



## **TECHNICAL REPORT #10:**

### **Comparison of Different Scoring Procedures for the CBM Maze Selection Measure**

*Miya Miura Wayman, Renata Ticha, Teri Wallace, Christine A.  
Espin, Hilda Ives Wiley, Xiaoqing Du, and Jeffrey Long*

**RIPM Year 2: 2004 – 2005**

**Date of Study: September 2004 – June 2005**

**September 2009**

Note: Data set and data collection procedures are the same as Technical Report #1 and #2.

The College of Education  
& Human Development

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UNIVERSITY OF MINNESOTA



Produced by the Research Institute on Progress Monitoring (RIPM) (Grant # H324H30003) awarded to the Institute on Community Integration (UCEDD) in collaboration with the Department of Educational Psychology, College of Education and Human Development, at the University of Minnesota, by the Office of Special Education Programs. See [progressmonitoring.net](http://progressmonitoring.net).

### *Comparison of Different Scoring Procedures for the CBM Maze Selection Measure*

Various scoring procedures have been applied to CBM scores to control for guessing. The most common scoring procedure used with the CBM maze selection measure is discontinuing scoring after three consecutive errors (e.g., Espin, Deno, Maruyama, & Cohen, 1989; Fuchs, Fuchs, Hamlett & Ferguson, 1992; Jenkins & Jewell, 1993) and counting the number of correct selections made before the last three consecutive errors. A similar procedure of discontinuing scoring after two consecutive errors has also been used (e.g., Deno et al., 2002; Pierce, McMaster & Deno, 2009). In addition to discontinuing scoring after a set number of consecutive errors, CBM reading researchers have subtracted the number of incorrect maze selections from the number of correct maze selections (e.g., Espin, Wallace, Lembke, Campbell, & Long, 2009; Pierce et al., 2009) or subtracted half of the number of incorrect maze selections from the number of correct maze selections to control for guessing (e.g. Deno et al.; Brown-Chidsey, Davis, & Maya, 2003; Pierce et al.). Although many of the studies mentioned above used various scoring procedures to correct for guessing, Deno et al. and Pierce et al. were the only studies that made direct comparisons across different maze selection scoring procedures. Deno et al. compared discontinuing scoring after two and three consecutive errors and found that the validity coefficients were similar for both procedures; however, using two consecutive errors decreased the number of false negatives (students who were in the bottom 20% on standardized reading measure). Pierce et al. compared using the score of correct maze selections with four different scoring procedures that adjusted for guessing (correct minus incorrect maze selections, correct minus half of incorrect maze selections, discontinuing scoring after two consecutive errors, and discontinuing scoring after three consecutive errors) and found that the technical features of the various scoring procedures were similar.

The purpose of this study was to extend the previous research on scoring procedures by comparing the reliability and validity of different CBM maze selection scoring procedures across students at elementary-, middle-, and high-school levels. Two different scoring procedures were examined in this study. The first scoring procedure compared discontinuing scoring after 2 consecutive errors with discontinuing scoring after 3 consecutive errors. The second scoring procedure compared using the score of correct maze selections with the score of correct minus incorrect maze selections. In this study, reliability is examined by looking at alternate-form reliability coefficients and validity is examined by looking at predictive validity coefficients. The following research question is addressed: Do reliability and validity differ with type of scoring procedure?

### Method

The participants, setting, CBM measures, and procedures are the same as found in Technical Report #1. See Technical Report #1 for complete details on participants, setting, CBM measures, criterion measures, and procedures.

#### *Maze Scoring Procedures*

Incorrect and skipped word choices were marked as errors. The scorers scored the maze passages using the two consecutive error rule and then rescored the passage using the three consecutive error rule. When using the two consecutive error rule, scorers stopped scoring the passage after the student had made two errors in a row. All correct and incorrect choices made before the two consecutive errors were recorded. When using the three consecutive error rule, scorers stopped scoring the passage after the student had made three errors in a row. All correct and incorrect choices made before the three consecutive errors were recorded. The number of correct choices was used to compare the reliability and validity of the two and three consecutive error rules. When comparing correct and correct minus

incorrect scoring procedures, the passages scored using the 3 consecutive error rule were used.

