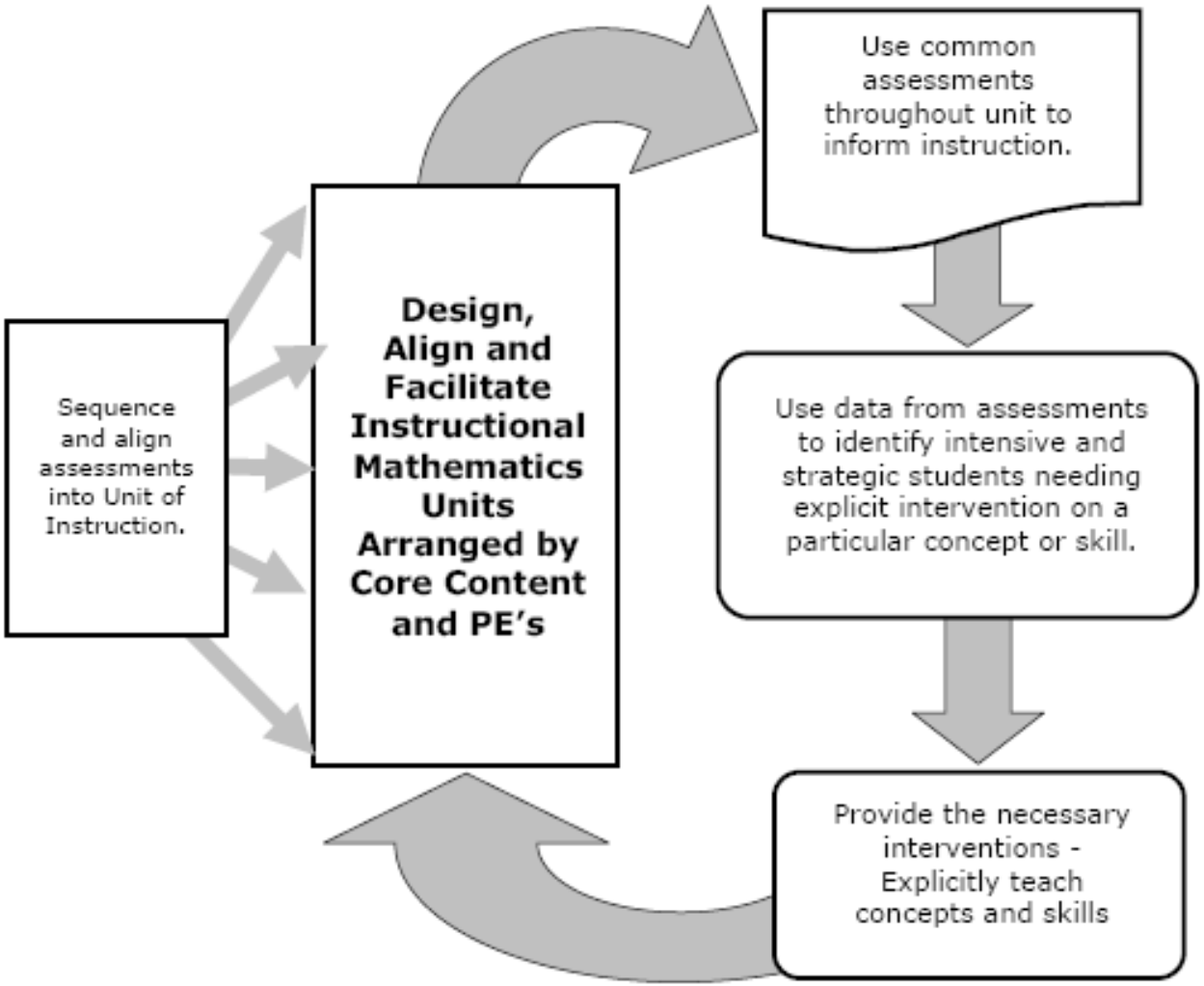
$1\frac{1}{4} = \frac{\square}{4}$

4.2.F Write a fraction equivalent to a given fraction.

Items written to match the format they will be assessed on the MSP

- **Item bank created for each PE Assessed on the MSP**
- **4 points for each assessment**
- **Multiple Choice – 1 point**
- **Completion - 1 point**
- **Short Answer - 2 points**

Our Formative Assessment Cycle



February 2012 — Grade 3 Math Pacing & Assessment Calendar

SUN	MON	TUE	WED	THU	FRI	SAT
			1 U4 S21 Supp. Set A2 Act.1; 3.2.G; 3.2.A; 3.2.C; 3.2.D; 3.2.F	2 U4 S22 Supp. Set A2 Act.2; 3.2.G; 3.2.A; 3.2.C; 3.2.D; 3.2.F	3 U4 S23 3.2.B; 3.2.C	4
5	6 U4 S24 Unit 4 Post-Assessment	7 U5 S1 Unit 5 Pre-Assessment	8 U5 S2 Supp. Set A3 Act.1 3.1.C; 3.1.D; 3.1.E	9 U5 S3	10 U5 S4 3.1.B	11
12	13 U5 S5 3.1.B; 3.1.C; 3.1.D	14 U5 S6 3.1.A; 3.1.C	15 U5 S7	16 U5 S8 3.1.C; 3.1.E; 3.5.C	17 Mid-Winter Break No School	18
19	20 President's Day No School	21 U5 S9 Supplement A3 Act 2 Mult. Fluency Checkup 3	22 U5 S10 3.1.C; 3.1.D; 3.1.E	23 U5 S11 3.1.D	24 U5 S12 3.1.D	25
26	27 U5 S13 3.1.C; 3.1.E	28 U5 S14 Supp. Set A3 Act.3 3.1.A; 3.1.C; 3.1.E	29 U5 S15 3.1.A			

Post-Assessment for All Schools: Administer Diagnostic Unit Assessment 3.2

Diagnostic Unit Assessment windows identified

Standards alignment serves as a guide for giving the Common Formative Assessments

Lesson alignment and pacing provided to all teachers

PUYALLUP SCHOOL DISTRICT

Bridges Lessons are typed in

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ws are shown in YELLOW.

Windows for the District Diagnostic Unit Assessments are provided.

NOTE: Teachers will enter Diagnostic Unit Assessment data one week after the testing window closes.

