



TECHNICAL REPORT #24:

Iowa Early Numeracy Indicator Screening Data: 2008-2009

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Abstract

Screening data from four Early Numeracy Indicators (Number Identification, Quantity Discrimination, Missing Number, and Mixed Numeracy) originally developed by Lembke and Foegen (2005) are presented in this report. These measures were used to collect benchmarking data during the fall, winter, and spring in a small Midwestern school district during the 2008-2009 academic year. As in earlier studies, mean scores on each of the measures increased over the course of the year. The mean scores for kindergarten students for the three screening periods were quite similar to those of earlier cohorts, while first grade students' scores were slightly lower than those in earlier studies. The alternate-form reliability coefficients for all four of the indicators have proven to be consistent over time with nearly all at the .80 level or greater. The levels of concurrent validity and predictive validity for the different measures have also stayed relatively constant over the years with Mixed Numeracy having the highest concurrent validity coefficients and the highest predictive validity coefficients for kindergarten students. Quantity Discrimination had the highest predictive validity coefficients for first grade students, followed by the Mixed Numeracy measures.

After considering four years of screening data for the Early Numeracy Indicators, we found support for the use of two Mixed Numeracy tasks for the fall, winter, and spring benchmarking assessments. Using a single measure for screening purposes (as opposed to four separate measures) will significantly decrease the amount of time that teachers need to spend gathering benchmarking data throughout the year.

Iowa Early Numeracy Indicator Screening Data: 2008-2009

The purpose of this study was to replicate aspects of four earlier studies (Foegen, Lembke, Klein, Lind, & Jiban, 2006; Impecoven-Lind, Olson, & Foegen, 2009; Lembke & Foegen, 2005; Olson, Foegen, & Singamaneni, 2009) by examining the technical adequacy of four established Early Numeracy Indicators (Number Identification, Quantity Discrimination, Missing Number and Mixed Numeracy).

Research Questions

The following research questions guided the study:

1. Are the scores earned by kindergarten and first grade students similar to those from earlier studies for the three screening periods?
2. When compared to the results from previous studies, are similar levels of alternate-form reliability produced by the Early Numeracy Indicators?
3. When compared to the results from previous studies, are similar levels of concurrent and predictive criterion validity produced by the Early Numeracy Indicators?
4. To what extent are the measures intercorrelated?

Method

Setting and Participants

The study was conducted in an elementary school (grades Pre-K-3) in a small Midwestern school district on the fringe of an urban community. The school district was composed of four schools. There was one Pre-K through third grade elementary school, one fourth and fifth grade elementary school, one middle school with grades six through eight, and one high school. During the 2008-2009 school year, the district enrolled 1,338 students, with 46 percent being female, 90.5% white, 5.4 percent Hispanic, 2.5% African American, 1.3% Asian,

and less than 1 percent Native American. Nearly 46% of the students qualified for free or reduced lunch, and 2.4% were identified as English Language Learners.

A total of 185 students participated in this study. There were 78 kindergarten students divided among four classes and 107 first grade students who were also divided among four classes. The kindergarten and first grade classes were more diverse than the district as a whole with the kindergarten classes having a student population that was 93.2% white, 5.4 % Hispanic, and 1.4%, African American and the first grade being 89% white, 7% Hispanic, 3% African American, and 1% Asian. More than 40% of the kindergarten and first grade students (41.9% and 49%, respectively) received free or reduced priced lunch. A smaller percentage of kindergarten students were classified as English Language Learners (2.7%) as compared to the first grade students in this study (6%). There were slightly more students receiving special education services in the first grade (6%) than in kindergarten (5.4%).

Gathering the early numeracy data was a part of the school's typical practices and ongoing commitment to making data driven decisions; therefore, individual consent was not needed for students' participation in the data collection efforts.

Measures

Early Numeracy Indicators. Four measures were used as benchmarking tools in this study: Number Identification (NI), Quantity Discrimination (QD), Missing Number (MN), and Mixed Numeracy (MX). See Appendix A for sample pages from each type of measure.

