DATA BASED DECISION MAKING IN THE RTI PROCESS: WEBINAR #3 RATE OF IMPROVEMENT & GAP ANALYSIS

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NYS RtI TAC

Agenda

- Key Decisions When Analyzing Universal Screening Data
  - Key Decisions When Analyzing Progress Monitoring Data
  - Basic Concepts of Rate of Improvement
  - Calculating Rate of Improvement
  - Conducting a Gap Analysis
  - Progress Monitoring ROI
  - Interpreting Progress Monitoring Data

General Strengths of CBM for Progress Monitoring

- Measures are generally short and efficient (1 minute for Reading individually administered, 8 minutes for math that can be group administered)

- Reading is General Outcome Measure, cuts across reading skills, strong correlations to state assessments

- Measures remain sensitive to growth within grades across the year

CBM is NOT only Measure for Progress Monitoring

- Concepts of Rate of Improvement apply to all monitoring measures
- Nature of calculations and specifics may need to be adapted for different measures
- Measures that provide growth rates can be used for ROI calculation and determination

Why ROI?

- RTI is about identifying whether a student responds or does not respond to instruction and intervention

- Key assumption – fidelity of core instruction and intervention must be strong for ROI to have meaning

- Requires determining a student's **Rate** of Response to Instruction and Intervention

- Determining Response involves two key items against peer expectations:
  - How LOW?
  - How SLOW?

How Low? How Slow?

- How Low = Level
  - How different is the student from their peers in terms of reaching the expected **benchmark scores**?
- Benchmark Scores
  - Cut scores that mark predicted low risk category
  - Represent the **minimum** score students should achieve
  - National vs local benchmarks
- How Slow = Growth
  - How different is the students's RATE of growth compared to what is expected for peers who grow at **benchmark rates?**

Key Resource

- Introduce key resource
  - http://rateofimprovement.com/roi/

Grade 2- How Slow? Or Benchmark Rate of Improvement (ROI)

- How Slow?
  - How different is the student from their peers in terms of the **Rate of Improvement** for expected **benchmark scores**?
  - How different is the student from their peers in terms of the **Rate of Improvement** for **progress monitoring** scores?
- ROI = Change Over Time

Grade 2 Student – How Low?
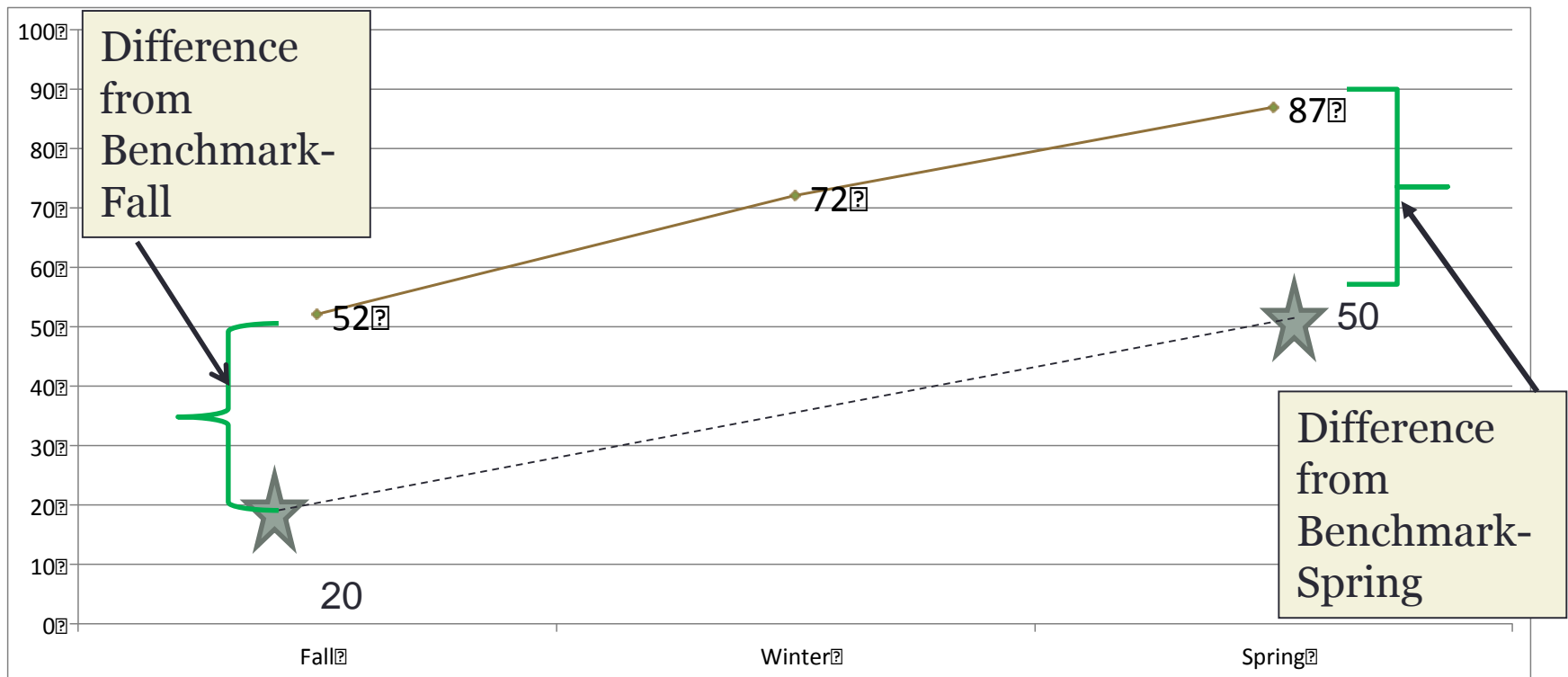
Key Terms in ROI

- TYPICAL Rate of Improvement (ROI)
  - Expected rate of progress of students from benchmark to benchmark

- TARGET Rate of Improvement
  - Rate of improvement of from the starting point of the student below benchmark to the next benchmark point

- ATTAINED Rate of Improvement
  - Rate of improvement (slope) actually attained by the student in progress monitoring

ROI Benchmark Calculations

- Benchmark Scores (DIBELS Next) – Grade 2
  - Typical ROI
    - From 52 to 87 in 36 weeks = (87 – 52)/36 = 0.97 wcpm/week
  - Target ROI
    - From 20 to 87 in 36 weeks = (87 – 20)/36 = 1.86 wcpm/wk
  - Attained ROI
    - From 20 to 50 in 36 weeks = (50 – 20)/36 = 0.83 wcpm/week
- DIBELS Next ROI
- AIMSweb ROI

DIBELS Next ROI

DIBELS Next benchmarks & ROI (ROI based on 18 weeks between benchmarks, 36 total weeks)

Measure	Fall	Winter (Fall-Win ROI)	Spring (Win-Spr ROI)	Total Year ROI
K-FSF	10	30 (1.1)	N/A	N/A
K-PSF	0	20 (1.1)	40 (1.1)	1.11
K-NWF	0	17 (.9)	28 (.6)	0.78
1 – NWF (CLS)	27	43 (.9)	58 (.8)	0.86
1 - ORF	0	23 (1.3)	47 (1.3)	1.31
2 - ORF	52	72 (1.1)	87 (.8)	0.97
3 – ORF	70	86 (.9)	100 (.8)	0.83
4 - ORF	90	103 (.7)	115 (.7)	0.69
5 – ORF	111	120 (.5)	130 (.6)	0.53
6 – ORF	107	109 (.1)	120 (.6)	0.36

AIMSweb ROI

AIMSweb® National Norms Table

Reading - Curriculum Based Measurement

Grade	%ile	Fall		Winter		Spring		Group ROI
		Num	WRC	Num	WRC	Num	WRC	
2	90		115		140		156	1.14
	75		88		115		131	1.19
	50		62		88		106	1.22
	25	38282	35	38282	64	38282	82	1.31
	10		17		39		59	1.17
	Mean		64		90		106	1.17
	StdDev		37		38		38	0.03
3	90		143		162		179	1.00
	75		116		139		152	1.00
	50		87		111		127	1.11
	25	40570	59	40570	84	40570	98	1.08
	10		38		56		73	0.97
	Mean		89		110		125	1.00
	StdDev		40		41		42	0.06
4	90		160		178		196	1.00
	75		134		152		168	0.94
	50		107		125		139	0.89
	25	37320	84	37320	101	37320	112	0.78
	10		61		78		90	0.81
	Mean		109		126		140	0.86
	StdDev		39		40		42	0.08

Num = Number of Students **WRC** = Words Read Correct **ROI** = Rate Of Improvement
ROI is Spring Score minus Fall Score (or Winter minus Fall) divided by 36 weeks (or 18 weeks)

User norms will be used when national norms are unavailable.