### *Analyses*

Alternate-form reliability was calculated by examining correlations among the three forms maze selection. Alternate-form reliability was calculated for both common and grade level passages. The mean reliability coefficient across the three forms for each set of passages was used for the analysis. Mean reliability coefficients were broken down by grade level. The alternate-form reliability is reported both across school districts and separately for each school district. Predictive validity was examined by calculating correlations between the mean Fall maze selection score (common and grade level) and Spring NALT/MAP for the respective grades. The data across districts was combined for the two versus three consecutive error rule analysis. The district data were analyzed separately for the correct versus correct minus incorrect analysis.

In addition to looking at differences in the alternate-form reliability and predictive validity, we performed a preliminary analysis comparing the individual mean scores for each scoring procedure for each student scoring in the bottom 10% of their grade level. The bottom 10% was determined by using the mean score (number of correct selections in 3 min) of the three common maze passages administered during the fall.

### Results

The alternate-form reliability for three consecutive errors is presented in Table 2 and the alternate-form reliability for two consecutive errors is presented in Table 3. The alternate-form reliability coefficients for the common passage using the three consecutive error rule ranged from .78-.87 for grade 3, .77-.88 for grade 5, .82-.88 for grade 8, and .85-.91 for grade 10 across minutes 1-3. Similar coefficients were found for the common passage using the two consecutive

error rule. The coefficients ranged from .77-.86 for grade 3, .79-.86 for grade 5, .80-.83 for grade 8, and .82-.88 for grade 10 across minutes 1-3.

The alternate-form reliability coefficients for the grade level passages using the three consecutive error rule ranged from .76-.85 for grade 3, .82-.88 for grade 5, .79-.85 for grade 8, and .74-.83 for grade 10 across minutes 1-3. Coefficients for grade level passages using the two consecutive error rule ranged from .76-.81 for grade 3, .75-.81 for grade 5, .75-.80 for grade 8, and .69-.79 for grade 10 across minutes 1-3.

Table 2: Maze Alternate-form Reliability - 3 Errors, Districts Combined

**Fall 2004 Maze Alternate-form Reliability (avg. across 3 forms),**

	Maze					
	Common Passage			Grade Level Passage		
	Correct Error 3			Correct Error 3		
	1 min	2 min	3 min	1 min	2 min	3 min
Grade						
3	0.78	0.85	0.87	0.76	0.81	0.85
5	0.77	0.85	0.88	0.82	0.87	0.88
8	0.82	0.87	0.88	0.79	0.85	0.85
10	0.85	0.90	0.91	0.74	0.83	0.83

Table 3: Maze Alternate-form Reliability - 2 Errors, Districts Combined

**Fall 2004 Maze Alternate-form Reliability (avg. across 3 forms),**

	Maze					
	Common Passage			Grade Level Passage		
	Correct Error 2			Correct Error 2		
	1 min	2 min	3 min	1 min	2 min	3 min
Grade						
3	0.77	0.84	0.86	0.76	0.80	0.81
5	0.79	0.85	0.86	0.75	0.81	0.81
8	0.80	0.83	0.82	0.75	0.80	0.80
10	0.82	0.86	0.88	0.69	0.78	0.79

The alternate-form reliabilities for correct and correct minus incorrect scores for district 1 are shown in Tables 4 and 5. In district 1, the alternate-form reliability coefficients for the common passage using the correct word choices score ranged from .72-.84 for grade 3, .77-.89 for grade 5, .85-.90 for grade 8, and .84-.90 for grade 10 across minutes 1-3. Similar coefficients were found

for the common passage using the correct minus incorrect score. The coefficients ranged from .71-.84 for grade 3, .77-.88 for grade 5, .82-.88 for grade 8, and .83-.90 for grade 10 across minutes 1-3. Alternate-form reliability coefficients for the grade level passages using the correct word choices score rule ranged from .74-.81 for grade 3, .78-.85 for grade 5, .75-.85 for grade 8, and .64-.78 for grade 10 across minutes 1-3. Coefficients for grade level passages using the correct minus incorrect score ranged from .73-.80 for grade 3, .76-.86 for grade 5, .68-.82 for grade 8, and .58-.78 for grade 10 across minutes 1-3.

