Deepening Place Value: The Key to Successful Understanding of Operations

Innov8 2016
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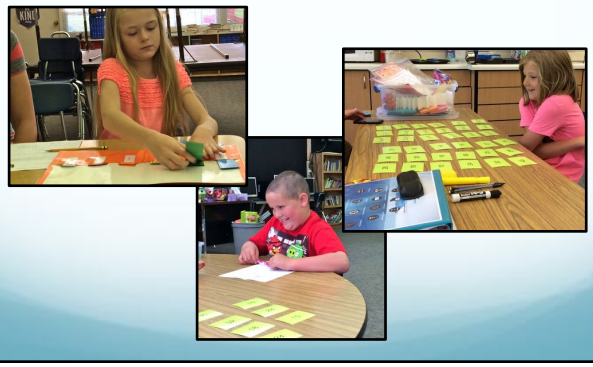
Introduction



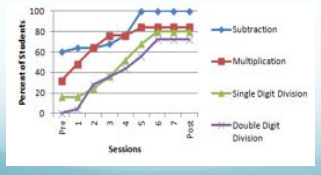
Agenda

- Place Value
- Targeting Interventions
  - Iceberg Model
  - Screeners
  - Place Value Iceberg Diagnostics
  - Interventions
  - Monitors

Need for Place Value Interventions

Summer Tutoring Program

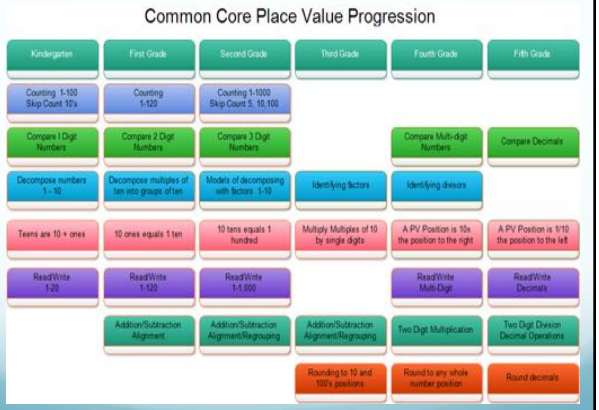
- 31 students
  - Referred by 4th grade teachers as "struggling in mathematics"
  - 56% Low Socio-Economic (free lunch)
  - 7 Receiving Special Education Services



21 Multiplication Mistakes

842 x 35 1060	842 x 35 830 826 9090	23 x25 65 50 115
842 x 35 10 20 40 6 12 24 260210	842 x 35 84 1260 1224	842 x 35 40210 2520 40730

Common Core Place Value Progression



Place Value Progression

Place Value

- Research studies indicate that place value understanding is a predictor of students' mathematic achievement in first, second and third grade (Ho & Cheng, 1997; Jordan, Glutting,& Ramineni, 2010; Jordan, et al, 2009; Moeller, Pixner, Zuber, Kaufmann & Nuerk, 2011).
- Yet, Gervasconi and Sullivan (2007) analysis of over 30,000 one on one clinical interviews indicated that 10% of first grader and 27% of second grade students have place value learning difficulties.

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Place Value

- When these difficulties are not remediated, they continue to limit the students' abilities to comprehend more complex mathematics topics and there is a growing consensus that many of the difficulties older students experience in mathematics can be traced to weaknesses in their basic understanding of place value and number competencies (Gersten, Jordan & Flojo 2005, Malofeeva, day Saco, Young, & Ciancio, 2004; National Mathematics Advisory Panel 2008).

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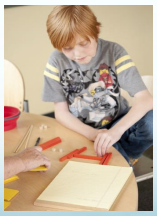
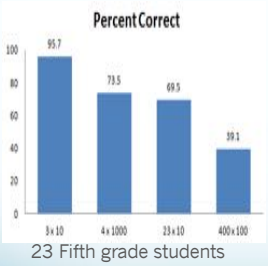
Effective Intervention begins with Place Value Intervention



Example

40 x 600

Multiplication Trick "Add the zeros"



23 Fifth grade students

100,000's	10,000's	1,000's	100's	10's	1's	
			2	5	1	
		2	5	1		x 10
	2	5	1			x 100
2	5	1				x 1000

