



TECHNICAL REPORT #19:

Reading Aloud, Word Identification, and Maze Selection
as Growth Measures: A Comparison of Slopes Derived
from Different Data Collection Schedules

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Note: Data set and data collection procedures are the same for Technical Reports #17, #18, #19, and #20.

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The purpose of this study was to compare the technical adequacy of single weekly CBM scores and different combinations of weekly CBM scores. The following research question was examined: Does combining scores across weekly administrations produce stronger reliability/validity coefficients than single weekly scores?

Method

The participants, setting, CBM measures, and procedures are the same as found in Technical Reports #17, #18, #19, and #20. See Technical Report #17 for complete details on participants, setting, CBM measures, and procedures.

Analysis

For all analyses, students in Grade 2 ($n = 10$) were included in the same group as students in Grade 3 group and students in Grade 4 ($n = 6$) were included in the same group as students in Grade 5. This decision was made based on the fact that there were two classrooms that combined grade levels (one Grade 2/3 split and one Grade 4/5 split) and the classroom teachers reported that there was no differentiation in reading instruction based on grade level within the classroom. Students in Grade 2 were receiving the same reading instruction as students in Grade 3 and students in Grade 4 were receiving the same reading instruction as students in Grade 5.

The ordinary least squares (OLS) based on each student's CBM score was used to calculate slopes and standard error of slopes (SEb) across weekly administration. The first step in analyzing data was to combine scores across consecutive weeks (e.g. add week 1 and week 2, week 3 and week 4, etc.). The second step was to employ a linear regression model to calculate slopes for combined scores and single scores. Finally, we compared the slopes of the combined scores to the slopes of the single scores. SPSS 13.0 was used for all analyses.

Results

Comparison of Slopes Derived from Combined Weekly Scores (Wks 1-2, Wks 3-4, Wks 5-6, etc) and single scores (Wks 1-12)

Table 1 shows the slopes of the combined scores and single scores for reading aloud at each grade level. Regardless of using combined scores or single scores, all slopes were significantly different from zero at each grade level. However, for Grades 2/3, the estimated slope of the combined scores was negative and the estimated slope of the single scores was positive. The opposite trend occurred for students in Grade 9. The estimated slope of the combined scores was positive and the estimated slope of the single scores was negative.

Table 1. Slope of combined scores and single scores for reading aloud

Weeks	Grade 1			Grade 2/3			Grade 4/5			Grade 9		
	Mean	SD	t	Mean	SD	t	Mean	SD	t	Mean	SD	T
Combi ned Scores	1.72	0.78	2.18*	-1.57	0.72	2.17*	6.28	0.84	7.45** *	2.84	0.96	2.95**
Single scores	1.26	0.20	6.32***	0.86	0.14	5.90***	1.32	0.16	7.95** *	-1.88	0.19	9.92***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Table 2 shows the slopes of the combined scores and single scores for maze selection at each grade level. Regardless of using combined scores or single scores, all slopes were significantly different from zero at each grade level. The estimated slope from combined scores was greater than the estimated slope from the single scores.

Table 2. Slope of combined scores and single scores for maze

Weeks	Grade 1			Grade 2/3			Grade 4/5			Grade 9		
	Mean	SD	t	Mean	SD	T	Mea n	SD	t	Mean	SD	T
Combin ed Scores	1.616	0.21	7.68***	1.566	0.20	7.50***	2.422	0.23	10.5***	2.463	0.27	9.09***
Single sc ores	0.415	0.06	6.23***	0.570	0.04	14.0***	0.645	0.05	12.2***	0.365	0.051	7.16***

Note. ***, $p < .001$

Table 3 shows the slopes of the combined scores and single scores for word identification at each grade level. Regardless of using combined scores or single scores, all slopes were significantly different from zero at each grade level. The estimated slope from combined scores was greater than the estimated slope from the single scores.

Table 3. Slope of combined scores and single scores for Word ID

Weeks	Grade 1		
	Mean	SD	t
Combined Scores	3.48	2.32	10.89
Single scores	1.76	1.16	11.07

Correlations between slopes based on data from pre to post measurement with slopes created from weekly measurement.

The second analysis was designed to determine whether slopes using weekly data points were similar to slopes obtained from using the beginning and ending data. To accomplish this, the mean of weeks 1-3 and 10-12 were computed and the straight line slope connecting those two points was computed. The pre to post slope estimates are presented in Tables 4, 5, and 6. The pre to post slopes for reading aloud, maze, and word identification were significantly different from zero. All slopes were positive with the exception of Grade 9 reading aloud. The slope estimates using pre and post scores were greater than the slope estimates using weekly data (i.e., single scores; see Tables 1-3).

