



Test of Early Numeracy (TEN)

Administration and Scoring of AIMSweb Early Numeracy Measures for Use with AIMSweb

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Table of Contents

This manual is to be used as a supplement to the *AIMSweb Power Point Training Presentation* and *AIMSweb Training Video Tape*.

| | |
|---|-----------|
| Letter to the AIMSweb Subscriber | 3 |
| Overview of AIMSweb Training Materials | 5 |
| Big Ideas About General Outcome Measurement (GOM) Measures | 6 |
| Workbook Overview | 7 |
| The AIMSweb Early Numeracy General Outcome Measurements | 7 |
| Things you need before Testing | 13 |
| Administration and Scoring of Early Numeracy Measures | 14 |
| Oral Counting | 14 |
| Number Identification | 19 |
| Quantity Discrimination | 24 |
| Missing Number | 29 |
| Appendix | 35 |
| Reproducible Directions | 36 |
| Qualitative Features | 41 |
| Accuracy in Implementation Rating Scales | 42 |
| Technical Adequacy | 46 |

Dear AIMSweb Subscriber:

Welcome to the AIMSweb formative assessment and basic skills improvement system. AIMSweb provides teachers, school administrators, and parents a complement to the summative (high stakes) assessment/evaluation model prevalent in education today. Rather than just providing schools with information about student learning at the end of the school year, AIMSweb organizes and reports the results of simple, accurate, low cost, and more frequent testing using validated General Outcome Measures like Curriculum-Based Measurement during the school year. The AIMSweb formative assessment model informs the instructional process as it occurs by identifying at risk students as early as possible and importantly, those students who are learning and those who are not progressing satisfactorily. The distinction between “did they learn last year” and “are they learning this year” represents a paradigm shift, one that is critical for quality improvement!

The AIMSweb system consists of four components:

1. Two web-based data management and information reporting programs to report and graph the results of Curriculum-Based Measurement (CBM) in early literacy, reading, spelling and early numeracy.
 - AIMSweb Benchmark manages, evaluates, reports, and charts the results of three times per year school benchmark assessments for all students Grades K-8.
 - AIMSweb Progress Monitor allows teachers to monitor students at risk or those students with more severe educational needs more frequently to evaluate the effects of interventions and document appropriate instructional changes.
2. Standard General Curriculum Assessment Materials:
 - Standard Benchmark Reading Assessment Passages: A set of 3 graded and equivalent standard passages for Grades 1-8 for establishing fall, winter and spring reading benchmarks (24 total passages). These passages are also available in Spanish.
 - Standard Progress Monitoring Reading Assessment Passages: A set of 30 graded and equivalent passages for Grades 2-8, 23 for Grade 1 and 23 for Pre-Primer Level for use in more frequent and continuous monitoring (256 passages total).
 - Standard Benchmark Early Literacy Assessment Measures: A set of 3 equivalent Standard Benchmark Early Literacy Measures to assess Phonemic Awareness and Phonics for Kindergarten and Grade 1 for establishing fall, winter, and spring benchmarks.
 - Standard Progress Monitoring Early Literacy Measures: A set of 30 equivalent Standard Early Literacy Measures for Kindergarten and Grade 1 for use in more frequent and continuous monitoring of early literacy skills (30 tests for each indicator).
 - Standard Benchmark Reading Maze Passages: Three Standard Assessment Reading Passages for Grades 1-8 have been prepared in a maze (multiple choice close) format for use as another measure of reading comprehension (24 maze passages total).
 - Standard Progress Monitoring Reading Maze Passages: A set of 30 graded and equivalent passages prepared in Maze format, for Grades 2-8, 23 for Grade 1 and 23 for Pre-Primer Level for use in more frequent and continuous monitoring (256 passages total).
 - Standard Benchmark Early Numeracy Measures: A set of 3 standard measures to assess number sense for Kindergarten and Grade 1 for establishing fall, winter, and spring benchmarks.

- Standard Progress Monitoring Early Numeracy Measures: A set of 30 equivalent Standard Early Numeracy Measures for Kindergarten and Grade 1 for use in more frequent and continuous monitoring of early numeracy skills (30 tests for each measure).
 - Standard Benchmark Spelling Lists: A set of 3 graded and equivalent standard spelling lists for use in Grades 2-8 for establishing fall, winter, and spring spelling benchmarks (21 total lists).
 - Standard Progress Monitoring Spelling Lists: A set of 30 graded and equivalent lists of Grade 2-8 spelling words (210 total) for use in more frequent and continuous monitoring.
3. Training Workbooks designed to train staff to implement the AIMSweb system.
- Administration and Scoring of Reading Curriculum-Based Measurement (R-CBM) for Use in General Outcome Measurement
 - Administration and Scoring of Early Literacy Measures for Use in General Outcome Measurement
 - Administration and Scoring AIMSweb Early Numeracy Measures for Use with AIMSweb
 - Administration and Scoring of Spelling Curriculum-Based Measurement (S-CBM) for Use in General Outcome Measurement
 - Administration and Scoring of Reading Maze for Use in General Outcome Measurement
 - Organizing and Implementing a Benchmark Assessment Program
 - AIMSweb Progress Monitor - Strategies for Writing Individualized Goals in General Curriculum and More Frequent Formative Evaluation

AIMSweb trainers are available to deliver the training onsite or the materials can be used without assistance.

4. Online Support:

AIMSweb users become members of a community of users and an online support site (AIMSonline) designed to solve problems, answer questions, and contribute to professional development and successful implementation. A network of Strategic School Partners and Certified AIMSweb Trainers located around the country are available for inquiries, expertise, training, onsite visits, etc. AIMSweb "informs" the teaching and learning process by providing continuous student performance data and reports improvement to students, parents, teachers, and administrators.

Our promise to you is simple. Use of the AIMSweb system will improve instruction, increase achievement, and report improvement to all stakeholders.

Gary Germann
President/CEO

Steve Jennen,
Vice President and Chief Technical Officer

Overview of AIMSweb Training Materials

Administration and Scoring of AIMSweb Early Numeracy Measures provides instruction and practice in the skill areas of early numeracy. The workbook describes four fluency measures designed to assess early numeracy acquisition from early Kindergarten to Grade 1, including Oral Counting, Number Identification, Quantity Discrimination, and Missing Number. The workbook is accompanied by a videotape of students taking these tests to demonstrate key features of administering and scoring each indicator. Critical activities to complete before, during, and after testing, including scoring rules, are provided. Practice examples and answer keys are provided for users to observe and score as well as reproducible forms for making testing easier and more accurate. A Power Point Presentation accompanies the user through the training experience. Other workbooks in the AIMSweb system include:

Administering and Scoring of Reading Curriculum-Based Measurement (R-CBM) for Use in General Outcome Measurement provides instruction and practice in the skill area of reading. The workbook is accompanied by the AIMSweb Practice Video which contains segments of students reading to demonstrate key features of administering and scoring the graded reading tests. Critical activities to complete before, during, and after testing, including scoring rules, are provided. Practice examples and answer keys are provided for users to observe and score as well as reproducible forms for making testing easier and more accurate. A Power Point Presentation accompanies the user through the training experience.

Administering and Scoring of Spelling Curriculum-Based Measurement (S-CBM) for Use in General Outcome Measurement provides instruction and practice in the skill area of spelling. The workbook is to be used with the AIMSweb Practice Video which also contains demonstrations of key features of administering the graded spelling lists. Critical activities to complete before, during, and after testing, including scoring rules, are provided. Practice examples and answer keys are provided for users to observe and score as well as reproducible forms for making testing easier and more accurate. A Power Point Presentation accompanies the user through the training experience.

Administering and Scoring of Early Literacy Measures for Use in General Outcome Measurement provides instruction and practice in the skill areas of early reading. The workbook describes four fluency measures designed to assess early literacy acquisition from early Kindergarten to Grade 1, including Letter Names, Letter Sounds, Phonemic Segmentation, and Nonsense Words. The workbook is accompanied by a videotape of students taking these tests to demonstrate key features of administering and scoring each indicator. Critical activities to complete before, during, and after testing, including scoring rules, are provided. Practice examples and answer keys are provided for users to observe and score as well as reproducible forms for making testing easier and more accurate. A Power Point Presentation accompanies the user through the training experience.

Administering and Scoring of Reading Maze for Use in General Outcome Measurement provides instruction and practice in the skill area of reading comprehension. Critical activities to complete before, during, and after testing, including scoring rules, are provided. Practice examples and answer keys are provided for users to observe and score as well as reproducible forms for making testing easier and more accurate. A Power Point Presentation accompanies the user through the training experience.

Organizing and Implementing a Benchmark Assessment Program provides information on how to conduct benchmark testing in general education classrooms. The workbook provides straightforward, simple, and valuable information for planning, communication, and conducting all school benchmark testing. This manual is intended for use with AIMSweb Benchmark web-based software.

AIMSweb Progress Monitor - Strategies for Writing Individualized Goals in General Curriculum and More Frequent Formative Evaluation instructs teachers on how to write individualized annual goals for students and monitor progress on a frequent and continuous basis. Intended for use with students in individualized remedial programs - such as special education or Title I - the Training Workbook demonstrates how to write individualized annual goals based on a Survey-Level Assessment (SLA) and provides strategies for collecting student outcome information frequently and continuously. This manual is intended for use with the AIMSweb Progress Monitor web-based software.