Table 4: Maze Alternate-form Reliability - Correct, District 1  
**Fall 2004 Maze Alternate-form Reliability (avg. across 3 forms),**  
 District 1

Grade	Maze					
	Common Passage			Grade Level Passage		
	Correct			Correct		
	1 min	2 min	3 min	1 min	2 min	3 min
3	0.72	0.80	0.84	0.74	0.78	0.81
5	0.77	0.88	0.89	0.78	0.84	0.85
8	0.85	0.88	0.90	0.75	0.85	0.85
10	0.84	0.89	0.90	0.64	0.77	0.78

Table 5: Maze Alternate-form Reliability - Correct Minus Incorrect, District 1  
**Fall 2004 Maze Alternate-form Reliability (avg. across 3 forms),**  
 District 1

Grade	Maze					
	Common Passage			Grade Level Passage		
	Correct-Incorrect			Correct-Incorrect		
	1 min	2 min	3 min	1 min	2 min	3 min
3	0.71	0.79	0.84	0.73	0.78	0.80
5	0.77	0.87	0.88	0.76	0.83	0.86
8	0.82	0.87	0.88	0.68	0.81	0.82
10	0.83	0.89	0.90	0.58	0.75	0.78

The alternate-form reliabilities for correct and correct minus incorrect scores for district 2 are shown in Tables 6 and 7. In district 2, the alternate-form reliability coefficients for the common

passage using the correct word choices score ranged from .82-.90 for grade 3, .75-.86 for grade 5, .77-.86 for grade 8, and .81-.87 for grade 10 across minutes 1-3. Similar coefficients were found for the common passage using the correct minus incorrect score. The coefficients ranged from .81-.88 for grade 3, .77-.88 for grade 5, .76-.86 for grade 8, and .80-.88 for grade 10 across minutes 1-3. Alternate-form reliability coefficients for the grade level passages using the correct word choices score rule ranged from .79-.88 for grade 3, .84-.89 for grade 5, .81-.85 for grade 8, and .71-.80 for grade 10 across minutes 1-3. Coefficients for grade level passages using the correct minus incorrect score ranged from .78-.86 for grade 3, .84-.90 for grade 5, .83-.89 for grade 8, and .69-.81 for grade 10 across minutes 1-3.

Table 6: Maze Alternate-form Reliability - Correct, District 2  
**Fall 2004 Maze Alternate-form Reliability (avg. across 3 forms),**

District 2						
Maze						
Common Passage				Grade Level Passage		
Correct				Correct		
	1 min	2 min	3 min	1 min	2 min	3 min
Grade						
3	0.82	0.88	0.90	0.79	0.84	0.88
5	0.75	0.81	0.86	0.84	0.88	0.89
8	0.77	0.83	0.86	0.81	0.85	0.85
10	0.81	0.87	0.87	0.71	0.80	0.79

Table 7: Maze Alternate-form Reliability - Correct Minus Incorrect, District 2  
**Fall 2004 Maze Alternate-form Reliability (avg. across 3 forms),**

District 2						
Maze						
Common Passage				Grade Level Passage		
Correct-Incorrect				Correct-Incorrect		
	1 min	2 min	3 min	1 min	2 min	3 min
Grade						
3	0.81	0.87	0.88	0.78	0.84	0.86
5	0.77	0.83	0.88	0.84	0.87	0.90
8	0.76	0.83	0.86	0.83	0.89	0.88
10	0.80	0.87	0.88	0.69	0.81	0.79

The predictive validity coefficients for the common passage using the three consecutive error rule ranged from .64-.71 for grade 3, .62-.65 for grade 5, .49-.51 for grade 8, and .56-.60

for grade 10 across minutes 1-3 (see Table 8). Similar coefficients were found for the common passage using the two consecutive error rule. The coefficients ranged from .65-.71 for grade 3, .63-.66 for grade 5, .50-.53 for grade 8, and .58-.62 for grade 10 across minutes 1-3 (see Table 9).

The predictive validity coefficients for the grade level passages using the three consecutive error rule ranged from .73-.78 for grade 3, .64-.69 for grade 5, .42-.26 for grade 8, and .54-.58 for grade 10 across minutes 1-3 (see Table 8). Coefficients for grade level passages using the two consecutive error rule ranged from .73-.79 for grade 3, .65-.70 for grade 5, .42-.49 for grade 8, and .57-.60 for grade 10 across minutes 1-3 (see Table 9).