Grade 2 Student – How Slow? Benchmark ROI

Typical Benchmark ROI = 0.97 wcpm/wk

Difference from Benchmark-Spring

Difference from Benchmark-Fall

Target Benchmark ROI = 1.86 wcpm/wk

Attained Benchmark ROI = 0.83 wcpm/wk

87

72

52

50

20

Fall   Winter   Spring
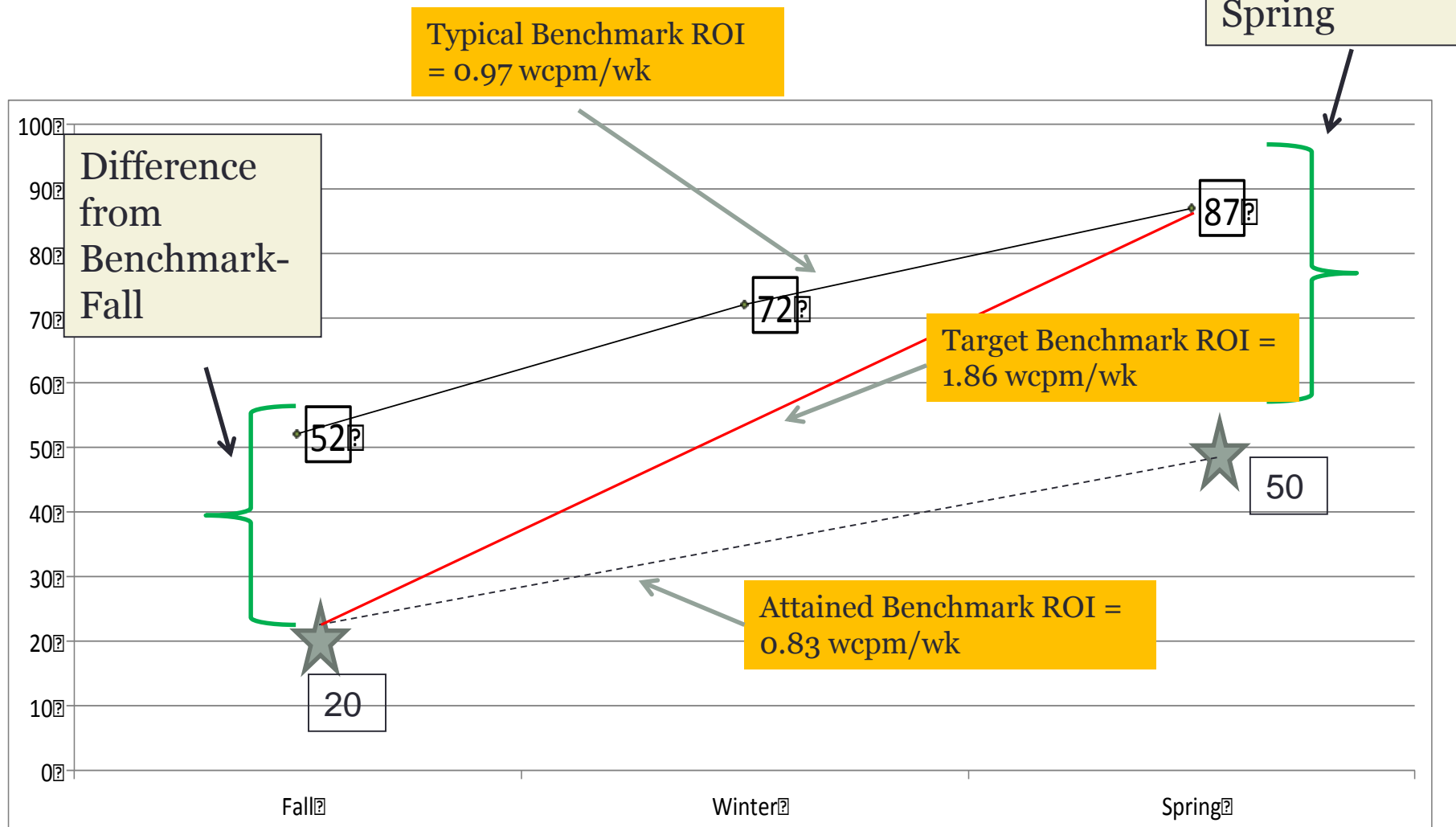
Benchmark ROI Interpretation
Gap Analysis

- Student needs to move at a rate faster than typical student's rate to close the gap.

- Student is moving at a rate about 20% slower than typical students rate.

- Gap between the student and what is expected has gotten larger, student is NOT responding to instruction and intervention.

Gap Analysis

- Simple quantitative way to describe how low and how slow.
- Discrepancy between expected and attained performance translated into empirical value
  - Divide performance at point of referral to the expected benchmark performance of same age/grade peers
  - Can be done for both benchmark assessments and rate of improvement

Not
Discrepant

Toward SLD
Determination

1.0

?? Critical
Value?
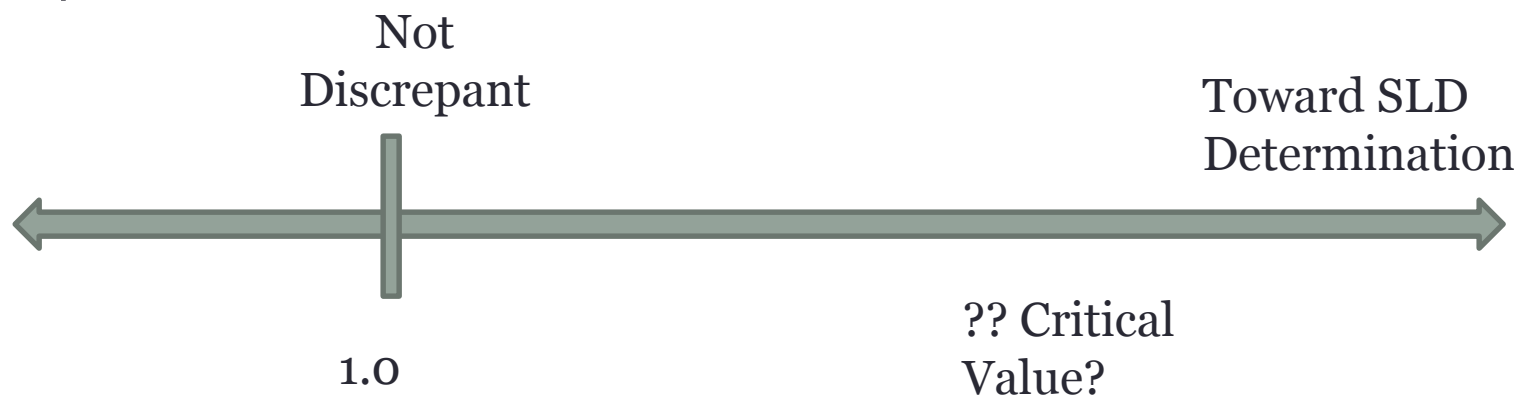
Example- Calculate Benchmark ROI

- Grade 3 DIBELS Next Benchmark

Fall	70
Winter	86
Spring	100

- Grade 3 Attained Scores

Fall	40
Winter	56
Spring	71

- Calculate Typical ROI, Target ROI, Attained ROI
  - Fall to Spring

Results- Benchmark ROI

- Typical ROI
 - Fall to Spring   (100 –70)/36 = 0.83 wcpm/wk
- Target
  - Fall to Spring   (100 –40)/36 = 1.67 wcpm/wk
- Attained ROI
  - Fall to Spring   (71 – 40)/36 = 0.86 wcpm/wk

- Student moving at slightly higher rate as peers but at low level.
- Student NOT closing the gap between themselves and peers.

Graphic Results

Typical Benchmark
Fall to Spring ROI = 0.83 wcpm/wk

Attained Benchmark
Fall to Spring = 0.86 wcpm

Target Benchmark
Fall to Spring = 1.67 wcpm
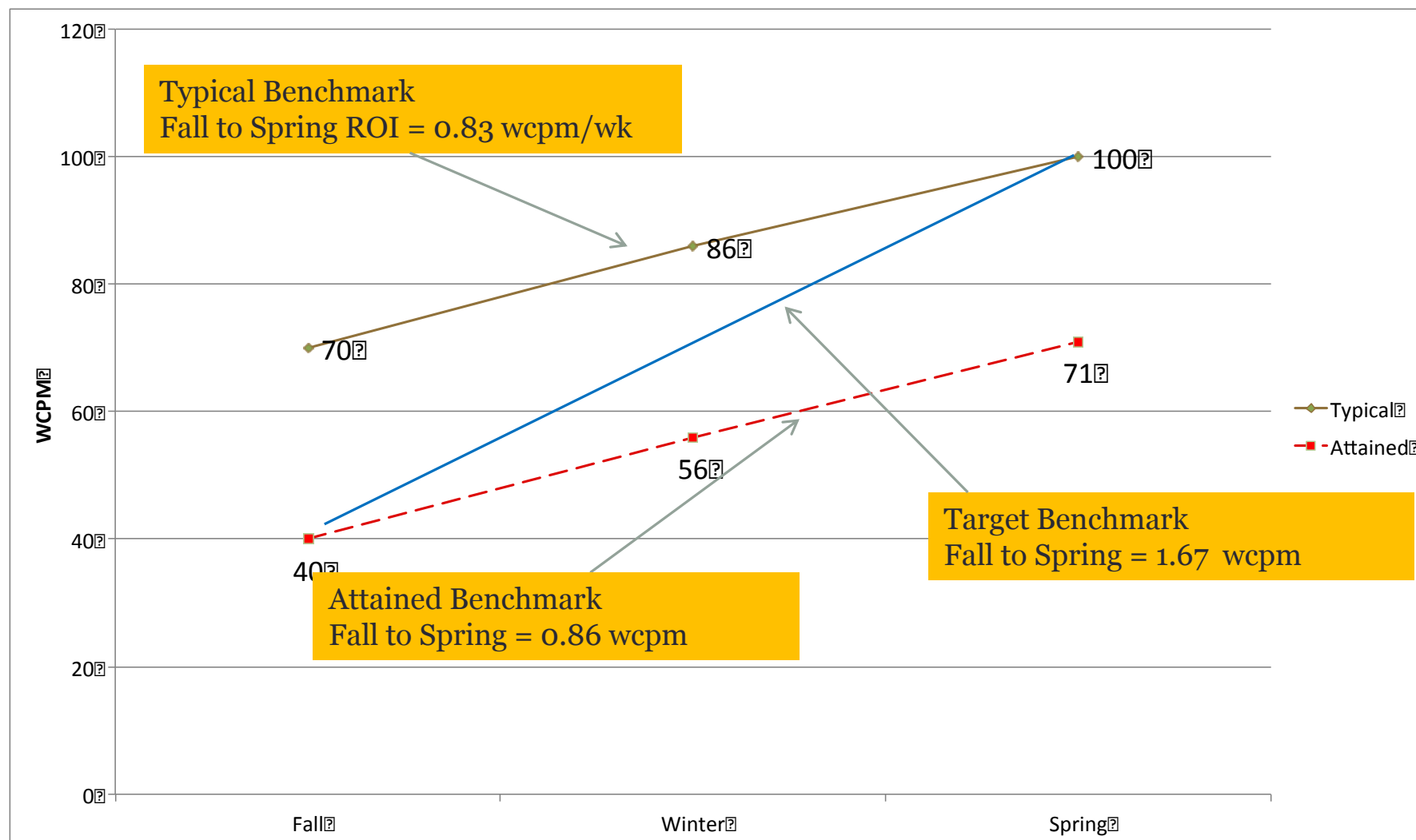
Worksheet - Discrepancy of Gap Analysis

