

Appendix 4

Sample Selection Instruments

Elementary Program Selection Criteria

reprinted with permission from Arlington Public Schools, Arlington, MA

K-8 Mathematics Adoption Pilot Evaluation

reprinted with permission from San Diego City Schools, San Diego, CA

Mathematics Materials Selection Criteria

reprinted with permission from Missoula County Public Schools, Missoula, MT

Reaching Every Teacher High School Selection Criteria

reprinted with permission from Waltham Public Schools, Waltham, MA, and Education Development Center, Inc., Newton, MA

Project 2061 Curriculum Selection Criteria

reprinted with permission from the American Association for the Advancement of Science

Evaluation Criteria from the U.S. Department of Education's Expert Panel on Mathematics and Science Education

in the public domain

Text: _____ Name: _____

SMALL GROUP ISSUES

Date: _____

NUMBER SENSE & NUMERATION	PATTERNS & RELATIONSHIPS
1. How does the program develop understanding of the <u>numeration system</u> (counting, grouping, regrouping, place value)?	1. To what extent does the program use <u>patterns, variables, open sentences, number sentences, and relationships</u> to explore mathematics?
2. How does the program develop understanding of the <u>numeration system</u> ? (+, -, x, ÷)	2. How does the program use <u>tables, graphs, rules, and equations</u> to represent situations and to <u>solve and model problems</u> ?
3. How does the program develop understanding of: fractions, mixed numbers, decimals, percents, integers, and rational numbers?	3. How does the program develop understanding of the <u>solving of linear equations</u> , using concrete, informal and formal methods?

<p style="text-align: center;">NUMBER SENSE & NUMERATION (cont.)</p> <p>4. How does the program model, explain and develop understanding of <u>basic facts & algorithms</u>?</p>	
<p>5. How does the program build understanding of the <u>representation of numerical relationships on graphs</u>?</p>	
<p>6. How does the program give practice in selection and use of appropriate <u>methods for computing</u>:</p> <p>mental arithmetic</p> <p>paper & pencil</p> <p>manipulative</p> <p>calculator</p> <p>computer</p> <p>other</p>	
<p>7. How does the program teach <u>estimation</u> to check the reasonableness of results?</p>	

GEOMETRY & MEASUREMENT	STATISTICS & PROBABILITY
<p>1. How does the program develop understanding of how to <u>describe, model, compare and classify</u> shapes?</p>	<p>1. How does the program provide experiences in collecting, organizing, describing, and interpreting displays of data?</p>
<p>2. How does the program use the process of measuring and concepts related to units of <u>measurement</u>?</p>	<p>2. How does the program teach students to make inferences and construct arguments based on <u>data analysis</u>?</p>
<p>3. How does the program demonstrate understanding of <u>perimeter, area, volume, angle</u>?</p>	

ISSUES

Text: _____ NAME _____

_____ DATE _____

GENERAL LEARNING ISSUES

1. To what extent does program set <u>high expectations</u> for students?	
2. How does the program help students to learn through a <u>variety of strategies and approaches</u> ?	
3. a. To what extent does the program foster learning that is based on <u>inquiry</u> ?	
b. <u>Problem-solving</u> ?	
c. <u>Application of key issues and concepts</u> ?	
4. How does the program point to <u>connections</u> between math topics & across the disciplines to other subjects?	
5. How does this program support <u>all learners at all levels</u> ?	
6. a. How does this program broaden understanding of mathematics in a <u>cultural context</u> ?	
b. Our culture?	
c. Other cultures?	
7. In which ways does the program foster mathematical thinking through technology (calculators & computers)?	
8. a. To what extent is student <u>mathematical discussion and interaction</u> fostered in the classroom?	
b. Is discussion <u>essential</u> to learning or is it an <u>added activity</u> ?	
9. What kinds of <u>teacher mathematical communication and student-teacher interaction</u> [are] fostered in the classroom?	
10. To what extent is writing about math fostered?	

IMPLEMENTATION

1. How does this program assist the teacher to <u>understand and manage</u> all of its components?	
2. What <u>information is sent home</u> to parents about children's learning?	
3. a. How does the program foster students' application of mathematics learning at home? b. On their Own? c. With their parents?	
4. What <u>transitions from current practice</u> will our staff need to make to teach this program?	
5. What kinds of in-service plan would this program require to insure successful implementation?	
6. a. How should the program be introduced? b. Which grades? c. In which order?	
7. What communication to parents is available to explain this program?	