Grade	Question	Wrong	Correct	Explain	10 x
3rd	How many times bigger is 200 than 20?	12.2	87.8	53.7	34.1
4th	How many times bigger is 200 than 20?	0	100.0	62.3	37.7
5th	How many times bigger is 200 than 20?	4.3	95.7	74.0	21.7

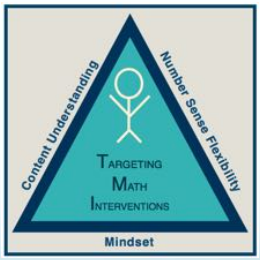
N = 3rd - 41, 4th – 61, 5th – 23

Grade	Question	Correct
4th	How many 10 in 200?	27.3%
4th	How many 100 in 1000?	22.7%
5th	3 is what fraction of 30	21.7%

N= 4th – 39, 5th -23

Understanding Multiplying by 10's

Targeted Interventions



Content Understanding

Regular Classroom Instruction

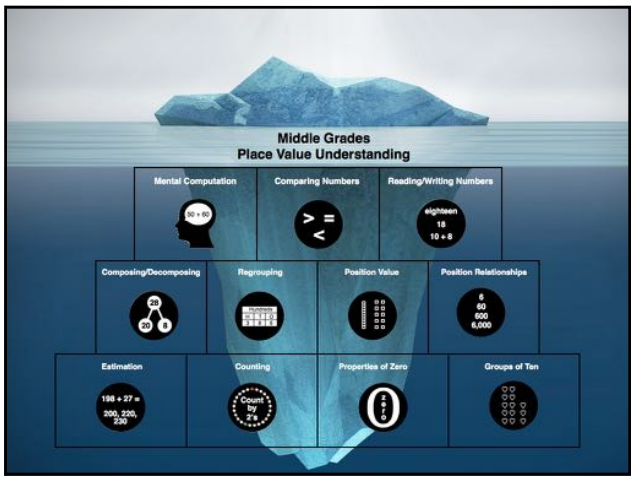
The Gap

Tier II

Special Education Instruction

Students Who Struggle

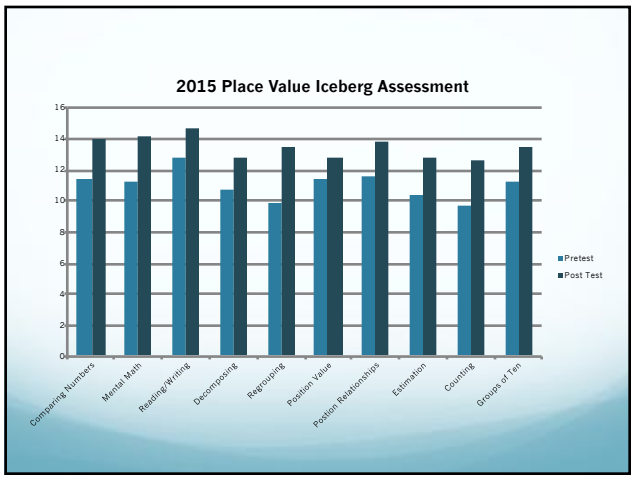
Dettori and Ott (2006) in a case study of two learning disabled students, demonstrated that even though the lack of content understanding was similar, the strength and weaknesses of the two students in their study were different. The students had different "blind spots" in their cognition and needed different methods, tools, and activities.



4th Grade
Place Value Pre- to Post- Iceberg
Diagnostic Comparisons - 2015

Place Value Content	Pretest		Post Test						Effect
	Mean	SD	Mean	SD	Gain	*df*	*t*	*p*	Size
Comparing Numbers	11.41	2.55	14.05	1.88	2.65	36	7.16	0.00	1.18
Place Value Mental Math	11.38	3.23	14.32	1.88	2.95	36	6.43	0.00	1.12
Reading/Writing Numbers	12.91	2.65	14.62	1.09	1.70	36	4.49	0.00	0.84
Decomposing/Composing	11.05	2.58	13.05	1.90	2.00	36	5.41	0.00	0.88
Regrouping	10.08	3.47	13.78	1.99	3.70	36	8.39	0.00	1.31
Position Values	11.65	2.69	13.49	1.88	1.84	36	5.86	0.00	0.79
Position Relationships	11.78	2.26	13.97	1.57	2.19	36	5.99	0.00	1.13
Estimation	10.48	3.56	13.11	2.66	2.62	36	5.75	0.00	0.83
Counting	10.11	3.18	12.81	2.42	2.70	36	5.19	0.00	0.96
Groups of Ten	11.35	3.33	13.59	2.73	2.24	36	6.16	0.00	0.74
Total Test	112.22	19.88	136.81	14.89	24.59	36	13.53	0.00	1.40