Table 8: Maze Validity - 3 Errors, Districts Combined  
**Validity, Fall 2004 CBM with Fall/Spring 2004 NALT/MAP**

Maze						
Common Mean			Grade Mean			
<b>Correct Error 3</b>			<b>Correct Error 3</b>			
	1 min	2 min	3 min	1 min	2 min	3 min
Grade						
3	.64	.68	.71	.73	.75	.78
5	.62	.65	.65	.64	.67	.69
8	.49	.51	.50	.42	.45	.46
10	.56	.59	.60	.54	.55	.58

Table 9: Maze Validity - 2 Errors, Districts Combined  
**Validity, Fall 2004 CBM with Fall/Spring 2004 NALT/MAP**

Maze						
Common Mean			Grade Mean			
<b>Correct Error 2</b>			<b>Correct Error 2</b>			
	1 min	2 min	3 min	1 min	2 min	3 min
Grade						
3	.65	.69	.71	.73	.77	.79
5	.63	.66	.66	.65	.69	.70
8	.50	.53	.52	.42	.47	.49
10	.58	.61	.62	.57	.58	.60

The validity coefficients for correct and correct minus incorrect scores for district 1 are presented in Tables 10 and 11. In district 1, the predictive validity coefficients for the common



passage using the correct score ranged from .60-.62 for grade 3, .50-.52 for grade 5, and .46-.52 for grade 8 across minutes 1-3. Similar coefficients were found for the common passage using the correct minus incorrect score. The coefficients ranged from .59-.62 for grade 3, .51-.53 for grade 5, and .46-.51 for grade 8 across minutes 1-3. The predictive validity coefficients for the grade level passages using the correct score ranged from .67-.72 for grade 3, .50-.52 for grade 5, and .36-.37 for grade 8 across minutes 1-3. Coefficients for grade level passages using the correct minus incorrect score ranged from .69-.73 for grade 3, .51-.54 for grade 5, and .40-.42 for grade 8 across minutes 1-3.

Table 10: Maze Validity - Correct, District 1  
**Validity, Fall 2004 CBM with Fall/Spring 2004 NALT/MAP**  
 District 1

Maze						
Common Mean				Grade Mean		
<b>Correct</b>				<b>Correct</b>		
	1 min	2 min	3 min	1 min	2 min	3 min
Grade						
3	.60	.61	.62	.67	.69	.72
5	.51	.52	.50	.50	.51	.52
8	.46	.52	.50	.37	.36	.36
10						

Note. Correlations for 10<sup>th</sup> grade are not available.

Table 11: Maze Validity - Correct Minus Incorrect, District 1  
**Validity, Fall 2004 CBM with Fall/Spring 2004 NALT/MAP**  
 District 1

Maze						
Common Mean				Grade Mean		
<b>Correct-Incorrect</b>				<b>Correct-Incorrect</b>		
	1 min	2 min	3 min	1 min	2 min	3 min
Grade						
3	.59	.61	.62	.69	.70	.73
5	.52	.53	.51	.51	.52	.54
8	.46	.51	.49	.42	.40	.40
10						

Note. Correlations for 10<sup>th</sup> grade are not available.

The validity coefficients for correct and correct minus incorrect scores for district 1 are presented in Tables 12 and 13. In district 2, the predictive validity coefficients for the common passage using the correct score ranged from .67-.76 for grade 3, .68-.75 for grade 5, .48-.49 for grade 8, and .58-.61 for grade 10 across minutes 1-3. Similar coefficients were found for the common passage using the correct minus incorrect score. The coefficients ranged from .69-.77 for grade 3, .72-.78 for grade 5, .51-.52 for grade 8, and .58-.62 for grade 10 across minutes 1-3. The predictive validity coefficients for the grade level passages using the correct score ranged from .78-.82 for grade 3, .72-.79 for grade 5, .45-.54 for grade 8, and .55-.60 for grade 10 across minutes 1-3. Coefficients for grade level passages using the correct minus incorrect score ranged from .80-.84 for grade 3, .75-.82 for grade 5, .51-.56 for grade 8, and .58-.63 for grade 10 across minutes 1-3.