Table 4. Mean, SD, and t- test for Slope from Pre and Post mean for Reading Aloud

Weeks	Grade 1			Grade 2/3			Grade 4/5			Grade 9		
	Mean	SD	t	Mean	SD	T	Mean	SD	t	Mean	SD	T
Slope	13.59	5.00	7.78* **	9.84	9.27	7.58***	8.42	10.29	5.04** *	-5.81	12.43	-3.30**

Note. ** $p < .01$, *** $p < .001$

Table 5. Mean, SD, and t- test for Slope from Pre and Post mean for Maze

Weeks	Grade 1			Grade 2/3			Grade 4/5			Grade 9		
	Mean	SD	t	Mean	SD	T	Mean	SD	t	Mean	SD	T
Slope	3.70	4.14	6.51* **	5.30	2.54	14.56** *	7.08	3.21	13.99* *	2.83	3.53	5.67***

Note. *** $p < .001$

Table 6. Mean, SD, and t- test for Slope from Pre and Post mean for WID

Weeks	Grade 1		
	Mean	SD	t
Slope	16.06	10.26	11.40 ***

Note. *** $p < .001$

The pre to post slopes were then correlated with the OLS slope derived from all 12 weekly data points. The correlations between the pre and post slopes and the slopes derived from the 12 weekly data points are presented in Table 7. As seen in Table 7, the pre to post reading aloud, maze, and word identification slopes were highly correlated with the overall slopes. All correlations were positive.

Table 7. Correlations between pre to post means with weekly slope

	Reading Aloud	Maze	Word ID
Grade 1	.979**	.929***	.977**
Grade 3	.937	.911***	
Grade 5	.953	.953***	
Grade 9	.960	.926***	

Note. * $p < .05$ ** $p < .01$ *** $p < .001$

The relationship between pre and post reading aloud and maze slopes and overall reading aloud and maze slopes was also examined. The correlations between pre and post reading aloud and maze slopes and overall reading aloud and maze slopes are presented in Table 8. Pre and post reading aloud and maze slopes were highly correlated for all grade levels. The relationship

between the overall slopes for reading aloud and maze was much weaker with correlations ranging from very low (Grade 9) to moderate (Grade 3).

Table 8. Correlation between reading aloud and maze for pre to post slopes and overall slopes

Reading aloud vs. maze	Pre to post slopes	Overall slope
Grade 1	.99	.25
Grade 3	.94	.46
Grade 5	.99	.30
Grade 9	.96	.12

Discussion

The primary purpose this study was to investigate the slope similarities for reading aloud, maze and word identification when using different combinations of scores from weekly progress measures. All analyses were based on weekly progress monitoring data obtained across a 12 week period during the school year. The first question addressed was whether combining scores from two consecutive weeks would result in differences from slopes based on weekly data points. Slopes derived from the two methods differed reliably from zero, but the absolute values of the slopes within grade level often differed markedly. In Grade 2/3 and 9, for example, the obtained read aloud slopes for the two approaches differed in direction --- one positive and one negative slope. In Grade 4/5 the difference in slope was 5 words per week. In general, for the maze and reading aloud procedures, the mean slopes from combined scores were higher than those of weekly scores. Why this should be is uncertain, but it does raise the possibility that combining the data from two weeks and using those combined scores results in a more stable, increasing slope. It is possible that considerable error variation occurs in weekly scores and that error variation contributes to flatter slopes.

A second question addressed in this study is whether the progress monitoring slopes produced by connecting the beginning and ending scores from a string of repeated measurements would be similar to the slopes derived from the entire set of repeated measurements. To answer this question, the pre to post slope was correlated with the slope derived from 12 weekly repeated measurements. The two slopes were highly correlated for reading aloud, maze, and word identification at all grade levels.

The results of the study reported here provide evidence to support two important conclusions regarding the use of reading aloud, maze, and word identification measures to monitor reading progress. The first is that the variability in weekly scores derived by having students read aloud from text appears to produce inconsistent slope estimates based on those scores. The results from this study do not clearly establish whether this inconsistency can be overcome through combining scores across weeks. This seems like a question to be pursued further.

The second important conclusion from these results is that, for reading aloud, maze, and word identification, slopes based on data collected at two points in time (that is, during the initial weeks of measurement and the final weeks of measurement) are comparable to the slopes derived from using all of the weekly data when examining the correlations, however, differences in the slope estimates were found when examining the slope estimates with pre to post slope estimates being much greater than the weekly slope estimates.