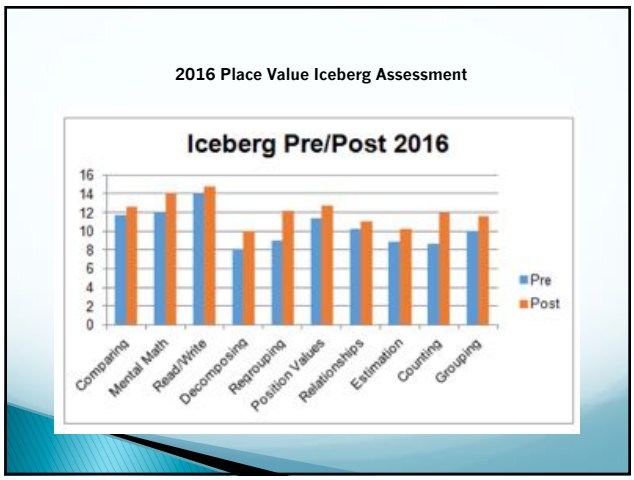
N=37



3rd Grade
Place Value Pre- to Post- Iceberg
Diagnostic Comparisons - 2016

Place Value Content	Pretest		Post Test						
	Mean	SD	Mean	SD	Gain	df	t	p	Effect Size
Comparing Numbers	11.68	3.09	12.57	2.94	0.89	28	2.07	0.05	0.29
Place Value Mental Math	11.86	3.88	14.07	2.18	2.21	28	4.06	0.00	0.70
Reading/Writing Numbers	13.79	1.91	14.82	0.67	0.86	28	2.58	0.02	0.60
Decomposing/Composing	8.07	2.50	10.04	3.02	1.96	28	4.06	0.00	0.71
Regrouping	9.00	2.02	12.21	2.11	3.21	28	7.98	0.00	1.55
Position Values	11.36	2.53	12.72	1.76	1.36	28	3.55	0.00	0.62
Position Relationships	10.32	2.28	11.14	2.26	0.82	28	1.82	0.08	0.36
Estimation	8.93	2.97	10.29	2.88	1.36	28	2.22	0.04	0.46
Counting	8.68	3.17	11.86	2.41	3.18	28	6.59	0.00	1.13
Groups of Ten	10.00	2.13	11.64	2.39	1.64	28	3.31	0.00	0.72
Total Test	103.86	15.43	121.36	11.95	17.50	28	11.14	0.00	1.27

28 Third Grade Students



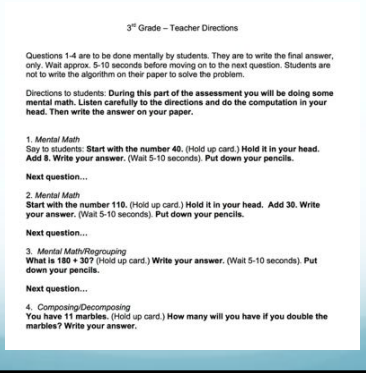
Teacher Implementation Examples

- Student
- Class
- Grade Level
- School

TMI Iceberg

- Identifying Assessments
  - Placement
  - Diagnostic
- Instructional Lessons
  - Conceptual and Procedural Focus
  - CPA or Concrete, Pictorial, Symbolic Sequences
- Practicing Activities
  - Student Work Lesson Strands
  - Games
- Monitoring Quizzes
  - Daily Learning Trajectories

Screener



3rd Grade – Teacher Directions

Questions 1-4 are to be done mentally by students. They are to write the final answer, only. Wait approx. 5-10 seconds before moving on to the next question. Students are not to write the algorithm on their paper to solve the problem.