DIBELS Next Benchmarks for 4th grade

    Fall =

    Winter =

    Spring =

Student's Scores on Benchmark Assessment Probes

    Fall =

    Winter =

    Spring =

<u>Typical F- Sp ROI =</u>   <u>Target F - Sp ROI =</u>   <u>Attained F-Sp ROI =</u>

Calculation	Gr 4	Answers
Level Discrepancy Analysis (How low?) (winter data) Performance Against Typical	Discrepancy = Benchmark /Attained % Expected Performance = 100 - (((Benchmark - Attained) / Benchmark) * 100)	_____ _____
ROI Benchmark Discrepancy Analysis (How slow?) Rate Against Target (did the gap close?)	Discrepancy = Targeted ROI/Attained ROI % targeted growth = 100 - [Targeted ROI–Attained ROI/Targeted ROI]	_____ _____
ROI Discrepancy Analysis- (How slow?) Against Typical (did the gap close)	Discrepancy = Typical ROI/Attained ROI % typical growth = 100 - [Typical ROI–Attained ROI/Targeted ROI]	_____ _____

Worked Example - Discrepancy of Gap Analysis

DIBELS Next Benchmarks for 3rd grade
 Fall = 70
 Winter = 86
 Spring = 100

Student's Scores on Benchmark Assessment Probes
 Fall = 40
 Winter = 56
 Spring = 71

Typical F-Sp ROI = 0.83   Target F-Sp ROI = 1.67   Attained F-Sp ROI = 0.86

Calculation	Gr 3	Answers
Level Discrepancy Analysis (How low?)	Discrepancy = Benchmark /Attained	**(May Data) 100 / 71 = 1.41**
Performance Against Typical	% Expected Performance =% Expected Performance = 100 - (((Benchmark - Attained) / Benchmark) * 100)	**100 - (((100 - 71) / 100) * 100) = 71%**
ROI Benchmark Discrepancy Analysis (How slow?)	Discrepancy = Targeted ROI/Attained ROI	1.67 / 0.86 = **1.94**
Rate Against Target (did the gap close?)	% Targeted Growth = 100 - (((Target ROI - Attained ROI) / Target ROI) * 100)	100 - (((1.67 - 0.86) / 1.67) * 100) = **51.5%**
ROI Discrepancy Analysis- (How slow?)	Discrepancy = Typical ROI/Attained ROI	.83 / 0.86 = **0.97x**
Against Typical (did the gap close)	% Typical Growth = 100 - (((Typical ROI - Attained ROI) / (Typical ROI) * 100)	100 - (((0.83 - 0.86) / (0.83) * 100) = **103.6%**

Interpretation of Worked Example

- How LOW?
  - Against expected grade level benchmarks, performing at end of the year 1.4x under expectations, or 71% of the performance expected by grade level peers
- How SLOW? (Catch Up Growth)
  - Against TARGETED GROWTH over the year to close the gap against grade level peers, remained 1.94x behind expected growth or made 51.5% of expected growth
- How SLOW? (Actual Growth)
  - Against growth of TYPICAL grade level peers, grew at rate slightly faster than peers, or 103.6% of typical performing peers
- Conclusions
  - Although student is growing at a good pace for second graders, his catch up growth remains substantially behind what would be desired.

Gap Analysis

- Discrepancy between expected and attained performance translated into empirical value

Not
Discrepant

Toward SLD
Determination

1.0

?? Critical
Value?

Interpretation Example

Is the student's progress slow?	Core Only	Core + Up to 20 minutes *(Classroom Based Flexible Groups – Tier 1*	Core + Up to 45 Minutes of Supplemental Intervention *(Standard Protocol – Tier 2)*	Core + 45 Minutes of Supplemental Intervention *(Standard Protocol – Tier 3)*
More than 150% of expected rate of growth				
110 – 150% of expected rate of growth				Possibly MDE (See below**)
95 – 110% of expected rate of growth				Consider MDE
81 – 95% of expected rate of growth	May Need More Support	May Need More Support	May Need More Support	Consider MDE
80% or less of expected rate of growth	Needs More		Needs More	Consider MDE
	Needs More		Needs More	Consider MDE

Progress Monitoring in RtI

- Key to data based decision making

- Use PM data as basis for continue tiered instruction, increase goals, change instruction

- Use PM data as basis for potential consideration down the road for eligibility decisions

Key Terms in ROI Progress Monitoring

- TYPICAL Rate of Improvement
  - Expected rate of progress of students from benchmark to benchmark
- TARGET Rate of Improvement
  - Rate of improvement from the starting point of the student's benchmark to the next benchmark point
- ATTAINED Rate of Improvement
  - Rate of improvement (slope) actually attained by the student in progress monitoring

Calculating ATTAINED ROI for Progress Monitoring

- Three Main Ways to calculate
  - Two point ROI
  - Modified two point ROI
  - Ordinary Least Squares (OLS) calculation

Two Point Attained ROI Calculation

- Similar to Benchmark ROI
- Use the starting and ending point of the data set
- Use the number of weeks across which progress monitoring is collected
- Example –Note that student scores on Benchmark Assessment Probes are being used here as starting and ending points
  - Ending point = 92
  - Starting point= 37
  - ROI = 92 – 37/36 weeks = 1.53
- Tool Available
  - Iris Vanderbilt Slope Calculator

What does it look like graphically?
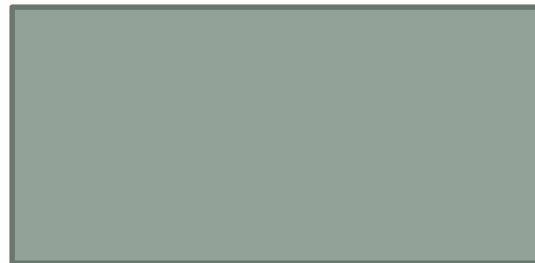
Dynamic Indicators of Basic Early Literacy Skills
Progress Monitoring Graphs
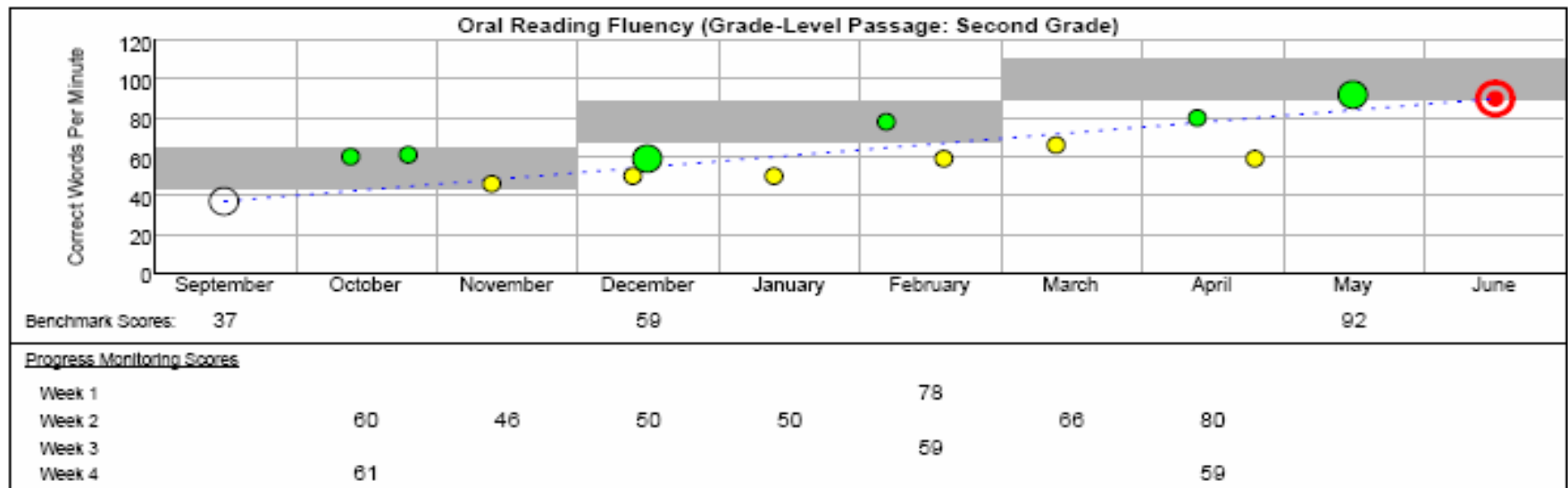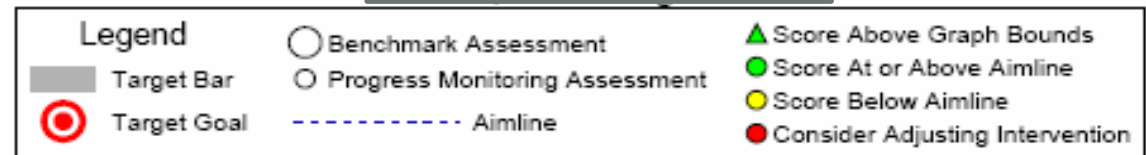
# Advantage/Disadvantage with Two Points Attained ROI Calculation