Table 12: Maze Validity - Correct, District 2  
**Validity**, Fall 2004 CBM with Fall/Spring 2004 NALT/MAP  
 District 2

Grade	Maze					
	Common Mean			Grade Mean		
	Correct			Correct		
	1 min	2 min	3 min	1 min	2 min	3 min
3	.67	.73	.76	.78	.80	.82
5	.68	.73	.75	.72	.75	.79
8	.49	.49	.48	.45	.52	.54
10	.58	.60	.61	.55	.57	.60

Table 13: Maze Validity - Correct Minus Incorrect, District 2  
**Validity**, Fall 2004 CBM with Fall/Spring 2004 NALT/MAP  
 District 2

Grade	Maze					
	Common Mean			Grade Mean		
	Correct-Incorrect			Correct-Incorrect		
	1 min	2 min	3 min	1 min	2 min	3 min
3	.69	.75	.77	.80	.82	.84
5	.72	.76	.78	.75	.79	.82
8	.52	.52	.51	.51	.55	.56
10	.58	.62	.62	.58	.60	.63

In addition to examining the reliability and validity of the different scoring procedures for the entire sample, we examined mean performance for individuals in the bottom 10% of their grade level to see if differences in scoring procedures existed for lower-performing students. The individual mean scores for each scoring procedure for students scoring in the bottom 10% presented by grade level in Tables 14-17.

Table 14: Comparison of Individual Scores for Bottom 10% of Grade 3 ( $n = 11$ )

		<b>ID 10007</b>	
		Correct	Correct Minus Incorrect
2 Consecutive Errors		0.33	0.00
3 Consecutive Errors		0.33	0.00
		<b>ID 10312</b>	
		Correct	Correct Minus Incorrect
2 Consecutive Errors		0.67	0.33
3 Consecutive Errors		1.00	0.00
		<b>ID 10017</b>	
		Correct	Correct Minus Incorrect
2 Consecutive Errors		3.00	1.00
3 Consecutive Errors		3.00	1.00
		<b>ID 10086</b>	
		Correct	Correct Minus Incorrect
2 Consecutive Errors		2.33	2.00
3 Consecutive Errors		3.00	2.00
		<b>ID 10009</b>	
		Correct	Correct Minus Incorrect
2 Consecutive Errors		3.33	1.67
3 Consecutive Errors		3.33	1.67
		<b>ID 10019</b>	
		Correct	Correct Minus Incorrect
2 Consecutive Errors		3.67	3.00
3 Consecutive Errors		3.67	3.00
		<b>ID 10303</b>	
		Correct	Correct Minus Incorrect
2 Consecutive Errors		3.67	3.67
3 Consecutive Errors		3.67	0.33
		<b>ID 10308</b>	
		Correct	Correct Minus Incorrect
2 Consecutive Errors		2.67	1.67
3 Consecutive Errors		3.67	2.00

<b>ID 10359</b>		
	Correct	Correct Minus Incorrect
2 Consecutive Errors	3.67	3.67
3 Consecutive Errors	4.33	3.67

<b>ID 10352</b>		
	Correct	Correct Minus Incorrect
2 Consecutive Errors	3.33	3.00
3 Consecutive Errors	4.67	4.33

<b>ID 10300</b>		
	Correct	Correct Minus Incorrect
2 Consecutive Errors	4.67	4.67
3 Consecutive Errors	5.00	4.33

Table 15: Comparison of Individual Scores for Bottom 10% of Grade 5 ( $n = 14$ )

<b>ID 10377</b>		
	Correct	Correct Minus Incorrect
2 Consecutive Errors	1.67	0.67
3 Consecutive Errors	2.67	0.00

<b>ID 10074</b>		
	Correct	Correct Minus Incorrect
2 Consecutive Errors	2.67	1.33
3 Consecutive Errors	4.00	1.33

<b>ID 10361</b>		
	Correct	Correct Minus Incorrect
2 Consecutive Errors	2.67	2.00
3 Consecutive Errors	4.00	2.00

<b>ID 10385</b>		
	Correct	Correct Minus Incorrect
2 Consecutive Errors	2.67	2.00
3 Consecutive Errors	6.00	0.67

<b>ID 10399</b>		
	Correct	Correct Minus Incorrect
2 Consecutive Errors	4.67	3.67
3 Consecutive Errors	6.00	3.00

<b>ID 10410</b>		
	Correct	Correct Minus Incorrect
2 Consecutive Errors	6.67	5.00
3 Consecutive Errors	8.67	5.00

<b>ID 10402</b>		
	Correct	Correct Minus Incorrect
2 Consecutive Errors	9.00	8.33
3 Consecutive Errors	9.33	8.00

