



College and Career Readiness Standards-in-Action

Foundational
Unit

2

FACILITATOR GUIDE
MATHEMATICS

**THINKING ACROSS
LEVELS TO
CONNECT LEARNING**

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Background and Purpose

The College and Career Readiness (CCR) Standards for Adult Education exemplify three key advances in instruction prompted by the Common Core State Standards (CCSS). This unit provides adult educators with an introduction to *coherence*, the second of these advances. Some of the connections in the CCR Standards link topics within a single level; however, most connections link across two or more levels to lay out a progression of increasing knowledge and skill.

A large body of research suggests that coherence is crucial for college and career readiness, and that adult learners would greatly benefit from a curriculum that displays coherence across levels of learning.

William Schmidt and his colleagues, who conducted some of the most powerful research emanating from the Trends in International Mathematics and Science Study (TIMSS), describe coherence as follows:

Content standards, taken together, are coherent if they are articulated over time as a sequence of topics and performances consistent with the logical and, if appropriate, hierarchical nature of the disciplinary content from which the subject matter derives. This is not to suggest that there is only one coherent sequence, but rather than any such coherent sequence reflects the inherent structure of the discipline. This implies that for a set of content standards “to be coherent” they must evolve from particulars (e.g., simple mathematics facts and routine computation procedures associated with whole number and fractions) to deeper structures. It is these deeper structures by which the particulars are connected (such as an understanding of the rational number system and its properties). This

evolution should occur both over time within a particular grade level and as the student progresses across grades.¹

Schmidt says that if standards are to be coherent, then the “depth” of those standards needs to increase as students progress from one grade to another, or from one level to another.² Coherent standards reflect a trajectory by “linking coverage of the topics over grades and by reducing the repetition over the same grades.” Schmidt and Houang found coherence to be related significantly to student achievement at the country level, as part of their TIMSS research.³ These findings are powerful when considering the CCR Standards for Adult Education, which progress across five levels: A (Grades K-1), B (Grades 2-3), C (Grades 4-5 and 6), D (Grades 6 and 7-8), and E (high school).

As part of the ACT National Curriculum Survey (2012), secondary teachers were asked whether topics taught in their classes were taught as part of their typical classroom instruction or as part of review.⁴ Findings indicated that too often a topic was taught at one level or course and then retaught at the same level of depth and complexity as part of typical content in one or more subsequent levels or courses. This lack of progression and coherence suggests

¹ Schmidt, W.H., H.A. Wang, and C.C. McKnight, (2005) “Curriculum Coherence: An Examination of US Mathematics and Science Content Standards From An International Perspective,” *Journal of Curriculum Studies*, 37(5).

² Schmidt, W., Houang, R., and Cogan, L., “A Coherent Curriculum: The Case of Mathematics,” *American Educator*, Summer 2002.

³ Schmidt, W.H., and Houang, R.T., “Lack of Focus in the Intended Mathematics Curriculum: Symptom or Cause?” in Loveless (ed.), *Lessons Learned: What International Assessments Tell Us About Math Achievement*. Washington, DC: Brookings Institution Press, 2007; and Schmidt, W.H., and Houang, R.T., “TIMSS International Curriculum Analysis and Measuring Educational Opportunities,” 3rd IEA International Research Conference, 2008.

⁴ 2009 ACT National Curriculum Survey.

that instructional time is not being used wisely across courses, and students may not be taught the higher-level content they need to become college- and career-ready.

The CCR Standards have been developed to promote coherence both within and across levels; they are designed to reflect the development and growth of conceptual understanding and continually return to such organizing principles as the property of operations. For example, the purposeful focus on understanding numbers and their properties across the levels is reflected by the progression from number to expressions and equations and then to algebraic thinking, to algebraic expressions and equations, and ultimately to a deep understanding of functions.

Coherence can be further exemplified in applications related to other domains within and across the levels, such as the connection between properties of operations (e.g., multiplication) and geometric applications (e.g., area).

By paying attention to coherence, adult educators will understand that mathematics is a logically progressing discipline that has intricate connections and requires sustained practice to learn. Instead of each standard signaling a new concept or idea, standards at higher levels become extensions of previous learning. Instructors can expect students to understand certain core content when they enter their classrooms.

Overview

This unit is the second in a series of four. It will allow participants to apply what they have learned from Unit 1, during which they explored the importance of focusing on the major work within a level. In this unit, participants will think about linking key mathematical concepts across levels.

The activity will provide participants an opportunity to closely read several CCR Standards for Mathematics and then think deeply about how the content progresses across the levels and reflects coherence through their sequencing.

Participants will investigate three key progressions present in the CCR Standards: the first dedicated to building fluency with operations, the second dedicated to expressions and equations, and the third focused on real-life applications. Standards within each of the three progressions will be provided to participants on like-colored cards. Participants will be asked to identify which progression (i.e., fluency with operations, expressions and equations, and real-life applications) aligns with each of the three color-coded sets of cards. Then they will organize the cards within each color group by level, from Level A through Level E. By carefully building the learning trajectory within and across levels, participants will learn how the CCR Standards support students' new understandings based on previously learned concepts and skills.