ASSESSMENT

<p>1. a. What assessment <u>practices</u> are used?</p> <p>b. Are they <u>consistent</u> with instructional practices?</p>	
<p>2. To what extent does the program help students to <u>understand for themselves</u> what they know and don't know?</p>	
<p>3. To what extent does the program offer a <u>comprehensive approach</u> to assessment? (i.e., providing any perspectives to understand students' progress?)</p>	

SUMMARY

<p>1. What is the overall program structure for the understanding of mathematics, e.g.</p> <p>a. linear (self-contained lesson after lesson),</p> <hr/> <p>b. widening spiral of topics,</p> <hr/> <p>c. in-depth exploration of topics over time,</p> <hr/> <p>d. themes or “big questions”,</p> <hr/> <p>e. other</p>	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
<p>2. To what extent does this program offer a <u>complete or comprehensive</u> mathematics education for our students?</p>	
<p>3. To what extent does this program prepare K-6 students for mathematics in grades 7 - 12?</p>	
<p>4. How would our students’ mathematics education be different as a consequence of adopting this program?</p>	

K-8 Mathematics Adoption Pilot Evaluation

Evaluation Prompts	Publisher:	Publisher:
1. Understanding of written materials by the students	Low 1 Comments: 2 3 High 4	Low 1 Comments: 2 3 High 4
2. Teacher friendliness of program: <ul style="list-style-type: none"> • directions are clear, easy to understand throughout lessons • teacher’s guide is well organized, easy to use • information regarding manipulatives is accessible and sufficient • information regarding support / supplementary materials is accessible and sufficient 	Low 1 Comments: 2 3 High 4	Low 1 Comments: 2 3 High 4
3. Friendliness of student materials: <ul style="list-style-type: none"> • visually appealing, easy to understand • provides good directions for students • language made accessible to all students • readability is developmentally appropriate 	Low 1 Comments: 2 3 High 4	Low 1 Comments: 2 3 High 4
Please answer if appropriate to your class population. 4a. Does it meet the needs of Bilingual students? 4b. Does it meet the needs of LEP students? 4c. Does it meet the needs of Spec. Ed. students? 4d. Does it meet the needs of GATE students?	4a. Low 1 2 3 High 4 4b. Low 1 2 3 High 4 4c. Low 1 2 3 High 4 4d. Low 1 2 3 High 4 Comments:	4a. Low 1 2 3 High 4 4b. Low 1 2 3 High 4 4c. Low 1 2 3 High 4 4d. Low 1 2 3 High 4 Comments:

Evaluation Prompts	Publisher:	Publisher:
<p>5a. Use of manipulatives as provided by program.</p> <p>5b. Availability of manipulatives not supplied by the program.</p> <p>5c. Amount of time spent duplicating materials that are essential to the program.</p>	<p>5a. Difficult 1 2 3 4 Easy</p> <p>5b. Inaccessible 1 2 3 4 Accessible</p> <p>5c. Above Average 1 2 3 4 Below Average</p> <p>Comments:</p>	<p>5a. Difficult 1 2 3 4 Easy</p> <p>5b. Inaccessible 1 2 3 4 Accessible</p> <p>5c. Above Average 1 2 3 4 Below Average</p> <p>Comments:</p>
<p>6. Adequacy of support materials:</p> <ul style="list-style-type: none"> materials other than the teacher's edition & kit materials, i.e., videotapes, audio tapes, trade books, etc. 	<p>Low 1 2 3 4 High</p> <p>Comments:</p>	<p>Low 1 2 3 4 High</p> <p>Comments:</p>
<p>7. A variety of assessment techniques are included:</p> <ul style="list-style-type: none"> pre/post embedded performance-based portfolios journals student self-evaluation, etc. 	<p>Low 1 2 3 4 High</p> <p>Comments:</p>	<p>Low 1 2 3 4 High</p> <p>Comments:</p>
<p>8. The teacher materials provide strategies for teacher management:</p> <ul style="list-style-type: none"> ease of preparation for setting up lessons use of problem solving skills in activities cooperative grouping ideas appropriate questioning strategies assessment management use of technology communication with parents, administrators 	<p>Low 1 2 3 4 High</p> <p>Comments:</p>	<p>Low 1 2 3 4 High</p> <p>Comments:</p>
<p>9. Overall rating of this program.</p>	<p>Low 1 2 3 4 High</p> <p>Comments:</p>	<p>Low 1 2 3 4 High</p> <p>Comments:</p>

MATHEMATICS MATERIALS SELECTION CRITERIA

October 1997

DIRECTIONS: Circle one number on each scale below. The higher the number, the better that text appears to meet the philosophy and Standards and Benchmarks outlined in Missoula County Public School (MCPS) new Mathematics curriculum.

Rating Scale: 5 = high
1 = low

Category 1: Mathematical Content

The mathematical content of the program reflects the curriculum Standards.

- **Mathematics as problem solving is built into the program at all levels.** The mathematics is developed from problem situations. Situations are sufficiently simple to be manageable but sufficiently complex to provide for diversity in approach. They are amenable to individual, small-group, or large group instruction; involve a variety of mathematical domains; and are open and flexible as to the methods to be used.
1 2 3 4 5
- **Mathematics as communication is built into the program at all levels.** Students have many opportunities to use language to communicate their mathematical ideas. The program asks students to explain, conjecture, and defend their ideas orally and in writing. As students mature and develop, the program expects students' mathematical communication to become more formal and symbolic. Students are asked to form multiple representations of ideas, express relationships within and among representation systems, and formulate generalizations.
1 2 3 4 5
- **Mathematics as reasoning is built into the program at all levels.** Throughout the program, students are asked to explain and justify their thinking and to question the statements of other students and the teacher. As students mature, the program asks students to do both inductive and deductive reasoning. In Grades 9-12, the program expects mathematically mature students to use informal and formal arguments to support conclusions.
1 2 3 4 5
- **Mathematical connections are clear in the program;** the program approaches mathematics as a whole. Concepts, procedures, and intellectual processes are interrelated through specific instructional activities designed to connect ideas and procedures among different mathematical topics, with other content areas, and to life situations.
1 2 3 4 5