Classroom Use of Formative Assessments

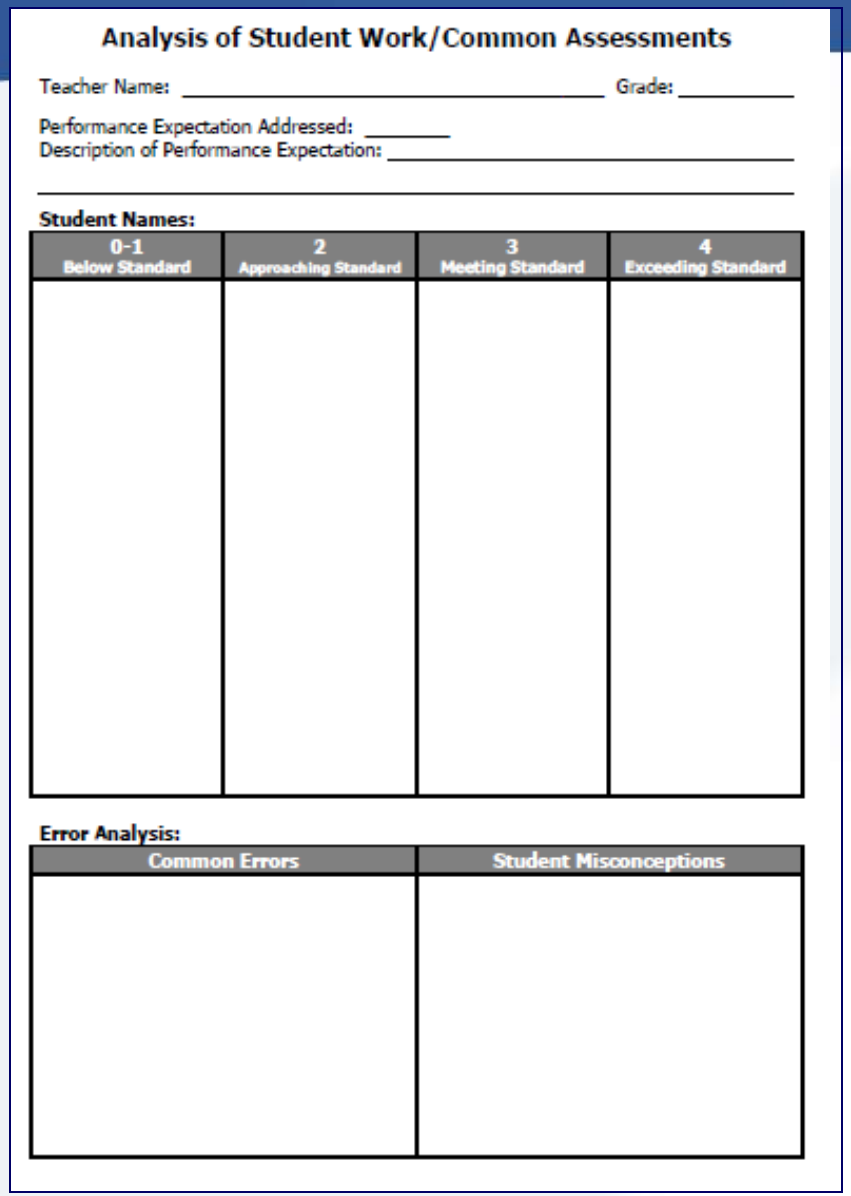
- In a whole group:
  - Put item under a document camera
  - Provide time for students to complete the item in their math journal or on a white board
  - Students can respond with answer by holding up colored cards for multiple choice or writing answer on white boards
  - Can be given as a pencil/paper assessment
- In small group:
  - Teacher can model problem solving
  - Items can be completed together/independently using white boards or math journals

After Giving a Common Formative Assessment…

Use the data to drive instruction

PROVIDE INTERVENTION: Explicit, targeted and focused instruction in concepts and skills not yet mastered

Analyzing Student Work Protocol



Analysis of Student Work/Common Assessments

Teacher Name: _____ Grade: _____

Performance Expectation Addressed: _____
Description of Performance Expectation: _____

_____

Student Names:

0-1 Below Standard	2 Approaching Standard	3 Meeting Standard	4 Exceeding Standard

Error Analysis:

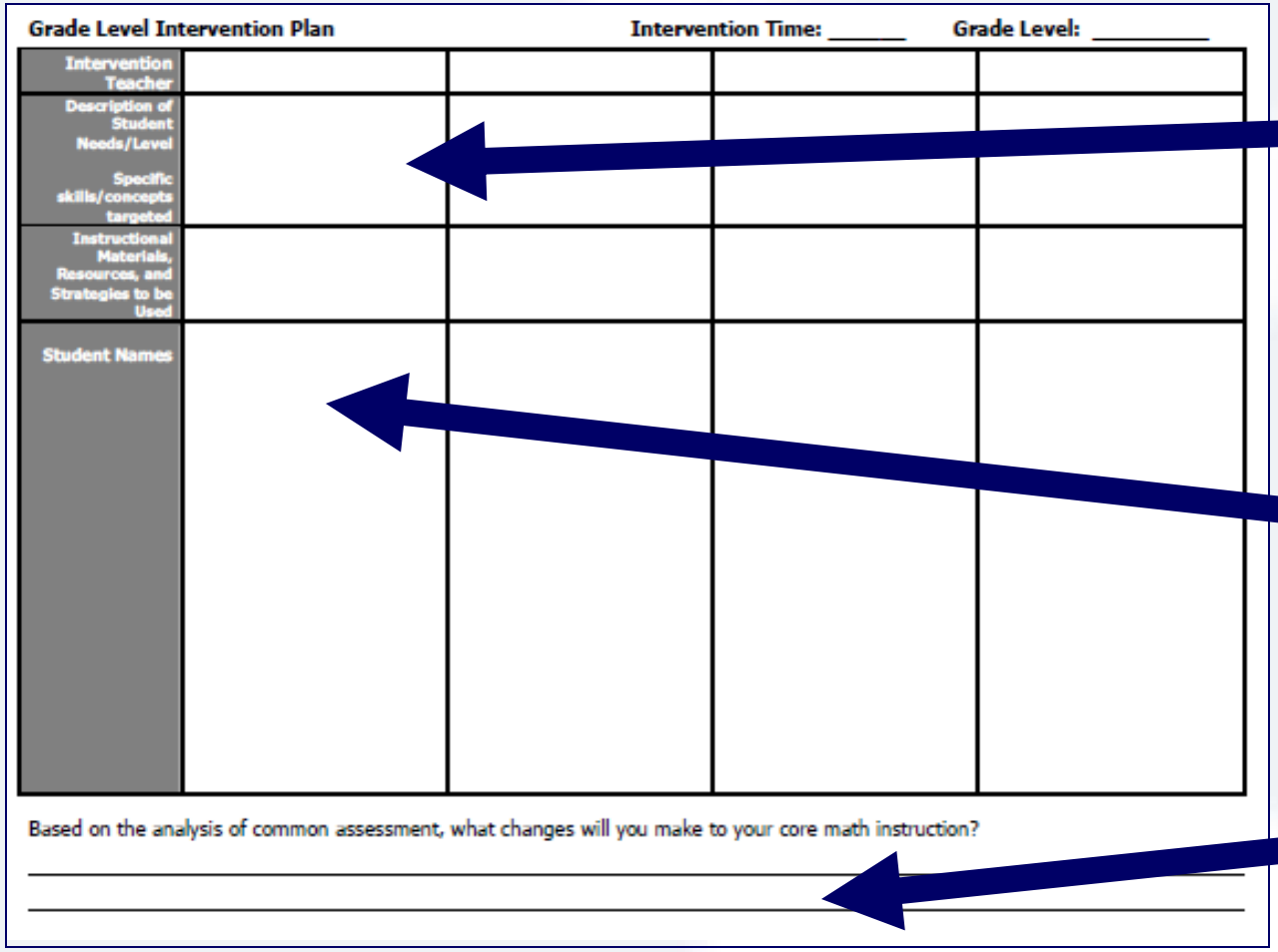
Common Errors	Student Misconceptions

Teachers meet in their PLCs (Grade Level Teams) to:

Step 1: Sort assessments by score level

Step 2: Identify common errors and student misconceptions

Analyzing Student Work Protocol



Grade Level Intervention Plan **Intervention Time: _____** **Grade Level: _____**

Intervention Teacher				
Description of Student Needs/Level Specific skills/concepts targeted				
Instructional Materials, Resources, and Strategies to be Used				
Student Names				

Based on the analysis of common assessment, what changes will you make to your core math instruction?