Big Ideas About General Outcome Measurement (GOM)

Medicine measures height, weight, temperature, and blood pressure; the Federal Reserve Board measures the Consumer Price Index; Wall Street measures the Dow-Jones Industrial Average; companies report earnings per share; and even McDonald's measures how many hamburgers they sell. What do these measures have in common? They all assess general outcomes so decisions are data-based and timely.

Although these measures do not assess all health, economic, stock market, business or even fast food sales behavior, they are indicators considered so important to outcomes that they are routine. These measures are simple, accurate, and reasonably inexpensive in terms of time and materials. They are collected on an ongoing basis over time. They shape a variety of important decisions.

Education has its own set of indicators of general basic skill success. Derived out of the research base generated by a set of assessment procedures called Curriculum-Based Measurement (CBM), these General Outcome Measures allow us to make important statements about our students' reading, spelling, written expression, and mathematics computation skills.

CBM was developed more than 20 years ago by Stanley Deno at the University of Minnesota, and first implemented in schools by Gary Germann, with the idea of giving educators simple, accurate, and efficient indicators of student achievement. School-based research on CBM with real students and real teachers continues to this day. The references included in this workbook provide extensive information about how CBM was developed and validated, and how CBM can be used to make a variety of general and special education decisions.

Originally, CBM was designed to assess growth and development in students' specific curricula. In spelling, teachers would create their own individual set of CBM spelling lists based on what they were teaching and would use the information to determine students' rates of progress and make changes in instruction as needed. This tie to curriculum had high instructional validity but lacked the necessary other technical features of reliable and valid measurement.

It soon became apparent that the positive effects of testing from materials selected from an individual teacher's curriculum were offset by the lack of standard information about students' progress. Some teachers had "no curriculum," the curriculum would change year to year, and the differences between schools, between teachers within schools, and so on, made accurate decisions about students' progress very difficult. Furthermore, teachers were too often burdened by the business of creating their own testing materials. In addition to being more time consuming, the variability in assessment practices was a concern.

After considerable research, it has been demonstrated that a perfect correspondence between what CBM assessed and students' specific curricula was not necessary. In fact, by using standard assessment materials, the same judgments about students' level of spelling skill and spelling progress, could still be made accurately, as well as provide appropriate, standards of growth and development across varied curricula, teachers, schools, and school districts.

What emerged from this school-based research was the following conclusion: Achievement can be improved by testing students (1) using standard, valid tests, (2) that measured something important, (3) on tasks of about equal difficulty tied to general curriculum (4) over time. CBM provided the assessment procedures to be able to do Numbers 1, 2, and 4. By developing graded and equivalent assessment materials of about equal difficulty tied to general curriculum, (Number 3) General Outcome Measurements (GOMs) evolved. Thus, the assessment procedures known as CBM are used in an assessment approach called General Outcome Measurement.

Workbook Overview

This workbook section covers administration and scoring of the four AIMSweb Early Numeracy Measures and what examiners need to do:

1. Before testing students,
2. While testing students, and
3. After testing students. Video practice tests for learning how to score are included.

To date, each Early Numeracy Measure, has been designed to serve as a general outcome measure. A current research program is investigating the strength of each early numeracy measure as a general outcome measure.

The Early Numeracy General Outcome Measurements

Beginning in the early 1990's and continuing today, increased attention has been placed on effective assessment and teaching practices for reading. Arising from this movement was a focus on the prevention of reading difficulties before they occur. For this to happen, educators needed tools to help them make decisions about students at-risk for failure in reading.

A similar movement is beginning in the assessment and teaching of mathematics. The National Research Council recently released "Adding it Up" (2001) a summary of math research intended to aid assessment and teaching practices.

Currently, educators can use Mathematics Curriculum-based measurement (M-CBM) to monitor the progress of children in mathematics after they are doing formal mathematics. However, this does not occur until the middle to end of first grade. Thus students may be failing to acquire critical mathematical knowledge that will form the basis of later understanding. Educators need tools to identify these at-risk children before problems occur.

What tools then exist to help us identify children at-risk for later failure in mathematics and what early numeracy skills should they be based upon? Because children come to school with a number of informal math skills such as counting, ability to identify numbers, discriminate between quantities, and formulate mental number lines, measures of early mathematics can be based upon these early informal math skills.

When educators are interested in making decisions with General Outcome Measurement so they can make accurate meaningful statements about student early numeracy growth and development, they use Early Numeracy General Outcome Measurements (EN-GOM). Based on research examining the development of children's informal mathematical knowledge, each measure requires the student to demonstrate a skill that provides a foundation for the latter acquisition of formal mathematics taught in school.

Students orally count, identify numbers, identify the bigger number from a pair, and identify the missing number from a number line. Each task is one minute and designed to represent a critical early numeracy skill for kindergarten and first grade students.

A summary of each measure including length, testing arrangement, and what is scored is shown below.

| Measure | Timing | Test Arrangements | What is Scored |
|------------------------------|----------|-------------------|----------------------------------|
| Oral Counting (OC) | 1 minute | Individual | Correct Oral Counts |
| Number Identification (NI) | 1 minute | Individual | Correct Number Identifications |
| Quantity Discrimination (QD) | 1 minute | Individual | Correct Quantity Discriminations |
| Missing Number (MN) | 1 minute | Individual | Correct Missing Numbers |

Things to Remember about General Outcome Measurement

Throughout learning to administer and score EN-GOM, it is important to remember each of the following features. All GOM assessments:

- Are designed to serve as “signs” of general achievement. They don’t measure everything, but measure important things.
- Are standardized assessments. They are intended to be administered, scored, and interpreted in a standard way.
- Are researched with respect to psychometric properties of reliability and validity. If we use standardized GOM testing procedures, we can be confident in accurate measures of general outcomes.
- Are sensitive to improvement in short periods of time. Improvement on General Outcome Measures over time means students are learning to read, spell, or use mathematics.
- Tell us how students earned their scores (Qualitative) as well as their scores (Quantitative).
- Are designed to be as short as possible to not conflict with teaching and to ensure its “do-ability.”
- Are linked to decision making for promoting positive achievement with general education students and for Problem-Solving decision making with at risk students or those in remedial programs like Title I and special education.

Using Standard Early Numeracy Probes

Edformation’s Standard Early Numeracy Probes are carefully designed to ensure that the probes at each grade level are similar in difficulty. Probes are “curriculum independent,” thus allowing educators to make decisions about general early numeracy outcomes regardless of early mathematics curriculum differences between teachers and schools.

AIMSweb uses Standard Early Numeracy Probes in two types of assessment for two primary purposes:

| Types | Purpose | Description |
|--------------------------|---|---|
| AIMSweb Benchmark | <ol style="list-style-type: none"> 1. To screen all students 3 times a year and to identify students in need of early numeracy interventions. 2. To monitor the improvement of individual students in the fall, winter, and spring of the school year. 3. To make program evaluation decisions and improve accountability. | Includes 3 Standard Benchmark Early Numeracy Probes for each measure in grades K and 1 to develop school early numeracy benchmarks. |
| AIMSweb Progress Monitor | <ol style="list-style-type: none"> 1. To provide a practical way of writing individualized progress goals, including IEPs. 2. To monitor the progress of individual students in early numeracy. 3. To provide teachers, parents, and administrators with data to make instructional decisions | Includes 30 standard Progress Monitoring Probes (for each measure) for frequently monitoring the progress of individual students. |

AIMSweb software provides an assessment and improvement management system via the Internet. By providing improvement reports in a timely and cost/time efficient manner, teachers, parents, and administrators are provided valuable information to improve instruction, increase achievement, and report success.

Illustration 1: Oral Counting

Listen to a student take the Oral Counting test. Listen and follow along.

| | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|-----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

Illustration 2: Oral Counting

Now listen to a student take the Oral Counting test. Listen and follow along.

| | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|-----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

1. Are their skills the same? How do they differ?
2. Which student is most at risk?

Illustration 3: Number Identification

Listen to a student take the Number Identification test. Listen and follow along.

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| 8 | 18 | 11 | 12 | 19 | 9 | 7 | 4 |
| 16 | 13 | 0 | 9 | 17 | 3 | 6 | 15 |
| 1 | 14 | 9 | 0 | 6 | 15 | 11 | 19 |
| 20 | 13 | 10 | 0 | 2 | 8 | 6 | 11 |
| 1 | 11 | 15 | 9 | 4 | 17 | 6 | 5 |
| 10 | 4 | 11 | 5 | 1 | 9 | 20 | 8 |
| 16 | 7 | 20 | 0 | 5 | 17 | 19 | 13 |
| 12 | 13 | 1 | 18 | 9 | 17 | 11 | 20 |
| 11 | 16 | 8 | 0 | 5 | 4 | 19 | 6 |
| 17 | 16 | 7 | 15 | 13 | 12 | 8 | 5 |

Illustration 4: Number Identification

Now listen to a student take the Number Identification test. Listen and follow along.