Advantages

- Simple to calculate
  - By calculator
  - Use of Slope calculator
- Easy to understand

Disadvantages

- Very vulnerable to single outliers
  - If last data point was 60 instead of 92, ROI would be =0.7
  - "End of school year drop"
  - If first data point was 60 instead of 37, ROI would be = 0.9
  - "Beginning of school year motivation"
- Does not account for entire set of PM data
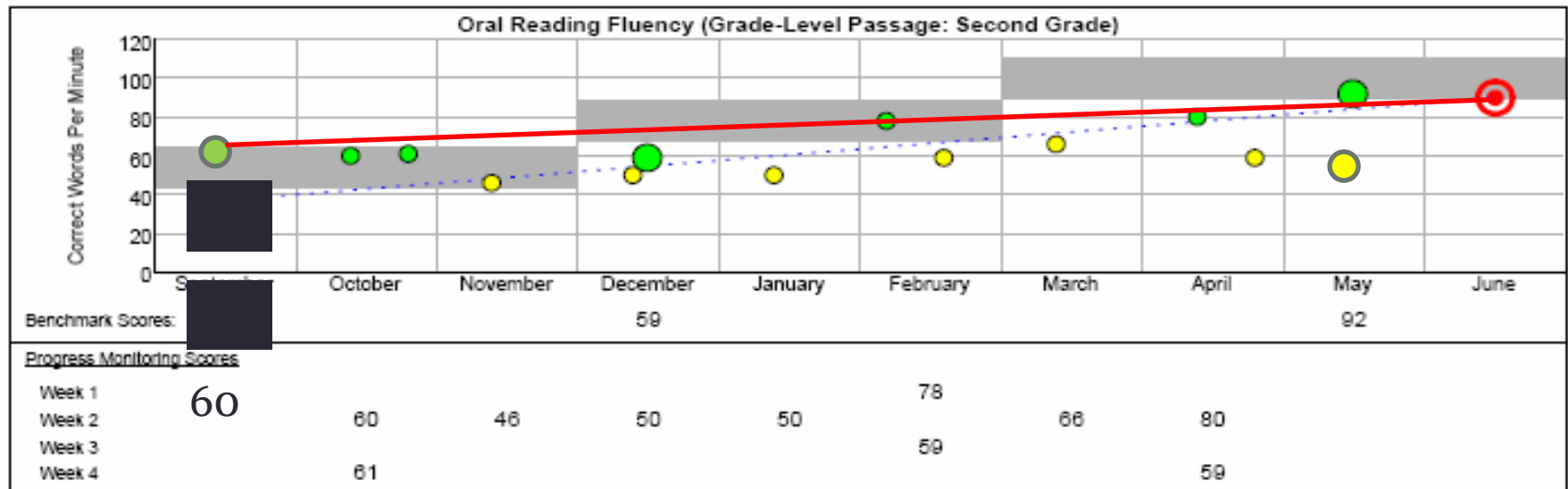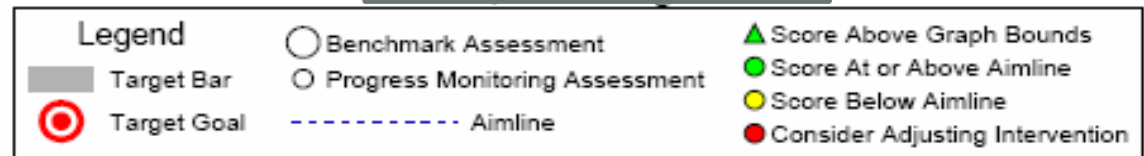- May prefer a more precise method high stakes diagnostic decision making

Outlier Data Point at End
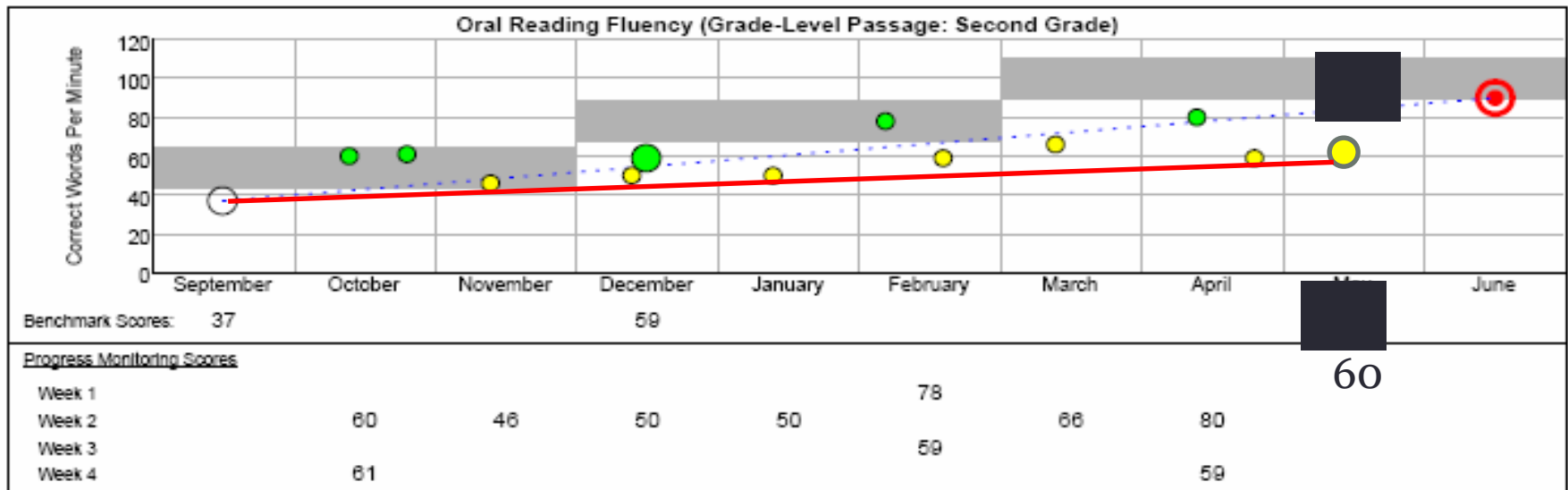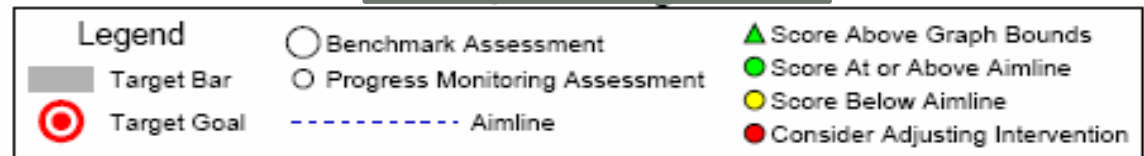
Outlier Data Point at Beginning