_____

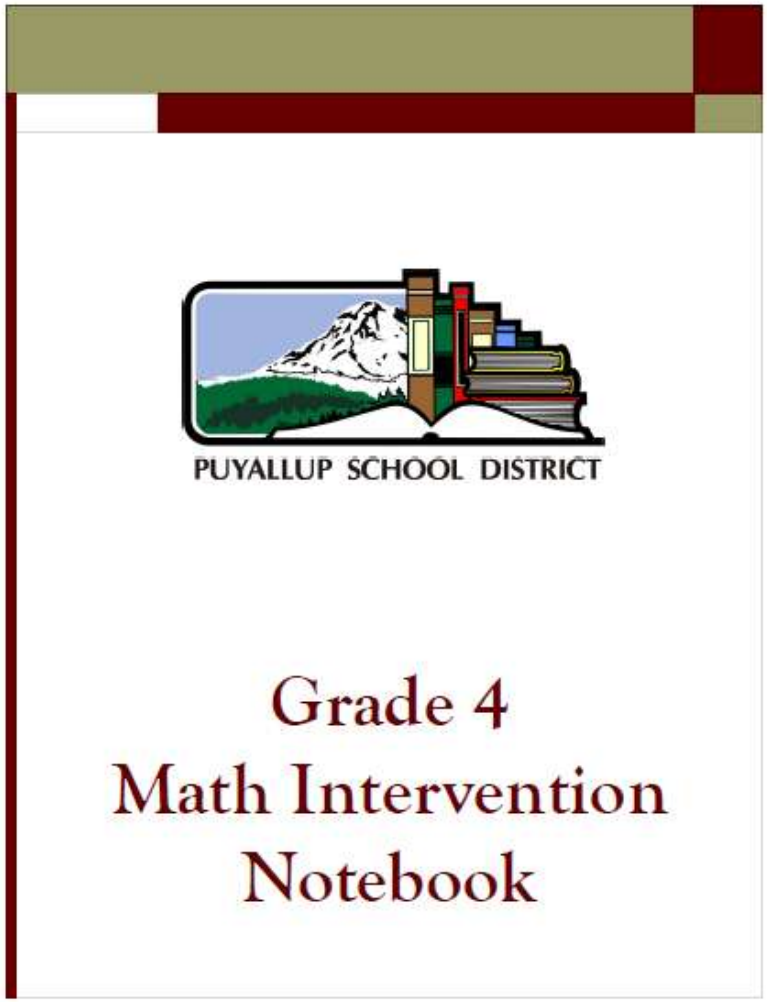
_____

Step 3: Identify student needs and teacher providing instruction

Step 4: Group students according to need

Step 5: Reflect on changes that need to be made to core math instruction

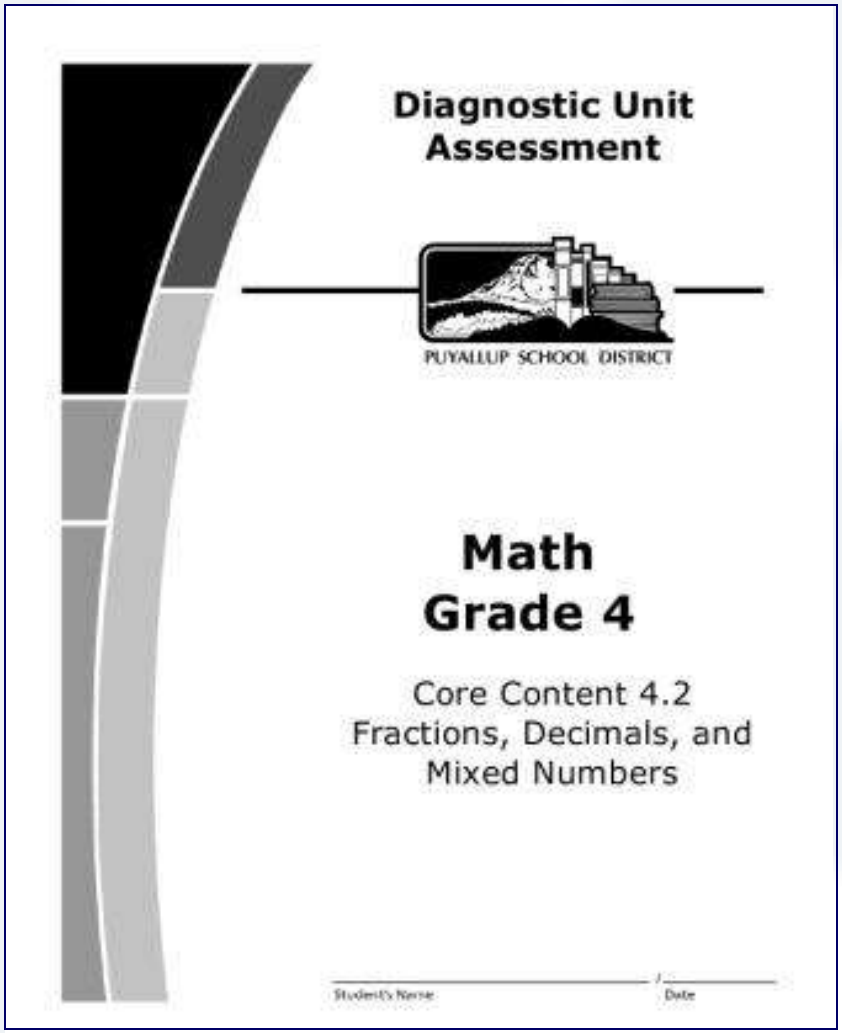
Math Intervention Notebooks



- Organized by Performance Expectations that are assessed on the MSP
- Used core curriculum and supplemental lessons
- Two sections for each Performance Expectation
  - Intensive Interventions
  - Strategic Interventions

Questions, Answers, and Your Feedback

The Common Diagnostic Math Assessments



Diagnostic Unit Math Assessments

How can these be used?

- A **PRE-ASSESSMENT** to gauge what students already know
- A **DIAGNOSTIC** assessment to identify what students need to know to meet standard
- A **SUMMATIVE ASSESSMENT** to measure what students learned

The Design of the Diagnostic Unit Assessments

- Each unit assessment is 10-18 questions in length
- Each unit corresponds to the Core Content for the grade level (e.g. 3.1 addition, subtraction and place value)
- Each item on the assessment is aligned to the math performance expectations (P.E.’s)
- Most assessments have two items written for each P.E. assessed on MSP

The Design of the Diagnostic Unit Assessments

- Test questions match the item format that they will be assessed on the MSP
  - »Multiple Choice
  - »Completion
  - »Short Answer
- Scoring guides are provided on the answer key that correspond to cut scores on the MSP

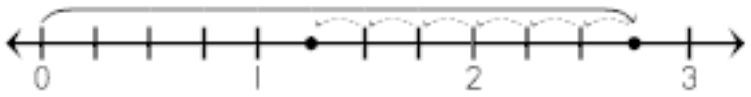
Multiple Choice & Completion - 1 Point

PE's are clearly identified

Items written to look and feel like the MSP

5.2.A

7. Which expression connects to the visual representation below?



○ A. $2\frac{3}{4} - 1\frac{1}{2}$

○ B. $1\frac{1}{4} + \frac{6}{4}$

○ C. $\frac{6}{4} - 1\frac{1}{4}$

5.2.G

8. Sandra is making a dollhouse and she wants to put a popsicle stick border around the perimeter of it. The perimeter of the dollhouse is 180 inches. Each popsicle stick measures $5\frac{7}{8}$ inches long. Estimate how many popsicle sticks she will need in order to go around the dollhouse.

