

# **Mathematics Screening: The Development and Pilot Study of a Mathematics Screening Instrument for K-2 Grades**

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## Abstract

This paper summarizes an action research project to develop a math screening instrument that would be effective (valid and reliable) and efficient (time for administration). An instrument was developed after review of the mathematics assessment and mathematics disabilities literature. The instrument was administered to kindergarten, first, and second graders during the 2009-2010 school year. Screening data was compared to both teacher rankings and end-of-the-year achievement tests. Correlations ranged from .54 to .89 and were statistically significant ( $p < .05$ ). Average administration time ranged from 17.5 minutes (kindergarten) to 11 minutes (second grade). Copies of the instruments are included in the appendix. Preliminary results are positive for further validity and reliability study.

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### Problem

At the elementary level, we have obtained from the reading research several screening instruments at the primary grades (e.g. DRA, MLPP, DIBELS). We now use these tools at every grade level not only to track student progress, but also to diagnose reading problems (e.g. lack of phonemic awareness or fluency) and to prioritize students for intervention programs (Reading Start, Reading Boost, Title I reading services). The pressure from NCLB has been to achieve 100% proficiency in student math and reading achievement as defined by state assessments. While we have the tools in reading to screen, diagnose, intervene, and track students, we do not have similar tools in math. While we have various standardized tests, often they are achievement oriented versus diagnostic and can take up to 1 hour or more to administer.

### Goal

The goal of this project was to develop a math screening instrument that would be effective and efficient. By effective we mean a valid and reliable instrument that could differentiate students' conceptual understanding of mathematics in order to provide the appropriate intervention services. By efficient we mean an instrument that could be used by classroom teachers in a short period of time to make the appropriate diagnosis and preserve allocated learning time.

### Math Assessment Literature

What follows is a summary of the professional literature that was used in the development of the screening instrument.

### Standards

NCTM (1995) in their learning standards states that (1) assessment should enhance mathematics learning and (2) multiple methods need to be employed.

### Criticisms

Most tests encourage rote and superficial learning. Authors recommend more of an emphasis of quantity versus quality. (Warren and Nisbet, 2001).

Teachers have not adopted a wide range of assessment techniques for the following reasons: (1) lack of knowledge, (2) national/state tests encourage more practices aligned with these tests and away from more authentic assessment, (3) teacher perceptions of assessment, and (4) little professional development on the topic (Warren and Nisbet, 2001).

High-stakes accountability tests instead of improving instruction actually encourage teachers to replace meaningful instruction with narrow test-prep curriculum (Foster and Noyce, 2004).

### Cognitive Learning Theory

Constructs from Piaget such as conservation, transitivity, and class inclusion appear to be prerequisites for most basic number concepts. How a student scores on Piaget's logical operations correlates with mathematics achievement (Romberg and Carpenter, 1986).

Tall (2004) proposes that cognitive growth of students proceeds through 3 "worlds of mathematics: (1) perceptions of the world, (2) the world of symbols, and (3) the world of properties expressed in terms of formal definitions (e.g. group, field, vector space).

### Current Practices

In a survey of grades 1-7 teachers in Australia the following methods were described in decreasing order of use (Likert scale, 5= used very often, 1=almost never, number indicates mean): observation (4.17), practical work (3.81), investigations (3.40), oral testing (3.39), informal interviews (3.09), assigned homework (3.03), timed tests (2.56), projects (2.46), journals (2.37), and assignments (2.32) (Warren and Nisbet, 2001).

### Forms of Assessment

Besides the traditional paper and pencil tests, Adams (1998) offers the following examples of alternative math assessments: portfolios, journals, observations, self-assessment, communication (individual and group, both written and oral), surveys, and interviews. Parke (2002) describes a middle school math assessment that is more open-ended and the development of a rubric for scoring.

### Curriculum-based Measurement

Curriculum-based measurement (CBM) has been a supported method of monitoring progress and effects on student achievement particularly in reading. There are two approaches for developing CBM's in mathematics: (1) sampling existing curriculum and (2) identify measures that represent broadly defined proficiency in mathematics which are correlated to math proficiency indicators (robust indicators). The primary advantage of sampling is its alignment and potential assistance to designing remediation. A disadvantage is that it is often only related to a single grade level. Robust indicators can be used across multiple grades, are predictive of math

outcomes, but less useful in providing diagnostic information. Most of current research focuses on the elementary level. Most studies of measures from number identification to math facts had mid- to high criterion validity. (Foegen, Jiban, and Deno, 2007).