Dynamic Indicators of Basic Early Literacy Skills
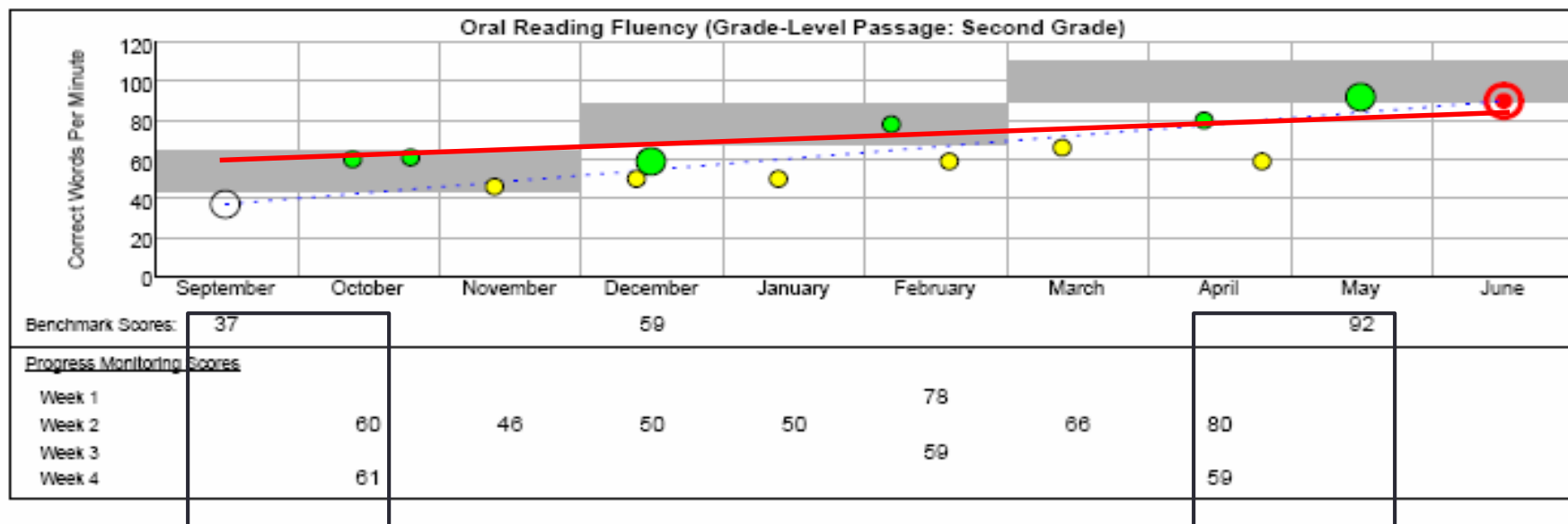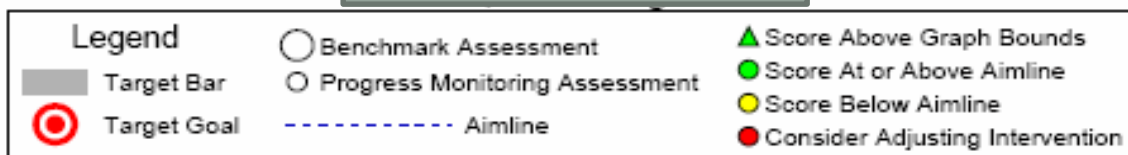Progress Monitoring Graphs

Modified Two Point Solution

- Use MEDIAN (Middle) score first 3 data points
- Use MEDIAN (Middle) score last 3 data points
- Calculate the two point ROI
  - Median first 3 = 60
  - Median last 3 = 80
  - ROI = 80- 60/36 = 0.6

What does it look like graphically?

Dynamic Indicators of Basic Early Literacy Skills
Progress Monitoring Graphs

Legend
○ Benchmark Assessment
○ Progress Monitoring Assessment
▲ Score Above Graph Bounds
● Score At or Above Aimline
○ Score Below Aimline
● Consider Adjusting Intervention
Target Bar
◉ Target Goal
------- Aimline

Oral Reading Fluency (Grade-Level Passage: Second Grade)

| Benchmark Scores: | 37 | | | 59 | | | | | | 92 |

Progress Monitoring Scores									
Week 1						78			
Week 2	60	46		50	50		66	80	
Week 3						59			
Week 4	61							59	

Median = 60

Median = 80

Advantage/Disadvantage with Modified Two Point Attained ROI Calculation

Advantages

- Controls for outliers at beginning of year
- Controls for outliers at end of year
- Simple to calculate
- Use of slope calculator

Disadvantage

- Does not take into account the entire set of PM data
- May prefer a more precise method high stakes diagnostic decision making

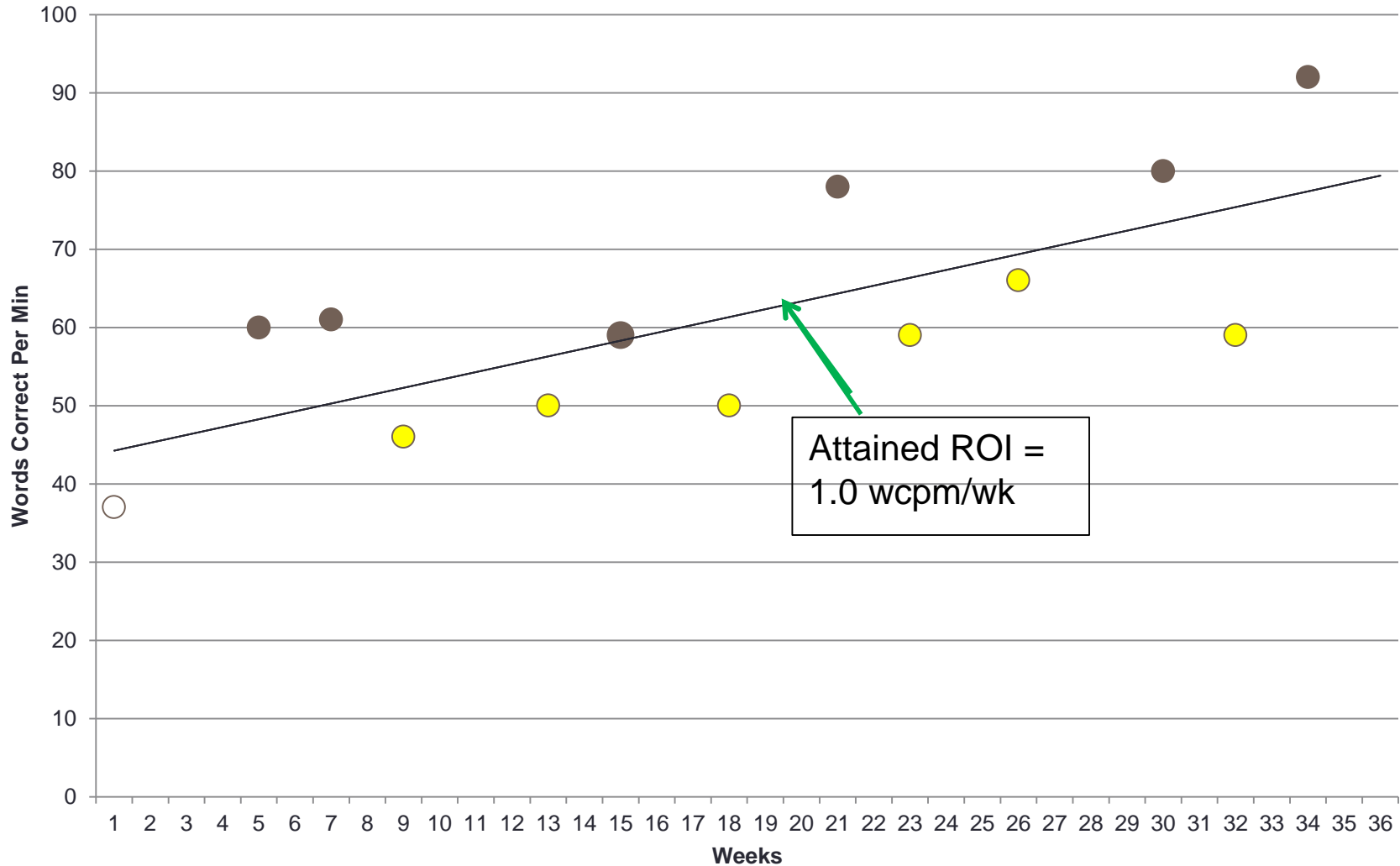# Ordinary Least Squares (OLS) Attained ROI Calculation