Materials You Need

For Participants (one copy per participant):

- Directions for Participants
- Resource: Major Work of the Levels
- Resource: CCR Standards for Adult Education (one copy per table)
- Resource: Color-coded set of standards cards on fluency with operations, expressions and equations, and real-world applications (one set per pair or small group of participants)

For Facilitators:

- Unit 2 PowerPoint Presentation: Thinking Across Levels to Connect Learning
- Answer Key: Thinking Across Levels to Connect Learning

Time Frame to Complete the Unit

Allow **90 minutes** for this unit, using the following guidance to help divide the time:

- 15 minutes – Introduce the unit.
- 60 minutes – Work in pairs or small groups to complete the activity.
- 15 minutes – Discuss reflections.

NOTE: Participants who are unfamiliar with the CCR Standards for Mathematics will need more time to complete the activity: They will need the time to closely read and understand the standards in the sorting activity.

Guidelines for Implementation

Step 1: Preparations

- a) Create small groups of participants, ideally with four to eight participants at each table.** The maximum size of a group for this session depends on your space, need, and comfort level. A guiding principle is to make sure the group is small enough that you can be in touch with each table of participants to determine whether they understand the concepts and are fully engaged or they are struggling and need more support.
- b) For best results, select table leaders in advance or ask each table of participants during the session to choose one person to be their lead.** The table leader will be responsible for keeping track of time, bringing participants together at the appropriate times, making sure participants are moving along, sharing information at appropriate times, and notifying you if there are questions or the group needs more support. (If table leaders are selected in advance, provide them with

copies of the PowerPoint Presentation, handouts, and answer key so they can prepare for the session.)

- c) **As a general strategy, be prepared to circulate around the room when participants are working individually or in pairs.** Circulating will allow you to check on their understanding and be readily available to answer questions.
- d) **Prepare the materials for participants.** Print three sets of standards cards on three different colors of cardstock. Each color represents a different progression of standards (blue, yellow, and green are suggested). One full set includes eight different standards for each of three progressions:
- Fluency with operations (Unit 2, Participant Materials – blue cardstock)
 - Expressions and equations (Unit 2, Participant Materials – yellow cardstock)
 - Real-world applications (Unit 2, Participant Materials – green cardstock)

Print, cut, and organize the standards cards. Make as many sets of the three progressions as you need for the size of your group. Each 8½” x 11” sheet of cardstock produces one set of cards with eight standards. As a rule, make a complete set of the three progressions for every two or three participants (e.g., if you have 24 participants, make 8 or 12 full sets). If the cards are to be reused, consider laminating them. You can use the answer key to verify that each three-color set is complete.

Provide a single copy of the CCR Standards for the table. In advance of the session, advise participants who think they might need their own copy of the CCR Standards to bring it with them.

e) **Become familiar with the PowerPoint Presentation and materials, including the answer key.** This will allow you to be at ease with the information and flow of the unit. Detailed notes are provided within the PowerPoint Presentation to help you prepare for the session. In particular, notes for each slide include the identification of the Big Idea, Facilitator Talking Points, and Facilitator Notes. These can help you frame your presentation and provide you important detail and context. This information is coupled with the information offered in this Facilitator Guide—including the research base, rationale, advice, and other guidelines—to give you the support and guidance you require.

The answer key is for your edification and is not meant to be handed out to participants. It includes “right” answers, but they are not necessarily the only right answers; it includes well-supported judgments that will guide you as you reflect on participant questions and answers.

Step 2: Implementation (15 minutes to introduce; 60 additional minutes working in pairs or small groups)

Introduce the three key advances in the CCR Standards for Mathematics.

Slide 2: Discuss with participants the three key advances and how they interact and build up to college and career readiness: While Unit 2 emphasizes *coherence*, which is Key Advance 2, it is important to understand the CCR Standards were developed to reflect and exemplify the three key advances of *focus*, *coherence*, and *rigor*.

Remind participants that in Unit 1 they learned about *focus* and used the Major Work of the Levels resource to become familiar with the topics emphasized within each CCR level.

In this unit, participants will extend their understanding of the CCR Standards to include the importance of flow and progression of content across the levels. Supporting topics within and across levels not only provides a sense of coherence but also reinforces the major work of the levels. Similarly, students need to develop conceptual understanding, procedural skill and fluency, and the ability to apply their mathematical understandings and skills to solve problems (a focus of Unit 3). This includes regular work with the Standards for Mathematical Practice (a focus of Unit 4). It is the interaction of these key advances of *focus*, *coherence*, and *rigor* within the CCR Standards, coupled with the Standards for Mathematical Practice, that will prepare adult learners for college and careers.

Introduce the concept of coherence in mathematics instruction.