Stecker, Fuchs, and Fuchs (2005) argue that CBM consists of three essential components: (1) general outcome measurement, (2) frequent monitoring and graphical depiction of student scores, and (3) documented technical adequacy. They report that a review of research indicates mixed results for CBM. They argue from this review that successful programs often have three factors that they feel essential to CBM's successful use: (1) teachers used of systematic data-based decision rules, (2) skills analysis, and (3) implementation of instructional modifications based upon the data. In their review of successful mathematics CBM programs, the assessments consisted of basic computational facts, sets of mixed computational skills and conceptual knowledge (e.g. money, measurement, word problems, graphs/charts, and geometry). Stecker and Fuchs (2000) used a computer-based CBM that assessed students and provided teachers with individual and class skills analysis. Students in the experimental group had significantly greater growth in mathematics.

Clark and Shinn's (2004) assessed the reliability, validity, and predictability of four curriculum based mathematics measures. The measurements in their study consisted of (1) oral counting, (2) number identification, (3) quantity discrimination, and (4) missing number (e.g. name the missing number in a string of 3 numbers). The criterion measure for predictability was a math CBM for grade 1 computation, the Woodcock Johnson Applied Problems subtest, and the Number Knowledge Test. Reliability correlations ranged from .78 to .99. Concurrent validity correlation medians ranged from .60 to .75. Predictive validity correlations from fall to spring testing on the criterion tests ranged from .46 to .79.

#### Screening Research, Predictive Factors

In a review of research and existing instruments Gerstein, Clark, and Jordan (2007) and Gersten, Jordan, and Flojo (2005) report the following factors had a significant relationship in predicting later math difficulties in early grades: number sense, magnitude comparison, strategic counting, curriculum based items, numeral recognition, and working memory. They recommend timed measures as being more potent screening devices than un-timed measures.

In another study by Downer and Pianta (2006) preschool students were assessed for both achievement and cognitive factors. The three top correlations to first grade mathematics was reading achievement ( $r=.57$ ), phoneme knowledge ( $r=.54$ ) and short-term memory ( $r=.52$ ).

From a review of research Durand et al (2005) hypothesized the following variables to have predictive relationships to math achievement: working memory (phonological and visuo-spatial memory skills), speed of information processing, spatial ability, and number processing. In their experiment with 162 students aged 7 to 10, they found only one variable, digit comparison in addition to verbal ability to be a significant independent predictor of arithmetic ability. They also reported that speed of digit comparison is a predictor of individual differences in arithmetic.

Jordan et al (2007) reported that when number sense was tracked at 6 points from kindergarten to first grade, it explained 66% of the variance in end of first grade math achievement. The curriculum based items of counting objects, selecting numbers, naming numbers, and visual discrimination were found to correlate with the Brigance and TEMA-2 (VanDerHeyden, Brouard, and Cooley, 2006) .In another study, Mazzocco and Thompson (2005) reported the following items were predictive of math learning disability (MLD): reading numerals, number constancy, magnitude judgments of one-digit, and mental addition of one-digit numbers.

Bull and Johnston (1997) review literature that indicates that there is a preponderance of evidence that links short-term memory to math difficulties. They contend that the underlying cause of this relationship is unclear. They tested 68 students in the areas of short-term memory, processing speed, sequencing ability, and long-term memory. They reported that of all the variables, processing speed best predicted math ability. They measured processing speed by having student look at 30 rows of 6 digits with 2 digits in each row being identical (e.g. 712616) The students were directly to circle the identical digits and to work as quickly and as accurately as possible.

### Mathematical Disabilities (MD)

Geary (1993, 2004) proposes a theory of math test performance. Counting knowledge and working memory (attentional allocation) affect procedural skills. Working memory (decay rate) and counting speed affect the knowledge base: fact retrieval. The contributing cognitive skills of procedural skills and knowledge base not only interact but contribute to performance on ability and achievement tests. Specific deficits associated with MD are (1) the representation or retrieval of arithmetic facts from semantic memory, (2) execution of arithmetical procedures, and (3) visuospatial representation of numerical information. An appropriately diagnosed student with MD has some form of underlying memory or cognitive deficit, not just low math achievement scores. Specifically in terms of counting, although MD children may have a counting strategy, they often do not understand the irrelevance principal (can count in any order) and believed that adjacency is an essential feature of counting. When students reach first or second grade, their counting strategies are immature (e.g. counting all vs. counting on) and don't show any shifts in different strategies. Problems with procedural skills often are shown in multi-step algorithms that may involve understanding of the base 10 system. Visuospatial deficits are often found in errors in estimation and the ability to solve complex word problems.

