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Curriculum Mapping: A Process for Continuous Quality Improvement

The curriculum mapping process supports teacher discussions about how to implement a curriculum aligned with standards and assessments. This issue of Notes & Reflections provides a step-by-step guide to the curriculum mapping process. Case examples drawn from the experience of NCREL’s staff illustrate this process.

A TOOL FOR CONTINUOUS QUALITY IMPROVEMENT

Improving the alignment of classroom instruction to district benchmarks and state standards can dramatically improve the quality—and equity—of education (Marzano, 2000). Professional development practitioners can attest that misalignment with these standards is common. Specifically, some important concepts are not taught long enough, if at all, to ensure depth of learning (Schmidt, McKnight, & Raizen, 1997). Even though the advent of state standards has usurped teachers’ latitude to pick and choose the topics they want to teach, unevenness in implementing the mandatory curriculum remains. Professional development practitioners sometimes observe that the complexity and abstractness of some curriculum guides limit the degree to which they direct what actually gets taught (termed the taught or enacted curriculum). Teachers, therefore, need guidance about how to align what they teach with what the district or state requires of them. And to do that, they need to know what they teach.

Curriculum mapping facilitates aligning to standards by providing a visual representation of the taught curriculum. Just as a map provides perspective and orientation, and thereby assists a wayward motorist in finding his ultimate destination, so too does the curriculum map facilitate the process of understanding standards and assessment data. During an interview, Bobb Darnell, Ed.D., a staff developer and coauthor of Guide for Instructional Leaders, explained, “If people don’t have a visual tool, they get lost in the detail and don’t see the big picture.”

The map becomes a source of data in explaining academic performance and a starting point for numerous conversations about how to improve it.

Continuous Improvement Process

Curriculum maps facilitate a process of critical inquiry for continuous improvement. This means that teachers are challenged to focus on what they want to...
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achieve, and to analyze how to get there. The continuous improvement process can be summarized with three critical questions:

1. What do you want?
This question refers to the vision or goal for what a student will know at the end of a particular phase of education (be it a single grade or the whole K-12 span of grades). It can also be represented by scores on standardized assessments.

2. What are you doing to get what you want?
The curriculum map roughly answers this question.

3. What are you going to change, and how?
As the saying goes, “If you keep doing what you’ve always done, you’ll keep getting what you’ve always gotten.” When faced with low assessment scores, teachers and administrators must consider a range of options for improving what they do. With the help of an experienced facilitator, the school’s personnel can identify practical changes to the curriculum.

In summary, curriculum mapping facilitates conversations about how to change the curriculum to meet particular challenges. It provides answers to critical questions about student performance. What follows is an overview about how these maps can be used to support such conversations. In this brief format, it is possible neither to discuss every possible use of curriculum mapping nor to describe all of the necessary elements of curriculum alignment. The Resources section on the Notes & Reflections Web site (www.ncrel.org /info/notes/) lists a variety of sources that provide a more complete picture of the entire curriculum writing and aligning process.

A PROCESS FOR CURRICULUM MAPPING

The following process describes one way to implement curriculum mapping in a school. The initial mapping and first discussion about alignment to standards are designed to take only two hours. Subsequent discussions may continue over additional sessions.

1. Preparation. Identify the participants and gather necessary materials.

2. Snapshot—The Initial Mapping. The purpose of the initial session is to get a “snapshot” of what the curriculum looks like as it currently stands. This step usually can be accomplished in about two hours.

3. Critical Inquiry Within Grades. Teachers within a grade (or course) come to decisions about which topics all teachers in the grade should teach, and which instructional strategies are most effective.

4. Critical Inquiry Across Grades. Teachers within a span of grades confer about what each grade ought to teach. The goal of this stage is to eliminate overlap and to solidify expectations about what a student should know after completing each grade.

Step 1: Preparation
The success of this activity requires that a school or district accomplish the following:

1. Clarify standards and benchmarks. Before discussing alignment, it is necessary to identify the set of standards that will serve as the frame of reference. The standards document should also list the benchmarks that identify the key student understandings that comprise each standard. Resources for identifying appropriate standards documents are available on the Notes & Reflections Web site at www.ncrel.org/info/notes/.

2. Identify participants. Ideally, every teacher in a grade or a particular course should participate. If that is not possible, select teachers who are representatives and respected leaders for their grades or topics. These teacher-leaders need to have the respect of their peers, a deep understanding of the content, and, ideally, training in issues related to curriculum alignment. The inclusion of a key decision maker, such as a principal or curriculum specialist, is crucial for the implementation of the decisions. It also demonstrates to the teachers the importance of their discussions, and helps to ensure follow-through.