Rating Scale: 5 = high

1 = low

- **The program is comprehensive and includes the mathematics content emphasized in the Standards at each level.**

K-8 -- see Standards and Benchmarks

High School -- Math I, II, and III see Standards and Benchmarks

High School -- Advanced Math classes see Standards and Benchmarks for each class

High School -- Topics I and Topics II classes see Standards and Benchmarks

1 2 3 4 5

Category 2: Organization and Structure

The program is organized into cohesive units, multi-day lessons, and worthwhile tasks.

- **The program is organized into units, modules, or other structure so that students have sufficient time to explore and investigate in-depth major mathematical ideas.** The units or modules include lessons, activities, and projects that are multi-days, emphasize that connections between mathematical concepts, and promote the attainment of several, rather than just one, instructional objectives.

1 2 3 4 5

- **The program asks students to work on worthwhile mathematical tasks.** The tasks do not separate mathematical thinking from mathematical concepts or skills; they capture students' curiosity and invite them to speculate and to pursue their hunches. Many tasks have more than one reasonable solution. The tasks require that students reason about different strategies and outcomes, weigh the pros and cons of alternatives, and pursue particular paths.

1 2 3 4 5

- **The instructional materials incorporate calculators and computers and other technology into the program as tools for students to use to do mathematics.** The program is designed with the expectation that calculators are available to all students at all times and that all students have access to a computer for individual and group work.

1 2 3 4 5

- **The program is appropriate for *all* students.** All students are expected to encounter typical problem situations related to important mathematical topics. All students are expected to experience mathematics in the context of the broad, rich curriculum described in the K-8 Standards. However, the program recognizes that students will differ in the vocabulary or notations used, the complexity of their arguments, and so forth. For grades 9-12, all students participate in the core program, with explicit differentiation in terms of depth and breadth of treatment and the nature of applications for mathematically mature students.

1 2 3 4 5

Rating Scale: 5 = high
1 = low

Category 3: Student Experiences

The program emphasizes students doing rather than memorizing mathematics. Students are actively involved with mathematics.

- **The program is designed so that students are active learners.** Students are encouraged to explore and investigate mathematical ideas. They are expected to read, write, and discuss mathematics. the program asks students to conjecture, test, and build arguments about a conjecture’s validity. Students are asked to reason about different strategies and outcomes, weigh the pros and cons of alternatives, and pursue varied paths when working on tasks. Students are expected to work on group and individual projects and assignments.

1 2 3 4 5

- **Students are expected to construct their own understanding of mathematics.** The program recognizes that students approach a new task with prior knowledge and encourages students to use natural language and informal procedures.

1 2 3 4 5

- **The program asks students to engage in mathematical discourse.** The materials ask students to talks with one another, as well as respond to the teacher. Students are expected to make public conjectures and reason with others about mathematics. Students are asked to clarify and justify their ideas orally and in writing.

1 2 3 4 5

- **Students use manipulatives and technology to explore mathematical ideas, model mathematical situations, analyze data, calculate numerical results, and solve problems.** Generally, students decide what tools are needed and when to use them.

1 2 3 4 5

- **Students are expected to determine when they need to calculate in a problem and whether they require an exact or approximate answer.** Students are expected to choose an appropriate procedure when calculating, whether it is using paper-and-pencil, mental calculation, or a calculator.

1 2 3 4 5

- **Students are expected to reflect on, make judgments about, and report on their own behavior, performance, and feelings.** Students are asked to do self-assessment on selected aspects of their experiences as one method for evaluating students performance and disposition.

1 2 3 4 5

- **Student materials are “user friendly.”** The program is at the appropriate level for students to read. Textual materials are generally well organized and attractive for students.

1 2 3 4 5

Rating Scale: 5 = high
1 = low

Category 4: Teacher's Role

The instructional materials provide suggestions to teachers to assist them in shifting toward the vision of teaching presented by the Standards.

- **The instructional materials provide suggestions to teachers** so that in tasks and lessons teachers can help students to:
 - work together to make sense of mathematics
 - rely more on themselves to determine whether something is mathematically correct
 - reason mathematically
 - learn to conjecture, invent, and solve problems
 - connect mathematics, its ideas, and its applications to other topics within mathematics and to other disciplines

1 2 3 4 5

- **The instructional materials provide suggestions for teachers in initiating and orchestrating mathematical discourse.** The materials suggest questions that elicit, engage, and challenge students' thinking. Teachers are encouraged to regularly follow students' statements with, "Why?" and "What if?" Also, teachers should ask students to explain their thinking and reasoning.

1 2 3 4 5

- **The instructional materials provide assistance to teachers to facilitate learning by all students.** Suggestions are provided on how to use a variety of methods so that all students can contribute to the thinking of the class. Students are expected to express themselves in writing and pictorially, concretely and representationally, as well as orally. The program encourages teachers to accept and respect the thinking of all students by providing examples of how to probe students' thinking and encourage students to follow and understand each others' approaches and ideas.

