Use Math to Solve Problems and Communicate
Framework

OREGON ADULT BASIC SKILLS Learning Standards
August 2010 & Revised May 2016

Oregon Department of Community Colleges and Workforce Development
Introduction to the Use Math To Solve Problems and Communicate Learning Standard Framework

In order to realize a consistent set of expectations and understandings about teaching and learning in Oregon's Adult Basic Skills (ABS) programs, instructors, administrators, professional developers, and State leadership collaborated to develop and pilot Learning Standards for the state. In April 2010, the Oregon Council of Adult Basic Skills Development adopted Learning Standards that reflect a common vision of what adults need to know and be able to do in the areas of reading, speaking, listening, and math in order to carry out their life goals and purposes. The "Vision for the Oregon ABS Learning Standards," which guides this initiative, is presented below and outlines the role of the ABS Learning Standards in supporting practitioners in their ongoing work to create a responsive, accountable, and adult-focused system.

In 2016, a comprehensive overhaul of the Use Math to Solve Problems and Communicate Learning Standard Framework was completed, aligning it with the College and Career Readiness Standards. The resulting document is a living one that will reside online such that when clarification is needed and expectations evolve, it can easily be altered.

The College and Career Readiness Standards call for the following key shifts in mathematics instruction:

- **Greater focus** in mathematics significantly narrowing and deepening concepts addressed. There is a shift to building conceptual understanding as opposed to blindly replicating procedures.
- **Coherent progression** from level to level. Topics are carefully connected across levels so that learners can build new understanding onto foundations built in previous levels.
- **Rigor**: Pursuing conceptual understanding, procedural skills and fluency, and application with equal intensity.

These shifts have been addressed in the revision of Oregon's math standards.

Each of Oregon's ABS Learning Standards is presented through a Learning Standards Framework, which provides detailed information for the performance levels defined by the National Reporting System, as well as any additional levels needed for transition into postsecondary education and training. This document presents the Framework for the Learning Standard Use Math to Solve Problems and Communicate.

Elements of the Learning Standard Framework

The Learning Standard Framework for Use Math to Solve Problems and Communicate is intended for use in Adult Basic Education (ABE) and Adult Secondary Education (ASE). The Framework was created to support adults’ effective use of math skills in family, community, work, and school contexts, with an eye toward preparing upper level students to succeed in post-secondary settings. Level 7 focuses, in particular, on the math skills that adults need for successful transition to college and/or occupational training programs.

In developing the Learning Standard Framework, practitioners attended to four core criteria: 1) maintaining a focus on adults, 2) drawing from research to describe the development of knowledge, skills, and strategies across levels, 3) being as clear as possible and providing supports for the reader (e.g., examples, definitions, etc.), and 4) formatting the document in a way that permits flexible use in
integrated, multi-level, and single-level classrooms. This section explains how the elements comprising the Framework reflect these core criteria.

The Use Math to Solve Problems and Communicate (UMSPC) Framework is organized into seven performance levels, each containing the following elements:

- Learning Standard
- Level Description
- Benchmarks/Sub-Benchmarks, organized by Strands

**Learning Standard**

The Learning Standard is a global statement of what learners at any level should be able to do, related to using math. Drawing from cognitive science research and the field research/work of Equipped for the Future (see Key References), the Learning Standard describes a problem-solving process adults use when they engage in math tasks for authentic purposes, such as managing a budget in order to take care of family needs, monitoring a process at work, or figuring how or whether to buy or lease a car.