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| 8 | 18 | 11 | 12 | 19 | 9 | 7 | 4 |
| 16 | 13 | 0 | 9 | 17 | 3 | 6 | 15 |
| 1 | 14 | 9 | 0 | 6 | 15 | 11 | 19 |
| 20 | 13 | 10 | 0 | 2 | 8 | 6 | 11 |
| 1 | 11 | 15 | 9 | 4 | 17 | 6 | 5 |
| 10 | 4 | 11 | 5 | 1 | 9 | 20 | 8 |
| 16 | 7 | 20 | 0 | 5 | 17 | 19 | 13 |
| 12 | 13 | 1 | 18 | 9 | 17 | 11 | 20 |
| 11 | 16 | 8 | 0 | 5 | 4 | 19 | 6 |
| 17 | 16 | 7 | 15 | 13 | 12 | 8 | 5 |

1. Are their skills the same? How do they differ?
2. Which student is most at risk?

Illustration 5: Quantity Discrimination

Listen to a student take the Quantity Discrimination test. Listen and follow along.

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| 9 | 18 | 19 | 15 | 12 | 15 | 13 | 7 |
| 2 | 1 | 19 | 7 | 19 | 14 | 0 | 7 |
| 8 | 10 | 9 | 19 | 5 | 18 | 17 | 11 |
| 17 | 10 | 14 | 19 | 1 | 4 | 0 | 10 |
| 18 | 10 | 17 | 0 | 4 | 1 | 7 | 11 |
| 16 | 18 | 10 | 14 | 15 | 14 | 0 | 11 |
| 1 | 16 | 7 | 2 | 16 | 2 | 15 | 2 |
| 12 | 20 | 2 | 14 | 3 | 0 | 14 | 11 |
| 14 | 20 | 11 | 19 | 1 | 15 | 20 | 8 |
| 14 | 15 | 9 | 7 | 11 | 8 | 6 | 9 |

Illustration 6: Quantity Discrimination

Now listen to a student take the Quantity Discrimination test. Listen and follow along.

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| 9 | 18 | 19 | 15 | 12 | 15 | 13 | 7 |
| 2 | 1 | 19 | 7 | 19 | 14 | 0 | 7 |
| 8 | 10 | 9 | 19 | 5 | 18 | 17 | 11 |
| 17 | 10 | 14 | 19 | 1 | 4 | 0 | 10 |
| 18 | 10 | 17 | 0 | 4 | 1 | 7 | 11 |
| 16 | 18 | 10 | 14 | 15 | 14 | 0 | 11 |
| 1 | 16 | 7 | 2 | 16 | 2 | 15 | 2 |
| 12 | 20 | 2 | 14 | 3 | 0 | 14 | 11 |
| 14 | 20 | 11 | 19 | 1 | 15 | 20 | 8 |
| 14 | 15 | 9 | 7 | 11 | 8 | 6 | 9 |

1. Are their skills the same? How do they differ?
2. Which student is most at risk?

Illustration 7: Missing Number

Listen to a student take the Missing Number test. Listen and follow along.

| | | |
|-----------|-----------|-----------|
| 8 9 ___ | 13 14 ___ | ___ 19 20 |
| ___ 6 7 | 14 ___ 16 | 13 ___ 15 |
| ___ 10 11 | 6 7 ___ | 3 ___ 5 |
| 10 11 ___ | 10 ___ 12 | ___ 7 8 |
| ___ 12 13 | 9 10 ___ | 11 12 ___ |
| 18 19 ___ | 5 6 ___ | 1 2 ___ |
| ___ 14 15 | ___ 9 10 | ___ 11 12 |
| 6 ___ 8 | 0 ___ 2 | ___ 2 3 |
| 14 15 ___ | 17 ___ 19 | ___ 8 9 |
| ___ 17 18 | 16 17 ___ | 9 ___ 11 |

Illustration 8: Missing Number

Now listen to a student take the Missing Number test. Listen and follow along.

| | | |
|-----------|-----------|-----------|
| 8 9 ___ | 13 14 ___ | ___ 19 20 |
| ___ 6 7 | 14 ___ 16 | 13 ___ 15 |
| ___ 10 11 | 6 7 ___ | 3 ___ 5 |
| 10 11 ___ | 10 ___ 12 | ___ 7 8 |
| ___ 12 13 | 9 10 ___ | 11 12 ___ |
| 18 19 ___ | 5 6 ___ | 1 2 ___ |
| ___ 14 15 | ___ 9 10 | ___ 11 12 |
| 6 ___ 8 | 0 ___ 2 | ___ 2 3 |
| 14 15 ___ | 17 ___ 19 | ___ 8 9 |
| ___ 17 18 | 16 17 ___ | 9 ___ 11 |

1. Are their skills the same? How do they differ?
2. Which student is most at risk?

Things You Need Before Testing

For all the Early Numeracy tests, three major tasks must be completed for efficient and accurate assessment:

1. Understanding the typical time frame for administering specific tests.
2. Getting the necessary testing materials, and
3. Arranging the testing environment

Understanding the Typical Timeframe

The following table illustrates when the AIMSweb Early Numeracy measures are intended to be given during Kindergarten and Grade 1.

Recommended AIMSweb Early Numeracy Assessment Schedule

| Kindergarten | | | First Grade | | |
|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| Fall | Winter | Spring | Fall | Winter | Spring |
| Oral Counting | Oral Counting | Oral Counting | Oral Counting | Oral Counting | Oral Counting |
| Number Identification | Number Identification | Number Identification | Number Identification | Number Identification | Number Identification |
| Quantity Discrimination | Quantity Discrimination | Quantity Discrimination | Quantity Discrimination | Quantity Discrimination | Quantity Discrimination |
| Missing Number | Missing Number | Missing Number | Missing Number | Missing Number | Missing Number |

It should be noted that currently all 4 AIMSweb Early Numeracy measures are given during each testing period. An ongoing research program to further define the measures and the optimal timeframe in which to utilize them is being conducted.

Getting the Early Numeracy Assessment Materials You Need

Students always use the AIMSweb Standard EN-GOM materials for the Oral Counting, Number Identification, Quantity Discrimination, and Missing Number Measure. The AIMSweb materials are available as downloads in Adobe Acrobat (pdf format) as part of the AIMSweb subscription.

Arranging the Testing Environment

Getting accurate early numeracy results is dependent on how the testing environment is arranged. Although EN-GOM testing is conducted 1 to 1, testing arrangements are flexible. A set-aside place in a classroom can work if it is reasonably quiet and away from classroom distractions such as sinks and water fountains. The station should include a small table for testing. Alternately, a testing station in the hallway where there is minimal student traffic is suitable. On more large scale student testing, such as schoolwide benchmarking, testing stations in the media center, gym, cafeteria, or empty classrooms will work.

Helpful Hints While Administering Early Numeracy Measures

- It's about testing, not teaching. The standard directions for each EN-GOM should always be used. That means keeping the testing a “test.” EN-GOM is not to be used as instruction. Students should not practice the measures prior to testing or have their errors corrected by the examiner during the testing session.
- Complete reliability checks before data collections with all examiners to ensure reliable administration. Additional reliability checks should be done at least once a year for all examiners, even those familiar with testing.
- Best versus Fastest responding. The testing environment must be structured to emphasize the student do their best responding versus their fastest. Timing should be done in a subtle manner and not in the face of the student.
- Sit across from, Not Beside. When we have students do early math work we sit beside them. When we assess students, we sit across from them. We want the students to be looking at the EN-GOM materials and not how, we the examiners, are scoring or what we are doing.

Oral Counting

The Oral Counting measure requires students to orally count starting from 1 as high as they can in one minute.

Before Testing

Testing Environment Arranged

Specific Materials Arranged

- Examiner copy of Oral Counting for scoring
- Clipboard to provide a hard surface for recording student answers
- Stopwatch
- Tape recorder (optional) to aid in scoring questions or for qualitative analysis.

The student does not have any materials. The examiner follows along on an examiner score sheet. An example examiner score sheet is found below. The copy is reduced in size to save space.

| | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|-----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

During Testing

The AIMSweb Oral Counting Measure is a standardized test. Therefore, these specific directions must be used during testing to have confidence in the reliability, validity, and comparability of the results.

Oral Counting Standard Directions for 1-Minute Administration

1. Place the examiner copy on a clipboard and position so the student cannot see what the examiner records.
2. Say these specific directions to the student:

“When I say start I want you to start counting aloud from 1 like this 1, 2, 3 until I tell you to stop. If you come to a number you don’t know, I’ll tell it to you. Be sure to do your best counting. Are there any questions? Ready, Start.”
3. Start your stopwatch. If the student fails to say “1” after 3 seconds, say “1” and continue.
4. Follow along on the examiner copy. Score according to scoring rules. After one minute has expired, place a bracket after the last number said and say “Stop.”

Things You Need to Do After Testing: Scoring

It is important that results are scored immediately after the 1 minute testing is completed to ensure accurate results. Students receive 1 point for every correct oral count in one minute.

Scoring Rules

Rule 1: If a student says the number that comes next in their sequence, score the number as correct.
Example: Student says . . . 12, 13, 14. . . . Scoring is 3 correct.

Rule 2: If a student repeats a sequence score, the sequence as correct.
Example: Student says 7, 8, 7, 8, 9. Scoring is 3 correct.

Rule 3: If a student self-corrects, score the number as correct.
Example: Student says 1, 2, 3, 5 oh 3, 4, 5. Scoring is 5 correct

Rule 4: If a student hesitates with a number for 3 seconds, tell the student the number and score the number on which the student hesitated as incorrect. You may tell the student only one number during testing.

Example: Student says 12, 13, . . . (3 seconds) examiner says “14”. Score 14 as incorrect and continue testing. Student continues to count and comes to 28, 29, . . . (3 seconds) examiner says "stop" and discontinues testing.