1 2 3 4 5

- **The instructional materials provide suggestions to teachers for establishing a classroom learning environment focused on sense making.** Teachers are provided suggestions on how to:
 - structure the time so students can grapple with significant mathematical ideas and problems
 - use physical space and material in ways that facilitates students' learning
 - assist students to work together collaboratively, as well as independently.

1 2 3 4 5

- **The instructional materials provide suggestions to teachers to help them reflect on what happens in the classroom so that they can adjust or adapt their teaching plans.** Teachers are provided suggestions on how to observe, listen to, and gather other information so they can assess and monitor student learning. Teachers also are provided suggestions on how to examine the effect of the task, discourse, and learning environment in promoting students' understanding of mathematics.

1 2 3 4 5

**Rating Scale: 5 = high
1 = low**

- **The instructional materials provide suggestions for how parents can be involved and kept informed about the program.**
1 2 3 4 5
- **Teacher’s guides are “user friendly.”** The program is easy for the teacher to follow and offers appropriate guidance in the use and integration of various student materials and technology.
1 2 3 4 5

Category 5: Assessment

The student assessment in the instructional materials provides teachers with information about what their students know and how they think about mathematics.

- **Student assessment is integrated into the instructional program.** Assessment activities are similar to learning activities. Assessment activities examine the extent to which students have integrated and made sense of information, whether they can apply it to situations that require reasoning and creative thinking, and whether they can use mathematics to communicate their ideas.
1 2 3 4 5
- **Multiple means of assessment are used, informal as well as formal.** Suggestions are provided for assessing students, individually or in small groups, through observations, oral, and written work, student demonstrations of presentations, and students self-assessment. The use of calculators, computer, and manipulatives are built into assessment activities. Assessment is built into the instructional materials as a continuous, dynamic, and often informal process.
1 2 3 4 5
- **All aspects of mathematical knowledge and how they are interrelated are assessed in the instructional materials.** However, assessment is not of separate or isolated competencies, although one aspect of mathematical knowledge might be emphasized more than another in a particular assessment. Conceptual understandings and procedural knowledge are frequently assessed through tasks that ask students to apply information about a given concept in novel situations.
1 2 3 4 5

TOTAL POINTS EARNED FOR THIS TEXT _____/130

OVERALL RATING

** Considering the philosophy, goals, and objectives of MCPS's new Mathematics curriculum, what overall rating would you give this text?

1 2 3 4 5

6 7 8 9 10

Not appropriate for MCPS

Most appropriate for MCPS

Pros to remember for later discussion:

Cons to remember for later discussion:

Name of Rater _____ School _____

The criteria by which the materials should be judged follows:

Category 1 — Mathematical Content

- Mathematics as problem solving is built into the program at all levels.
- Mathematics as communication is built into the program at all levels.
- Mathematics as reasoning is built into the program at all levels.
- Mathematical connections are clear in the program.
- The program is comprehensive and includes the mathematics content emphasized in the Standards at each level.

Category 2 — Organization and Structure

- The program is organized into units, modules, or other structure so that students have sufficient time to explore and investigate in-depth major mathematical ideas.
- The program asks students to work on worthwhile mathematical tasks.
- The instructional materials incorporate calculators and computers and other technology into the program as tools for students to use to do mathematics.
- The program is appropriate for *all* students.

Category 3 — Student Experiences

- The program is designed so that students are active learners.
- Students are expected to construct their own understanding of mathematics.
- The program asks students to engage in mathematical discourse.
- Students use manipulatives and technology to explore mathematical ideas, model mathematical situations, analyze data, calculate numerical results, and solve problems.
- Students are expected to determine when they need to calculate in a problem and whether they require an exact or approximate answer
- Students are expected to reflect on, make judgments about, and report on their own behavior, performance, and feelings.
- Student materials are “user friendly.”

Category 4 — Teacher Support

- The instructional materials provide suggestions to teachers.
- The instructional materials provide suggestions for teachers in initiating and orchestrating mathematical discourse.
- The instructional materials provide assistance to teachers to facilitate learning by all students.
- The instructional materials provide suggestions to teachers for establishing a classroom learning environment focused on sense making.
- The instructional materials provide suggestions to teachers to help them reflect on what happens in the classroom so that they can adjust or adapt their teaching plans.
- The instructional materials provide suggestions for how parents can be involved and kept informed about the program.
- Teachers’ guides are “user friendly.”

Category 5 — Assessment

- Student assessment is integrated into the instructional program.
- Multiple means of assessment are used, informal as well as formal.
- All aspects of mathematical knowledge and how they are interrelated are assessed in the instructional materials.

Indicate your 1st, 2nd, or 3rd choice of math program by writing the name of the company/program. If you believe that a set of materials should NOT be considered, please indicate that in your comments.

1st Choice _____

2nd Choice _____

3rd Choice _____

Please use the back side of this sheet to express ideas that you may have about the math programs that are being considered.