Two different forms of each measure were used during each screening period (fall, winter, and spring) for a total of six forms per measure. The Number Identification tasks had 84 boxes with numerals (ranging from 0 to 100) in them. Each student was to say the names of as many of the numerals as he or she could in the time allotted. All of the 63 items in the Quantity

Discrimination measures had a pair of numerals (ranging from 0 to 20). Students were to say the name of the greater number in each pair. For the Missing Number measures, each item was a box with a sequence of three numerals and a blank line (63 in all). The position of the blank line varied across the four possible positions. Students were to state the name of the missing number in the sequence. Most sequences involved counting by ones; however, some required students to count by fives or tens. The Mixed Numeracy measures included items that were similar to the three earlier measures. It began with a row of four number identification items, followed by a row of four quantity discrimination items, and then a row of four missing number items. This sequence repeated for a total of 84 items.

Criterion measures. The criterion measure used in this study was teachers' ratings of their students' overall math proficiency. Teachers were asked to rate each student's general proficiency in mathematics relative to other students in his/her class, on a Likert scale ranging from 1 to 7, with 1 representing lower proficiency and 7 representing higher proficiency. Teachers were also asked to use the entire scale and to not cluster students only in the middle or toward one end. All teachers completed student ratings in the fall and the spring, concurrent with the respective probe administration. A copy of the teacher rating scale is presented in Appendix B.

Procedures

Trained data collectors gathered all of the data. Each data collector participated in a small-group training session lasting approximately one hour. The project coordinator delivered this training session using a revised version of the previous year's training materials. During the training session an overview of the study was provided, then the project coordinator modeled how to administer each of the four measures. Data collectors practiced administering each of the

tasks and then administered each task to a peer while the trainer observed and completed an 11-item fidelity checklist. All of the data collectors were required to achieve 100% percent accuracy before data collection with students began.

Students participated in three rounds of data collection spread across the academic year. Fall data were collected during the seventh week of school in late September and early October, winter data during the twenty-third week of school in early February, and spring data during the thirty-fourth week of school in late April. Two forms of each task were individually administered by trained data collectors during each data collection period. Students were given one minute to attempt as many items as they could for each task, with each data collection session lasting approximately ten minutes per child. Administration of the tasks took place at desks or tables in the hallways outside of the students' classrooms. Data collectors provided a brief introduction to each measure and had each student try three sample problems to ensure that the student understood the task before administering the two forms of a measure. Data collectors wrote all of a student's responses in a screening booklet. All of the measures were hand scored by counting the number of correct responses.

Students who were absent during a data collection day were assessed if the testing could be completed within the one-week time limit. If this could not be accomplished, that student's data were omitted for that period, but the student was assessed in subsequent rounds of data collection using standard procedures.

Project staff completed all of the scoring and data entry. Twenty-percent of the measures were rescored during each round of data collection to assess inter-scorer agreement. We computed an estimate of agreement by counting the number of items considered agreements (i.e., scored correctly) and the number of items for which there was a disagreement in scoring (i.e.,

scoring errors) and dividing the number of agreements by the sum of agreements and disagreements. We computed scoring accuracy by measure type for each of the selected scoring booklets and then averaged across all of the booklets to obtain an overall estimate of inter-scorer agreement. Scorers were very consistent with mean agreement averages of at least 99% or better (see Table 1).

Table 1

Mean Agreement, Range, and Number of Probes Examined for Inter-scorer Agreement

	Number Identification			Quantity Discrimination		
	<u>Mean Agreement</u>	<u>Range</u>	<u># Probes Rescored</u>	<u>Mean Agreement</u>	<u>Range</u>	<u># Probes Rescored</u>
Fall	99%	95 -100%	72	100%	92-100%	72
Winter	100%	93-100%	68	100%	96-100%	68
Spring	100%	100%	62	100%	97-100%	62

	Missing Number			Mixed Numeracy		
	<u>Mean Agreement</u>	<u>Range</u>	<u># Probes Rescored</u>	<u>Mean Agreement</u>	<u>Range</u>	<u># Probes Rescored</u>
Fall	99%	83-100%	71	99%	62-100%	72
Winter	99%	89-100%	68	100%	95-100%	68
Spring	100%	94-100%	62	100%	97-100%	62

Scoring and Data Analyses

Data analyses were conducted using number correct scores for each of the four early numeracy indicators. Alternate-form reliability was computed by correlating scores from the two forms of each type during each data collection period. For the criterion measures, teacher ratings were standardized by classroom and the resulting z-scores were used in the analyses. We

examined concurrent criterion validity by correlating the mean of the scores from the two forms of each measure and the standardized teacher ratings, comparing fall scores with fall ratings, and then comparing spring scores with spring ratings. To determine predictive validity we compared fall mean scores with spring teacher ratings.