3. Bring in a facilitator. It is crucial to involve a facilitator who is knowledgeable in curriculum, instruction, and alignment to standards. He or she can guide the entire process.

4. Find the time. The school or district leadership needs to create a time line for the alignment activities, including a realistic goal for completing the process. Administrators will need to schedule blocks of time throughout the year for the participants to be released from their typical duties.

Step 2: Snapshot—The Initial Mapping
The purpose of the initial session is to get a “snapshot” of what the curriculum looks like as it currently stands. This step typically can be accomplished in about two hours, and it prepares teachers to begin the discussion about alignment to standards. The number of participants can range from the teachers in a single grade (or course level) to the whole school. The
The basic method described here arranges a course according to its major units or themes, the underlying topics, and the critical skills. Other methods, such as the one promoted by Heidi Hayes Jacobs, also arrange the map according to the calendar year. See the tip “When and Why to Use Calendar Mapping” for a discussion about which method is best for different grade levels.

1. **Identify major units.** The first step is to determine the major units or themes of a course. These major units should be written as headings along the top row of the top sheet of paper that is tacked to the wall.

2. **Add concepts and topics.** Mapping begins in earnest when all members of the team fill in the middle level of the map, namely, the topics and concepts taught within each unit. Teachers should work alone at this point, and the leader of the session should enforce a no-talking rule. Teachers may list the same topic in more than one location.

3. **Add skills.** After the teachers finish filling in the concepts or topics, they should then fill in the third level—the specific skills covered in the unit. This also should be done without conversation.

4. **Validate.** Teachers must validate their collective map. This can be done outside a formal session by creating a large poster of the map and posting it where the teachers have access to it. Over the period of a week, teachers should think of any additions to the map that they wish to make. When this is finished, teachers should have an accurate snapshot of what they teach, collectively.

Note: The Inspiration software package (available at www.inspiration.com) is useful for creating a nicely formatted copy of the map suitable for enlargement.

5. **Map the standards and benchmarks.** Participants should label each concept or skill with the standard and benchmark that it meets. Write each benchmark in a different color to highlight visually the possible areas of imbalance. Depending on time constraints, this step can be included in the first session, or it can begin the critical inquiry phase described in Step 3.
### Whole Numbers

**Concepts/Topics**
- Place Value (6A)
- Rounding (6A)
- Comparing (6D)
- Operations with whole numbers (6C)
- Estimation of whole numbers (6C)
- Exponents (6B)

**Skills**
- Identify the place value of a number (6A)
- Round to a specific place value (6B)
- Compare greater, less than, or equality of whole numbers (6D)
- Add, subtract, multiply and divide whole numbers with and without a calculator (6C)
- Estimate sums, differences, products and quotients of whole numbers (6C)

### Number Expressions

**Concepts/Topics**
- Evaluation of number expressions (6C)
- Simplifying number expressions (6B)
- Order of operations
- Evaluating expressions with parentheses (6B)
- Equivalent number expressions

**Skills**
- Add, subtract, multiply, and divide number expressions with and without a calculator (6C)
- Use order of operations to simplify number expressions (6B)
- Determine whether number expressions are equivalent (6D)
- Determine whether number equations are equivalent (6D)

### Algebraic Properties

**Concepts/Topics**
- Addition properties (8A)
- Multiplication properties (8A)
- Distributive property (8A)
- Division properties

**Skills**
- Recognize Commutative, Associative, and Identity properties of addition (8A)
- Recognize Commutative, Associative, and Identity properties of multiplication (8A)
- Recognize Distributive property (8A)
- Recognize Division properties (8A)

### Variable Expressions

**Concepts/Topics**
- Variable expressions (8D)
- Like terms (8D)
- Combining like terms (6B, 8D)
- Simplifying variable expressions (6B, 8D)
- Evaluating variable expressions (6B, 8D)

**Skills**
- Identify variable expressions (6A)
- Name the variables (8D)
- Identify and combine like terms (6B, 8D)
- Substitute to evaluate variable expressions (6B, 8D)
- Substitute to evaluate expressions with more than one variable (6B, 8D)

### Variable Equations

**Concepts/Topics**
- Variable equations (8A)
- Equivalent variable equations (8A, D)
- Solving variable equations (6B, 8D)

**Skills**
- Identify a variable equation (8A)
- Determine if two equations are equal (8A)
- Use the properties of equality to prove equations are equal (8D)
- Use the algebraic properties to solve variable equations (6B, 8D)
- Use inverse operations to solve variable equations (6B, 8D)
- Solve multiple-step variable equations with whole numbers (8D)