Please return this form to the Curriculum Office by MONDAY, APRIL 13

**MCPS Middle School Mathematics Materials
Parent/Community Response Form**

Name _____

Date _____

My child(ren) attend or will attend the following MCPS middle school

I am a student and will attend the following MCPS middle school

Please check one of the following:

_____ **I support the middle school mathematics materials as presented.**

_____ **I generally support the middle school mathematics materials as presented
with the stipulations described below.**

_____ **I do not support the middle school mathematics materials as presented.
(Please indicate areas of concern.)**

Comments:

Curriculum Analysis Questionnaire - HIGH SCHOOL

Please fill out one of these forms for each of the curricula at your level:

Curriculum You're Looking At : _____

1. What grade levels is this program for? (circle) K 1 2 3 4 5 6 7 8 9 10 11 12

Which components does this program have? (√)	Curriculum Components	On which component did you base this analysis? (√)
	Teachers' guide	
	Student book	
	Reproducible masters	
	Assessment guide	
	Other resources _____	
	Other resources _____	

What lesson did you do from this program?

2. For each content strand listed below, check off (4) whether or not it is covered in the program. Then rank how well the materials address that content:

	1	2	3	4	5	
	Not well-addressed		Somewhat or satisfactorily addressed		Very well-addressed	
<i>Content</i>	<i>Covered?</i>			<i>Ranking</i>		
Algebra	<input type="checkbox"/>	1	2	3	4	5
Functions	<input type="checkbox"/>	1	2	3	4	5
Geometry from a synthetic perspective	<input type="checkbox"/>	1	2	3	4	5
Geometry from an Algebraic perspective	<input type="checkbox"/>	1	2	3	4	5
Trigonometry	<input type="checkbox"/>	1	2	3	4	5
Statistics	<input type="checkbox"/>	1	2	3	4	5
Probability	<input type="checkbox"/>	1	2	3	4	5
Discrete mathematics	<input type="checkbox"/>	1	2	3	4	5
Conceptual underpinnings of calculus	<input type="checkbox"/>	1	2	3	4	5
Mathematical structure	<input type="checkbox"/>	1	2	3	4	5

The Project 2061 Curriculum-Analysis Procedure

Introduction

Deciding which curriculum materials to use is one of the most important professional judgments that educators make. Textbook adoption committees make recommendations that influence instruction for years to come, and the daily decisions teachers make about which teaching units or chapters to use and how to use them largely determine what and how students will be expected to learn.

Such important decisions require a valid and reliable method for evaluating the quality of curriculum materials. Even an in-depth review of the topics covered by a textbook or a teaching unit may not be sufficient to determine whether the material will actually help students learn that content. What is needed is a manageable process for examining curriculum materials that gets below the surface by focusing intensely on the appropriateness of content and the utility of instructional design.

With funding from the National Science Foundation and in collaboration with hundreds of K-12 teachers, curriculum specialists, teacher educators, scientists, and materials developers, Project 2061 of the American Association for the Advancement of Science (AAAS) has been developing a process for analyzing curriculum materials. Field tests suggest that Project 2061's curriculum-analysis procedure will not only serve the materials adoption needs of the schools but also help teachers revise existing materials to increase their effectiveness, guide developers in the creation of new materials, and contribute to the professional development of those who use it.

Specific Learning Goals Are Key

Until recently, there was nothing against which to judge appropriateness of content and utility of instructional design. Now, as a result of the standards-based reform movement in education, these judgments can be made with a high degree of confidence. In mathematics, for example, the appearance of *Science for All Americans* (AAAS, 1989), *Curriculum and Evaluation Standards for School Mathematics* (National Council of Teachers of Mathematics, 1989), and *Benchmarks for Science Literacy* (AAAS, 1993) has made it possible to make more thoughtful decisions about curriculum materials than ever before.

Although the Project 2061 curriculum-analysis procedure was developed using the learning goals in Benchmarks and the mathematics and science standards, subsequent work has indicated that some state education frameworks also can be used. Indeed, the process would seem to apply to any K-12 school subject for which specific learning goals have been agreed upon. These goals must be explicit statements of what knowledge and skills students are expected to learn, and they must be precise. Vague statements such as "students should understand fractions" are not adequate. Instead, consider this benchmark dealing with the meanings of fractions that students should know by the end of the eighth grade:

Students should know that the expression a/b can mean different things: a parts of size $1/b$ each, a divided by b , or a compared to b .

At its simplest level, the Project 2061 curriculum-analysis procedure involves the following five steps:

- ◆ Identify specific learning goals to serve as the intellectual basis for the analysis. This is done before beginning to examine any curriculum materials. The source for appropriate goals can be national standards or documents such as those mentioned above, state or local standards and curriculum frameworks, or sources like them. To be useful, the goals must be precise in describing the knowledge or skills they intend students to have. If the set of goals is large, a representative sample of them should be selected for purposes of analysis.
- ◆ Make a preliminary inspection of the curriculum materials to see whether they are likely to address the targeted learning goals. If there appears to be little or no correspondence, the materials can be rejected without further analysis. If the outlook is more positive, go on to a content analysis.
- ◆ Analyze the curriculum materials for alignment between content and the selected learning goals. The purpose here is to determine, citing evidence from the materials, whether the content in the material matches specific learning goals not just whether the topic headings are similar. At the topic level, alignment is never difficult, since most topics: proportions, equations, graphing, and so forth lack specificity, making them easy to match. If the results of this analysis are positive, then reviewers can take the next step.
- ◆ Analyze the curriculum materials for alignment between instruction and the selected learning goals. This involves estimating the degree to which the materials (including their accompanying teacher's guides) reflect what is known generally about student learning and effective teaching and, more important, the degree to which they support student learning of the specific knowledge and skills for which a content match has been found. Again, evidence from the materials must be shown.
- ◆ Summarize the relationship between the curriculum materials being evaluated and the selected learning goals. The summary can take the form of a profile of the selected goals in terms of the content and instruction criteria, or a profile of the criteria in terms of the selected goals. In either case, a statement of strengths and weaknesses should be included. With this information in hand, reviewers can make more knowledgeable adoption decisions and suggest ways for improving the examined materials.

In addition to its careful focus on matching content and instruction to very specific learning goals, the Project 2061 procedure has other features that set it apart. For example, its emphasis on collecting explicit evidence (citing page numbers and other references) of a material's alignment with learning goals adds rigor and reliability to decisions about curriculum materials. Similarly, the Project 2061 procedure calls for a team approach to the analytical task, thus providing opportunities for reviewers to defend their own judgments about materials and to question those of other reviewers. These and other characteristics help make participation in the analytical process itself a powerful professional development experience.

The Project 2061 Curriculum-Analysis Procedure in Detail

To provide a better sense of how the procedure works, the following describes in more detail each step in the procedure. The description pays particular attention to the various criteria used to evaluate the instructional effectiveness of materials.

Identify specific learning goals to serve as the intellectual basis for the analysis. After reviewers have agreed upon a set of learning goals as a framework for the analysis, the task is then to choose specific learning goals that will serve as the focus of further study.

When evaluating stand-alone curriculum units that cover a relatively short period of time, it might be possible and worthwhile to analyze all of the learning goals that appear to be targeted by the material. However, in the evaluation of year-long courses or multi-year programs, this becomes impractical. Therefore, a crucial step in the analysis procedure is the sampling of a few learning goals that will lead to valid and reliable generalizations about the material.

Sampling of standards should be representative of the whole set of goals specified in the framework or standards being applied and should reflect the reviewers' needs. For example, if the review committee's task is to select a course in high school Algebra that is aligned with a state mathematics framework or NCTM *Standards*, it might identify a sample of learning goals from important topic areas (e.g., number systems, equations, graphs, functions) and include learning goals that reflect different types of knowledge (e.g., skills, conceptual understanding, problem solving). When examining elementary or middle-school mathematics materials, one would probably want to broaden the range of learning goal statements examined to include important strands in mathematics (e.g., number, geometry, algebra, statistics).

Make a preliminary inspection of the curriculum materials to see whether they are likely to address the targeted learning goals. Once learning goal statements have been selected, the next step is to make a first pass at the materials to identify those whose content appears to correspond reasonably well to the learning goals. Materials that do not meet these initial criteria are not analyzed further.

Reviewers then examine materials on the shortened list more carefully to locate and record places where each selected learning goal seems to be targeted (e.g., particular readings, experiments, discussion questions). If several sightings are found for some or all of the sample learning goals in the material, then these sightings will be looked at more carefully in subsequent steps of the analysis. If, on the other hand, sightings cannot be found for a significant number of the sample learning goals, then the material is dropped from the list.

Analyze the curriculum materials for alignment between content and the selected learning goals. This analysis is a more rigorous examination of the link between the subject material and the selected learning goals and involves giving precise attention to both ends of the match: the precise meaning of the learning goal on one end and the precise intention of the material on the other.

With respect to each of the sampled learning goals, the material is examined using such questions as:

- ◆ Does the content called for in the material address the substance of a specific learning goal or only the learning goal's general "topic"?
- ◆ Does the content reflect the level of sophistication of the specific learning goal, or are the activities more appropriate for targeting learning goals at an earlier or later grade level?
- ◆ Does the content address all parts of a specific learning goal or only some? (While it is not necessary that any particular unit would address all of the ideas in a learning goal or standard, the K-12 curriculum as a whole should do so. The purpose of this question is to provide an account of precisely what ideas are treated.)

In addition, an attempt is made to estimate the degree of overlap between the material's content and the set of learning goals of interest. Thus, this step in the analysis is designed to answer questions regarding the material's inclusion of content that is not required for reaching mathematics literacy and the extent to which the material distinguishes between essential and non-essential content. (While distinguishing content essential for literacy from non-essential content in material might seem to be a luxury, it assists teachers in determining the range of students for which the material can be used. Identifying the non-essential material makes it easier for the teacher to direct better students to enrichment activities and allows students themselves to avoid overload from ideas that go beyond what is vital.)

Analyze the curriculum materials for alignment between instruction and the selected learning goals. The purpose here is to estimate how well material addresses targeted learning goals from the perspective of what is known about student learning and effective teaching. The criteria for making the judgments in the instructional analysis are derived from research on learning and teaching and on the craft knowledge of experienced educators. In the context of mathematics literacy, these are summarized in Chapter 13, "Effective Learning and Teaching," of *Science for All Americans*; in Chapter 15, "The Research Base," of *Benchmarks for Science Literacy*.