- Uses linear regression
  - Mathematical process for establishing the straight line that cuts through all the data points
  - Establishes the LINEAR TREND in the data
- Takes into account ALL data points in the series
- Requires mathematical calculation best left to software to do!
- Some commercial software (AIMSweb) does it for you.
- Some commercial software (DIBELS) gives you the ability to do it.
- EXCEL can do it! (But you need a moderate level of EXCEL comfort level)
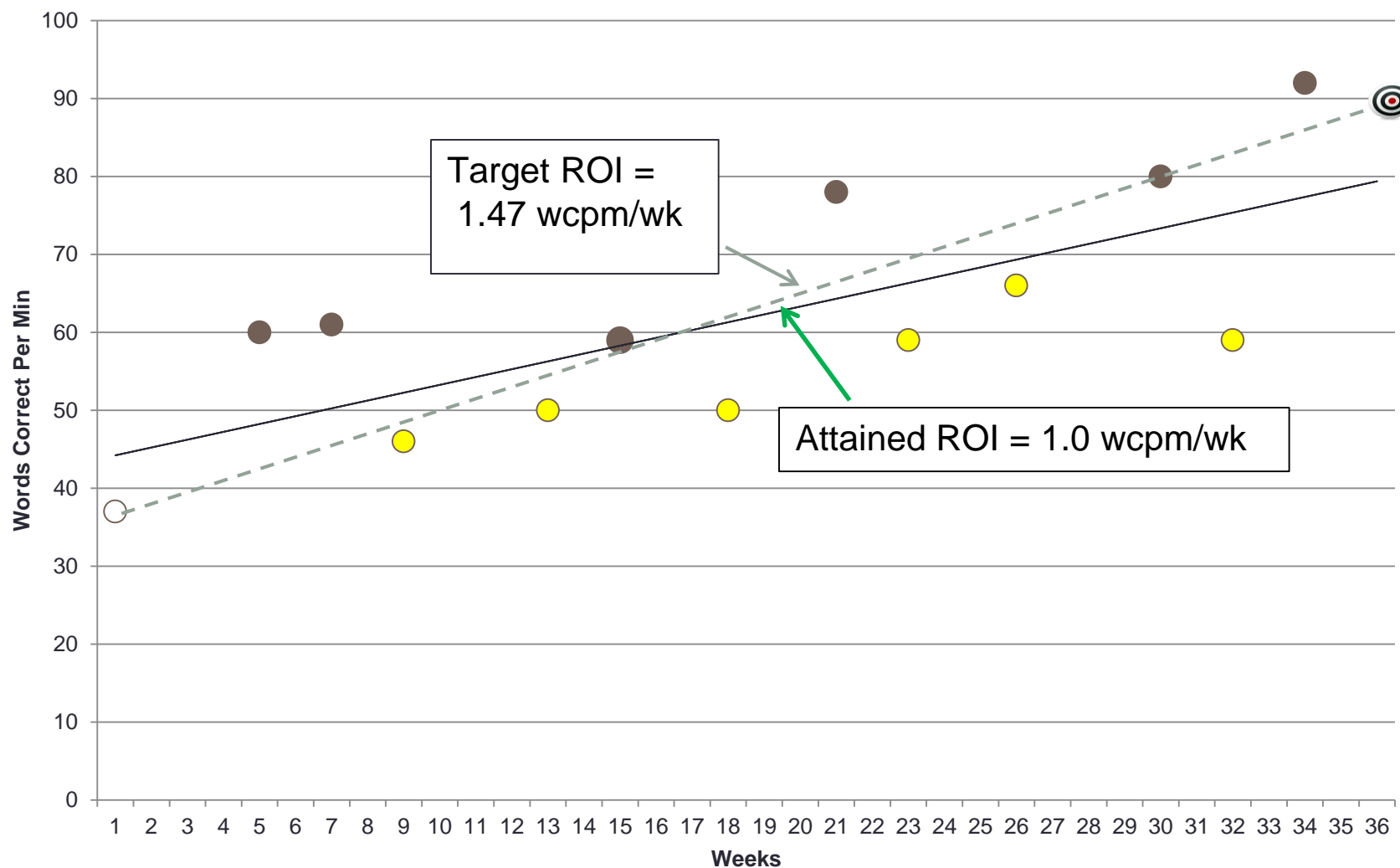
OLS Calculation of Attained ROI

- Spreadsheet must be set up to do this
- Demonstration here is with an established spreadsheet using the same DIBELS data
- Demonstrate using spreadsheet
    - $y = bx + a$

      Rate of Improvement
      (Slope)

- Excellent resource for OLS Calculation
    - Caitlin Flinn, Andrew McCrae, Mathew Ferchalk
    - Rate of Improvement

OLS Calculation with DIBELS Data

Attained ROI = 1.0 wcpm/wk

OLS Calculation with DIBELS Data

Target ROI = 1.47 wcpm/wk

Attained ROI = 1.0 wcpm/wk

Words Correct Per Min

Weeks

Let's Compare Calculations

- Typical ROI = 90-44/36 = 1.28
- Targeted ROI = 90 – 37/36= 1.47
- Attained ROI
  - Two Point Calculation = 1.53
  - Modified Two Point Calculation = 0.56
  - OLS Calculation = 1.00
- Different approaches result in different outcomes
- Recommended approach in literature is OLS

Interpreting Progress Monitoring Data

How Many Data Points?

- 10 data points are a minimum requirement for a reliable trendline (Gall & Gall, 2007)

- 7-8 is minimum for using the Tukey Method (Wright, 1992)

- 8-9 for stable slopes of progress in early writing (McMaster, 2011)

- Take-away: The more data points the more stable the slope (Christ, 2006; Hintze & Christ, 2004)

Results Summary

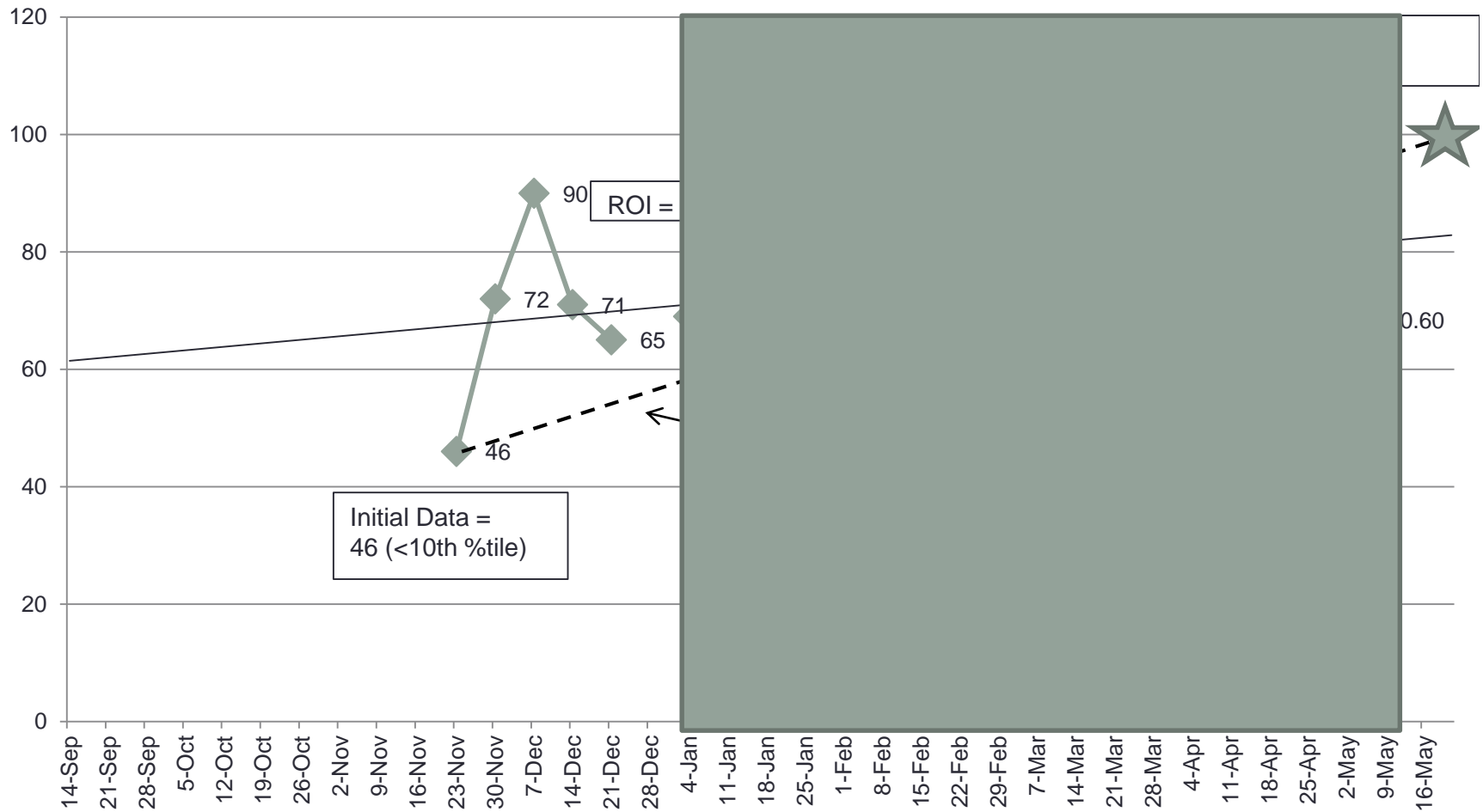| Dataset Quality Residual (ε_{ij}) =	Very Good 5							Good 10						
CBMs-R per Occasion	3	3	1	1	3	3	1	3	3	1	1	3	3	1
Schedule of Occasions	Pre-Post Mean	1 per month	1 per week	3x per week	1 per week	2x per week	5x per week	Pre-Post Mean	1 per month	1 per week	3x per week	1 per week	2x per week	5x per week
Number of Weeks[a]														
2														
4														
6[a]						○	○							
8				◐	◐	●	●						○	○
10[a]	◐	◐	◐	●	●	●	●						◐	◐
12	◐		◐	●	●	●	●				◐	◐	◐(pink)	◐(pink)
14[a]	◐(pink)	●	●	●	●	●	●			○	◐(pink)	◐(pink)	●	●
16	●		●	●	●	●	●			◐	●	●	●	●
18[a]	●	●	●	●	●	●	●	◐	◐	◐	●	●	●	●
20	●		●	●	●	●	●	◐		◐(pink)	●	●	●	●

Legend:

- (blank) Does not meet criteria
- ○ AUC .85 or above
- ◐ AUC .85 or above + Validity .70 or above
- ◐(pink) AUC .85 or above + Validity .70 or above + Reliability .70 or above
- ● AUC .85 or above + Validity .70 or above + Reliability .70 or above + RMSE .35 or below