### Problem Solving

**Concepts/Topics**
- Interpreting word problems (6B)
- Solving word problems (8A, B)
- Using a graphic to solve a word problem (8B)

**Skills**
- Guess, check, and revise answers to word problems (6B)
- Develop an equation to solve a word problem (6B, 8D)
- Draw a picture to represent the problem and solve the problem (8B)
- Determine the pattern (8A)
- Working backwards to solve a word problem (8B)
- Using a pattern to solve a word problem (8B)

### Applications

**Concepts/Topics**
- Perimeter (7C)
- Area (7C)
- Volume (7C)
- Working with formulas (7C)
- Mean (8B)
- Tables and bar graphs (8B)

**Skills**
- Calculate perimeter (7C)
- Calculate area (7C)
- Calculate volume (7C)
- Substitute and solve a formula (7C)
- Calculate mean (6C)
- Organize and interpret a frequency table (8B)
- Create and interpret a bar graph (8B)
**Step 3: Critical Inquiry Within Grades**

Now that the participants have a visual representation of their curriculum, they are ready to examine data about their teaching effectiveness and to conduct a critical inquiry about how they can improve. The process begins by identifying where the curriculum addresses standards and benchmarks. Then the improvement team can look at the relevant test data that exists.

1. **Begin informal inquiry about curriculum.** Before convening the group to consider all the data, teachers should take time by themselves to look over their map and consider it in light of how their students performed on each unit, topic, and skill. Teachers should begin to form hypotheses to explain those areas in which their students perform not as well as expected on classroom tests and standardized assessments.

2. **Examine achievement data along with standards.** Examining student achievement scores reinforces the need to improve the curriculum by revealing areas of academic weakness and strength. In the same session, the facilitator should highlight which standards, if any, the grade’s curriculum map does not adequately assess. Frequently, those areas of poor achievement scores correspond to the gaps in meeting the standards that the tests are designed to assess. The narrative of Project REAL (see “NCREL Experience,” page 8) illustrates the use of performance data to motivate change.

Note: Information on data-driven decision making resources is also available as a resource on the Web version of Notes & Reflections (www.ncrel.org/info/notes).

3. **Engage in critical inquiry.** The participants next ask why students perform well in certain areas yet poorly in others. When possible, the facilitator should steer the conversation toward the most instructive topics (i.e., those on which student performance is clearly linked to recognizable gaps in the curriculum). When inquiring about performance on a particular topic, teachers should consider the following questions:

   - Are we teaching what is tested? Does the concept get taught before the date of the test?
   - Are we teaching the topic the way it is tested?
   - Are we teaching the topic long enough for our students to learn it sufficiently?
   - Do our students have the prerequisite skills (content knowledge or study skills) to learn?

Each of these questions fosters a discussion about the adequacy of the enacted curriculum. For example, poor performance on achievement tests often reflects gaps in the curriculum. Consider a school whose students perform poorly on a comparison writing sample. Curriculum mapping participants need to inquire about the way in which their school teaches writing. They might find that they narrative writing is heavily emphasized and that comparison writing receives too little focus.

Obviously, the explanation for substandard performance can be rather complex. It is helpful to utilize the “fishbone” group process both to generate the different causes of the performance, and to represent them graphically. Instructions for the fishbone group process are available below.

**FISHBONE GROUP PROCESS**

The fishbone group process guides a group in identifying multiple causes to a particular effect.

1. Define the effect. Be as specific as possible. Example: Why do our 9th-grade students perform below grade level in the assessment of comparison writing?
2. Write the effect in a box at the right side of a sheet of chart-sized paper.
3. Write the four main categories of causes for the specified effect. Brainstorm a list of specific reasons under each category, and write them underneath the category heading.

<table>
<thead>
<tr>
<th>CAUSES</th>
<th>EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment</td>
<td>Student preparation</td>
</tr>
<tr>
<td>Students lack paragraph-writing skills</td>
<td>Comparison writing performance</td>
</tr>
<tr>
<td>Need to align instruction to state assessment</td>
<td>Concept not taught long enough for mastery</td>
</tr>
<tr>
<td>Students need to practice in other classes</td>
<td>Scope and sequence</td>
</tr>
<tr>
<td>Integration</td>
<td></td>
</tr>
</tbody>
</table>

**Notes & Reflections**
Step 4: Critical Inquiry Across Grades

Some of the causes for low performance that the grade-level team identifies will no doubt be beyond the control of the participants. For example, if students are entering the grade without the prerequisite skills or knowledge, the solution depends on having discussions with other grade levels. The same process of critical inquiry should take place within a grade band (e.g., fourth through sixth grade). Once again, the curriculum maps can serve as data to support a critical inquiry into student performance. During these initial discussions, it is often best to focus only on what needs to be taught when, not on instructional strategies.