Results

The results section begins with descriptive statistics for all four of the Early Numeracy Indicators. These statistics are followed by analyses specific to each of the research questions. Table 2 includes the means and standard deviations for each of the individually administered indicators for kindergarten students, and Table 3 includes the same information for first grade students. Tests of skewness and kurtosis were conducted for data from the Early Numeracy Indicators. All of the statistics fell within the commonly acceptable range.

We examined the distributions produced on each of the measures, noting possible floor or ceiling effects, as well as the magnitude of the standard deviations. As in earlier studies, kindergarten students earned the most zeroes during the fall administration, with the number dropping for subsequent administrations. Nevertheless, two students still earned a score of zero on one of the spring Missing Number tasks. The most zeroes were earned on Missing Number, while the fewest scores of zero occurred on Number Identification. For first grade students, scores of zero only occurred during the fall administration with one score of zero reported for a Quantity Discrimination, Missing Number, and Mixed Numeracy task.

When we examined the data for ceiling effects, we did not find any for kindergarten students; however, we did have some very high scores on the Number Identification and Quantity Discrimination measures for first grade students. For the Number Identification indicators, two students scored 80/84 and one student scored 84/84 during the spring

administration. For the Quantity Discrimination measures, there was one student who scored 61/63 during the winter administration period and one student who scored 63/63 with two seconds to spare during the spring.

As we considered the distribution of scores for each of the measures, we found the same pattern for both grades across all the three administration periods. Number Identification had the largest standard deviations, followed by Quantity Discrimination, Mixed Numeracy, and then Missing Number. This was also the same pattern that occurred during the 2007-2008 academic year.

Table 2

Descriptive Statistics for Early Numeracy Indicators for Kindergarten Students

<u>Measure</u>	<u>Date</u>	<u>Form</u>	<u>Kindergarten</u>					
			<u>n</u>	<u>Min</u>	<u># of Zeroes</u>	<u>Max</u>	<u>M</u>	<u>SD</u>
Number Identification	Fall	1	75	0	1	48	14.72	8.50
		2	75	0	3	47	12.83	8.54
		Mean	75	0	1	47.5	13.77	8.32
	Winter	1	74	4	0	56	22.85	11.17
		2	74	2	0	56	22.23	11.48
		Mean	74	3	0	56	22.54	11.14
	Spring	1	75	3	0	67	26.47	13.71
		2	75	4	0	58	25.03	11.74
		Mean	75	4	0	62.5	25.75	12.35
Quantity Discrimination	Fall	1	75	0	4	35	11.01	8.10
		2	75	0	9	37	10.29	8.35
		Mean	75	0	4	34.5	10.65	8.11
	Winter	1	74	0	1	47	18.54	9.32
		2	74	4	0	42	18.84	8.63
		Mean	74	2	0	44.5	18.69	8.81
	Spring	1	75	4	0	43	20.65	9.14
		2	75	3	0	38	19.88	7.79
		Mean	75	3.5	0	40.5	20.27	8.19
Missing Number	Fall	1	75	0	8	18	6.00	4.18
		2	75	0	9	16	6.76	4.54
		Mean	75	0	6	17	6.38	4.21
	Winter	1	74	0	2	19	9.27	4.18
		2	74	0	2	19	9.38	4.50
		Mean	74	0	1	18.5	9.32	4.19
	Spring	1	75	1	0	22	11.16	4.59
		2	75	0	2	24	11.04	4.53
		Mean	75	.5	0	21	11.10	4.29
Mixed Numeracy	Fall	1	75	0	4	28	11.41	5.90
		2	75	0	5	27	11.91	6.16
		Mean	75	0	4	26	11.66	5.92
	Winter	1	74	3	0	30	17.00	5.50
		2	74	2	0	32	17.43	6.51
		Mean	74	3	0	30.5	17.22	5.84
	Spring	1	75	5	0	34	20.07	6.04
		2	75	5	0	33	21.29	6.21
		Mean	75	5.5	0	32.5	20.68	5.86