Rule 5: If a student skips a number while counting, score the number as incorrect and continue testing.

Example: Student says 6, 7, 9. Score 8 as incorrect and continue testing.

Practice Exercise 1: Oral Counting

| | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|-----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

1. Count the total number of Oral Counts ____
2. Count the total number of errors ____
3. Subtract errors from total number. Correct Oral Counts ____

Practice Exercise 1: Oral Counting ANSWER KEY:

| | | | | | | | | | |
|---------------|---------------|---------------|---------------|---------------|----|----|----|---------------|---------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

1. Count the total number of Oral Counts ____
2. Count the total number of errors ____
3. Subtract errors from total number. Correct Oral Counts ____

Practice Exercise 2: Oral Counting

| | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|-----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

1. Count the total number of Oral Counts _____
2. Count the total number of errors _____
3. Subtract errors from total number. Correct Oral Counts _____

Practice Exercise 2: Oral Counting ANSWER KEY:

| | | | | | | | | | |
|----|----|----|----|---------------|----|----|----|----|---------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

1. Count the total number of Oral Counts _____
2. Count the total number of errors _____
3. Subtract errors from total number. Correct Oral Counts _____

Checking Out Accuracy in Test Administration

Getting accurate student results should not depend on who assesses the students. If we use standardized instructions and score correctly, different examiners should obtain the same results. To ensure that examiners are consistent in administration and scoring, we recommend “check outs”, the process of each observing each other administer Oral Counting. We use an accuracy of implementation ratings scales (AIRS) like the one in the Appendix, after we watch a trainee administer Oral Counting, we complete an AIRS and provide feedback for accurate and consistent standardized testing.

Figuring Out Inter-Scorer Agreement

Because no testing is perfectly reliable, we need to know how much different examiners agree. This process of obtaining Inter-Scorer agreement is not done just after training but periodically to ensure that examiners are consistent in scoring.

A simple formula for calculating Inter-Scorer agreement is:

small number/larger number x 100

Inter-Scorer Agreement Practice

For two examiners who scored Carl as 39 and 40 Correct Oral Counts their inter-rater agreement would be 97.5% as follows.

Small Number is 39

Large Number is 40

Small Number (39)/Larger Number (40) x 100 = 97.5%

Number Identification

The Number Identification measure requires students to orally identify numbers. Kindergarten students identify numbers between 1 and 10 and first grade students orally identify numbers between 1 and 20.

Before Testing

Testing Environment Arranged

Specific Materials Arranged

- Examiner copy of Number Identification for Scoring
- Student copy of Number Identification for Scoring
- Clipboard to provide a hard surface for recording student answers
- Stopwatch
- Tape recorder (optional) to aid in scoring questions or for qualitative analysis.

The student looks at numbers arranged in 7 rows of 8 numbers. The examiner follows along on an identical set of materials. An example student sheet is found below. The copy is reduced in size to save space.

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| 8 | 18 | 11 | 12 | 19 | 9 | 7 | 4 |
| 16 | 13 | 0 | 9 | 17 | 3 | 6 | 15 |
| 1 | 14 | 9 | 0 | 6 | 15 | 11 | 19 |
| 20 | 13 | 10 | 0 | 2 | 8 | 6 | 11 |
| 1 | 11 | 15 | 9 | 4 | 17 | 6 | 5 |
| 10 | 4 | 11 | 5 | 1 | 9 | 20 | 8 |
| 16 | 7 | 20 | 0 | 5 | 17 | 19 | 13 |
| 12 | 13 | 1 | 18 | 9 | 17 | 11 | 20 |
| 11 | 16 | 8 | 0 | 5 | 4 | 19 | 6 |
| 17 | 16 | 7 | 15 | 13 | 12 | 8 | 5 |

During Testing

The AIMSweb Number Identification Measure is a standardized test. Therefore, these specific directions must be used during testing to have confidence in the reliability, validity, and comparability of the results.

Number Identification Standard Directions for 1-Minute Administration

1. Place the student copy in front of the student.
2. Place the examiner copy on a clipboard and position so the student cannot see what the examiner records.
3. Say these specific directions to the student:

“Look at the paper in front of you. It has a number on it (demonstrate by pointing).
What number is this?”

Example 1

| CORRECT RESPONSE: | INCORRECT RESPONSE: |
|--|--|
| “Good. The number is 8. Look at the number next to 8 (demonstrate by pointing). What number is this?” | “This number is 8 (point to 8). What number is this? Good. Let’s try another one. Look at the number next to 8 (demonstrate by pointing). What number is this?” |

Example 2

| CORRECT RESPONSE: | INCORRECT RESPONSE: |
|---|--|
| “Good. The number is 4.” (Turn the page). | “This number is 4 (point to 4). What number is this? Good.” (Turn the page). |

“The paper in front of you has numbers on it. When I say start, I want you to tell me what the numbers are. Start here and go across the page (demonstrate by pointing). If you come to a number you don’t know, I’ll tell you what to do. Are there any questions? Put your finger on the first one. Ready, start.”

4. Start your stopwatch. If the student fails to answer the first problem after 3 seconds, tell the student to “try the next one.”
5. If the student does not get any correct within the first 5 items, discontinue the task and record a score of zero.
6. Follow along on the examiner copy. Put a slash (/) through any incorrects.
7. The maximum time for each item is 3 seconds. If a student does not provide an answer within 3 seconds, tell the student to “try the next one.”
8. At the end of 1 minute, place a bracket () around the last item completed and say “Stop.”

Things You Need To Do After Testing: Scoring

It is important that results are scored immediately after the 1-minute testing is completed to ensure accurate results. Students receive 1 point for every item correctly completed in 1 minute.

Scoring Rules

Rule 1: If a student correctly identifies the number score the item as correct.

Rule 2: If the student states any number other than the item number score the item as incorrect.

Rule 3: If a student hesitates or struggles with a number for 3 seconds tell the student to “try the next one” and score the item as incorrect.

Rule 4: If a student skips a number, score the number as incorrect.

Rule 5: If a student skips an entire row, mark each number in the row as incorrect by drawing a line through the row on the examiner scoresheet.

Rule 6: If a student misses 5 items consecutively discontinue testing.

Practice Exercise 3: Number Identification

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| 8 | 18 | 11 | 12 | 19 | 9 | 7 | 4 |
| 16 | 13 | 0 | 9 | 17 | 3 | 6 | 15 |
| 1 | 14 | 9 | 0 | 6 | 15 | 11 | 19 |
| 20 | 13 | 10 | 0 | 2 | 8 | 6 | 11 |
| 1 | 11 | 15 | 9 | 4 | 17 | 6 | 5 |
| 10 | 4 | 11 | 5 | 1 | 9 | 20 | 8 |
| 16 | 7 | 20 | 0 | 5 | 17 | 19 | 13 |
| 12 | 13 | 1 | 18 | 9 | 17 | 11 | 20 |
| 11 | 16 | 8 | 0 | 5 | 4 | 19 | 6 |
| 17 | 16 | 7 | 15 | 13 | 12 | 8 | 5 |

1. Count the total number of Number Identifications ____
2. Count the total number of errors ____
3. Subtract errors from total number. Correct Number Identifications ____

Practice Exercise 3: Number Identification ANSWER KEY

| | | | | | | | |
|---------------|---------------|----|----|---------------|-----------------|----|---------------|
| 8 | 18 | 11 | 12 | 19 | 9 | 7 | 4 |
| 16 | 13 | 0 | 9 | 17 | 3 | 6 | 15 |
| 1 | 14 | 9 | 0 | 6 | 15] | 11 | 19 |
| 20 | 13 | 10 | 0 | 2 | 8 | 6 | 11 |
| 1 | 11 | 15 | 9 | 4 | 17 | 6 | 5 |
| 10 | 4 | 11 | 5 | 1 | 9 | 20 | 8 |
| 16 | 7 | 20 | 0 | 5 | 17 | 19 | 13 |
| 12 | 13 | 1 | 18 | 9 | 17 | 11 | 20 |
| 11 | 16 | 8 | 0 | 5 | 4 | 19 | 6 |
| 17 | 16 | 7 | 15 | 13 | 12 | 8 | 5 |

1. Count the total number of Number Identifications ____
2. Count the total number of errors ____
3. Subtract errors from total number. Correct Number Identifications ____

Practice Exercise 4: Number Identification

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| 8 | 18 | 11 | 12 | 19 | 9 | 7 | 4 |
| 16 | 13 | 0 | 9 | 17 | 3 | 6 | 15 |
| 1 | 14 | 9 | 0 | 6 | 15 | 11 | 19 |
| 20 | 13 | 10 | 0 | 2 | 8 | 6 | 11 |
| 1 | 11 | 15 | 9 | 4 | 17 | 6 | 5 |
| 10 | 4 | 11 | 5 | 1 | 9 | 20 | 8 |
| 16 | 7 | 20 | 0 | 5 | 17 | 19 | 13 |
| 12 | 13 | 1 | 18 | 9 | 17 | 11 | 20 |
| 11 | 16 | 8 | 0 | 5 | 4 | 19 | 6 |
| 17 | 16 | 7 | 15 | 13 | 12 | 8 | 5 |

1. Count the total number of Number Identifications _____
2. Count the total number of errors _____
3. Subtract errors from total number. Correct Number Identifications _____

Practice Exercise 4: Number Identification ANSWER KEY

| | | | | | | | |
|----|---------------|---------------|---------------|---------------|---------------|----|---------------|
| 8 | 18 | 11 | 12 | 19 | 9 | 7 | 4 |
| 16 | 13 | 0 | 9 | 17 | 3 | 6 | 15 |
| 1 | 14 | 9 | 0 | 6 | 15 | 11 | 19 |
| 20 | 13 | 10 | 0 | 2 | 8 | 6 | 11 |
| 1 | 11 | 15 | 9 | 4 | 17 | 6 | 5 |
| 10 | 4 | 11 | 5 | 1 | 9 | 20 | 8 |
| 16 | 7 | 20 | 0 | 5 | 17 | 19 | 13 |
| 12 | 13 | 1 | 18 | 9 | 17 | 11 | 20 |
| 11 | 16 | 8 | 0 | 5 | 4 | 19 | 6 |
| 17 | 16 | 7 | 15 | 13 | 12 | 8 | 5 |

1. Count the total number of Number Identifications _____
2. Count the total number of errors _____
3. Subtract errors from total number. Correct Number Identifications _____

Checking Out Accuracy in Test Administration

A copy of the Accuracy of Implementation Rating Scale (AIRS) for Number Identification is in the Appendix.