1. **Focus on a goal.** Identify a given benchmark that needs improvement, based on student-performance data. Define what students should know after finishing the grade band. Then work back, examining the maps of each grade to understand how that topic is taught over the course of the grade band, and what needs to be added to (or deleted from) the maps in order to support learning.

2. **Identify and discuss overlap.** One activity that can be used to eliminate overlap across grades is a carousel walk-through.

Have each grade create a curriculum map in which each element of the map is written on a colored self-sticking note. For example, in a sixth-grade mathematics class, a skill such as calculating the area of a two-dimensional figure would be written on its own note. Each grade looks at the maps of the other grades and records every instance of overlap with its own curriculum. The teachers investigate and discuss the reasons behind these cases of overlap. With the assistance of their district curriculum guide and state standards, teachers decide when the topic should be first introduced, which grade should be responsible for teaching it in-depth, and when it should be reviewed by subsequent grades. NCREL’s Curriculum Mapping Web site (currmap.ncrel.org) supports decisions about how long math and science topics need to be retained in the curriculum.

3. **View progress.** It is important for teachers to see the amount of progress they have made. When a grade decides to “give up” teaching a particular element of the map, it is transferred to the other grade. The end result is a mixture of different colors, which serves as a visual record of the amount of progress made during the discussion.

**NEXT STEPS: FURTHER DISCUSSION**

The process of critical inquiry described up to this point has focused on the what of the curriculum—what topics are covered and for how long. Subsequent inquiries in the continuous improvement process should extend to different topics, depending on the needs of the particular school. Following are some additional discussions that curriculum mapping supports:

**Resource Alignment**

A critical component of curriculum alignment is gathering appropriate materials to teach every concept and skill in the curriculum. Teachers need an expert in curriculum and instruction to help them determine the resources they will need in order to implement each standard and benchmark. As described in

**SPIRALING TOPICS**

When a concept is cut from a grade, it is possible to schedule periodic reminders of that concept so that it is not forgotten. These can be five-minute review sessions of previously learned topics. It is better to come back repeatedly to remind students of a concept than to reteach it.
NCREL’s experiences at McCorkle (see page 8), teachers need help in reviewing their textbook to identify the benchmarks and topics for which they will require additional resources. In the opinion of Arlene Hambrick, a professional developer with the North Central Eisenhower Mathematics and Science Consortium (NCEMSC), “Teachers must be a part of the process in order to know what is in the curriculum, and not just teach ‘the book.’”

In order to know what is in the curriculum, and not just teach ‘the book.’” It is easier to request new resources of a school board when the resources can be linked clearly to the standards.

1. **Prepare a new map.** Design it so there is room to write comments next to each concept or skill. In this blank space, the teachers list all the instructional materials they currently have in order to implement the particular element of the curriculum. As mentioned previously, teachers need to look in their textbooks to see which of their instructional needs are met for each activity or concept. The result of this step is to identify the areas for which additional resources are needed.

2. **Fill the areas of resource need.** Teachers should sift through workbooks, other available texts, resource books, and catalogs for additional materials and extended learning activities. They should be sure to examine textbooks targeted for one grade level above and below their own.

**ALIGNING RESOURCES**

When teachers from different grades discuss which topics each grade needs to eliminate and add to the curriculum, the choices can be painful. A third-grade teacher may have invested heavily in dinosaur resources and may be reluctant to step aside and let the second grade take over. On the other hand, one of the second-grade teachers might not have amassed any resources to teach dinosaurs at all! NCEMSC’s Hambrick offers the following solutions to this problem:

- The third-grade, dinosaur-loving teacher can loan out his resources and materials to the second-grade class.
- Alternatively, the teachers can agree to swap classes for that particular unit to teach a particular lesson. Thus, the third-grade teacher would teach the dinosaur unit, while the second-grade teacher would take over the third-grade class for the duration of the unit.