Standard Error – Interpreting Trend

- All measures have error
- Change in performance over time must be interpreted by considering error
- If change from one point to next is within error, no big deal
- If change from one point to next is larger than error, need to check whether change is "real" or "accidental"
  - Easier or harder passage than one before
  - Student was physically ill
  - Student just clicked away on the computer
- CBM ORF SEM = 10 wcpm (range 5-15)
  - Christ, T. J.; Silberglitt, B., (2007) School Psychology Review, 36(1), 130-146.
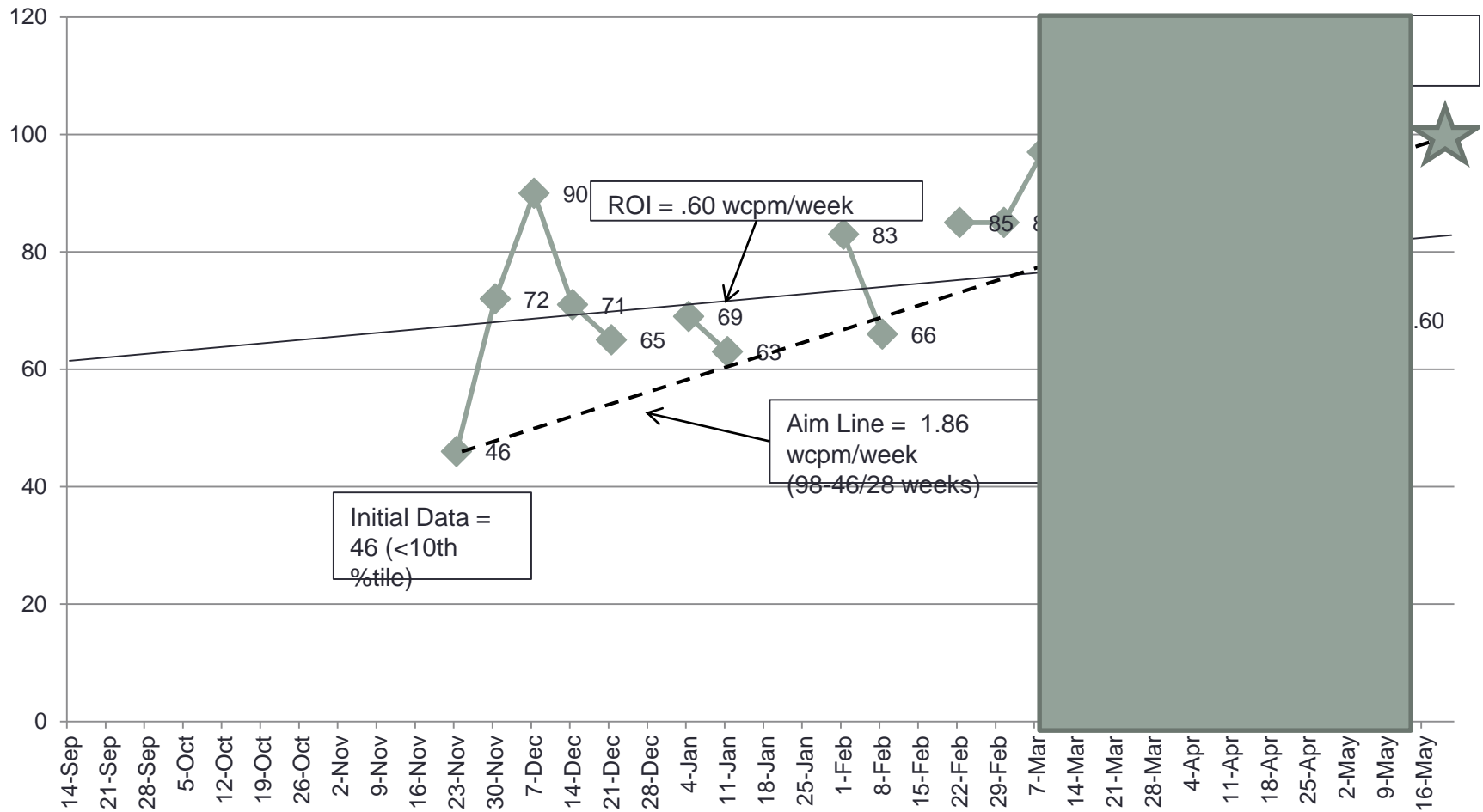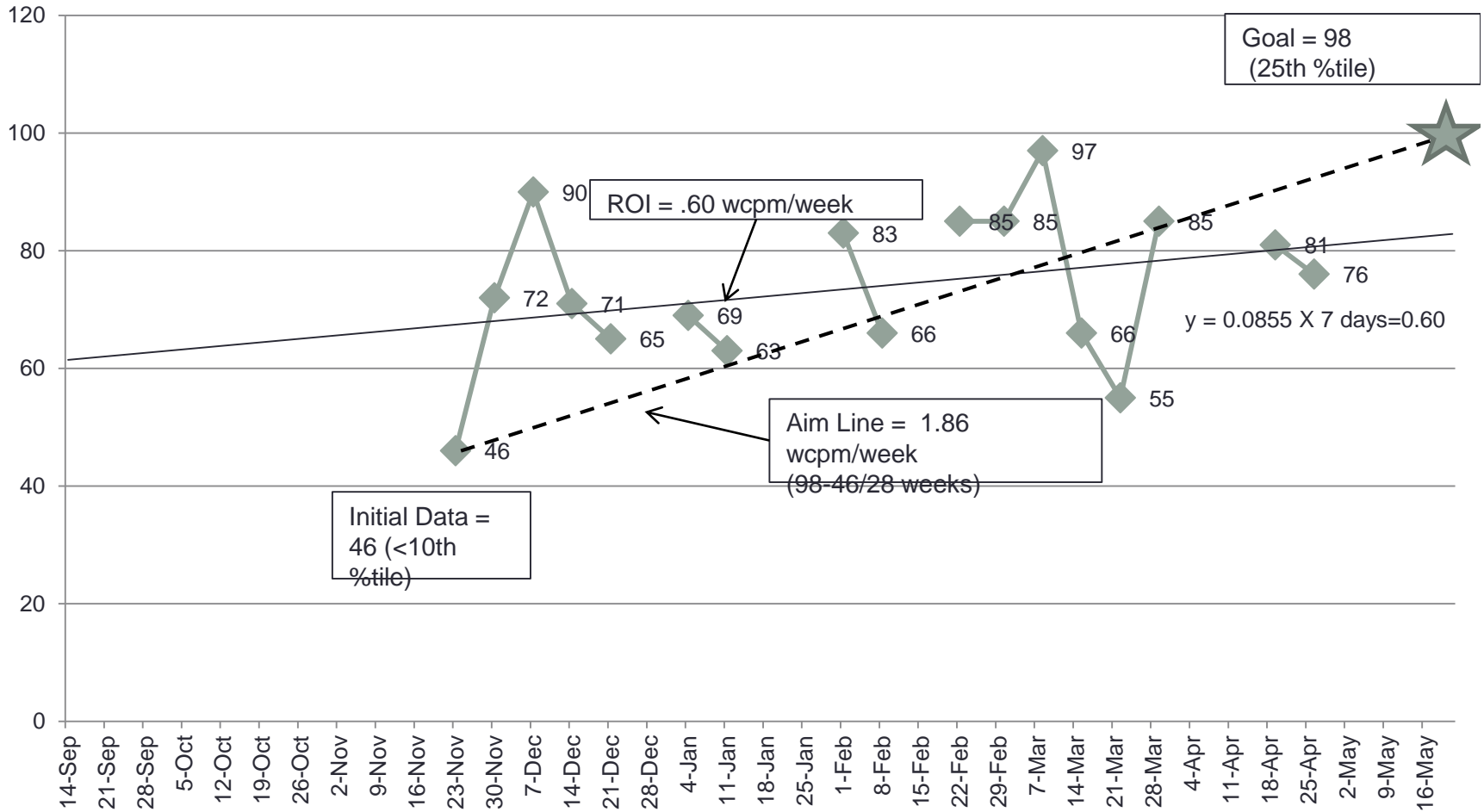
Grade 2= Real or Error?
SEM = 10