Fletcher (2005) points out that although there is often a correlation between mathematical disabilities (MD) with reading disabilities (RD) a comparison of profiles of students with these problems indicates a significant difference in their profiles. He argues that an early screening of MD should incorporate numbers and numerical components (number sense) as opposed to assessments of underlying processes, such as working memory.

Dowker (2005) argues that MD students are heterogeneous. In a review of literature, the most common problem of MD students is a difficulty in carrying out multi-step arithmetic.

### Number Sense

Sowder and Schappelle (2002) use the following definition from Reys et al (1991) of number sense:

Number sense refers to an intuitive feeling for numbers and their various uses interpretations; an appreciation for various levels of accuracy when figuring; the ability to detect arithmetical errors, and a common-sense approach to using numbers.... Above all, number sense is characterized by a desire to make sense of numerical situations.

Their studies indicate that children acquire good number sense in classrooms where there is an emphasis on sense-making and an atmosphere conducive to sense-making through the encouragement of questioning, evaluating, criticizing, and shared learning through student interaction. Change is more likely to occur when students are required to explain, elaborate, or defend one's position. They argue that number sense is developed through activities that encourage the examination of number size, place value, fractions, and computational estimation.

Markovits, Hershdowitz, and Bruckheimer (2002) in their studies found that most computational errors occur when students use standard steps taught for algorithms rather than relying on their number sense. The examples of activities they advocate for teachers to use include number size (which is greater), estimation based on place value, rounding off, and questions that explain answers or errors.

Berch (2005) in his article summarizes the literature on number sense as being "...a biologically based 'perceptual' sense of quantity and a 'higher order' depiction as and acquired 'conceptual sense-making' of mathematics." (p.334). He argues that timed tests of number sense is important in that it can reveal important differences in numerical information processing that may not be measured by assessing accuracy alone. He reviews various studies that seem to indicate that number sense can be taught. The following are the various components he has found in the literature for number sense (p.334):

1. A faculty permitting the recognition that something has changed in a small collection when, without direct knowledge, an object has been removed or added to the collection.
2. Elementary abilities or intuitions about numbers and arithmetic.
3. Ability to approximate or estimate.
4. Ability to make numerical magnitude comparisons.
5. Ability to decompose numbers naturally.
6. Ability to develop useful strategies to solve complex problems.
7. Ability to use the relationships among arithmetic operations to understand the base-10 number system.
8. Ability to use numbers and quantitative methods to communicate, process, and interpret information.
9. Awareness of various levels of accuracy and sensitivity for the reasonableness of calculations.
10. A desire to make sense of numerical situations by looking for links between new information and previously acquired knowledge.
11. Possessing knowledge of the effects of operations on numbers.
12. Possessing fluency and flexibility with numbers.

13. Can understand number meanings.
14. Can understand multiple relationships among numbers.
15. Can recognize benchmark numbers and number patterns.
16. Can recognize gross numerical errors.
17. Can understand and use equivalent forms and representations of numbers as well as equivalent expressions.
18. Can understand numbers as referents to measure things in the real world.
19. Can move seamlessly between the real world of quantities and the mathematical world of numbers and numerical expressions.
20. Can invent procedures for conducting numerical operations.
21. Can represent the same number in multiple ways depending on the context and purpose of the representation.
22. Can think or talk in a sensible way about the general properties of a numerical problem or expression-without doing any precise computation.
23. Engenders an expectation that numbers are useful and that mathematics has a certain regularity.
24. A non-algorithmic feel for numbers.
25. A well-organized conceptual network that enables a person to relate number and operation.
26. A conceptual structure that relies on many links among mathematical relationships, mathematical principles, and mathematical procedures.
27. A mental number line on which analog representations of numerical quantities can be manipulated.
28. A nonverbal, evolutionarily ancient, innate capacity to process approximate numerosities.
29. A skill or kind of knowledge about numbers rather than an intrinsic process.
30. A process that develops and matures with experience and knowledge.