The Learning Standard for math is **Use Math to Solve Problems and Communicate**

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**Implementation of the Oregon Use Math to Solve Problems and Communicate Standard involves adult learners using math for a variety of purposes, integrating their knowledge, skills, and strategies, and practices to carry out the following processes:**

1. Make sense of the mathematics contextualized situations and persevere in obtaining solutions.
2. Reason abstractly and quantitatively, apply life experiences and knowledge of mathematical concepts, procedures, and technology to figure out how to answer a question, solve a problem, make a prediction, or carry out a task that has a mathematical dimension.
3. Understand, interpret, and model with concrete objects and symbolic representations (e.g., **pictures, numbers, graphs, computer representations**).
4. Look for and make use of structure.
5. Look for and express regularity in repeated reasoning.
6. Use appropriate tools strategically and estimate to predict results and to check to see if results are reasonable.
7. Attend to precision in calculation, symbolism and communication.
8. Communicate reasoning and results in a variety of ways such as words, graphs, charts, tables, and algebraic models.
9. Construct viable arguments and critique the reasoning of others.

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Each bullet in the Standard is called a **component of the Standard** and is referred to as a **Mathematical Practice** in the CCRS, and describes one important aspect of the problem-solving process. The components are numbered; however they are not always used sequentially - individuals move back and forth among components/practices as they use their skills to carry out real activities. The Standard is reiterated throughout the document as a reminder to keep the focus on using math for meaningful adult purposes and to engage students in applying the full problem-solving process.
**Level Descriptions**

The Level Descriptions for UMSPC’s seven performance levels draw from a variety of research and seminal sources (see *Key References*) to describe what *independent* adult performance of the Learning Standard looks like when *exiting* each level. Although people at every level use a similar math problem-solving process, they draw upon a broadening base of knowledge, skills, and strategies as they move up the levels. In addition, the range of situations in which they can use that process, as well as their independence and fluency, increase. The Level Descriptions support instructors in identifying math tasks which will provide an appropriate amount of challenge to learners at particular levels. The Level Descriptions may also be used to guide placement and to develop or select informal and formal assessments. An example of a Level Description is provided below:

**Level 1 Description:**

Adult learners exiting Level 1 can independently use math with ease and confidence in one or two comfortable and familiar situations in highly-structured, concrete, single-step tasks involving:

<table>
<thead>
<tr>
<th>Patterns, Functions, and Algebraic Reasoning</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very simple patterns and relationships (e.g., counting by 2s, 5s, and 10s)</td>
<td>Establish a routine for giving a child daily medication.</td>
</tr>
<tr>
<td>Very simple symbolic information (e.g., $3 + \square = 5$)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data and Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very simple ways to collect, interpret, and represent data (check sheets, lists, or very simple tables)Very simple, familiar concepts of probability</td>
</tr>
<tr>
<td>Locate and discuss specific information from a simple chart, diagram or graph related to a nutrition graph in a health pamphlet.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Geometry and Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>High frequency standard units of measurement (pounds, feet, inches, centimeters), geometric shapes, and length and width</td>
</tr>
<tr>
<td>Give oral directions for getting from one familiar place to another (directions for a new worker to go from a work station to the cafeteria).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number and Operation Sense</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole numbers (up to three digits), common monetary values, and benchmark fractions (1/2) and percentages (50%)</td>
</tr>
<tr>
<td>Determine about how much a $40 item would cost if it were ½ off.</td>
</tr>
</tbody>
</table>

**Other Examples:**

- Sort telephone numbers by area code to determine which ones are long distance calls.
- Collect and classify data on students’ favorite drinks in order to figure out what to buy for a class celebration.
- Plan a neighborhood party and keep track of who will or will not attend.
**Benchmarks/Sub-Benchmarks**

Informed by research and best practice (see Key References), the Benchmarks provide information about the specific knowledge, skills, and strategies learners draw from to perform the Learning Standard as described in the Level Description for that level, or to lay the foundation for performance at higher levels. As illustrated in the **Example** below, Sub-Benchmarks are more explicit examples of the sub-skills/strategies comprising a Benchmark.