Write your answer on the line.

Sandra will need approximately _____ popsicle sticks to go around the perimeter of the dollhouse.

Short Answer – 2 points

S2.H

15. Desiree's science fair project tested the question, "Does the amount of oil used in a brownie recipe effect the height of the brownies?" She controlled all the variables except the amount of oil she used in the recipe.

Brownie Recipe Results

Amount of Oil Used in Recipe	Height of Brownies
$\frac{1}{4}$ cup	1.7 cm
$\frac{1}{3}$ cup	1.52 cm
$\frac{1}{2}$ cup	1.25 cm

What was the difference in the brownie height from the recipe using $\frac{1}{4}$ cup oil and $\frac{1}{3}$ cup oil?

6 10
1.70
-1.52
0.18

The difference in brownie height from the recipe using $\frac{1}{4}$ cup oil and $\frac{1}{3}$ cup oil was 0.18 cm.

One point for work leading to the right answer

One point for the right answer

Answer Keys and Scoring Rubrics

Scoring rubrics help identify students needing intervention

5th Grade - Math
5.2 Addition and Subtraction of Fractions and Decimals
Common Unit Assessment Answer Key

	Standard	Pts	Answer
1	5.2.D	1	C
2	5.2.C	1	B
3	5.2.F	1	A
4	5.3.E	1	1
5	5.2.B	1	A
6	5.2.F	1	528.682
7	5.2.A	1	A
8	5.2.G	1	30
9	5.2.D	1	C
10	5.2.H	2	$24.25
11	5.2.C	1	B
12	5.2.A	1	C
13	5.2.B	1	A
14	5.2.E	1	C
15	5.2.H	2	0.18
16	5.2.G	1	$10\frac{1}{4}$
	TOTAL	18	

1pt for answer
1 pt for showing work that leads to answer.

Listed below are score values assigned to number of points earned. These ranges are closely related to score ranges found on the MSP. Grades assigned to students should not be based on one assessment of learning. Multiple measures should be used.

	1 Intensive	2 Strategic	3 Benchmark	4 Exceeds Benchmark
Points Scored	0-5	6-11	12-17	16-18

Multiple Choice = 10 questions
Short Answer = 2 questions
Completion Items = 4 questions
TOTAL = 16 questions

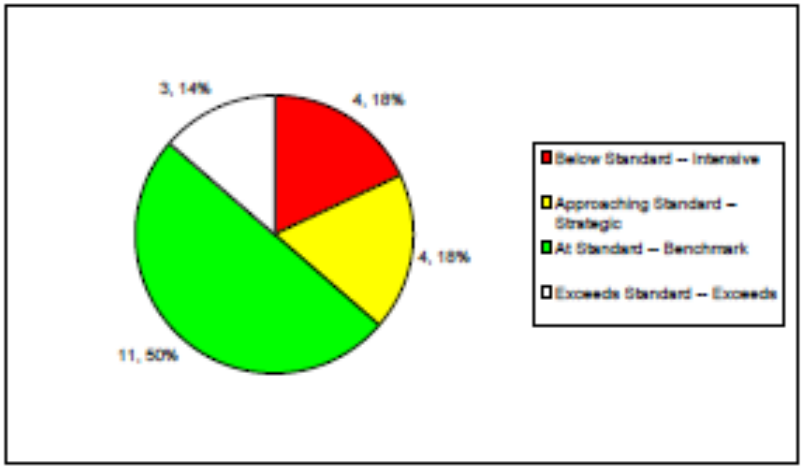
Collecting the Data: Using the Electronic Scoring Roster

Grade 3 Diagnostic Unit Math Assessment
3.2 Concepts of Multiplication

	Student Names	3.2.A		3.2.B		3.2.C		3.2.G		3.2.H		Raw Score	Score Level
	Problems Addressing the PE	4	9	1	6	2	8	3	5	7	10		
1	Jesse	0	0	0	1	1	1	0	1	0	0	4	1
2	Cole	1	0	1	0	1	0	0	1	2	2	8	3
3	Izzy	1	1	0	0	1	1	1	1	2	2	10	3
4	Tevin	0	0	1	0	1	1	0	0	2	2	7	2
6	Itzel	0	0	0	1	0	1	0	1	0	0	3	1
8	Citlally	0	1	1	1	1	0	0	1	1	1	7	2
7	Joanna	1	1	1	1	1	0	0	1	2	2	10	3
8	Phillip	1	0	0	0	1	1	0	1	2	2	8	3
9	Braydyn	1	1	1	0	1	0	0	1	2	2	9	3
10	Alex	1	1	1	0	1	1	0	1	2	2	10	3
11	Andrew	1	1	1	0	1	1	0	1	2	2	10	3
12	Jordana	1	1	1	1	1	1	0	1	2	2	11	4
13	Perla	0	1	0	0	0	1	0	0	0	0	2	1
14	Katelyn	1	1	1	1	1	1	0	0	0	2	8	3
15	Brendan	1	1	1	0	1	1	1	1	0	2	9	3
16	Zeke	1	1	1	1	1	1	0	1	2	2	11	4
17	Kylie	1	1	1	1	1	1	0	1	2	2	11	4
18	Ethan	0	1	1	0	1	1	0	1	2	1	8	3
19	Spiro	0	1	1	0	1	1	0	1	0	2	7	2
20	Kahnora	1	1	1	0	1	1	0	1	0	2	8	3
21	Mitchell	0	1	0	0	1	0	0	1	0	2	5	2
22	Melanie	0	0	0	0	0	0	0	0	0	0	0	1
23													
24													
25													
26													
27													
28													

3.2 A	Represent multiplication as repeated addition, arrays, counting by multiples, and equal jumps on the number line, and connect each representation to the related equation.
3.2 B	Represent division as equal sharing, repeated subtraction, equal jumps on the number line, and formation of equal groups of objects, and connect each representation to the related equation.
3.2 C	Determine products, quotients, and missing factors using the inverse relationship between multiplication and division.
3.2 G	Multiply any number from 11 through 19 by single-digit number using the distributive property and place value concepts.
3.2 H	Solve single- and multi-step word problems involving multiplication and division and verify the solutions.