Inter-Scorer Agreement Practice

Compare your scores for ____ with a partner and compute Inter-Scorer Agreement.

Small Number score ____

Large Number score ____

Small Number/Large Number x 100 = ____%

Quantity Discrimination

The Quantity Discrimination measure requires students to orally identify the bigger number from a pair of numbers. Kindergarten students identify bigger numbers from pairs of numbers between 1 and 10 and first grade students identify bigger numbers from pairs of numbers between 1 and 20.

Before Testing

Testing Environment Arranged

Specific Materials Arranged

- Examiner copy of Quantity Discrimination for Scoring
- Student copy of Quantity Discrimination for Scoring
- Clipboard to provide a hard surface for recording student answers
- Stopwatch
- Tape recorder (optional) to aid in scoring questions or for qualitative analysis.

The student looks at pairs of numbers arranged in 7 rows of 4 pairs. The examiner follows along on an identical set of materials. An example student Quantity Discrimination measure is found below. The copy is reduced to save size and space.

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| 9 | 18 | 19 | 15 | 12 | 15 | 13 | 7 |
| 2 | 1 | 19 | 7 | 19 | 14 | 0 | 7 |
| 8 | 10 | 9 | 19 | 5 | 18 | 17 | 11 |
| 17 | 10 | 14 | 19 | 1 | 4 | 0 | 10 |
| 18 | 10 | 17 | 0 | 4 | 1 | 7 | 11 |
| 16 | 18 | 10 | 14 | 15 | 14 | 0 | 11 |
| 1 | 16 | 7 | 2 | 16 | 2 | 15 | 2 |
| 12 | 20 | 2 | 14 | 3 | 0 | 14 | 11 |
| 14 | 20 | 11 | 19 | 1 | 15 | 20 | 8 |
| 14 | 15 | 9 | 7 | 11 | 8 | 6 | 9 |

During Testing

The AIMSweb Quantity Discrimination measure is a standardized test. Therefore, these specific directions must be used during testing to have confidence in the reliability, validity, and comparability of the results.

Quantity Discrimination Standard Directions for 1-Minute Administration

1. Place the student copy in front of the student.
2. Place the examiner copy on a clipboard and position so the student cannot see what the examiner records.
3. Say these specific directions to the student:

“Look at the piece of paper in front of you. The box in front of you has two numbers in it (demonstrate by pointing). I want you to tell me the number that is bigger.”

Example 1

| | |
|--|---|
| <p>CORRECT RESPONSE: “Good. The bigger number is 7. Now look at this box (demonstrate by pointing). It has two numbers in it. Tell me the number that is bigger.”</p> | <p>INCORRECT RESPONSE: “The bigger number is 7. You should have said 7 because 7 is bigger than 4. Now look at this box (demonstrate by pointing). It has two numbers in it. Tell me the number that is bigger.”</p> |
|--|---|

Example 2

| | |
|--|---|
| <p>CORRECT RESPONSE: “Good. The bigger number is 4.” (Turn the page).</p> | <p>INCORRECT RESPONSE: “The bigger number is 4. You should have said 4 because 4 is bigger than 2.” (Turn the page).</p> |
|--|---|

“The paper in front of you has boxes on it. In the boxes are two numbers. When I say start, I want you to tell me the number in the box that is bigger. Start here and go across the page (demonstrate by pointing). If you come to a box and you don’t know which number is bigger, I’ll tell you what to do. Are there any questions? Put your finger on the first one. Ready, start.”

4. Start your stopwatch. If the student fails to answer the first problem after 3 seconds, tell the student to “try the next one.”
5. If the student does not get any correct within the first 5 items, discontinue the task and record a score of zero.
6. Follow along on the examiner copy. Put a slash (/) through any incorrects.
7. The maximum time for each item is 3 seconds. If a student does not provide an answer within 3 seconds, tell the student to “try the next one.”
8. At the end of 1 minute, place a bracket () around the last item completed and say “Stop.”

Things You Need To Do After Testing: Scoring

It is important that results are scored immediately after the 1 minute testing is completed to ensure accurate results. Students receive 1 point for every item correctly completed in 1 minute.

Scoring Rules

Rule 1: If a student states the bigger number, score the item as correct.

Rule 2: If the student states both numbers, score the item as incorrect.

Rule 3: If the student states any number other than the bigger number, score the item as incorrect.

Rule 4: If a student hesitates or struggles with an item for 3 seconds, tell the student to “try the next one.” Score the item as incorrect.

Rule 5: If a student skips an item, score the item as incorrect.

Rule 6: If a student skips an entire row, mark each item in the row as incorrect by drawing a line through the row on the examiner scoresheet.

Rule 7: If a student misses 5 items consecutively, discontinue testing.

Practice Exercise 5: Quantity Discrimination

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| 9 | 18 | 19 | 15 | 12 | 15 | 13 | 7 |
| 2 | 1 | 19 | 7 | 19 | 14 | 0 | 7 |
| 8 | 10 | 9 | 19 | 5 | 18 | 17 | 11 |
| 17 | 10 | 14 | 19 | 1 | 4 | 0 | 10 |
| 18 | 10 | 17 | 0 | 4 | 1 | 7 | 11 |
| 16 | 18 | 10 | 14 | 15 | 14 | 0 | 11 |
| 1 | 16 | 7 | 2 | 16 | 2 | 15 | 2 |
| 12 | 20 | 2 | 14 | 3 | 0 | 14 | 11 |
| 14 | 20 | 11 | 19 | 1 | 15 | 20 | 8 |
| 14 | 15 | 9 | 7 | 11 | 8 | 6 | 9 |

1. Count the total number of Quantity Discriminations ____
2. Count the total number of errors ____
3. Subtract errors from total number. Correct Quantity Discriminations ____

Practice Exercise 5: Quantity Discrimination ANSWER KEY

| | | | | | | | |
|--------------|---------------|---------------|----|----|---------------|---------------|----|
| 9 | 18 | 19 | 15 | 12 | 15 | 13 | 7 |
| 2 | 1] | 19 | 7 | 19 | 14 | 0 | 7 |
| 8 | 10 | 9 | 19 | 5 | 18 | 17 | 11 |
| 17 | 10 | 14 | 19 | 1 | 4 | 0 | 10 |
| 18 | 10 | 17 | 0 | 4 | 1 | 7 | 11 |
| 16 | 18 | 10 | 14 | 15 | 14 | 0 | 11 |
| 1 | 16 | 7 | 2 | 16 | 2 | 15 | 2 |
| 12 | 20 | 2 | 14 | 3 | 0 | 14 | 11 |
| 14 | 20 | 11 | 19 | 1 | 15 | 20 | 8 |
| 14 | 15 | 9 | 7 | 11 | 8 | 6 | 9 |

1. Count the total number of Quantity Discriminations ____
2. Count the total number of errors ____
3. Subtract errors from total number. Correct Quantity Discriminations ____

Practice Exercise 6: Quantity Discrimination

| | | | | | | | |
|---|---|----|---|----|---|----|---|
| 7 | 1 | 6 | 5 | 10 | 2 | 10 | 0 |
| 1 | 0 | 0 | 5 | 7 | 9 | 9 | 3 |
| 4 | 0 | 3 | 2 | 4 | 5 | 9 | 1 |
| 0 | 7 | 3 | 8 | 7 | 2 | 10 | 1 |
| 2 | 4 | 5 | 9 | 0 | 6 | 2 | 6 |
| 2 | 5 | 10 | 9 | 8 | 9 | 1 | 3 |
| 0 | 3 | 9 | 7 | 10 | 3 | 1 | 5 |

1. Count the total number of Quantity Discriminations ____
2. Count the total number of errors ____
3. Subtract errors from total number. Correct Quantity Discriminations ____

Practice Exercise 6: Quantity Discrimination ANSWER KEY

| | | | | | | | |
|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 7 | 1 | 6 | 5 | 10 | 2 | 10 | 0 |
| 1 | 0 | 0 | 5 | 7 | 9 | 9 | 3 |
| 4 | 0 | 3 | 2 | 4 | 5 | 9 | 1 |
| 0 | 7 | 3 | 8 | 7 | 2 | 10 | 1 |
| 2 | 4 | 5 | 9 | 0 | 6 | 2 | 6 |
| 2 | 5 | 10 | 9 | 8 | 9 | 1 | 3 |
| 0 | 3 | 9 | 7 | 10 | 3 | 1 | 5] |

1. Count the total number of Quantity Discriminations ____
2. Count the total number of errors ____
3. Subtract errors from total number. Correct Quantity Discriminations ____

Checking Out Accuracy in Test Administration

A copy of the Accuracy of Implementation Rating Scale (AIRS) is in the Appendix.