**EXAMPLE: Level 3 Benchmark and Its Sub-Benchmarks**

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Sub-Benchmark</th>
</tr>
</thead>
</table>
| P3.1 Interpret and apply whole number and benchmark fractional patterns and expressions involving all four basic operations.” | b. Identify parts of an expression using mathematical terms (for example, sum, term, product, factor, quotient, coefficient, etc.).
| | c. Read and write expressions using variables. *For example: Rewrite “Subtract y from 5” as 5 – y.* |

Together, Benchmarks and Sub-Benchmarks can be used by teachers as **objectives for instruction**. The primary instructional focus should be the Benchmarks, using the Sub-Benchmarks to identify and practice specific sub-skills that would help learners with the broader Benchmarks. It is important to remember that the list of Sub-Benchmarks is not all-inclusive, and it is possible that learners may require instruction in a sub-skill that is not mentioned in order to achieve the performance described by the Benchmark.

The next sub-sections overview key information about how the Benchmarks/Sub-Benchmarks are organized:

**Strands**: The **Use Math to Solve Problems and Communicate** Benchmarks are clustered into four Strands shown below:

<table>
<thead>
<tr>
<th>Use Math to Solve Problems and Communicate Strands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patterns, Functions, and Algebraic Reasoning (P)</td>
</tr>
<tr>
<td>Data and Statistics (D)</td>
</tr>
<tr>
<td>Geometry and Measurement (G)</td>
</tr>
<tr>
<td>Number and Operation Sense (N)</td>
</tr>
</tbody>
</table>

Adults using math integrate knowledge from all of these Strands when they use their skills in real situations, but grouping the Benchmarks into Strands is meant to help practitioners easily find specific Benchmarks of interest. For instance, the Benchmark/Sub-Benchmarks on the previous page comes from the **Patterns, Functions, and Algebraic Reasoning** strand.

The four Strands are not intended to be taught sequentially (for example, Geometry and Measurement does not have to be taught after Data and Statistics or Patterns, Functions, and Algebraic Reasoning). In fact, many of the Benchmarks within a Strand can support Benchmarks in other Strands. For example, the Benchmark from Operations and Number Sense N1 (Apply simple types of mathematical concepts to real-life and theoretical problems involving whole numbers/integers) can be addressed
at the same time as Patterns, Functions, and Algebraic Reasoning P1 (Interpret and apply common addition and subtraction patterns and number properties in expressions.), or the Data and Statistics Benchmark D1 (Read, represent and interpret very simple data and statistical information).

**Notation:** Each Benchmark is notated by the Strand, and the level, a Benchmark number and a Sub-Benchmark letter, so **D2.1a** would be the data strand, level 2, Benchmark 1, Sub-Benchmark a. The Benchmarks have been constructed so that each one addresses similar content in every level. For example, **D1.1** is about interpreting data and statistical information from different sources; **D1.2** is about posing questions, and then collecting, organizing, and interpreting the resulting data. The Sub-Benchmarks add lowercase letters to the Benchmark notation as in the example below:

**EXAMPLE:** Level 3 Benchmarks/Sub-Benchmarks in the *Data and Statistics* Strand

<table>
<thead>
<tr>
<th>Strand: Data and Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Analysis of Data</strong></td>
</tr>
<tr>
<td><strong>Representations</strong></td>
</tr>
</tbody>
</table>
| D3.1 Read, represent and interpret common data and statistical information | a. Extract discrete information from lists, tables, bar graphs, pictographs, or line plots  
b. Describe how the scale in a bar or a line graph can distort interpretation of the data  
c. Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8).  
d. Critique questions posed as statistical, or not. |
| **Data for Answers**        |
| D3.2 Pose questions that can be answered with common data and collect, organize, and represent the relevant data to answer them | a. Design simple data investigations to address a question and collect categorical data.  
b. Organize categorical data and represent them in a line graph or stem-and-leaf plots.  
c. Verify that data represented are the actual data collected.  
d. Make simple, straightforward inferences based on the data. |

**NOTE:** Whereas the Benchmark notation is consistent from level to level, the use of lower-case letters associated with specific content in the Sub-Benchmarks is not. For instance, “b” at Level 3 may not be about the same sort of information as “b” at Level 4.