Below Standard -- Intensive	4
Approaching Standard -- Strategic	4
At Standard -- Benchmark	11
Exceeds Standard -- Exceeds	3



Using the Data to Inform Instruction

- **INTERVENTION** ~ Provide explicit, targeted and focused instruction in concepts and skills not yet mastered

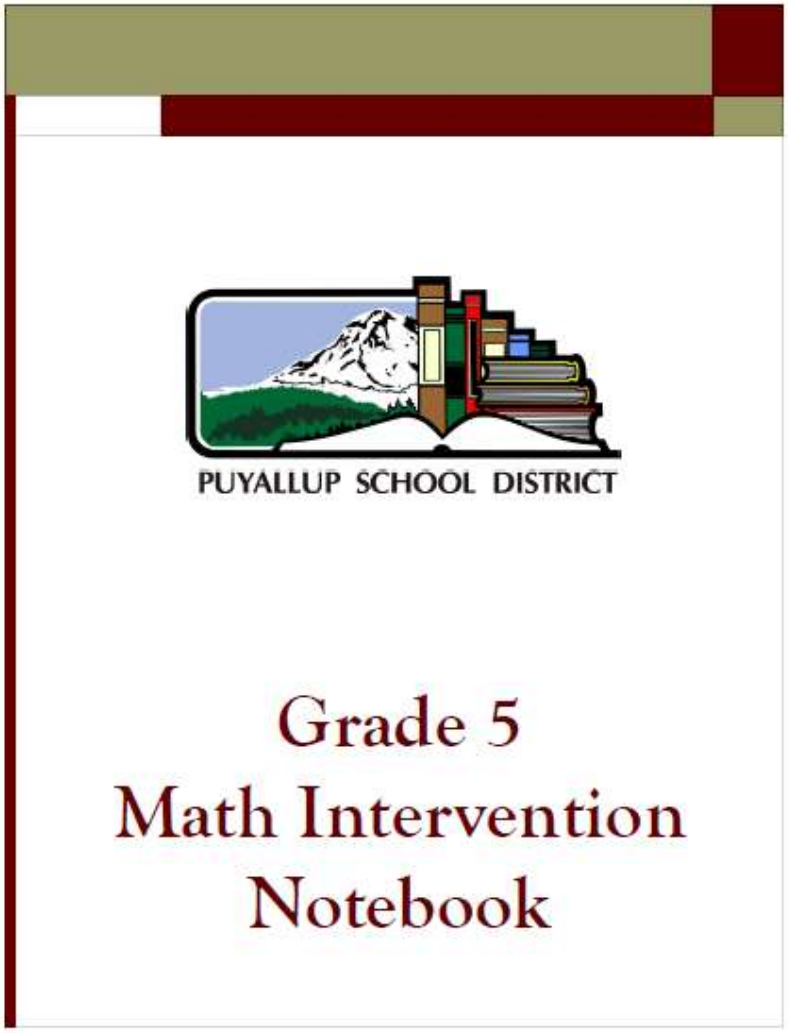
Small Group Instruction

5th Grade Math Intervention Groups for Core Content 5.2

5.2.A	5.2.C	5.2.E	5.2.H
Josh A.	Lilly	Mackenzie	Grace A.
Piper	Caden	Sophie	Margarita
Cameron	Nathan	Luis	Megan
Josh F.	Mackenzie	Mackayla	Lilly
Todd	Sophie	Alex	Brandon
Hayley	Luis		Caden
	Alex		

Whole Class Reteaching: 5.2.B

Math Intervention Notebooks



Questions, Answers, and Your Feedback

Using Data to Examine the Impact on Student Achievement in Math

3 Sources of Data:

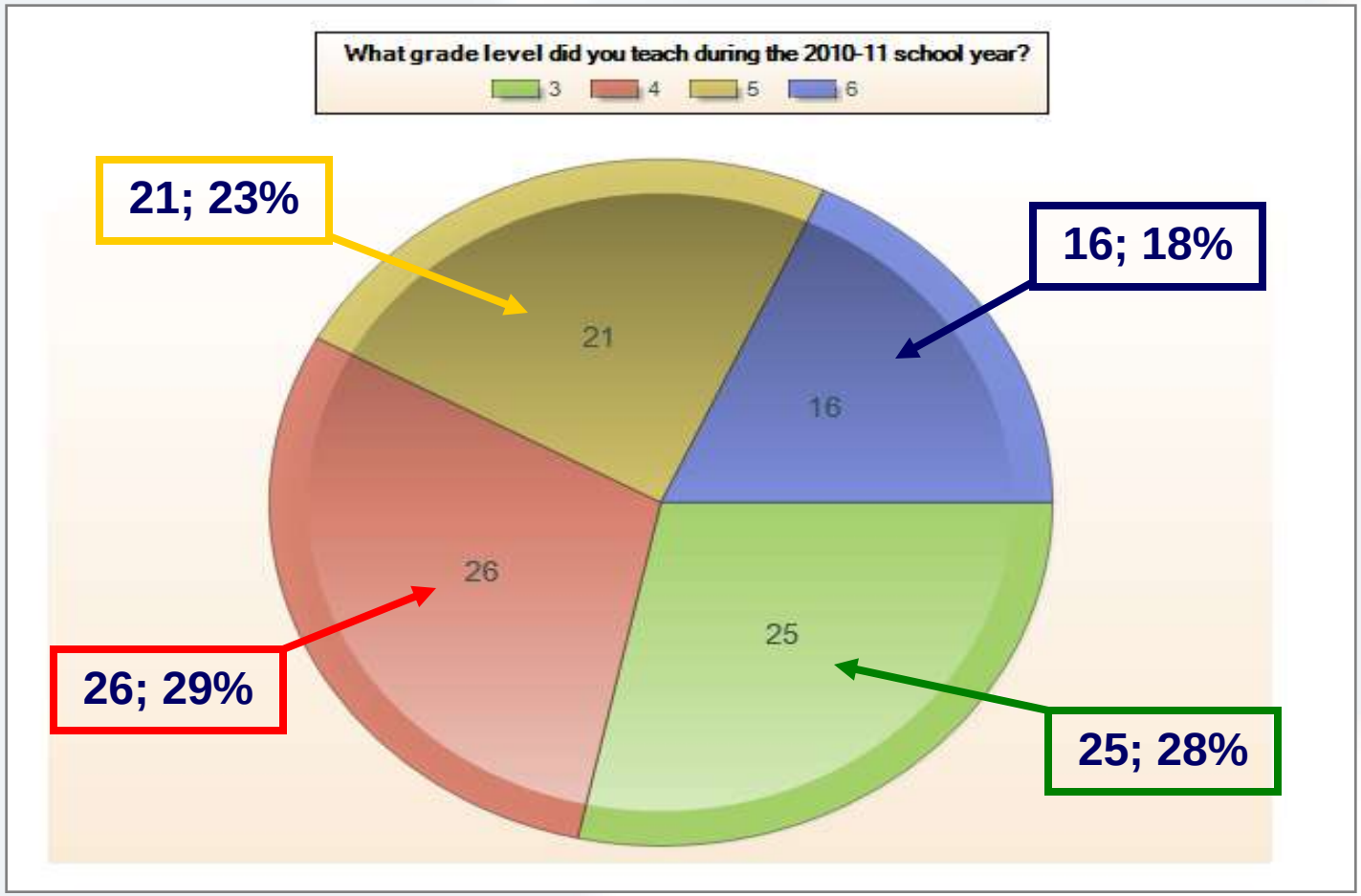
- Teacher Survey Data
- MSP Math Annual Data
- MSP Math Cohort Data