Inter-Scorer Agreement Practice

Compare your scores for ____ with a partner and compute Inter-Scorer Agreement.

Small Number score _____

Large Number score _____

Small Number/Large Number x 100 = _____ %

Missing Number

The Missing Number measure requires students to orally identify the missing number from a string of three numbers. Kindergarten students identify missing numbers from a string of numbers between 1 and 10 and first grade students identify missing numbers from a string of numbers between 1 and 20.

Before Testing

Testing Environment Arranged

Specific Materials Arranged

- Examiner copy of Missing Number for Scoring
- Student copy of Missing Number for Scoring
- Clipboard to provide a hard surface for recording student answers
- Stopwatch
- Tape recorder (optional) to aid in scoring questions or for qualitative analysis.

The student looks at strings of numbers arranged in 7 rows of 3 strings. The examiner follows along on an identical set of materials. An example student Missing Number measure is found below. The copy is reduced to save size and space.

| | | |
|------------|------------|------------|
| 8 9 ____ | 13 14 ____ | ____ 19 20 |
| ____ 6 7 | 14 ____ 16 | 13 ____ 15 |
| ____ 10 11 | 6 7 ____ | 3 ____ 5 |
| 10 11 ____ | 10 ____ 12 | ____ 7 8 |
| ____ 12 13 | 9 10 ____ | 11 12 ____ |
| 18 19 ____ | 5 6 ____ | 1 2 ____ |
| ____ 14 15 | ____ 9 10 | ____ 11 12 |
| 6 ____ 8 | 0 ____ 2 | ____ 2 3 |
| 14 15 ____ | 17 ____ 19 | ____ 8 9 |
| ____ 17 18 | 16 17 ____ | 9 ____ 11 |

During Testing

The AIMSweb Missing Number Measure is a standardized test. Therefore, these specific directions must be used during testing to have confidence in the reliability, validity, and comparability of the results.

Missing Number Standard Directions for 1-Minute Administration

1. Place the student copy in front of the student.
2. Place the examiner copy on a clipboard and position so the student cannot see what the examiner records.
3. Say these specific directions to the student:

“The box in front of you has two numbers in it (point to first box). I want you to tell me the number that goes in the blank. What number goes in the blank?”

Example 1

| CORRECT RESPONSE: | INCORRECT RESPONSE: |
|---|--|
| <p>“Good. 1 is the number that goes in the blank.” Let’s try another one (point to second box). What number goes in the blank?”</p> | <p>“The number that goes in the box is 1. See 1, 2, 3 (demonstrate by pointing). 1 goes in the blank. Let’s try another one (point to second box). What number goes in the blank?”</p> |

Example 2

| CORRECT RESPONSE: | INCORRECT RESPONSE: |
|---|---|
| <p>“Good. 7 is the number that goes in the blank.” (Turn the page).</p> | <p>“The number that goes in the blank is 7. See 5, 6, 7 (demonstrate by pointing). 7 goes in the blank.” (Turn the page).</p> |

“The piece of paper in front of you has boxes with numbers in them. When I say start you are going to tell me the number that goes in the blank for each box. Start with the first box and go across the row (demonstrate by pointing). Then go to the next row. If you come to one you don’t know, I’ll tell you what to do. Are there any questions? Put your finger on the first one. Ready, start.”

4. Start your stopwatch. If the student fails to answer the first problem after 3 seconds, tell the student to “try the next one.”
5. If the student does not get any correct within the first 5 items, discontinue the task and record a score of zero.
6. Follow along on the examiner copy. Put a slash (/) through any incorrects.
7. The maximum time for each item is 3 seconds. If a student does not provide an answer within 3 seconds, tell the student to “try the next one.”
8. At the end of 1 minute, place a bracket () around the last item completed and say “Stop.”

Things You Need To Do After Testing: Scoring

It is important that results are scored immediately after the 1 minute testing is completed to ensure accurate results. Students receive 1 point for every item correctly completed in 1 minute.

Scoring Rules

Rule 1: If a student correctly states the missing number, score the item as correct.

Rule 2: If a student incorrectly states the missing number next, score the item as incorrect by placing a slash through the number on the examiner scoresheet.

Rule 3: If a student hesitates or struggles with an item for 3 seconds, tell the student to “try the next one” (demonstrate by pointing). Score the item as incorrect.

Rule 4: If a student skips an item, score the item as incorrect.

Rule 5: If a student skips an entire row, mark each item in the row as incorrect by drawing a line through the row on the examiner scoresheet.

Rule 6: If a student misses 5 items consecutively, discontinue testing.

Practice Exercise 7: Missing Number

| | | |
|-----------|-----------|-----------|
| 8 9 ___ | 13 14 ___ | ___ 19 20 |
| ___ 6 7 | 14 ___ 16 | 13 ___ 15 |
| ___ 10 11 | 6 7 ___ | 3 ___ 5 |
| 10 11 ___ | 10 ___ 12 | ___ 7 8 |
| ___ 12 13 | 9 10 ___ | 11 12 ___ |
| 18 19 ___ | 5 6 ___ | 1 2 ___ |
| ___ 14 15 | ___ 9 10 | ___ 11 12 |
| 6 ___ 8 | 0 ___ 2 | ___ 2 3 |
| 14 15 ___ | 17 ___ 19 | ___ 8 9 |
| ___ 17 18 | 16 17 ___ | 9 ___ 11_ |

- Count the total number of Missing Numbers ____
- Count the total number of errors ____
- Subtract errors from total number. Correct Missing Numbers ____

Practice Exercise 7: Missing Number ANSWER KEY

| | | |
|----------------------|------------------------|----------------------|
| 8 9 ___ | 13 14 ___ | ___ 19 20 |
| ___ 6 7 | 14 ___ 16 | 13 ___ 15 |
| ___ 10 11 | 6 7 ___ | 3 ___ 5 |
| 10 11 ___ | 10 ___ 12] | ___ 7 8 |
| ___ 12 13 | 9 10 ___ | 11 12 ___ |
| 18 19 ___ | 5 6 ___ | 1 2 ___ |
| ___ 14 15 | ___ 9 10 | ___ 11 12 |
| 6 ___ 8 | 0 ___ 2 | ___ 2 3 |
| 14 15 ___ | 17 ___ 19 | ___ 8 9 |
| ___ 17 18 | 16 17 ___ | 9 ___ 11 |

- Count the total number of Missing Numbers ____
- Count the total number of errors ____
- Subtract errors from total number. Correct Missing Numbers ____

Practice Exercise 8: Missing Number

| | | |
|---------------|----------------|----------------|
| 5 6 ___ | 4 5 ___ | ___ 6 7 |
| ___ 5 6 | ___ 3 4 | ___ 2 3 |
| 6 ___ 8 | 7 8 ___ | 2 ___ 4 |
| 1 ___ 3 | 2 3 ___ | 1 2 ___ |
| ___ 8 9 | 4 ___ 6 | ___ 9 10 |
| ___ 7 8 | 7 ___ 9 | ___ 4 5 |
| 8 9 ___ | 8 ___ 10 | 3 ___ 5 |

1. Count the total number of Missing Numbers ____
2. Count the total number of errors ____
3. Subtract errors from total number. Correct Missing Numbers ____

Practice Exercise 8: Missing Number ANSWER KEY

| | | |
|-------------------------|-----------------------|-----------------------|
| 5 6 ___ | 4 5 ___ | ___ 6 7 |
| ___ 5 6 | ___ 3 4 | ___ 2 3 |
| 6 ___ 8 | 7 8 ___ | 2 ___ 4 |
| 1 ___ 3 | 2 3 ___ | 1 2 ___ |
| ___ 8 9] | 4 ___ 6 | ___ 9 10 |
| ___ 7 8 | 7 ___ 9 | ___ 4 5 |
| 8 9 ___ | 8 ___ 10 | 3 ___ 5 ___ |

1. Count the total number of Missing Numbers ____
2. Count the total number of errors ____
3. Subtract errors from total number. Correct Missing Numbers ____

Checking Out Accuracy in Test Administration

A copy of the Accuracy of Implementation Rating Scale (AIRS) for Missing Numbers is in the Appendix.

Inter-Scorer Agreement Practice

Compare your scores for ____ with a partner and compute Inter-Scorer Agreement.

Small Number is _____

Large Number is _____

Small Number/Large Number x 100 = _____%

Things You Need to do After Testing

After the “Things You Need to do After Testing” is completed as specified previously for each early numeracy measure, the examiner should fill out the Early Numeracy Qualitative Features Checklist. The amount of information obtained by utilizing EN-GOM measures extends beyond a quantitative score. We believe that educational decision-making is enhanced by adding your professional judgments regarding the quality of a student’s responses, to a quantitative assessment of a student’s early numeracy skills. The checklist of early numeracy qualitative features in the Appendix is a method by which to structure observations of a student’s growth and development in early numeracy skills.