Directions to students: **During this part of the assessment you will be doing some mental math. Listen carefully to the directions and do the computation in your head. Then write the answer on your paper.**

1. *Mental Math*
Say to students: **Start with the number 40.** (Hold up card.) **Hold it in your head. Add 8. Write your answer.** (Wait 5-10 seconds). **Put down your pencils.**

Next question…

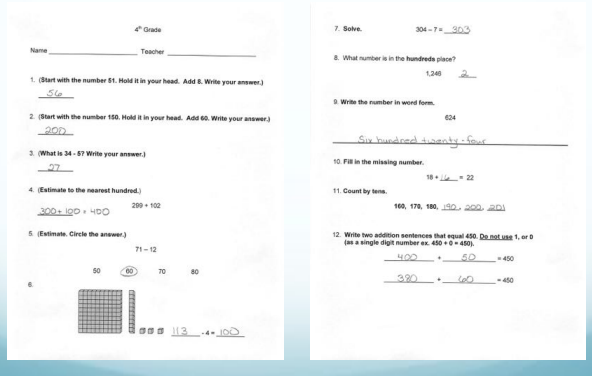
2. *Mental Math*
Start with the number 110. (Hold up card.) **Hold it in your head. Add 30. Write your answer.** (Wait 5-10 seconds). **Put down your pencils.**

Next question…

3. *Mental Math/Regrouping*
What is 180 + 30? (Hold up card.) **Write your answer.** (Wait 5-10 seconds). **Put down your pencils.**

Next question…

4. *Composing/Decomposing*
You have 11 marbles. (Hold up card.) **How many will you have if you double the marbles? Write your answer.**



4th Grade

Name _____ Teacher _____

1. (Start with the number 51. Hold it in your head. Add 8. Write your answer.)
56

2. (Start with the number 150. Hold it in your head. Add 60. Write your answer.)
210

3. (What is 34 - 5? Write your answer.)
27

4. (Estimate to the nearest hundred.)
299 + 102
300 + 100 = 400

5. (Estimate. Circle the answer.)
71 – 12
50 (60) 70 80

6.
113 - 4 = 109

7. Solve. 304 – 7 = 303

8. What number is in the hundreds place?
1,246 2

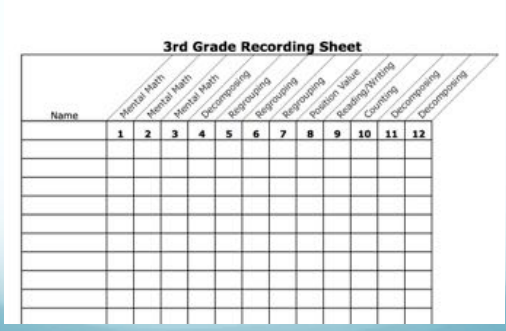
9. Write the number in word form.
624
Six hundred twenty-four

10. Fill in the missing number.
18 + 14 = 22

11. Count by tens.
160, 170, 180, 190, 200, 210

12. Write two addition sentences that equal 450. Do not use 1, or 0 (as a single digit number ex. 450 + 0 = 450).
400 + 50 = 450
390 + 60 = 450

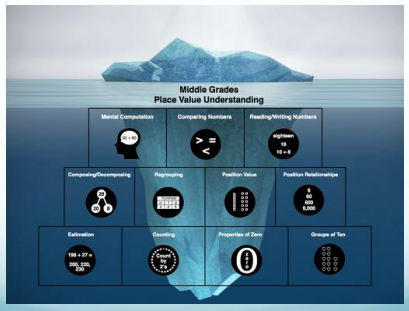
Tracking Results



3rd Grade Recording Sheet

Name	Mental Math	Mental Math	Mental Math	Decomposing	Regrouping	Regrouping	Regrouping	Position Value	Reading/Writing	Counting	Decomposing	Decomposing
	1	2	3	4	5	6	7	8	9	10	11	12

Place Value Iceberg Diagnostic



PV Iceberg Diagnostic

MC2 **Using mental math solve 123,407 + 4,000**. Ask student to explain their answer.

	Response
1	Adds using incorrect place value positions
2	Written algorithm
3	Mentally uses traditional algorithm
4	Uses mental place value or compensation with miscalculation
5	Correct – 127,407 solved mentally

MC2

123,407 + 4,000

CN3-**Tell me a number that would come between 410,000 and 411,000**

	Response
1	Response does not include 4 and 1 in the hundred and ten thousands
2	Response is 412,000
3	Response is greater than 411,000,000
4	Response is less than 410,000,000
5	Response is correct

CN3

410,000 _____ 411,000

Comparing Numbers

Measures understanding of magnitude, order and density

- **Which of these numbers is of the greatest value? Which number is of the least value**?