From these and other sources, seven criteria clusters (shown below) have been identified to serve as a basis for the instructional analysis (for the specific questions within each cluster, see "How to Do Mathematics Curriculum Materials Analysis" on the Project 2061 web site (<http://project2061.aas.org>). The proposition here is that (1) the analysis would tie the instruction to each one of the sample learning goals rather than look at instructional strategies globally and (2) in the ideal case, all questions within each cluster would be well-addressed in any material.

Cluster I. Providing a Sense of Purpose: Part of planning a coherent curriculum involves deciding on its purposes and on which learning experiences will likely contribute to those purposes. But while coherence from the curriculum designers' point of view is important, it may not give students an adequate sense of what they are doing and why. This cluster includes criteria to determine whether the material attempts to make its purposes explicit and meaningful to students, either by itself or by instructions to the teacher.

Cluster II. Taking Account of Student Ideas: Fostering better understanding in students requires taking time to attend to the ideas they already have, both ideas that are incorrect and ideas that can serve as a foundation for subsequent learning. Such attention requires that teachers be informed about prerequisite ideas/skills needed for understanding a learning goal and what their students' initial ideas are in particular, the ideas that may interfere with learning the scientific information. Moreover, teachers can help address students' ideas if they know what is likely to work. This cluster examines whether the material contains specific suggestions for identifying and relating to student ideas.

Cluster III. Engaging Students with Mathematical Ideas: Much of the point of mathematics is finding patterns and modeling ideas and relationships in terms of a small number of generalizations or ideas. For students to appreciate the power of mathematics, they need to have a sense of the range and complexity of ideas and applications that mathematics can explain or model. "Students need to get acquainted with the things around them—including devices, organisms, materials, shapes, and numbers—and to observe them, collect them, handle them, describe them, become puzzled by them, ask questions about them, argue about them, and then try to find answers to their questions." (Science for All Americans, p. 201) Furthermore, students should see that the need to explain comes up in a variety of contexts.

Cluster IV. Developing and Using Mathematical Ideas: *Science for All Americans* includes in its definition of mathematics literacy a number of important yet quite abstract ideas—e.g., symbolic representation, patterns and relationships, summarizing data. Such ideas cannot be readily discovered in the real world; the ideas themselves were developed over many hundreds of years as a result of considerable discussion and debate about the existence and logic of laws of mathematics and proofs of theorems. Mathematics literacy requires that students see the link between concepts and skills, see mathematics itself as logical and useful, and become skillful at using mathematics. This cluster includes criteria to determine whether the material expresses and develops ideas in ways that are accessible and intelligible to students, and to demonstrate the usefulness of the concepts and skills in varied contexts.

Cluster V. Promoting Student Thinking About Concepts, Procedures, and Knowledge: No matter how clearly materials may present ideas, students (like all people) will make their own meaning out of it. Constructing meaning well is aided by having students make their ideas and reasoning explicit, hold them up to scrutiny, and recast them as needed. This cluster includes criteria for whether the material suggests how to help students express, think about, and reshape their ideas to make better sense of the world.

Cluster VI. Assessing Progress: There are several important reasons for monitoring student progress toward specific learning goals. Having a collection of alternatives can ease the creative burden on teachers and increase the time available to analyze student responses and make adjustments in instruction based on those responses. This cluster includes criteria for evaluating whether the material includes a variety of goal-relevant assessments.

Cluster VII. Enhancing the Learning Environment: Many other important considerations are involved in the selection of curriculum materials for example, the help they provide to teachers in encouraging student curiosity and creating a classroom community where all can succeed, or the material's scientific accuracy or attractiveness. The criteria listed in this cluster provide reviewers with the opportunity to comment on these and other important features.

Summarize the relationship between the curriculum materials being evaluated and the selected learning goals. In the preliminary inspection, a few learning goals were selected as representative of the set of goals that the material appears to target. Having analyzed whether the content in the material matches these specific learning goals and how well the instructional strategies in the material support students learning these learning goals, the final step in the process is to provide a profile of the material based on this analysis.

The analysis makes it possible to produce two sets of profiles. The first illustrates how well the material treats each learning goal (for which a content match was found) across all criteria examined in the instructional analysis. Based on these profiles, conclusions can be made about what the material under consideration can be expected to accomplish in terms of learning goals. For example, the profiles may indicate that the material treats one of the examined learning goals well and the rest only moderately or poorly.

The second set of profiles illustrates how well the material meets each criterion in the instructional analysis tool across all learning goals examined. These profiles point to major strengths and weaknesses in the instructional design of the material. For example, the profiles may indicate that the material consistently includes appropriate experiences with phenomena relevant to the learning goals but only occasionally provides students with opportunities to reflect on these experiences. Depending on the time available and their interests, a review committee could decide to produce either one or both sets of profiles. Profiles of different materials provide the basis for selection decisions.