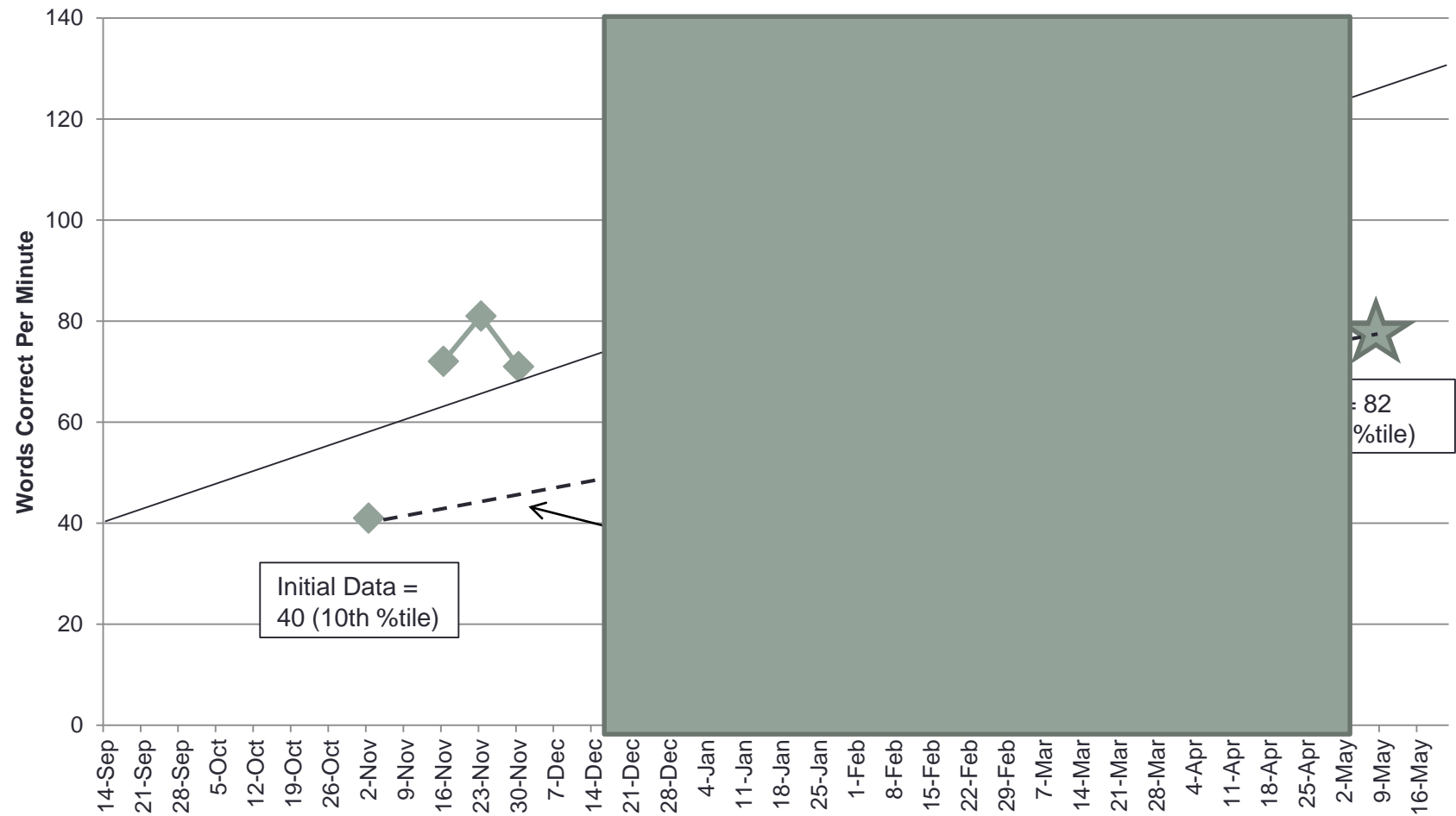Chart showing assessment scores from 14-Sep to 16-May. Y-axis ranges from 0 to 120. Data points: 46 (23-Nov), 72 (30-Nov), 90 (7-Dec), 71 (14-Dec), 65 (21-Dec). A star marker near 100 at 16-May. Labels: "ROI =", "0.60", "Initial Data = 46 (<10th %tile)".

Grade 2= Real or Error?
SEM = 10

Chart showing reading progress monitoring data. Y-axis ranges from 0 to 120. X-axis shows weekly dates from 14-Sep to 16-May. Data points: 46, 72, 90, 71, 65, 69, 63, 83, 66, 85, 85, 97.

ROI = .60 wcpm/week

Aim Line = 1.86 wcpm/week (98-46/28 weeks)

Initial Data = 46 (<10th %tile)

Grade 2= RCBM PM Example

Goal = 98
(25th %tile)

ROI = .60 wcpm/week

y = 0.0855 X 7 days=0.60

Aim Line = 1.86
wcpm/week
(98-46/28 weeks)

Initial Data =
46 (<10th
%tile)

Data points: 46, 72, 90, 71, 65, 69, 63, 83, 66, 85, 85, 97, 66, 55, 85, 85, 81, 76

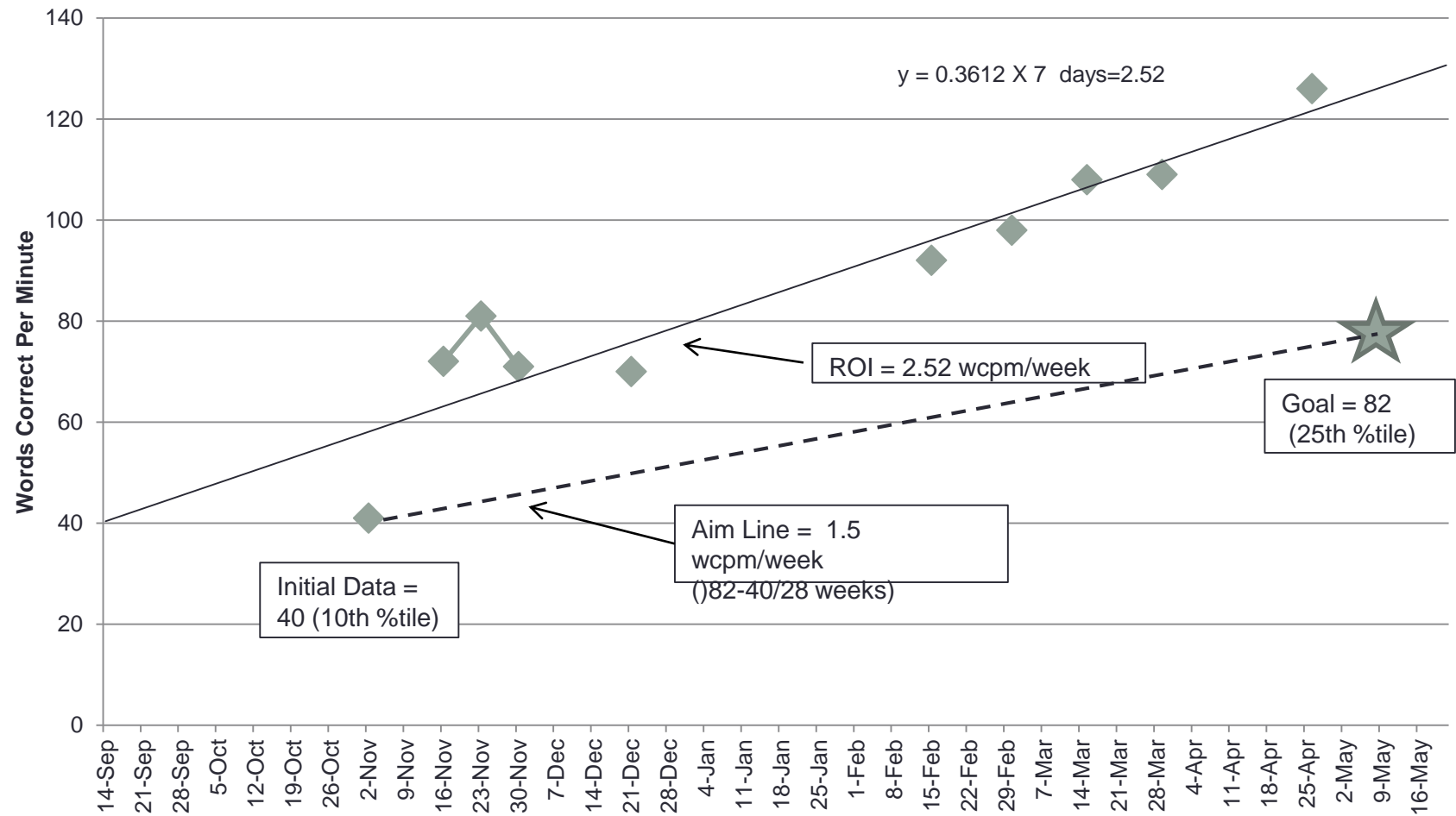# Grade 3 – Real or Error?
SEM = 10

Initial Data =
40 (10th %tile)

= 82
%tile)

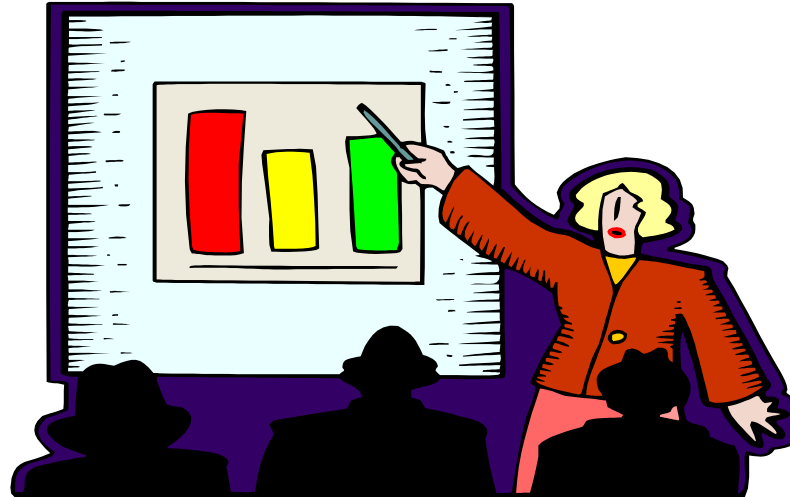# Grade 3 – Real or Error?
SEM = 10

Guidelines for Decision Making

- Examples from one school district
- Used to guide decisions toward evaluation consideration

Incorporating Discussion of ROI into Tier Movement

- [Schools in NY have developed decision rules regarding tier movement](#)

End day 3

- Next Webinar- Monday, January 12, 2015 4 – 5:30 pm

- Practical Suggestions for Using Data Based Decision Making in Your School
- Q & A with participants