### Counting

Counting in the literature not only seems to be a predictive variable to later math problems, but also is a skill learned at the early stages of math development. What follows is a summary of information on counting from Geary (1993).

Counting by preschool children is governed by 5 principles: (1) one-to-one correspondence (only one word tag, e.g. one, two, three...), (2) stable order (the order of the word tags are the same), (3) cardinality (the value of the word tag in the count represents the sum of items), (4) abstraction (objects of any kind may be counted), and (5) order irrelevance (items can be counted in any sequence).

Four features of counting: (1) standard direction (counting starts at one end of an array), (2) adjacency (a consecutive count of contiguous objects), (3) pointing (counted items are typically pointed at but only once), and (4) start-at-an-end (counting proceeds from left to right). These features are usually found with most students by age 5. This knowledge appears to be related to skill at using computation.

“Strategy development involves changes in the mix of existing strategies as well as the construction of new ones and abandonment of old ones.” (p.347). The development of strategies for counting, especially when it comes to addition is from the “sum” method of counting both addends together to the “min” method of counting on from the minimum addend, to direct retrieval from long-term memory.

He speculates,

However, for the execution of a computational strategy to lead to the construction of a long-term memory representation between a problem and the answer, both the problem’s augend (the first number) and addend (second number), as well as the generated answer, must be simultaneously active in working memory. The availability of working-memory resources or numerical memory span is related to how much information can be rehearsed in a 2- to 3-s span. In the domain of arithmetic, rehearsal time should be related to counting speed, the faster the counting speed the longer the memory span. (p.347).

His research shows that one of the problems for math disabled children when compared to their peers are (1) immature problem-solving strategies, (2) long solution time, (3) and frequently commit computational and memory-related errors. He concludes:

The computational and memory-retrieval errors, as noted above, might be related to the availability of working-memory resources, which on top of being influenced by counting speed, is influenced by several components (e.g. attentional allocation and rate of decay).

### Estimation

Siegler and Booth (2004) from a previous study of estimation theorize that the younger a child, the more logarithmic are their estimates of quantity on a number line. As students develop, their estimates become more linear and accurate. In the experiment described in the article estimates of the magnitude of numbers on a number line fit their theory and were significantly different between grades K, 1, and 2. They also used the Stanford Achievement test to correlate to student estimates. Estimates were significantly correlated to math achievement.

### Interventions

Gersten, Jordan, and Flojo (2005) in their review of literature on early intervention programs proposes that programs consist of interventions to help build more rapid retrieval of information and concerted instruction in any and all areas of number sense or arithmetic concepts that are underdeveloped in the student (e.g. commutativity or “counting on”).

Dowker (2005) described the Mathematics Recovery program as consisting of counting procedures; counting principals; written symbolism for numbers; understanding the role of place value in number operations; word problem solving; number fact retrieval; derived fact strategy use; arithmetical estimation; and translation between arithmetical problems presented in concrete, verbal, and numerical formats. The Early Numeracy Program emphasized learning to count from concrete objects to abstract numerals.



## Commercial Screening Tests

Stanford Diagnostic Mathematics Test, Fourth Edition- \$27 per examination kit. \$85.50 per 25 machine-scorable answer books. Administration time 65 minutes for multiple choice and 90 minutes for free response. Lowest grade assessed is 1.5. Aligned with NCTM standards. “.if evidence could be presented to show that the test successfully identified particular areas where remedial instruction resulted in improved performance, I would be satisfied. Regrettably, such evidence was not presented for the SDMT 4.” (Review in Mental Measurement Yearbook, #293).

Test of Early Mathematics Ability, third edition- No time limits, although authors suggest that average assessment time would be from 45 to 60 minutes. Administered individually. Can be administered to children as young as 3. Criterion tests correlations range from .54 to .91. No recommendations for remediation interpretation.

### Test Development

A first draft of an instrument was developed based upon the literature reviewed above and then analyzed by grade level collegial teams in Kindergarten, First, and Second Grades. Revisions were made that included several curricular items. Norms from the Test of Memory and Learning (TOMAL) were used to determine above and below average short-term memory for each age group.