Appendix

Reproducible Administration Directions

Oral Counting Standard Directions for 1-Minute Administration

1. Place the examiner copy on a clipboard and position so the student cannot see what the examiner records.
2. Say these specific directions to the student:

“When I say start I want you to start counting aloud from 1 like this 1, 2, 3 until I tell you to stop. If you come to a number you don’t know, I’ll tell it to you. Be sure to do your best counting. Are there any questions? Ready, Start.”
3. Start your stopwatch. If the student fails to say “1” after 3 seconds, say “1” and continue.
4. Follow along on the examiner copy. Score according to scoring rules. After one minute has expired, place a bracket after the last number said and say “Stop.”

Number Identification Standard Directions for 1-Minute Administration

1. Place the student copy in front of the student.
2. Place the examiner copy on a clipboard and position so the student cannot see what the examiner records.
3. Say these specific directions to the student:
“Look at the paper in front of you. It has a number on it (demonstrate by pointing).
What number is this.”

Example 1

| | |
|--|--|
| CORRECT RESPONSE: “Good. The number is 8. Look at the number next to 8 (demonstrate by pointing). What number is this?” | INCORRECT RESPONSE: “This number is 8 (point to 8). What number is this? Good. Let’s try another one. Look at the number next to 8 (demonstrate by pointing). What number is this?” |
|--|--|

Example 2

| | |
|---|--|
| CORRECT RESPONSE: “Good. The number is 4.” (Turn the page). | INCORRECT RESPONSE: “This number is 4 (point to 4). What number is this? Good.” (Turn the page). |
|---|--|

“The paper in front of you has numbers on it. When I say start, I want you to tell me what the numbers are. Start here and go across the page (demonstrate by pointing). If you come to a number you don’t know, I’ll tell you what to do. Are there any questions? Put your finger on the first one. Ready, start.”

4. Start your stopwatch. If the student fails to answer the first problem after 3 seconds, tell the student to “try the next one.”
5. If the student does not get any correct within the first 5 items, discontinue the task and record a score of zero.
6. Follow along on the examiner copy. Put a slash (/) through any incorrects.
7. The maximum time for each item is 3 seconds. If a student does not provide an answer within 3 seconds, tell the student to “try the next one.”
8. At the end of 1 minute, place a bracket () around the last item completed and say “Stop.”

Quantity Discrimination Standard Directions for 1-Minute Administration

1. Place the student copy in front of the student.
2. Place the examiner copy on a clipboard and position so the student cannot see what the examiner records.
3. Say these specific directions to the student:

“Look at the piece of paper in front of you. The box in front of you has two numbers in it (demonstrate by pointing). I want you to tell me the number that is bigger.”

Example 1

| CORRECT RESPONSE: | INCORRECT RESPONSE: |
|--|---|
| “Good. The bigger number is 7. Now look at this box (demonstrate by pointing). It has two numbers in it. Tell me the number that is bigger.” | “The bigger number is 7. You should have said 7 because 7 is bigger than 4. Now look at this box (demonstrate by pointing). It has two numbers in it. Tell me the number that is bigger.” |

Example 2

| CORRECT RESPONSE: | INCORRECT RESPONSE: |
|---|---|
| “Good. The bigger number is 4.” (Turn the page). | “The bigger number is 4. You should have said 4 because 4 is bigger than 2.” (Turn the page). |

“The paper in front of you has boxes on it. In the boxes are two numbers. When I say start, I want you to tell me the number in the box that is bigger. Start here and go across the page (demonstrate by pointing). If you come to a box and you don't know which number is bigger, I'll tell you what to do. Are there any questions? Put your finger on the first one. Ready, start.”

4. Start your stopwatch. If the student fails to answer the first problem after 3 seconds, tell the student to “try the next one.”
5. If the student does not get any correct within the first 5 items, discontinue the task and record a score of zero.
6. Follow along on the examiner copy. Put a slash (/) through any incorrects.
7. The maximum time for each item is 3 seconds. If a student does not provide an answer within 3 seconds, tell the student to “try the next one.”
8. At the end of 1 minute, place a bracket () around the last item completed and say “Stop.”

Missing Number Standard Directions for 1-Minute Administration

1. Place the student copy in front of the student.
2. Place the examiner copy on a clipboard and position so the student cannot see what the examiner records.
3. Say these specific directions to the student:

“The box in front of you has two numbers in it (point to first box). I want you to tell me the number that goes in the blank. What number goes in the blank?”

Example 1

| | |
|---|--|
| <p>CORRECT RESPONSE:</p> <p>“Good. 1 is the number that goes in the blank.” Let’s try another one (point to second box). What number goes in the blank?”</p> | <p>INCORRECT RESPONSE:</p> <p>“The number that goes in the box is 1. See 1, 2, 3 (demonstrate by pointing). 1 goes in the blank. Let’s try another one (point to second box). What number goes in the blank?”</p> |
|---|--|

Example 2

| | |
|---|---|
| <p>CORRECT RESPONSE:</p> <p>“Good. 7 is the number that goes in the blank.” (Turn the page).</p> | <p>INCORRECT RESPONSE:</p> <p>“The number that goes in the blank is 7. See 5, 6, 7 (demonstrate by pointing). 7 goes in the blank.” (Turn the page).</p> |
|---|---|

“The piece of paper in front of you has boxes with numbers in them. When I say start you are going to tell me the number that goes in the blank for each box. Start with the first box and go across the row (demonstrate by pointing). Then go to the next row. If you come to one you don’t know, I’ll tell you what to do. Are there any questions? Put your finger on the first one. Ready, start.”

4. Start your stopwatch. If the student fails to answer the first problem after 3 seconds, tell the student to “try the next one.”
5. If the student does not get any correct within the first 5 items, discontinue the task and record a score of zero.
6. Follow along on the examiner copy. Put a slash (/) through any incorrects.
7. The maximum time for each item is 3 seconds. If a student does not provide an answer within 3 seconds, tell the student to “try the next one.”
8. At the end of 1 minute, place a bracket () around the last item completed and say “Stop.”

Qualitative Features Checklist

Student Name: _____ Grade: _____

Rater: _____ Date: _____

After the student completes the EN-GOM measures, judge the degree to which the student exhibits the following early numeracy skills.

Oral Counting

- _____ Understands rote structure of 1-10
- _____ Understands rote structure of 1-20
- _____ Demonstrates decade transitions (e.g. 20, 30, 40,...)
- _____ Demonstrates rote 1-9 structure after decade transitions

Number Identification

- _____ Correctly identifies numbers below 10
- _____ Correctly identifies numbers between 10 and 20 (1st grade only)
- _____ Note numbers frequently missed

Quantity Discrimination

- _____ Correctly identifies bigger numbers from pairs below 10
- _____ Correctly identifies bigger numbers from pairs above 10 (1st grade only)

Missing Number

- _____ Correctly identifies missing numbers in the last position (e.g. 5 6 __)
- _____ Correctly identifies missing numbers in the middle position (e.g. 5 __ 7)
- _____ Correctly identifies missing numbers in the first position (e.g. __ 6 7)
- _____ Correctly identifies missing numbers below 10
- _____ Correctly identifies missing numbers between 10 and 20 (1st grade only)

Oral Counting Accuracy in Implementation Rating Scale (AIRS)

| Oral Counting Accuracy in Implementation Rating Scale (AIRS) | | | |
|--|---------------------------|--|--|
| Examiner: _____ | Date: Observation 1 _____ | | |
| Observer: _____ | Observation 2 _____ | | |
| X = completed accurately O = incorrect | Observation 3 _____ | | |

| Step | Observation 1 | Observation 2 | Observation 3 |
|--|---------------|---------------|---------------|
| Seated appropriate distance from child | | | |
| Places examiner copy out of view of child | | | |
| Says standardized directions | | | |
| Turns tape recorder on (optional) | | | |
| Says "Start" | | | |
| Starts stopwatch at correct time (after student says first number) | | | |
| Marks errors on examiner copy | | | |
| Times accurately for 1 minute | | | |
| Says "Stop" | | | |
| Stops stopwatch | | | |
| Marks last number stated with a bracket | | | |
| Turns off tape recorder (optional) | | | |
| Determines # of Correct Oral Counts | | | |
| Records score | | | |

Number Identification Accuracy in Implementation Rating Scale (AIRS)

| Number Identification Accuracy in Implementation Rating Scale (AIRS) | | | |
|--|--|---------------------------|--|
| Examiner: _____ | | Date: Observation 1 _____ | |
| Observer: _____ | | Observation 2 _____ | |
| | | Observation 3 _____ | |
| X = completed accurately O = incorrect | | | |

| Step | Observation 1 | Observation 2 | Observation 3 |
|--|---------------|---------------|---------------|
| Seated appropriate distance from child | | | |
| Places practice item in front of child | | | |
| Places student copy in front of child | | | |
| Places examiner copy out of view of child | | | |
| Says standardized directions | | | |
| Turns tape recorder on (optional) | | | |
| Says "Start" | | | |
| Starts stopwatch at correct time (after student says first number) | | | |
| Marks errors on examiner copy | | | |
| Times accurately for 1 minute | | | |
| Says "Stop" | | | |
| Stops stopwatch | | | |
| Marks last number stated with a bracket | | | |
| Turns off tape recorder (optional) | | | |
| Determines # of Correct Number Identifications | | | |
| Records score | | | |