**Progression across Levels:** Similar concepts, skills, and/or strategies are found in Benchmarks and Sub-Benchmarks across multiple levels; however, differences in language or in the examples provided will mark (perhaps subtly) important changes in the range or complexity of what is being described. Concepts, skills, and strategies that are mentioned at a lower level but not at higher levels are assumed to be mastered by most learners performing at those higher levels. If gaps in those areas are noted and are affecting performance of the Benchmark, instruction should be provided.
Considerations

**The Role of Content Knowledge:** Most adult students need ongoing development in a range of knowledge areas (e.g., science, government, work culture, etc.) that are not identified in the Learning Standard Framework but which provide important contexts for skill development and application. This knowledge is identified and developed through initiatives such as Oregon Pathways to Adult Basic Skills (OPABS), the Ocean Sciences and Math Collaborative, EL/Civics, and class-negotiated themes.

**Learners with Disabilities:** The Learning Standard Framework describes *what students need to know and be able to do* at each level. The Learning Standard, Level Descriptions, and Benchmarks/Sub-Benchmarks apply to all students *except* when the nature of a disability directly affects the student’s capacity to perform in a specific area. In other cases, learners have the ability to perform in a specific area but may need accommodations either in how they are instructed or how they are assessed in order to develop and demonstrate their skills. Programs need to consider carefully how best to use the Learning Standard Framework equitably with students with disabilities without sacrificing rigor and opportunity to learn.

**Organization of the Document**

This document presents the elements of the Framework (Learning Standard, Level Descriptions, Benchmarks/Sub-Benchmarks) in two formats: *cross-level matrices* and *single-level views*. In the cross-level matrices, each Framework element is presented separately, with one matrix showing all the Level Descriptions across the seven levels and then another matrix showing all the Benchmarks/Sub-Benchmarks across the seven levels. The purpose of this format is to enable practitioners to track the development of a particular aspect over multiple levels and to support instructors who teach in multi-level settings. In the single-level views (*Appendix A*), all the elements for a level are lifted from the matrices and pulled together *by level*.

Although this view may be preferred by teachers in single-level classes, it should be used in conjunction with the cross-level matrix, since students will have strengths and gaps across the Benchmarks. **Instructors should not assume that students are working at the same level for all the Benchmarks.** For instance, a “Level 4” student may have strong computation skills but have weak algebraic reasoning or geometry skills, especially if she was exposed mostly to computation without the opportunity to apply those computations to geometry, data, and algebra. In order to help this student continue to develop as someone able to effectively use math, the teacher may need to work with this student on some of the Pattern activities at *Level 2*. In essence, the cross-level matrix will help instructors identify which concepts, skills, and strategies—from whichever level—students need to develop in order to keep progressing.

The Strands are somewhat artificial organizational structures since there is much overlap of the skills, concepts, and strategies addressed in Benchmarks in a particular Strand. For example, ratio and proportion are key concepts in Number and Operation Sense, and proportional reasoning is also necessary for Patterns, Functions, and Algebraic Reasoning. Many Geometry and Measurement concepts also require application of ratios and proportions. Therefore, practitioners may need to check in more than one location for a particular Benchmark if they do not find it in the first place they look.

Since one of the purposes of the Learning Standards is to build a common language and understanding related to a subject area, a *Glossary* (*Appendix B*) has been developed to clearly state how particular terms used in the Framework are defined. Finally, *Appendix C* presents a table showing...
correspondences provided by the National Reporting System for CASAS scores for the first six performance levels addressed by the Framework. Level 7, the Transition Level, is considered to be beyond what is expected at NRS Level 6.

A Final Word

The Learning Standard Framework is designed to be used flexibly by experienced and new practitioners alike to meet the diverse needs of students throughout Oregon. By maintaining a focus on adult contexts, research-based skill development, clarity, and usability, this Framework is a vital tool for the continuous improvement of the field and its service to ABS learners.