### Administration

The pilot math screening instrument was administered to each student individually in the hallway. Manipulatives were obtained from the classroom teachers for counting and sorting. A standard of 15 seconds was used to determine whether a student knew an answer before moving on to the next question. Numbers were recorded for each section of the test. However, total numbers for the screening instrument were used for analysis. The final draft that was administered to students is included in the Appendix.

### Pilot Study and Sample

Since a criterion-referenced or norm test was unavailable for students in grades K-3, teachers were asked to rank their students based upon their observations. The sample, then was 3 “high,” 3 “medium,” and 3 “low” students from each class. (9 students x 3 classes per grade level = 27 per grade). At the end of the second year of development an end-of-the-year mathematics test for grades 1 and 2 was adopted and administered to all students by the school district. Therefore, outcome data from the pilot screening instrument was analyzed at the Kindergarten level for rank order data and at the first and second grades for both rank order and criterion-referenced test data. Using SPSS, a Spearman rho correlation coefficient was used to compare rank order data to pilot study results and a Pearson r was determined comparison to end-of-the-year test data.

### Results

Table 1 shows the average time for administration of the screening instrument at each grade level. Table 2 shows the correlations derived and their level of significance in comparing the pilot math screening test data.

**Table 1  
Administration Time**

<b>Grade Level</b>	<b>Average Time in Minutes</b>
<b>K</b>	<b>17.58</b>
<b>1</b>	<b>13.65</b>
<b>2</b>	<b>11.22</b>

**Table 2  
Correlations**

<b>Grade Level</b>	<b>Rank Order (Spearman rho correlation, significance 1 tailed)</b>	<b>End of Year Tests (Pearson r correlation, significance 2-tailed)</b>
<b>K</b>	<b>.889 p&lt;.0001</b>	
<b>1</b>	<b>.846 p&lt;.0001</b>	<b>.717 p&lt;.002</b>
<b>2</b>	<b>.662 p&lt;.001</b>	<b>.543 p&lt;.02</b>

Discussion

There are several limitations to this study. The first is the use of a small sample. The second is the reliance on rank order data. However, the results seem to indicate that the draft is reliable and valid in the discrimination of students to make determinations for intervention. In addition, providing teachers with not only summary results, but also the results in each section based upon math disabilities research may be helpful in identifying students for remediation and the type of intervention needed.

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## **APPENDIX**

Kindergarten Mathematics Screening Instrument

1. Working Memory (Digits backwards). *Listen while I say some numbers. Repeat them to me backwards. In other words, if I say 4—7, you would say the numbers backwards, 7-4. Let's try one. 9-2.* (If child understands, proceed)

Count each number repeated in the correct order.

Repeat Backward	Number correct
8-5	
3-10	
6-8-3	
2-1-5	
4-6-1-9	
3-2-4-10	
6-9-1-3-5	
10-6-8-5-9	

Ages 5.0 -5.11 50<sup>th</sup> %ile on TOMAL= 7-8  
 Ages 6.0-6.11 -----9-11  
 Ages 7.0-7.11-----12-13

2. Numeracy. (Counting). Given 20 items, student counts to 20.

Counting characteristics	Number correct
Counting to 20	/20
Standard direction	Yes No
Cardinality (which one is third? Fifth? Second? When items put in pile, how much is there?)	/4
Order irrelevance (count from a different starting point)	/20
Sample to 100	

3. Numeracy. (Writing Numbers). Ask student to write numbers on scratch paper given the following sample of numbers: 3, 15, 7, 12, 4, 18, 1, 13, 6, 19.

<b>Writing Numbers</b>	/10
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4. Numeracy (magnitude). Ask student to circle either the bigger number or the smaller number. For correct order, count each number in correct position or order.

Magnitude understanding	Number correct
Bigger than	/9
Smaller than	/9
Correct order	/9

5. Numeracy (decomposition and operations).

a. Decomposition

1. Give student 8 objects. Please count the objects. How many are there? Yes, 8. Now can you take this pile of 8 items and separate it into two piles that equal 8? (e.g.  $3 + 5$ ). Ask student to separate 8 into two more ways with different addends.
2. Give base 10 blocks. Have student construct 34, 65, and 42.

b. Operations.