Table 3

Descriptive Statistics for Early Numeracy Indicators for First Grade Students

<u>Measure</u>	<u>Date</u>	<u>Form</u>	<u>Grade 1</u>					
			<u>n</u>	<u>Min</u>	<u># of Zeroes</u>	<u>Max</u>	<u>M</u>	<u>SD</u>
Number Identification	Fall	1	101	8	0	57	29.43	12.66
		2	101	6	0	56	26.23	12.04
		Mean	101	7	0	56	27.83	12.12
	Winter	1	98	13	0	69	42.20	12.72
		2	98	10	0	74	40.29	13.53
		Mean	98	11.5	0	67	41.25	12.83
	Spring	1	102	19	0	80	50.36	13.29
		2	102	14	0	84	46.57	13.85
		Mean	102	21	0	82	48.47	13.32
Quantity Discrimination	Fall	1	101	2	0	44	24.78	9.59
		2	101	0	1	47	24.34	9.88
		Mean	101	1	0	45.5	24.56	9.57
	Winter	1	98	15	0	61	33.31	8.55
		2	98	9	0	59	32.49	8.79
		Mean	98	12	0	60	32.90	8.47
	Spring	1	102	16	0	58	37.93	9.07
		2	102	16	0	63	36.42	8.94
		Mean	102	19.5	0	60.5	37.18	8.83
Missing Number	Fall	1	101	3	0	23	13.13	4.75
		2	101	0	1	24	14.10	4.54
		Mean	101	2	0	23.5	13.61	4.43
	Winter	1	98	5	0	30	15.76	4.84
		2	98	5	0	32	16.38	4.79
		Mean	98	5	0	31	16.07	4.58
	Spring	1	102	7	0	36	19.61	5.56
		2	102	8	0	35	19.22	5.65
		Mean	102	8.5	0	35	19.41	5.35
Mixed Numeracy	Fall	1	101	5	0	39	20.34	6.06
		2	101	0	1	42	20.93	6.54
		Mean	101	2.5	0	40.5	20.63	6.11
	Winter	1	98	12	0	45	27.09	6.36
		2	98	12	0	48	28.10	6.68
		Mean	98	14.5	0	46.5	27.60	6.32
	Spring	1	102	20	0	56	32.81	7.02
		2	102	15	0	53	33.55	7.58
		Mean	102	17.5	0	51.5	33.18	6.93

The descriptive statistics for the criterion measures appear in Table 4. Teachers were to use the full range of ratings, and the data show that they did. Nevertheless, we calculated z-scores for the teacher ratings by classroom to control for possible variability in the teachers' application of the rating scale.

Table 4

Descriptive Statistics for Criterion Measures

<u>Measure</u>	<u>n</u>	<u>Min</u>	<u>Max</u>	<u>M</u>	<u>SD</u>
<u>Kindergarten</u>					
Teacher Rating, Fall	75	1	7	4.05	1.83
Teacher Rating, Spring	75	1	7	4.20	1.95
Teacher Rating z Score, Fall	75	-2.06	1.86	.0012	.98
Teacher Rating z Score, Spring					
<u>First Grade</u>					
Teacher Rating, Fall	100	1	7	4.03	1.86
Teacher Rating, Spring	102	1	7	4.39	1.84
Teacher Rating z Score, Fall	100	-2.18	2.59	-.0006	.98
Teacher Rating z Score, Spring					

Research Question 1: Are the scores earned by kindergarten and first grade students similar to those from earlier studies for the three screening periods?

During previous studies (Foegen et al., 2006; Impecoven-Lind et al, 2009; Olson et al, 2009), mean scores on all of the indicators increased over the course of the academic year. This was also true for the 2008-2009. Kindergarten students' mean scores were consistently higher than the previous year's scores for each of the three screening periods and comparable or higher than the scores for 2005-2006 and 2006-2007. In contrast, the mean scores for students in the 2008-2009 first grade cohort were slightly lower than those for earlier cohorts for all the

measures during all of the screening periods except for spring Quantity Discrimination when the mean score was the same as that for the 2007-2008 cohort.

Research Question 2: When compared to the results from previous studies, are similar levels of alternate-form reliability produced by the Early Numeracy Indicators?

The data in Table 5 show that all of the alternate-form reliability coefficients for the two forms of each type of measure were greater than .80 for all but one comparison (Spring Missing Number in kindergarten) and nearly two thirds of the correlation coefficients were .88 or greater. These correlation coefficients were very similar to those found in the earlier studies. Number Identification and Quantity Discrimination had the highest levels of alternate-form reliability, followed by Mixed Numeracy, and then Missing Number during 2008-2009.