Slide 3: Explain the objectives of the unit: 1) to understand the research base that explains the importance of coherence; 2) to understand that the focus of content in each level includes coherence within and across levels; and 3) to develop an understanding of how particular progressions of critical concepts are reflected in the CCR Standards.

Slide 4: When referencing research, note findings from TIMSS and the ACT National Curriculum Survey. Research supports the fact that coherent standards and curricula are important for student performance as well as college and career readiness.

Slide 5: Discuss the implications that coherence has on classroom instruction by reviewing each of the three points on the slide. Reinforce the connection that coherence (Key Advance 2) has to focus (Key Advance 1). All of the key advances are connected to one another, but particularly to the first advance of focusing on the major work of the level. It is important to point out that the progression of topics

is related to the critical concepts—or the major work—identified for each level.

Begin the hands-on activity of Thinking Across Levels to Connect Learning.

Slide 6: *Introduce the hands-on activity for Thinking Across Levels to Connect Learning.* This activity will involve participants in creating progressions of critical concepts across the CCR levels. Participants will be working collaboratively to arrange three sets of standards that relate to (1) fluency with operations; (2) expressions and equations; and (3) real-world applications into progressions that span the CCR levels.

Slide 7: *Distribute participants' materials for Thinking Across Levels to Connect Learning.* This includes directions for participants, the Major Work of the Levels resource, one complete set of standards cards (1 green set, 1 blue set, and 1 yellow set) for each pair or small group, and one copy of the CCR Standards for Adult Education for each table of participants. Be sure that each pair or small group has the materials it needs.

Slides 8-9: *Provide directions to participants on how to complete the activity.* Remind them that these cards do not represent an exhaustive list of standards for a given progression but rather a sampling of standards within each progression. Also, let participants know that when the cards are placed in order there will be at least one standard card for each level (A, B, C, D, and E). There might be more than one standard for some levels, indicating a possible progression within a level in addition to the progression across the levels.

The first task will be for participants to identify the progression topic to which each color group of standards belongs. Move through this part of the activity quickly.

Have participants discuss the three titles of the progressions (fluency with operations, expressions and equations, or real-world applications) with their partner. Ask them to hold up the color when you call out the title of the progression.

To accommodate groups with little experience with the CCR Standards, lessen the challenge by reducing the number of progressions (to two rather than three) or providing only one standard per level for each progression. Have participants spread out in the room with their partner(s), so they have enough space to read and sort the cards by color group from the lowest to highest level. Ask participants to work with a partner.

Here are the directions to give participants:

TIP: If participants are having trouble, instruct them to use the CCR Standards in conjunction with the cards. They will see more easily, for example, that fluency with addition and subtraction comes before multiplication and division.

1. Identify the progression topic to which each color group of standards belongs: fluency with operations, expressions and equations, or real-world applications.
2. Begin with the fluency (blue) cards. Use knowledge of how concepts and skills build on one another to organize the color-coded cards in a logical order of progression from the lowest to highest level.
3. Use knowledge of the CCR Standards and the Unit 1 resource, Major Work of the Levels, to help identify the level (A, B, C, D, or E) for each standard on a fluency card.
4. Share results with others at your table, and discuss any points of agreement and disagreement.
5. Repeat steps 2 through 4 for the expressions and equations (yellow) and real-world applications (green) cards.

Reflections: Thinking Back and Looking Forward (15 minutes)

Slide 10: Bring the whole group together for a debriefing of the unit. (An alternative is to keep the discussions at the tables, and then have the table leaders share one or two insights from their group discussion.) This unit builds on the foundation laid by Unit 1, Focusing on the Major Work of the Levels, and its activity. The following culminating questions provided on this slide will allow participants to reflect on the reasoning behind this key advance.

- What have you learned from the activity about coherence across the levels?
- Did you find some examples of coherence within a level?
- What connections between “thinking across the levels” and “focusing where the standards focus” do you see?
- How might you apply what you learned from this unit to your classrooms?
- Why do you think some standards appear in more than one of the progressions?

These questions should stimulate discussion of the value of making apparent the important progressions within and across the levels. This shift in purpose for adult educators toward readiness for postsecondary training and education is crucial for student success.

Slide 11: After participants complete the hands-on activity, ask them to reflect on and then discuss what they have learned. Ask them to consider how they plan to use what they have learned. Below are some questions for participants’ reflections on their next steps:

- How has participating in this activity changed your thinking about the CCR Standards?

- How will you use the information and understanding you have acquired to improve your teaching practice and student learning?
- What additional training and tools would strengthen your ability to do so?

Once participants understand the need for a clear focus at each level and for coherent progressions within and across the levels, the next priority is to gain understanding of how to create a rigorous mathematics curriculum. Unit 3, The Three Components of Rigor, provides an opportunity for participants to delve into the CCR Standards for evidence of the three components of rigor: conceptual understanding, procedural skill and fluency, and real-world applications of knowledge. They will learn the importance of each of the components in planning lessons and how the components are connected in the standards.