1. Here is a pile of 3 \_\_\_\_\_ and a pile of 4 \_\_\_\_\_. How many are there all together? Can you find the answer in a different way?
2. Here is a pile of 5 \_\_\_\_\_ and a pile of 8 \_\_\_\_\_. How many are there all together? Can you find the answer in a different way?
3. Here is 9 \_\_\_\_\_. What happens if I take away 3 \_\_\_\_\_? Can you find the answer in a different way?

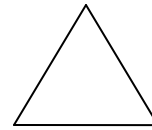
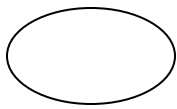
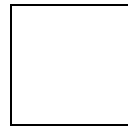
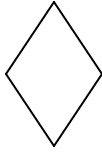
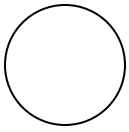
Decomposition	/6
Operations	/3

Note method(s) to add and subtract:

6. Curriculum Based (Measurement and geometry).

- i. Correctly identifies shape. (\_\_\_/1)

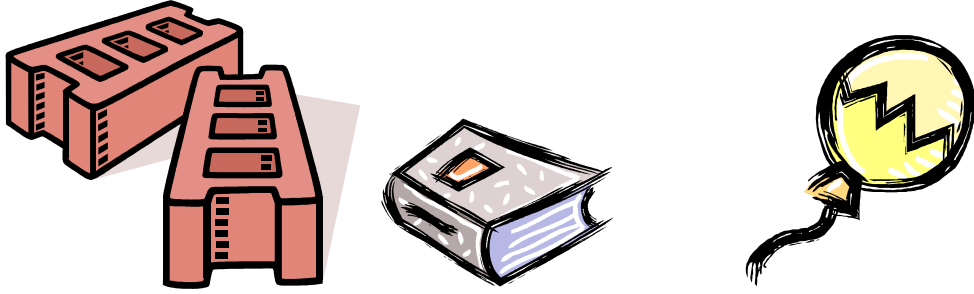




ii. Point to the lines in the order from smallest to largest. (\_\_\_/1)



iii. Point to each of these objects in the order of their weight. Go from the lightest to the heaviest. (\_\_\_/1)



Magnitude Comparison

Read these numbers to me starting with the smallest number and ending with the largest.

(\_\_\_/3)

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16    2    23

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8    27    13

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14    17    22

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First Grade Mathematics Screening Instrument

Working Memory (Digits backwards). *Listen while I say some numbers. Repeat them to me backwards. In other words, if I say 4—7, you would say the numbers backwards, 7-4. Let's try one. 9-2.* (If child understands, proceed)

Count each number repeated in the correct order.

Repeat Backward	Number correct
8-5	
3-10	
6-8-3	
2-1-5	
4-6-1-9	
3-2-4-10	
6-9-1-3-5	
10-6-8-5-9	

Ages 5.0 -5.11 50<sup>th</sup> %ile on TOMAL= 7-8  
Ages 6.0-6.11 -----9-11  
Ages 7.0-7.11-----12-13

2.0 Numeral recognition. Read these numbers to me.

2    13    28    32    47    56    77    80    94    105    110

3.1 Numeracy. (Counting).

What number comes next?

35, 36, 37, \_\_\_\_\_

92, 94, 96, \_\_\_\_\_

85, 90, 95, 100, \_\_\_\_\_

10, 20, 30, \_\_\_\_\_

3.2. Numeracy (magnitude comparison)

Read the numbers starting with the smallest and ending with the largest.

21, 16, 35, 8

52, 28, 9, 84

3.3. Numeracy (more than, less than)

What is 10 more than 45?

What is 1 less than 74?

3.4. Numeracy (composition) Give student number blocks.

What is 3 tens and 4 ones?

48 is how many 10's and one's?

4.1 Strategic counting. Give student manipulatives.

Show me how you would find the answer.

$5 + 7$

$10+5$

$8 + 8$

Can you show me another way to find the same answer? (\_\_\_\_doubles, \_\_\_\_order irrelevance, \_\_\_\_counting on, \_\_\_\_ 10's \_\_\_\_\_other:\_\_\_\_\_ check all that apply. Keep asking until student has no further methods.)

Show me how you would find the answer.

$10-2$

$19-7$

$8-3$

Can you show me another way to find the same answer? (Count the different methods used).