Math Assessment Survey Data

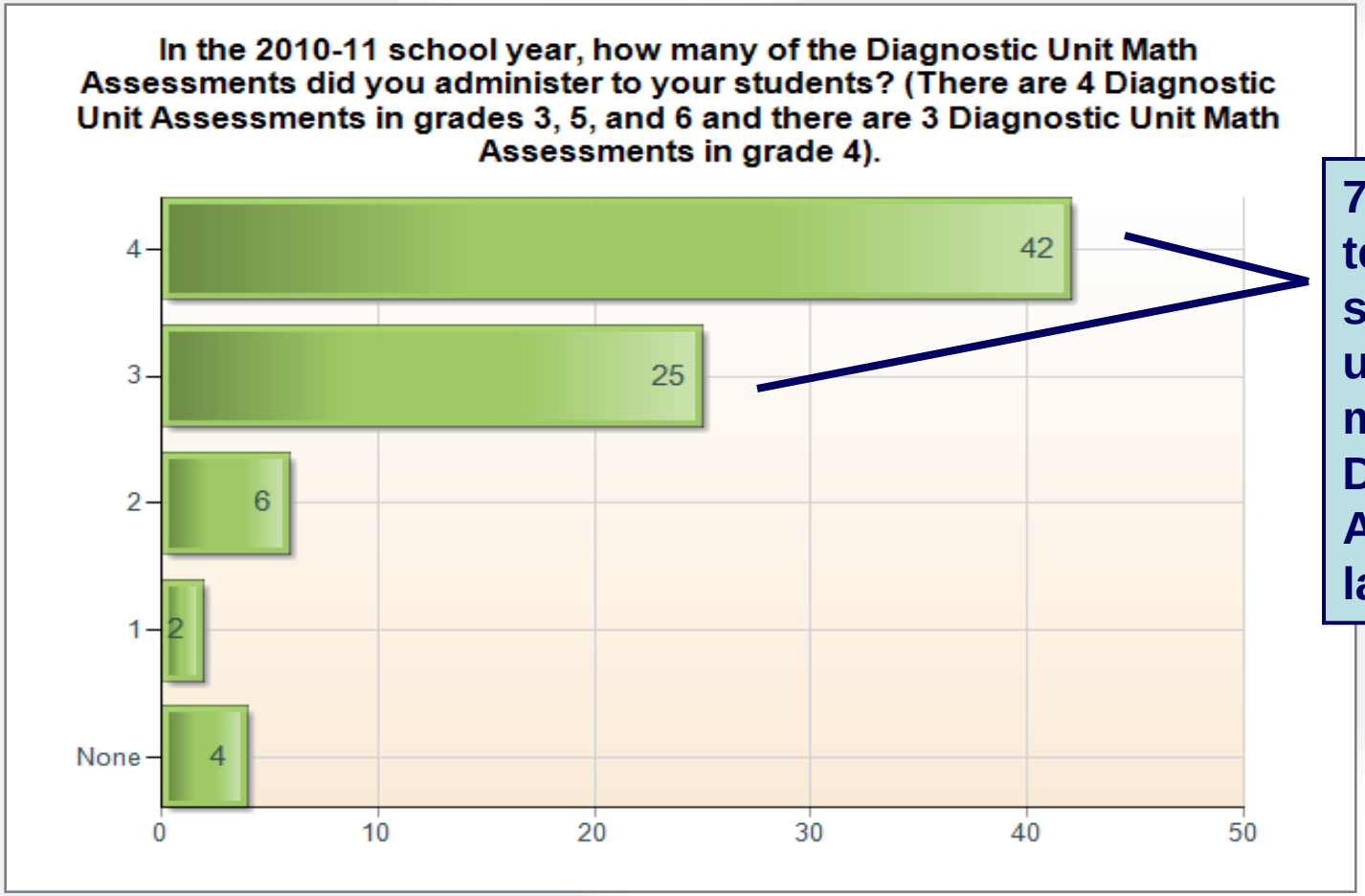
zoomerang
Online Surveys & Polls

What grade level did you teach during the 2010-11 school year?