**A BALANCED APPROACH TO TEXTBOOK USE**

A major impediment to proper alignment is overreliance on textbooks. Hambrick learned from her experiences in the McCorkle School that “teachers see their textbook (not the curriculum guide and standards) as their ‘Bible.’” The problem with overreliance on textbooks is that they are too generic. A textbook made in California cannot address all the needs of, say, the Chicago Public Schools. How does one promote a balanced approach to textbook use? Curriculum mapping itself is part of the solution, because it gives teachers a comprehensive view of what their students need to know. The mapping process should help them understand that the textbook is not the curriculum; it is just a resource. To withdraw completely from textbook dependence, teachers can look in the textbook to see if it meets their needs—does it teach the activity or the concept? If not, teachers need to locate new resources (e.g., teacher-made materials, other texts). See the Resource Alignment section for more information about how to ensure that teachers have the necessary materials to implement the curriculum.
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Assessment Alignment

Aligning curriculum with standards is a crucial first step. If the topics of the curriculum are not taught in the manner in which they are assessed, it will be difficult to demonstrate gains in student achievement. According to a recent synthesis of numerous research studies on curriculum reform, the greatest gains in quantified student achievement require alignment to assessment as well as to the standards document. Moreover, thinking about assessment helps the instructional process by clarifying the behaviors that demonstrate deep knowledge of a concept. The following steps represent a process for aligning the assessment of a concept with the standards:

1. **Map the assessment to the curriculum.** It is necessary to ascertain if students are learning the curriculum. Therefore, each element of the curriculum needs to be mapped to its corresponding assessment. If teachers have already completed their curriculum maps with concepts and skills, they simply need to add another column in which they list the assessment strategy (e.g., multiple-choice test, story problem, practical uses of skills, written assignments).

2. **Identify critical benchmarks.** For each standard, teachers should identify the benchmark that indicates learning at the appropriate depth for the grade level. A benchmark for number sense, for example, might be the ability to use different kinds of number concepts (e.g., place value, exponents, prime and composite numbers) in a story. The Resource section of the Notes & Reflections Web site (www.ncrel.org/info/notes) lists numerous resources that assist with this step.

3. **Discuss.** Teachers should discuss if they assess the critical benchmarks that indicate learning. The best assessments observe the performance of some task and identify the actual method students use to accomplish it. Long story problems are an example of this sort of assessment.

Integrating the Curriculum

Using a calendar map supports discussion about integrating the curriculum. Teachers within the same grade can discuss how they can teach related concepts at the same time. For example, middle school math and science teachers can coordinate their schedules to teach the use of tables and graphs at the same time. Students benefit by performing similar skills simultaneously in different classes. Jacobs’ (1997) Mapping the Big Picture: Integrating Curriculum and Assessment K-12 presents an extensive discussion of how to integrate the curriculum.

NCREL EXPERIENCE

**McCorkle Elementary School in Chicago**

McCorkle Elementary School sits in the imposing shadow of one of Chicago’s few remaining public housing projects. The school’s nondescript façade belies its lofty purpose—providing a ray of hope for its 350 students to escape the poverty in which they all live. NCEMSC professional developer Arlene Hambrick accepted the challenge to help this low-performing K-8 school do something to improve. At the time of her engagement with the school, only 5 percent of its students tested at grade level in math.

Among the many serious difficulties facing McCorkle, poor curriculum alignment was identified by Hambrick as the most pressing—and the most amenable to improvement. Her prescription for change corresponded to the steps already described, with slight modifications. At the start of the year, the teachers brought in the previous year’s plan book. Working individually, they listed the different concepts they taught, along with activities and other examples of in-depth learning. When teachers within a grade band (e.g., K-3) examined one another’s curricula, they discovered that their students were being forced to endure frequent repetitions of the same material for several years. With this unpleasant fact brought to light, the initial task of curriculum mapping provided motivation for the teachers to engage in conversations about which grade is most fitting for chronically repeated topics (e.g., dinosaurs). Subsequent discussions led to decisions about how to align with the district’s standards.

Change at McCorkle did not result from a single session. Follow-up sessions were necessary to support the alignment with teaching resources (see the Resource Alignment section above), and it took nearly a year to complete the process. Hambrick was satisfied with the pace of progress at the school, explaining that “the process needs time to get buy-in from teachers—for them to talk about it, think about it, plan, get used to the idea, and be willing to change.” The results from the year-long effort of McCorkle’s teachers were dramatic: The proportion of students meeting their grade-level competency standards in mathematics rose from 5 percent to 38 percent!

**Project REAL**

Another example of NCREL’s use of curriculum mapping was with Project REAL (Rural Education Aligned for Learning). A distinguishing feature of this work was the use of student-achievement data to highlight the need to fill gaps in meeting standards. A detailed account of this professional development effort is available in the Fall 2000 issue of NCREL’s Learning Point magazine (www.ncrel.org/info/nlp/lp00/real.htm).
RESOURCES ON THE *Notes & Reflections* WEB SITE
(www.ncrel.org/info/notes)

The Resources section of the *Notes & Reflections* Web site can assist you with the following topics:

- Curriculum Mapping Resources
- Identifying Standards and Benchmarks
- Data-Driven Decision Making Resources
- Curriculum Alignment Resources
- State-Based Standards and Resources

REFERENCES