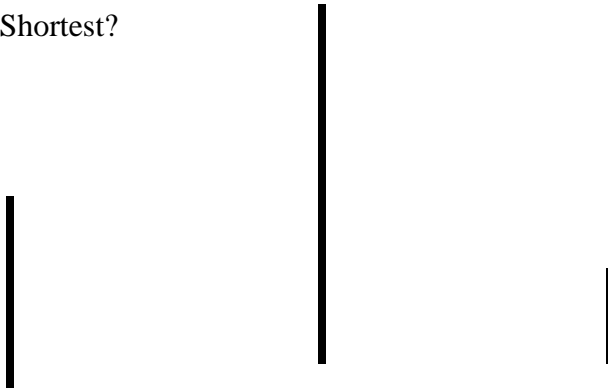
5.1 Geometry

Given a paper clip, how long is this line?



5.2. Geometry (Comparison)

Which is tallest? Shortest?



5.3. Curriculum Based (Clock to hour).

5.4. Curriculum Based (Money). How much money is this? (1 nickel, 1 dime, and 1 quarter).

Second Grade Mathematics Screening Instrument

1.0 Working Memory (Digits backwards). *Listen while I say some numbers. Repeat them to me backwards. In other words, if I say 4—7, you would say the numbers backwards, 7-4. Let's try one. 9-2.* (If child understands, proceed)

Count each number repeated in the correct order.

Repeat Backward	Number correct
8-5	
3-10	
6-8-3	
2-1-5	
4-6-1-9	
3-2-4-10	
6-9-1-3-5	
10-6-8-5-9	

Ages 5.0 -5.11 50<sup>th</sup> %ile on TOMAL= 7-8  
Ages 6.0-6.11 -----9-11  
Ages 7.0-7.11-----12-13

3.0 Numeral recognition. Read these numbers to me.

18    36    147    408    555    623    699    711    880    1000

3.1 Numeracy. (Counting).

What number comes next?

0, 3, 6, 9, 12, \_\_\_\_\_

0, 4, 8, 12, 16, \_\_\_\_\_

88, 90, 92, 94, \_\_\_\_\_

210, 215, 220, \_\_\_\_\_

860, 870, 880, \_\_\_\_\_

3.2. Numeracy (magnitude comparison)

Read the numbers starting with the smallest and ending with the largest.

406, 325, 189,

299, 304, 401

890, 765, 901

### 3.3. Numeracy (more than, less than)

What is 10 more than 120?

What is 5 more than 200?

What is 1 less than 200?

What is 5 less than 365?

What is 2 less than 288?

### 3.4. Numeracy (composition) Give student number blocks.

Please show me 243.

Please show me 137

In the number 876, what does the 8 mean?, the 7 mean?, the 6 mean?

Can you take apart a number? For example, the number 100 can be taken apart to equal  $98 + 2$ .

Can you take apart 124?

### 4.1 Strategic counting. Give student manipulatives.

Show me how you would find the answer.

$25 + 7$

$103 + 5$

$38 + 28$

Can you show me another way to find the same answer? (\_\_\_\_ doubles, \_\_\_\_ order irrelevance, \_\_\_\_ counting on, \_\_\_\_ 10's \_\_\_\_\_ other: \_\_\_\_\_ check all that apply.)

Keep asking until student has no further methods.)

Show me how you would find the answer.

$10 - 2$

$19 - 7$

$8 - 3$

Can you show me another way to find the same answer? (Count the different methods used).



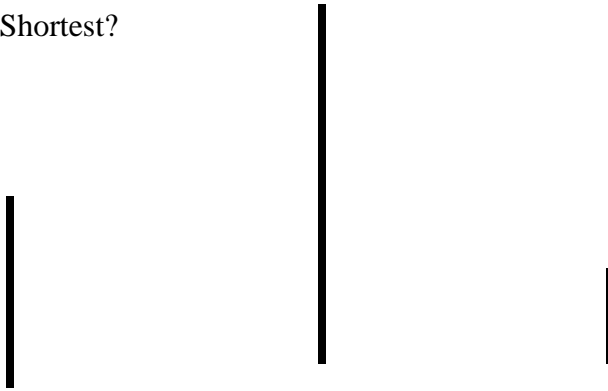
## 5.1 Geometry

Given a paper clip, how long is this line?



5.2. Geometry (Comparison)

Which is tallest? Shortest?



5.5. Curriculum Based (Clock to hour).

5.6. Curriculum Based (Money). How much money is this? (1 nickel, 1 dime, and 1 quarter).