

## Appendix E: SLIFE Numeracy Assessment Protocol

**Numeracy skills**, like literacy skills, provide a gateway for students to successfully engage in their education and beyond. Numeracy skills provide a foundation for understanding grade-level mathematical concepts. Interruptions in formal instruction can impact a student's numeracy skills.<sup>1</sup> The following protocol provides a framework for estimating the grade-level numeracy skills of students as part of the SLIFE identification process.<sup>2</sup>

### What are numeracy skills?

Students demonstrate numeracy skills when they “apply grade-level basic and computational skills by identifying and understanding numbers, performing simple arithmetic operations, and comparing numerical magnitude.”

~ Adapted from Reyna, V. F.; Nelson, W. L.; Han, P. K.; Dieckmann, N. F. (2009).

### How to Use the Protocol

The Protocol is organized to help educators (1) identify expected grade-level numeracy skills in relation to same-aged peers and (2) select appropriate assessment activities. The *Massachusetts Mathematics Framework Progression Chart* is a tool designed for teams to use with the Protocol. **The Progression Chart** highlights the numeracy skills embedded within the pre-Kindergarten through Grade 8 *Massachusetts Mathematics Curriculum Framework*.<sup>3</sup> Once expected grade-level numeracy skills have been determined, educators can use this information to adapt or develop appropriate assessment activities to estimate a student's grade-level numeracy skills.

- Determine Expected Grade Level

- Identify Grade - Level Domains and Clusters

- Identify Numeracy Skills within Clusters

#### Part One: Identify Expected Grade-Level Numeracy Skills

#### Part Two: Select Assessment Activities

- Adapt or Create Assessment Tools and Activities
- Assess the Student's Numeracy Skills

MA Mathematics Framework Progression Chart									
PK	K	1	2	3	4	5	6	7	8
Counting & Cardinality	Counting & Cardinality								
Operations & Algebraic Thinking	Operations & Algebraic Thinking	Operations & Algebraic Thinking	Operations & Algebraic Thinking	Operations & Algebraic Thinking	Operations & Algebraic Thinking	Operations & Algebraic Thinking			
	Number & Operations in Base Ten	Number & Operations in Base Ten	Number & Operations in Base Ten	Number & Operations in Base Ten	Number & Operations in Base Ten	Number & Operations in Base Ten			
				Number & Operations - Fractions	Number & Operations - Fractions	Number & Operations - Fractions	Ratios & Proportional Relationships	Ratios & Proportional Relationships	
							The Number System	The Number System	The Number System
Measurement & Data	Measurement & Data	Measurement & Data	Measurement & Data	Measurement & Data	Measurement & Data	Measurement & Data	Expressions & Equations	Expressions & Equations	Expressions & Equations
									Functions
Geometry	Geometry	Geometry	Geometry	Geometry	Geometry	Geometry	Geometry	Geometry	Geometry
							Statistics & Probability	Statistics & Probability	Statistics & Probability

<sup>1</sup> SLIFE students typically function two or more years below expected grade level in numeracy relative to typical peers.

<sup>2</sup> While this is a generalized process, educators should always consider the individual needs of students. Furthermore, parents or guardian should be informed of all EL programs, services, and their children's EL status (ESE; G.L. c. 71A, section 7; 603 C.M.R. 14.02).

<sup>3</sup> PreK-8 math is generally considered a subject, while high school math is organized into several different courses that vary by school district. It was determined that a Grade 8 numeracy skill assessment is adequate for placement in appropriate high school courses.

## Part One: Identifying Expected Grade-Level Numeracy Skills

### Determining Expected Grade Level

Student's expected grade level is determined in comparison to same-aged Massachusetts peers. For example, a 10 year-old student entering a Massachusetts school in April may generally be placed at the fourth grade level, and a 16 year-old student entering school in October may generally be placed at the tenth grade level.<sup>4</sup>

The chart is a grid with columns labeled PS, K, 1, 2, 3, 4, 5, 6, 7, 8. The rows are labeled with domains: Counting & Cardinality, Operations & Algebraic Thinking, Number & Operations in Base Ten, Measurement & Data, and Geometry. Column 4 is highlighted with an orange border. The content in column 4 is: Counting & Cardinality, Operations & Algebraic Thinking, Number & Operations in Base Ten, Measurement & Data, and Geometry.