Quantity Discrimination Accuracy in Implementation Rating Scale (AIRS)

| Quantity Discrimination Accuracy in Implementation Rating Scale (AIRS) | | | |
|--|---------------------------|--|--|
| Examiner: _____ | Date: Observation 1 _____ | | |
| Observer: _____ | Observation 2 _____ | | |
| | Observation 3 _____ | | |
| X = completed accurately O = incorrect | | | |

| Step | Observation 1 | Observation 2 | Observation 3 |
|--|---------------|---------------|---------------|
| Seated appropriate distance from child | | | |
| Places practice item in front of child | | | |
| Places student copy in front of child | | | |
| Places examiner copy out of view of child | | | |
| Says standardized directions | | | |
| Turns tape recorder on (optional) | | | |
| Says "Start" | | | |
| Starts stopwatch at correct time (after student says first number) | | | |
| Marks errors on examiner copy | | | |
| Times accurately for 1 minute | | | |
| Says "Stop" | | | |
| Stops stopwatch | | | |
| Marks the last item completed with a bracket | | | |
| Turns off tape recorder (optional) | | | |
| Determines number of Correct Quantity Discriminations | | | |
| Records score | | | |

Implementation Rating Scale (AIRS)

Missing Number Accuracy in Implementation Rating Scale (AIRS)

| Missing Number Accuracy in Implementation Rating Scale (AIRS) | | | |
|--|---------------------------|--|--|
| Examiner: _____ | Date: Observation 1 _____ | | |
| Observer: _____ | Observation 2 _____ | | |
| | Observation 3 _____ | | |
| X = completed accurately O = incorrect | | | |

| Step | Observation 1 | Observation 2 | Observation 3 |
|--|----------------------|----------------------|----------------------|
| Seated appropriate distance from child | | | |
| Places practice item in front of child | | | |
| Places student copy in front of child | | | |
| Places examiner copy out of view of child | | | |
| Says standardized directions | | | |
| Turns tape recorder on (optional) | | | |
| Says "Start" | | | |
| Starts stopwatch at correct time (after student says first number) | | | |
| Marks the last item completed with a bracket | | | |
| Times accurately for 1 minute | | | |
| Says "Stop" | | | |
| Stops stopwatch | | | |
| Marks last letter or words read with a bracket | | | |
| Turns off tape recorder (optional) | | | |
| Determines number of Correct Missing Numbers | | | |
| Records score | | | |

Technical Adequacy

Reliability and validity evidence for the technical adequacy of the Early Numeracy Curriculum-Based Measurement (EN-CBM) is based on a program of research initiated by Ben Clarke, Ph.D. The first of a series of technical articles is in press for the scientific journal *School Psychology Review* (Clarke, B., & Shinn, M.R. (in press) *An Investigation into the Identification and Development of Early Mathematics Curriculum-Based Measurement*). A complete copy of this research study is available from Dr. Clarke at www.aimsweb.com. Ongoing research projects are expanding the results obtained in the initial study.

Reliability

The inter-scoring, alternate-form, and test-retest reliability of Early Numeracy Curriculum-Based Measurement for 52 Grade 1 subjects is reported in Table 1. Salvia and Ysseldyke (1998) provide a set of criteria with which to evaluate reliability in the context of educational decision making. Reliabilities of .90 or greater are recommended for making educational decisions about individual students. Reliabilities of .80 or greater are recommended for making screening decisions about individuals. Decisions made from early identification measures are used for screening and/or progress monitoring typically do not involve a high-stakes decision to change an individual student's placement or educational classification and thus, reliabilities of .80 or greater provide a suitable standard (Kaminski & Good, 1998).

Inter-scoring reliability for all measures was very high (.99 for the OC, NI, and QD measures; .98 for the MN measure), exceeding the standard for making individual educational decisions. Alternate-form reliabilities also were very high. In the Fall, students were tested on alternate forms for the NI, QD, and MN measures, but not the OC measure. Students were tested on alternate forms of all four measures during the Winter testing session. At this time, subjects repeated the OC measure (i.e., counting from 1) because there was only one possible form of this measure. The order in which alternate forms for the NI, QD, and MN measures, or repeated for the OC measure, were given to subjects was alternated to avoid practice effects.

Alternate-form reliability for the OC measure, NI measure, and the QD measure was consistently high and attained the .90 benchmark for individual educational decisions. Reliability for this MN measure was lower in the Fall (.83) and Winter (.78), but approximated the .80 standard for screening decisions. Two-week test-retest reliability was very high for the NI and QD measures. The MN measure and the OC measure were lower, but acceptable. Test-retest reliability for all subjects was examined from the Fall to Winter (13 weeks) and from the Fall to Spring (26 weeks). All measures were acceptable, approaching or exceeding .80.

Table 1: Early Numeracy Curriculum-Based Measurement Reliability For All Testing Sessions

| EN-CBM | Inter-Scorer | Alternate- Form (Fall) | Alternate- Form (Winter) | Test-retest (2 weeks) | Test-retest (13 weeks) | Test-retest (26 weeks) |
|---------------------------------|--------------|------------------------|--------------------------|-----------------------|------------------------|------------------------|
| 1. Oral Counting (OC) | .78 | .99 | -- | .93 | .77 | .80 |
| 2. Number Identification (NI) | .99 | .89 | .93 | .97 | .85 | .76 |
| 3. Quantity Discrimination (QD) | .99 | .93 | .92 | .96 | .85 | .86 |
| 4. Missing Number (MN) | .98 | .83 | .78 | .84 | .79 | .81 |

Concurrent Validity

Concurrent validity was assessed by examining correlations among the four Early Numeracy Curriculum-Based Measurement measures and three criterion measures, the Woodcock Johnson Applied Problems subtest (WJ-AP), Mathematics Curriculum- Based Measurement (M-CBM), and the Number Knowledge Test. These relations were examined at each of three data collection periods. Concurrent criterion-related validity data were collected in the fall with the WJ-AP and the NST, in the winter with M-CBM, and in the spring with the WJ-AP and M-CBM.

Concurrent validity coefficients among the experimental measures and between the early numeracy and criterion measures by time frame are reported in Table 2. All correlations showed strong evidence of concurrent validity. Correlations with the criterion measures was highest for the QD measure ranging from .71 to .80 with a median of .75. Of the EN-CBM measures, the OC measure had the lowest correlations ranging from .49 to .70 with a median of .60. The NI measure and MN measure concurrent validity evidence were between the two with the NI measure ranging from .60 to .70 with a median of .66 and the MN measure ranging from .68 to .75 with a median of .71.

Table 2: Concurrent Validity Correlations Among Early Numeracy Curriculum-Based Measurement Measures and Criterion Measures

| Early Numeracy Curriculum-Based Measurement Measures | NKT (Fall) | WJ-AP (Fall) | M-CBM (Winter) | WJ-AP (Spring) | M-CBM (Spring) |
|--|------------|--------------|----------------|----------------|----------------|
| 1. Oral Counting (OC) | .70 | .64 | .49 | .60 | .50 |
| 2. Number Identification (NI) | .70 | .65 | .66 | .63 | .60 |
| 3. Quantity Discrimination (QD) | .80 | .71 | .71 | .79 | .75 |
| 4. Missing Number (MN) | .74 | .68 | .75 | .69 | .74 |

Predictive Validity

Again, all Early Numeracy measures displayed sufficient evidence for good predictive validity. Predictive validity data were analyzed using the Fall measures and M-CBM collected in the Winter and the WJ-AP and M-CBM data collected in the Spring. The predictive validity of the experimental measures is summarized in Table 3.

The QD measure had the highest median correlation of .76, followed by the MN measure (.72). Both the NI measure (.68), and the OC measure (.56) had strong relationships as well.

Table 3: Predictive Validity Correlations Between Early Numeracy Measures and Criterion Measures

| Early Numeracy Measures | CBM-M (Winter) | CBM-M (Spring) | WJ-AM (Spring) |
|------------------------------|----------------|----------------|----------------|
| Oral Counting Fall | .56 | .56 | .72 |
| Number Identification Fall | .68 | .60 | .72 |
| Quantity Discrimination Fall | .76 | .70 | .79 |
| Missing Number Fall | .78 | .67 | .72 |

Sensitivity

Further evidence of validity is provided by examining the sensitivity of the CBM Early Numeracy measures over time. If the measures were assessing early mathematics achievement, then it was hypothesized that as subjects progressed throughout the school year, they would learn more mathematics content and thus obtain higher scores on the EN-CBM measures. Overall growth over the 26-week study and average rate of growth per week on the CBM Early Numeracy measures is provided in Table 4.

Subjects’ scores improved on each of the four experimental measures across the 26-week period ranging from 6.1 to 14.0 units. Gain in units per week ranged from .23 to .54. To further examine growth over time a repeated measures, an analysis of variance (ANOVA) was conducted. Growth for each measure was found not to be due to chance using the parameters of $F(1,51), p < .01$. The OC measure appeared to be the most sensitive of the experimental measures followed by the NI, QD, and MN measures.

Table 4: Sensitivity of CBM Early Numeracy Measures from Fall to Spring

| Early Numeracy | Fall to Spring | |
|---------------------------------|----------------|----------------|
| | Mean Growth | Units per Week |
| 1. Oral Counting (OC) | 14.0 | .54 |
| 2. Number Identification (NI) | 12.1 | .47 |
| 3. Quantity Discrimination (QD) | 9.3 | .36 |
| 4. Missing Number (MN) | 6.1 | .23 |