90 teachers surveyed; 38% participation rate

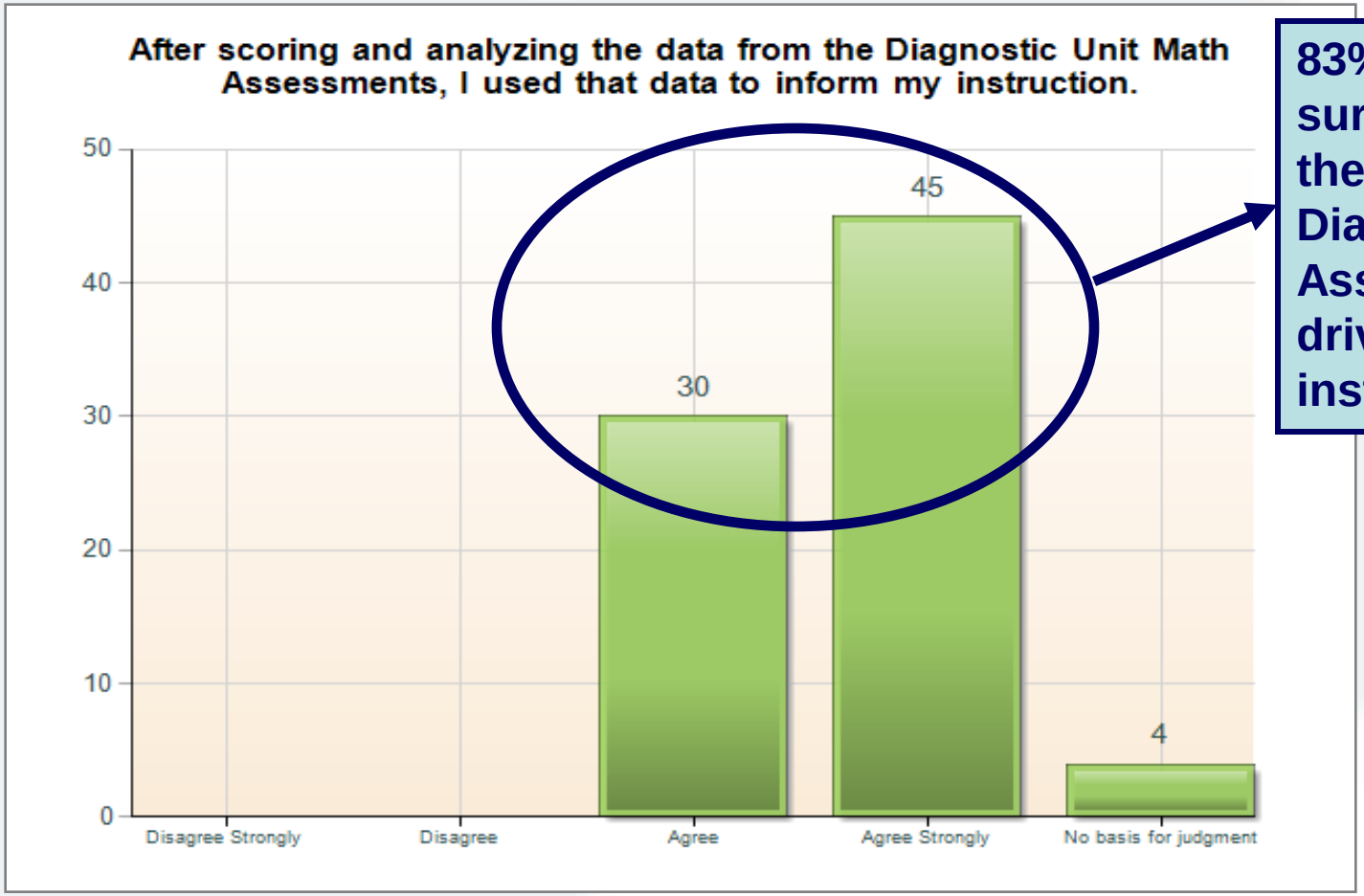


Prevalence of Use:
Diagnostic Unit Math Assessments



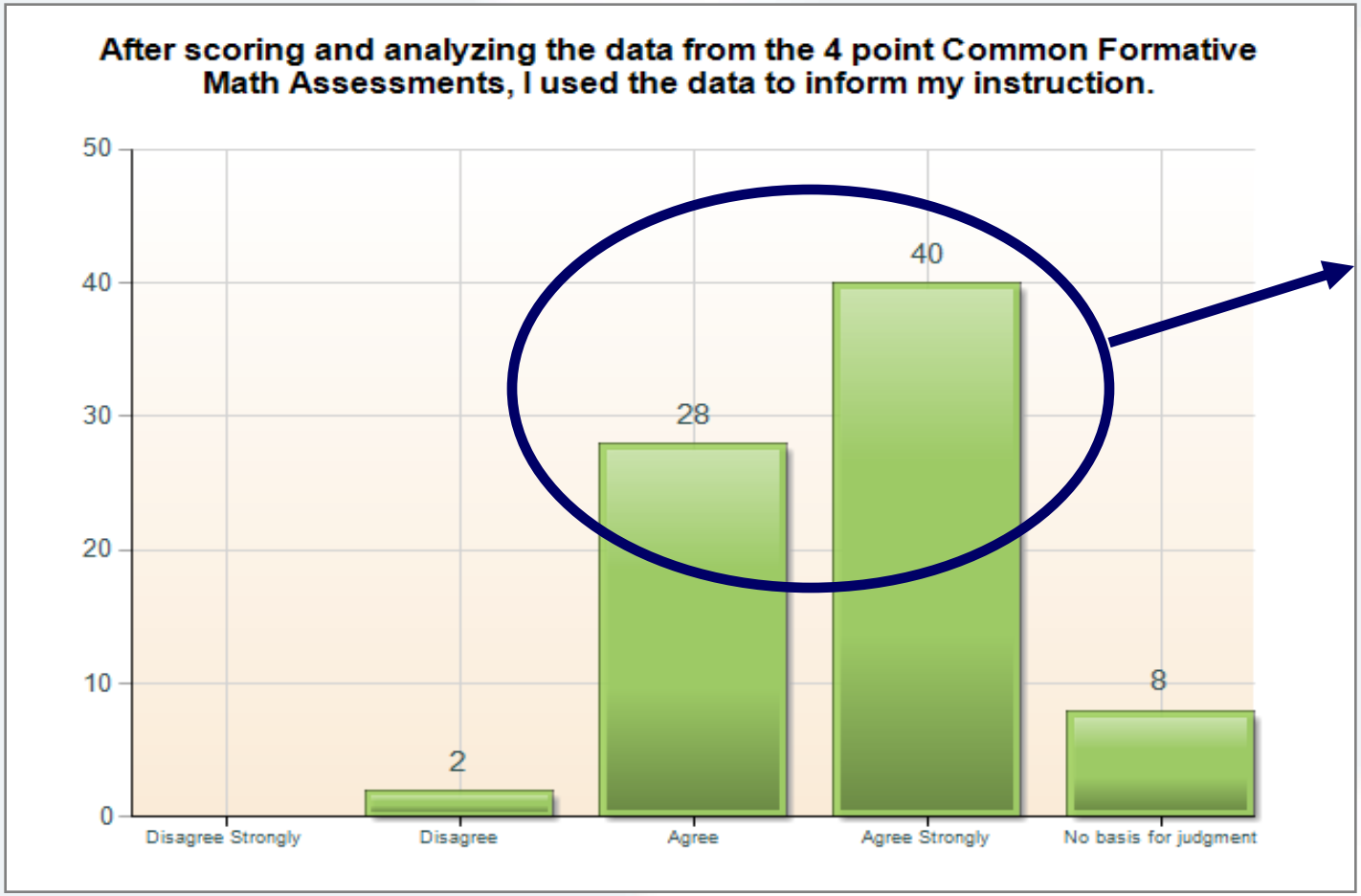
74% of teachers surveyed used all or most of the Diagnostic Assessments last year

Using the Data from the Diagnostic Assessments to Drive Instruction



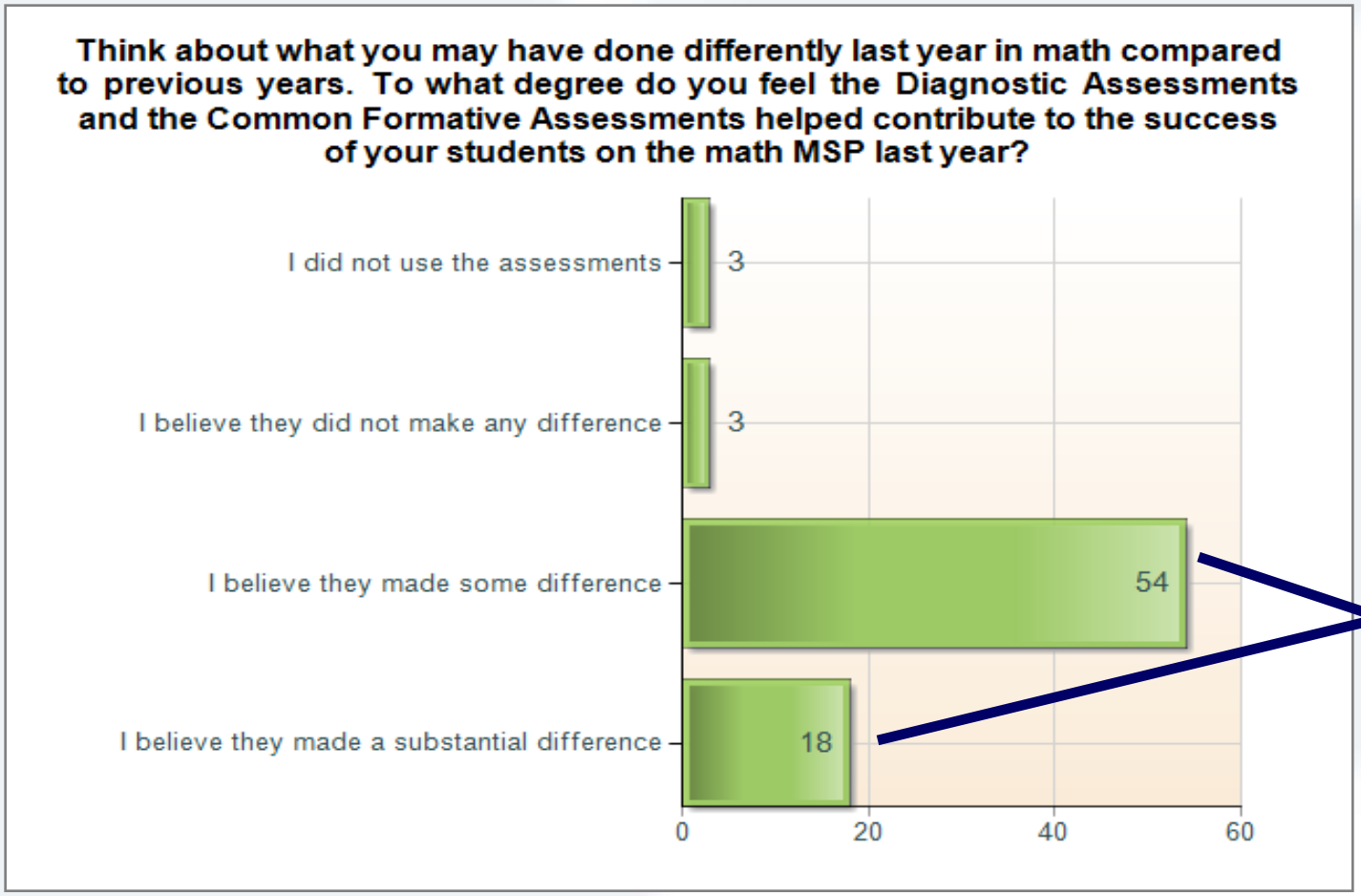
83% of teachers surveyed used the data from the Diagnostic Assessments to drive their instruction