### Identifying Grade-Level Domains...

The Progression Chart is organized by columns (grade level) and rows (domains).

The chart is a grid with columns labeled PS, K, 1, 2, 3, 4, 5, 6, 7, 8. The rows are labeled with domains: Counting & Cardinality, Operations & Algebraic Thinking, Number & Operations in Base Ten, Measurement & Data, and Geometry. Row 4 is highlighted with an orange border. The content in row 4 is: Counting & Cardinality, Operations & Algebraic Thinking, Number & Operations in Base Ten, Measurement & Data, and Geometry.

### ...and Clusters<sup>5</sup>

Each domain calls out related **clusters** throughout the Progression Chart.

The chart is a grid with columns labeled PS, K, 1, 2, 3, 4, 5, 6, 7, 8. The rows are labeled with domains: Counting & Cardinality, Operations & Algebraic Thinking, Number & Operations in Base Ten, Measurement & Data, and Geometry. A 2x2 cluster of cells is highlighted with an orange border, spanning rows 4 and 5 and columns 4 and 5. The content in this cluster is: Operations & Algebraic Thinking, Number & Operations in Base Ten, Measurement & Data, and Geometry.

<sup>4</sup> While this is a generalized process, educators should always consider the individual needs of students and inform parents or guardians of EL programs, EL services, and their children's EL status (ESEA; G.L. c. 71A, section 7; 603 C.M.R. 14.02).

<sup>5</sup> Domains are larger groups of related standards; Clusters are groups of related standards. Note that standards from different clusters may sometimes be closely related, because mathematics is a connected subject; Standards from different domains may also be closely related. Standards define what students should understand and be able to do.

## Identifying Numeracy Skills within Clusters

Numeracy skills are embedded within each cluster. Educators must revisit the definition of *numeracy skills* and identify these within each cluster.<sup>6</sup>

For example, numeracy skills embedded within the Grade 4 cluster include use of the four operations to solve problems. This cluster description meets the definition of numeracy skills as it requires students to “perform simple arithmetic operations” at the very basic level (examples: addition, subtraction, multiplication and, division). In the same manner, the Grade 3 cluster requires the same for multiplication and division; and addition and subtraction for Grade 2.

2	3	4
Operations & Algebraic Thinking	Operations & Algebraic Thinking	Operations & Algebraic Thinking
Number & Operations in Base Ten	Number & Operations in Base Ten	Number & Operations in Base Ten
A. Understand place value. B. Use place value understanding and properties of operations to add and subtract.	A. Use place value understanding and properties of operations to perform multi-digit arithmetic.	A. Generalize place value understanding for multi-digit whole numbers less than or equal to 1,000,000. B. Use place value understanding and properties of operations to perform multi-digit arithmetic on whole numbers less than or equal to 1,000,000.
Measurement & Data	Measurement & Data	

### Reminder

- Students should only be assessed on the numeracy skills embedded within domain clusters.
- The definition of numeracy skills should be revisited regularly when developing or adapting assessments to ensure that identification tools and activities appropriately measure these skills.

<sup>6</sup> Not all clusters have embedded numeracy skills.

## **Part Two: Selecting Appropriate Assessment Activities**

### **Adapt or Create Assessment Tools and Activities**

Assessments should measure only numeracy skills and not a student's English language proficiency. Tools and activities should be as free from linguistic or cultural bias as much as possible. Educators should select assessment tools and activities that allow students to demonstrate their understanding and application of grade-level numeracy skills. As part of the identification process, assessment activities should be brief and should provide a snapshot of students' skills.

### **Assess the Student's Numeracy Skills**

After aligning assessment activities to the numeracy skills embedded in the Progression Chart, a trained proctor (preferably a math content expert) administers the assessment. The school-based SLIFE Placement Team then analyzes assessment results and makes appropriate recommendations for supporting the student.