Table 5

Alternate-form Reliability

	<u>Kindergarten</u>			<u>Grade 1</u>		
	Fall	Winter	Spring	Fall	Winter	Spring
NI Means	.91	.94	.88	.93	.91	.91
QD Means	.94	.93	.87	.93	.91	.92
MN Means	.87	.86	.77	.82	.81	.82
MX Means	.93	.89	.83	.88	.88	.80

Note. All correlations are significant at the $p < 0.01$ level.

Research Question 3: When compared to the results from previous studies, are similar levels of concurrent and predictive criterion validity produced by the Early Numeracy Indicators?

To calculate concurrent validity coefficients, we compared fall teacher ratings with students' fall mean scores for the two forms of each measure and spring mean scores and spring teacher ratings (see Table 6). We found the concurrent validity coefficients for kindergarten students for Number Identification and Quantity Discrimination increased from fall to spring, but decreased for Missing Number and Mixed Numeracy. For first grade students, the concurrent validity coefficients were basically the same for Number Identification and the coefficients decreased from fall to spring for all the remaining indicators. Looking across both grades and both time periods, we found that Mixed Numeracy typically had the highest concurrent validity, Number Identification had the second highest concurrent validity, and the Missing Number measure had the lowest concurrent validity. For the most part, the concurrent validity data are similar to those from earlier studies for all four of Early Numeracy Indicators.

Table 6

Concurrent Validity Coefficients for Kindergarten and Grade 1 Students

	<u>Kindergarten</u>		<u>Grade 1</u>	
	Fall Teacher Rating	Spring Teacher Rating	Fall Teacher Rating	Spring Teacher Rating
NI	.68	.73	.65	.66
QD	.66	.75	.71	.57
MN	.65	.59	.64	.58
MX	.77	.72	.70	.62

Note. All correlations are significant at the $p < 0.01$ level.

Table 7 includes the predictive validity coefficients for each of the measures. We compared students' fall mean scores for the two forms of each measure with spring teacher ratings to examine the predictive validity of each measure for this study. All of the predictive coefficients were near or above .60. For kindergarten students, the Mixed Numeracy measure had the highest predictive validity (.76), followed by Quantity Discrimination and Number Identification (.70 and .69, respectively). The Quantity Discrimination measure had the greatest predictive validity in first grade (.72), followed by the Mixed Numeracy measure (.70). The predictive validity coefficients for all four of the measures were in the same range as those found in 2005-2006 and 2007-2008 (teacher ratings were not gathered in 2006-2007).

Table 7

Predictive Validity Coefficients for Kindergarten and Grade 1 Students

	<u>Kindergarten</u>	<u>Grade 1</u>
	Spring Teacher Rating	Spring Teacher Rating
NI	.69	.67
QD	.70	.73
MN	.57	.65
MX	.76	.70

Research Question 4. To what extent are the measures intercorrelated?

Table 8 displays the intercorrelations between the four Early Numeracy Indicators over the course of the academic year in Kindergarten. When we examined the intercorrelations for kindergarten students for each administration period, we found the Mixed Numeracy measures had the highest rate of intercorrelation with the other three measures with all of the coefficients

at the .75 level or above. This is not surprising because the Mixed Numeracy probes contain rows of items that are similar to each of the other measures. The greatest amount of intercorrelation was found between the Mixed Numeracy and Quantity Discrimination indicators (all .90 or .91). All of the intercorrelation coefficients for the Number Identification and Quantity Discrimination measures were .85 and above, while these coefficients ranged from the .65 to the .71 level for the Number Identification and the Missing Number tasks. The intercorrelations between the Quantity Discrimination and the Missing Number measures ranged from .64 to .74.

The intercorrelation data for first grade students are presented in Table 9. The data for the Mixed Numeracy measures were similar to that from the kindergarten students, with this measure having the highest intercorrelation coefficients for eight of the nine comparisons among the three other measures during the three administration periods (close to or above the .80 level). The intercorrelations between the Mixed Numeracy and Quantity Discrimination measures were also the highest for first grade students with coefficients ranging from .81 to .90. The intercorrelations between the Number Identification and the Quantity Discrimination tasks ranged from .76 to .87, while the coefficients for Number Identification and Missing Number varied from .62 to .71. Finally, the intercorrelations between the Quantity Discrimination and Missing Number indicators were slightly higher with a range from .69 to .76.