Using Data from Common Formative Assessments to Inform Instruction



97% of teachers surveyed used the data from the Common Formative Assessments to drive their instruction

Impact of Using the Assessments on MSP Scores



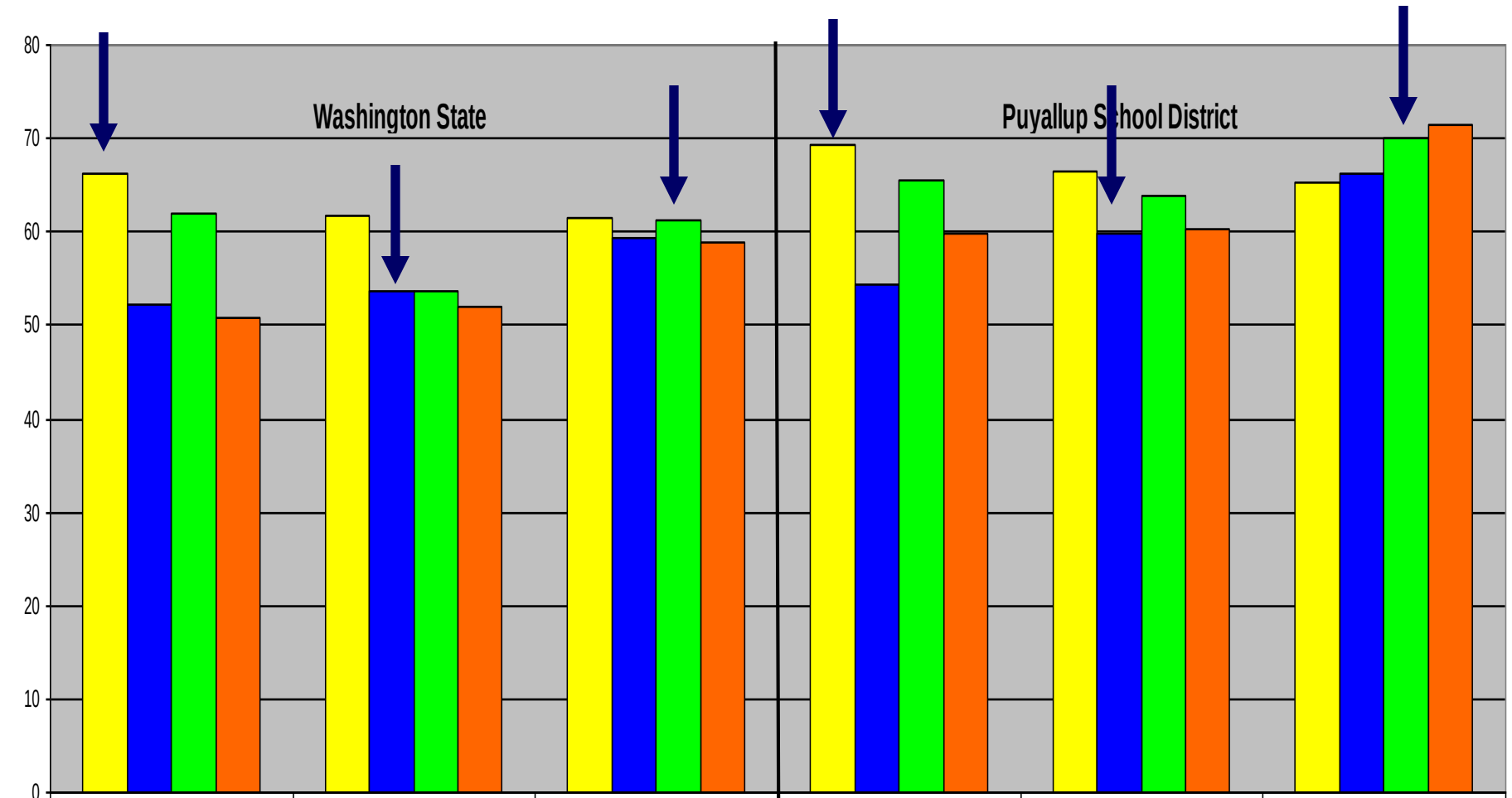
80% of teachers surveyed believe the math assessments helped contribute to higher MSP scores

Walk the Walls Activity

Take a few minutes to read some of comments teachers surveyed said.

Does the Data Support the Work?

MSP Math Scores 2009, 2010, 2011



	2008-09 State	2009-10 State	2010-11 State	2008-09 PSD	2009-10 PSD	2010-11 PSD
3rd	66.3	61.8	61.6	69.4	66.5	65.2
4th	52.3	53.7	59.3	54.3	59.8	66.3
5th	61.9	53.6	61.3	65.6	63.9	70.1
6th	50.9	51.9	58.8	59.8	60.4	71.5

Percent Change in MSP Cohort Data from 2009-10 to 2010-11

	State 2010 to 2011	PSD 2010 to 2011
3rd to 4th	-2.5%	0.4%
4th to 5th	7.6%	11.2%
5th to 6th	5.2%	9.1%

PSD Student Achievement Gains

- Three elementary schools receive School of Distinction Awards
- All three elementary schools “in improvement” in math last year are no longer in improvement
- Puyallup School District experienced the largest gains in math last year in grades 3-6

Next Steps

- Continue teacher collaboration on improving common assessments and using the data to impact achievement
- Write additional formative assessments
- Continue to disaggregate data to determine impact on achievement gap
- Collect data district wide
- Create primary formative assessments
- Revise assessments to align with the Common Core Standards

Assessing What we Value… Valuing What we Assess..

Our parting gifts:

- E-Copies of the Common Formative Assessments Grades 3-6
- E-Copies of the Diagnostic Unit Assessments Grades 3-6
- Electronic Excel Scoring Rosters
- Analyzing Student Work Template

Thank you for attending our session!

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