U.S. Department of Education
Expert Panel on Mathematics and Science Education

Evaluation Criteria

A. Quality of Program

Criterion 1. *The program's learning goals are challenging, clear, and appropriate for the intended student population.*

- Indicator a. The program's learning goals are explicit and clearly stated.
- Indicator b. The program's learning goals are consistent with research on teaching and learning or with identified successful practices.
- Indicator c. The program's learning goals foster the development of skills, knowledge, and understandings.
- Indicator d. The program's learning goals can include important concepts within the subject area.
- Indicator e. The program's learning goals can be met with appropriate hard work and persistence.

Criterion 2. *The program's content is aligned with its learning goals, and is accurate and appropriate for the intended student population.*

- Indicator a. The program's content is aligned with its learning goals.
- Indicator b. The program's content emphasizes depth of understanding, rather than breadth of coverage.
- Indicator c. The program's content reflects the nature of the field and the thinking that mathematicians use.
- Indicator d. The program's content makes connections within the subject area and between disciplines.
- Indicator e. The program's content is culturally and ethnically sensitive, free of bias, and reflects diverse participation and diverse student interests.

Criterion 3. *The program's instructional design is appropriate, engaging, and motivating for the intended student population.*

- Indicator a. The program's instructional design provides students with a relevant rationale for learning this material.
- Indicator b. The program's instructional design attends to students' prior knowledge and commonly held conceptions.
- Indicator c. The program's instructional design fosters the use and application of skills, knowledge, and understandings.
- Indicator d. The program's instructional design is engaging and promotes learning.
- Indicator e. The program's instructional design promotes student collaboration, discourse, and reflection.
- Indicator f. The program's instructional design promotes multiple and effective approaches to learning.
- Indicator g. The program's instructional design provides for diverse interests.

Criterion 4. *The program's system of assessment is appropriate and designed to inform student learning and to guide teachers' instructional decision.*

- Indicator a. The program's system of assessment is an integral part of instruction.
- Indicator b. The program's system of assessment is consistent with the content, goals, and instructional design of the program.
- Indicator c. The program's system of assessment encourages multiple approaches and makes use of diverse forms and methods of assessment.
- Indicator d. The program's system of assessment probes students' abilities to demonstrate depth, flexibility, and application of learning.
- Indicator e. The program's system of assessment provides information on students' progress and learning needs.
- Indicator f. The program's system of assessment helps teachers select or modify activities to meet learning needs.

B. Usefulness to Others

Criterion 5. *The program can be successfully implemented, adopted, or adapted in multiple educational settings.*

Indicator a. The program provides clear instructions and sufficient training materials to ensure use by those not in the original program.

Indicator b. The program is likely to be successfully transferred to other settings.

Indicator c. The program specifies the conditions and resources needed for implementation.

Indicator d. The program's costs (time and money) can be justified by the benefits.

C. Educational Significance

Criterion 6. *The program's learning goals reflect the vision promoted in national standards in mathematics education.*

Indicator a. The program's learning goals and subject matter content are consistent with national standards.

Indicator b. The program's pedagogy and assessment are aligned with national standards.

Indicator c. The program promotes equity and equal access to knowledge, as reflected in national standards.

Criterion 7. *The program addresses important individual and societal needs.*

Indicator a. The program is of sufficient scope and importance to make a significant difference in student learning.

Indicator b. The program contributes to increases in teachers' knowledge of effective teaching and learning.

Indicator c. The program:

- is designed to improve learning for a wide spectrum of students *OR*
- serves to meet the special learning needs of under-served students *OR*
- serves to meet the special learning needs of students whose interests and talents go beyond core mathematics education.

D. Evidence of Effectiveness and Success

Criterion 8. The program makes a measurable difference in student learning.

Promising Programs, in addition to satisfying Criteria 1–7, must provide **preliminary evidence** of effectiveness in **one or more sites** for **at least one** of the indicators below:

- Indicator a. The program has evidence of gains in student understanding of mathematics.
- Indicator b. The program has evidence of gains in inquiry, reasoning, and problem solving skills.
- Indicator c. The program has evidence of improvements in course enrollments, graduation rates, and post-secondary school attendance.
- Indicator d. The program has evidence of improvements in attitudes toward learning.
- Indicator e. The program has evidence of narrowing the gap in achievement or accomplishment between disaggregated groups.
- Indicator f. The program has other evidence of effectiveness or success.

Exemplary Programs, in addition to satisfying Criteria 1–7, must provide **convincing** evidence of effectiveness in **multiple sites with multiple populations** regarding **two or more** of the indicators below. The items must include either both indicators from Part I or one indicator from Part I and one indicator from Part II. Providing evidence of two indicators from Part II is not sufficient.

Part I

- Indicator a. The program has evidence of gains in student understanding of mathematics.
- Indicator b. The program has evidence of gains in inquiry, reasoning, and problem solving skills.

Part II

- Indicator c. The program has evidence of improvements in course enrollments, graduation rates, and post-secondary school attendance.
- Indicator d. The program has evidence of improvements in attitudes toward learning.
- Indicator e. The program has evidence of narrowing the gap in achievement or accomplishment between disaggregated groups.
- Indicator f. The program has other evidence of effectiveness or success.