Table 8

Intercorrelations Between Early Numeracy Indicators for Kindergarten Students

	FNI Mean	FQD Mean	FMN Mean	FMX Mean	WNI Mean	WQD Mean	WMN Mean	WMX Mean	SNI Mean	SQD Mean	SMN Mean	SMX Mean
FNI Mean	--											
FQD Mean	.85	--										
FMN Mean	.65	.64	--									
FMX Mean	.87	.90	.79	--								
WNI Mean	.80	.80	.61	.81	--							
WQD Mean	.80	.87	.67	.86	.86	--						
WMN Mean	.63	.67	.73	.79	.71	.73	--					
WMX Mean	.78	.82	.68	.86	.84	.91	.82	--				
SNI Mean	.79	.81	.64	.73	.89	.89	.73	.87	--			
SQD Mean	.76	.84	.69	.76	.84	.89	.79	.87	.88	--		
SMN Mean	.60	.62	.57	.74	.66	.70	.76	.74	.71	.74	--	
SMX Mean	.73	.76	.74	.83	.77	.85	.76	.83	.85	.91	.75	--

Note. All correlations are significant at the $p < 0.01$ level.

Table 9

Intercorrelations Between Early Numeracy Indicators for First Grade Students

	FNI Mean	FQD Mean	FMN Mean	FMX Mean	WNI Mean	WQD Mean	WMN Mean	WMX Mean	SNI Mean	SQD Mean	SMN Mean	SMX Mean
FNI Mean	--											
FQD Mean	.87	--										
FMN Mean	.63	.72	--									
FMX Mean	.86	.90	.80	--								
WNI Mean	.80	.77	.64	.76	--							
WQD Mean	.71	.76	.68	.75	.81	--						
WMN Mean	.60	.61	.72	.69	.71	.76	--					
WMX Mean	.72	.73	.74	.76	.85	.86	.83	--				
SNI Mean	.74	.70	.61	.74	.91	.71	.66	.81	--			
SQD Mean	.65	.76	.64	.75	.72	.79	.64	.78	.76	--		
SMN Mean	.55	.63	.70	.66	.62	.72	.79	.76	.62	.69	--	
SMX Mean	.66	.69	.67	.71	.80	.83	.75	.85	.79	.81	.83	--

Note. All correlations are significant at the $p < 0.01$ level.

Discussion

Considering all of the reliability and validity data, as well as the examination of the intercorrelation information from the 2007-2008 and 2008-2009 academic years, we conclude that there is support for using two Mixed Numeracy indicators for each screening period rather than continuing to use all four measures during the fall, winter, and spring. The data support the technical adequacy of the Mixed Numeracy measure, which has levels of reliability and criterion validity that are comparable to the other measures. Furthermore, these results have been replicated across two academic years. This recommendation also holds great practical significance for teachers, as using a single measure will significantly decrease the amount of time that teachers need to spend gathering benchmarking data throughout the year.

References

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Appendix A

Early Numeracy Indicators

Number Identification

Sample Number Identification Measure Page

Quantity Discrimination

Sample Quantity Discrimination Measure Page

Missing Number

Sample Missing Number Measure Page

Mixed Numeracy

Sample Mixed Numeracy Page

Number Identification, page 1—Student copy

6

4

2

9

16

5

18

8

39

8

26

0

18

30

16

2

18

94

17

22

7

64

47

9

1

34

24

97

Quantity Discrimination, page 1—student copy

5	2
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7	1
---	---

8	3
---	---

1	18
---	----

8	10
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7	8
---	---

16	8
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9	1
---	---

10	7
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2	6
---	---

6	14
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9	4
---	---

12	5
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9	15
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10	8
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17	11
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0	6
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8	10
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15	14
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6	1
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5	1
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Missing Number, page 1—Student copy

7 8 ___ 10

3 4 5 ___

4 ___ 6 7

30 40 50 ___

1 2 3 ___

4 5 ___ 7

___ 3 4 5

5 10 15 ___

7 8 ___ 10

___ 4 5 6

7 8 ___ 10

6 ___ 8 9

10 15 20 ___

6 7 ___ 9

___ 2 3 4

3 4 5 ___

4 ___ 6 7

5 6 7 ___

0 1 ___ 3

___ 1 2 3

30 40 50 ___

Appendix B

Teacher Rating Scale