403,578 401,999 410,000

- **This number line shows the numbers 470 and 490. What number do you think the x represents**? (475)

- **Tell me a number that would come between 410,000 and 411,000**

410,000 _____ 411,000

Comparing Numbers

Mental Math

Mental addition/subtraction of place value positions

- Solve 381 + 100 using mental math.

  81 + 10

- Solve 369 - 10 using mental math.

  369 - 10

- Solve 467 - 100 using mental math.

  467 - 100

- Solve 878 – 5 using mental math.

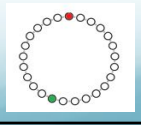
  878-5

Mental Math

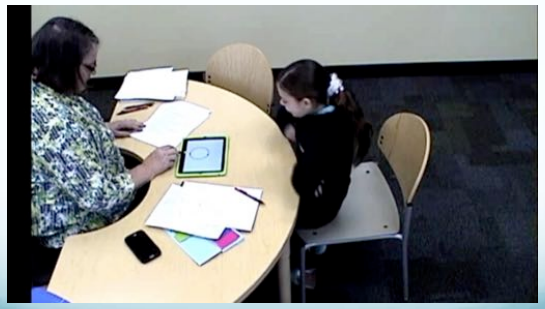
Counting

Counting and skip counting across transitions.

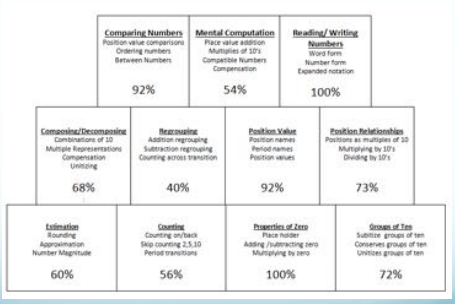
- Imagine the person at the red dot started at 188 and each person in the circle counted by twos to the person with the green dot. Count clockwise around the circle to the person with the green dot.
- This time imagine the person at the red dot started at 270 and each person in the circle counted by tens to the person with the green dot.
- This time imagine the person at the red dot started at 106 and each person in the circle counts backward by ones to the person with the green dot.



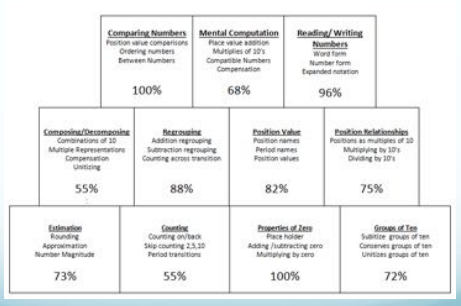
Counting



What Do They Need?



What Do They Need?



Intervention Session Format

- Assessment Monitor
- Short Teaching Strand
- Follow-up Activity

Got It!

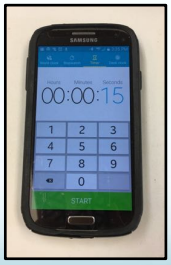
- Comparing numbers

Box Top Multiples

- Mental Math

Cell Phone Pass

- Counting

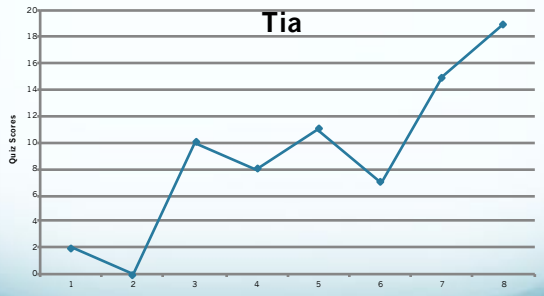


Monitoring

Tia

Difficulties with Mental Math

Monitoring



Alisha

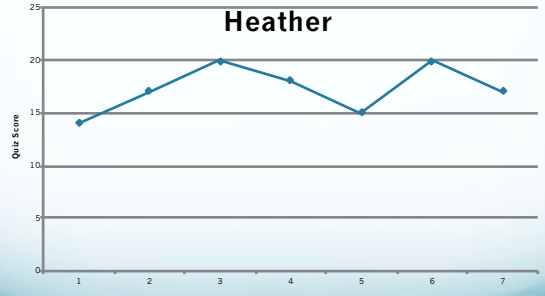
Reading and Writing Numbers

Monitoring

Heather

Composing and Decomposing Numbers

Monitoring



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Diagnostic Assessments

https://sites.google.com/site/mathwomanproject/innov8-16