**ID 10384**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	9.50	7.50
3 Consecutive Errors	9.50	7.50

**ID 10423**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	9.33	8.00
3 Consecutive Errors	9.67	7.67

**ID 10069**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	11.00	10.33
3 Consecutive Errors	11.00	10.33

**ID 10368**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	11.00	10.33
3 Consecutive Errors	11.00	10.33

**ID 10467**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	8.33	7.67
3 Consecutive Errors	12.33	9.67

**ID 10078**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	10.00	9.67
3 Consecutive Errors	12.67	11.67

**ID 10416**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	12.67	12.00
3 Consecutive Errors	12.67	12.00

Table 16: Comparison of Individual Scores for Bottom 10% of Grade 8 ( $n = 9$ )

**ID 10469**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	6.33	5.67
3 Consecutive Errors	10.00	6.67

**ID 10449**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	13.67	11.33
3 Consecutive Errors	13.67	11.33

**ID 10430**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	17.00	15.67
3 Consecutive Errors	17.00	15.67

**ID 10464**

	Correct	Correct Minus Incorrect
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2 Consecutive Errors	18.00	16.67
3 Consecutive Errors	18.00	16.67

**ID 10138**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	20.00	20.00
3 Consecutive Errors	20.00	20.00

**ID 10437**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	20.33	19.33
3 Consecutive Errors	20.33	19.33

**ID 10154**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	23.67	23.67
3 Consecutive Errors	23.67	23.67

**ID 10155**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	19.33	18.67
3 Consecutive Errors	26.00	24.67

**ID 10150**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	26.33	26.33
3 Consecutive Errors	26.33	26.33

Table 17: Comparison of Individual Scores for Bottom 10% of Grade 10 ( $n = 18$ )

**ID 10580**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	1.00	1.00
3 Consecutive Errors	1.00	1.00

**ID 10563**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	10.67	8.67
3 Consecutive Errors	12.33	9.67

**ID 10582**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	15.33	12.67
3 Consecutive Errors	15.33	12.67

**ID 10228**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	16.00	16.00
3 Consecutive Errors	16.00	16.00

**ID 10502**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	17.00	16.33

3 Consecutive Errors	17.00	16.33
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**ID 10500**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	19.67	18.67
3 Consecutive Errors	19.67	18.67

**ID 10592**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	19.67	17.33
3 Consecutive Errors	19.67	17.33

**ID 10605**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	20.67	19.67
3 Consecutive Errors	20.67	19.67

**ID 10503**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	9.00	7.00
3 Consecutive Errors	21.33	14.67

**ID 10586**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	13.00	12.33
3 Consecutive Errors	22.00	20.00

**ID 10589**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	9.00	8.00
3 Consecutive Errors	22.33	16.33

**ID 10510**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	23.33	22.67
3 Consecutive Errors	23.33	22.67

**ID 10581**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	23.33	23.00
3 Consecutive Errors	23.33	23.00

**ID 10522**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	21.00	18.67
3 Consecutive Errors	23.67	19.67

**ID 10607**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	16.33	16.00
3 Consecutive Errors	23.67	22.33

**ID 10542**

	Correct	Correct Minus Incorrect
2 Consecutive Errors	18.33	16.33

3 Consecutive Errors	24.67	22.00
<b>ID 10540</b>		
	Correct	Correct Minus Incorrect
2 Consecutive Errors	25.33	25.33
3 Consecutive Errors	25.33	25.33
<b>ID 10579</b>		
	Correct	Correct Minus Incorrect
2 Consecutive Errors	26.00	24.00
3 Consecutive Errors	26.00	24.00

For lower-performing students in Grade 3, observed differences in individual means were found for 55% of the students when using correct maze selections and comparing 2 consecutive errors to 3 consecutive errors, 45% of the students when using correct minus incorrect maze selections and comparing 2 consecutive errors to 3 consecutive errors, 73% of the students when using 2 consecutive errors and comparing correct maze selections to correct minus incorrect maze selections, and 100% of the students when using 3 consecutive errors and comparing correct maze selections to correct minus incorrect maze selections.

For lower-performing students in Grade 5, observed differences in individual means were found for 71% of the students when using correct maze selections and comparing 2 consecutive errors to 3 consecutive errors, 50% of the students when using correct minus incorrect maze selections and comparing 2 consecutive errors to 3 consecutive errors, 100% of the students when using 2 consecutive errors and comparing correct maze selections to correct minus incorrect maze selections, and 100% of the students when using 3 consecutive errors and comparing correct maze selections to correct minus incorrect maze selections.

For lower-performing students in Grade 8, observed differences in individual means were found for 22% of the students when using correct maze selections and comparing 2 consecutive errors to 3 consecutive errors, 22% of the students when using correct minus incorrect maze selections and comparing 2 consecutive errors to 3 consecutive errors, 67% of the students when using 2 consecutive errors and comparing correct maze selections to correct



minus incorrect maze selections, and 67% of the students when using 3 consecutive errors and comparing correct maze selections to correct minus incorrect maze selections.

For lower-performing students in Grade 10, observed differences in individual means were found for 39% of the students when using correct maze selections and comparing 2 consecutive errors to 3 consecutive errors, 39% of the students when using correct minus incorrect maze selections and comparing 2 consecutive errors to 3 consecutive errors, 83% of the students when using 2 consecutive errors and comparing correct maze selections to correct minus incorrect maze selections, and 83% of the students when using 3 consecutive errors and comparing correct maze selections to correct minus incorrect maze selections.

### Discussion

The patterns of correlations were similar in terms of alternate-form reliability coefficients and validity coefficients for 2 versus 3 consecutive errors and correct versus correct minus incorrect regardless of the type of passage used (common level or grade level). These results indicate that teachers can use two consecutive errors or three consecutive errors and correct or correct minus incorrect as scoring rules for maze selection. Given that two consecutive errors and scoring correct choices is more efficient, teachers may want to use these scoring procedures instead of three consecutive errors and correct minus incorrect.

Even though no major differences existed when looking at the technical features of different scoring procedures with a wide range of skill levels, some differences existed when looking at different scoring procedures with lower-performing students. It appears that more mean differences exist for younger students (45% - 71% for grades 3 and 5) than for older students (22% - 39% for grades 8 and 10) when comparing 2 and 3 consecutive errors. The mean differences were more similar across grade levels when comparing correct maze selections to correct minus incorrect maze selections (73% - 100% for grades 3 and 5, 67% - 83% for grades 8 and 10), although more differences were evident for the younger students.

Given the differences in scoring procedures that were found for lower-performing students based on the pattern of means in our preliminary analysis, future research should continue to investigate whether differences in reliability and validity exist when comparing 2 versus 3 consecutive errors and correct versus correct minus incorrect scoring rules using other methods (e.g. looking at differences in rank ordering, reliability, validity, and growth) with students from different age and skill levels (e.g. general education vs. special education) as well as students from different backgrounds (e.g., English learners vs. English-speaking students).

## References

- Brown-Chidsey, R., Davis, L., & Maya, C. (2003). Sources of variance in curriculum-based measures of silent reading. *Psychology in the Schools, 40*(4), 363-377.
- Deno, S. L., Anderson, A.R., Calender, S., Lembke, E., Zorka, H., & Casey A. (2002, March). *Developing a school-wide progress monitoring system*. Paper presented at the Annual Meeting of the National Association of School Psychologists.
- Espin, C. A., Deno, S. L., Maruyama, G., & Cohen, C. (1989). *The Basic Academic Skills Samples (BASS): An instrument for the screening and identification of children at risk for failure in regular education classrooms*. Paper presented at the National Convention of the American Educational Research Association, March, 1989.
- Espin, C.A., Wallace, T., Lembke, E., Campbell, H., & Long, J. (2009). *Creating a progress measurement system in reading for secondary-school students: Monitoring progress towards meeting high stakes assessment standards*. Manuscript submitted for publication.
- Fuchs, L.S., Fuchs, Hamlett, & Ferguson (1992). Effects of expert system consultation within Curriculum-Based Measurement, using a reading maze task. *Exceptional Children, 58*, 436-450.
- Jenkins, J. R., & Jewell, M. (1993). Examining the validity of two measures for formative teaching: Reading aloud and maze. *Exceptional Children, 59*(5), 421-432.
- Pierce, R. L., McMaster, K. L., & Deno, S. L. (2009). *Scoring maze measures: The effects of using different scoring procedures*. Manuscript submitted for publication.