

## Chapter Six

# Instructional Resources

## A. Overview

Science and mathematics teaching is strongly affected by the quality and availability of instructional resources. The 2000 National Survey of Science and Mathematics Education included a series of items on science and mathematics textbooks/programs—which ones were being used, how much of the textbook was covered, and teachers' perceptions of textbook quality. Teachers were also asked about the availability and use of a number of other instructional resources, including various types of calculators, computers, and Internet capabilities. These results are presented in the following sections.

## B. Textbook Usage

Each teacher in the sample was asked if a particular, randomly selected class was using one or more commercially published textbooks or programs. As can be seen in Table 6.1, 85 percent or more of grades 5–8 and 9–12 science classes and grades K–4, 5–8, and 9–12 mathematics classes use published textbooks/programs. Use of commercially produced textbooks/programs is markedly lower, however, in grade K–4 science classes (64 percent).

**Table 6.1**  
**Science and Mathematics Classes Using**  
**Commercially Published Textbooks/Programs**

	Percent of Classes			
	Science		Mathematics	
Grades K–4	64	(2.3)	87	(1.6)
Grades 5–8	85	(2.5)	92	(1.3)
Grades 9–12	96	(0.5)	94	(0.8)

Teachers who reported that the selected class uses a commercially published textbook or program were then asked if one material was used all or most of the time, or if multiple textbooks/programs were used. Table 6.2 shows teachers' responses to this question. Mathematics classes are more likely than science classes to use only one textbook or instructional program throughout the year (62–79 percent compared to 37–63 percent) while science classes are more likely to use multiple textbooks or programs (24–36 percent compared to 15–25 percent). In both science and mathematics instruction, reliance on a single textbook/program is highest in grades 9–12.

**Table 6.2**  
**Science and Mathematics Classes Using**  
**Textbooks and/or Programs, by Grade Range**

	Percent of Classes					
	Grades K–4		Grades 5–8		Grades 9–12	
<b>Science</b>						
Use one textbook or program all or most of the time	37	(2.6)	48	(3.0)	63	(2.7)
Use multiple textbooks or programs	24	(2.5)	36	(2.5)	32	(2.6)
No textbook or program used	38	(2.5)	15	(2.6)	4	(0.5)
<b>Mathematics</b>						
Use one textbook or program all or most of the time	62	(2.6)	66	(2.2)	79	(1.4)
Use multiple textbooks or programs	25	(2.4)	25	(2.1)	15	(1.3)
No textbook or program used	13	(1.6)	8	(1.3)	6	(0.8)

Teachers who indicated that the randomly selected class used a published textbook/program were given a list of science and mathematics textbook publishers and asked to indicate the publisher of the one textbook/program used most often by students in that class. Table 6.3 shows the share of the market held by each of the major science and mathematics textbook publishers.

It is interesting to note that three publishers (Addison-Wesley Longman, Inc./Scott Foresman; Silver, Burdett, & Ginn; and McGraw-Hill/Merrill Co.) account for almost 70 percent of the textbook usage in grade K–4 science classes. Similarly, three publishers (Prentice Hall; McGraw-Hill/Merrill; and Addison-Wesley Longman, Inc./Scott Foresman) account for 64 percent of the grade 5–8 science textbook usage, and three publishers (McGraw-Hill/Merrill Co; Holt, Rinehart, Winston; and Prentice Hall) account for 69 percent of the grade 9–12 science textbook usage.

The publishers with the largest grade K–4 mathematics textbook market share are Addison-Wesley Longman, Inc./Scott Foresman; Harcourt, Brace, & Jovanovich; and Houghton Mifflin/McDougal Littell/D.C. Heath; together these three account for 51 percent of the textbook usage. Similarly, three publishers—McGraw-Hill/Merrill Co.; Houghton Mifflin/McDougal Littell/D.C. Heath; and Addison-Wesley Longman, Inc./Scott, Foresman—account for 56 percent of the textbook usage in grade 5–8 mathematics classes and for 61 percent of the mathematics textbook usage in grades 9–12.

**Table 6.3**  
**Market Share of Commercial Science and**  
**Mathematics Textbook Publishers, by Grade Range**

	Percent of Classes					
	Grades K-4		Grades 5-8		Grades 9-12	
<b>Science</b>						
Addison Wesley Longman, Inc./Scott Foresman	30	(3.3)	17	(3.1)	13	(1.1)
Silver Burdett Ginn	26	(3.8)	14	(2.4)	0	*
McGraw-Hill/Merrill Co	13	(2.3)	23	(2.5)	30	(2.2)
Scholastic, Inc.	6	(1.6)	2	(1.4)	0	*
Harcourt Brace/Harcourt, Brace & Jovanovich	5	(1.6)	4	(1.2)	3	(0.5)
Holt, Rinehart and Winston, Inc.	2	(1.1)	6	(1.2)	21	(1.8)
Houghton Mifflin Company/McDougall Littell/D.C. Heath	2	(0.9)	3	(1.1)	5	(0.9)
Encyclopaedia Britannica**	2	(1.1)	0	(0.4)	0	*
A-Beka	2	(1.1)	0	*	0	*
National Science Resource Center	2	(1.3)	0	*	0	*
Kendall Hunt Publishing	0	(0.3)	1	(0.4)	2	(0.7)
Prentice Hall, Inc.	0	*	24	(2.4)	18	(1.5)
Globe Fearon, Inc/Cambridge	0	*	2	(0.6)	0	(0.2)
CORD Communications	0	*	0	*	2	(0.6)
<b>Mathematics</b>						
Addison Wesley Longman, Inc./Scott Foresman	20	(3.0)	16	(2.0)	12	(1.4)
Harcourt Brace/Harcourt, Brace & Jovanovich	16	(2.5)	10	(1.9)	1	(0.4)
Houghton Mifflin Company/McDougall Littell/D.C. Heath	15	(2.4)	18	(2.4)	27	(2.0)
Saxon Publishers	11	(2.5)	8	(1.9)	3	(0.8)
Silver, Burdett, & Ginn	11	(2.4)	3	(0.7)	0	*
McGraw-Hill/Merrill Co.	10	(2.6)	22	(2.3)	22	(1.8)
Everyday Learning Corporation	7	(1.7)	4	(1.4)	1	(0.2)
Dale Seymour Publications***	2	(0.9)	3	(0.7)	0	(0.0)
Open Court	2	(1.3)	0	*	0	*
A-Beka	1	(0.4)	3	(1.8)	0	*
Creative Publications	1	(0.5)	2	(0.9)	0	*
Holt, Rinehart and Winston, Inc.	0	(0.3)	0	(0.2)	4	(0.8)
Prentice Hall, Inc.	0	*	6	(1.2)	13	(2.4)
Aamsco	0	*	0	(0.1)	5	(1.1)
Key Curriculum Press	0	*	0	(0.1)	3	(0.6)
South-Western Educational Publishing	0	*	0	(0.3)	3	(0.7)

\* No teachers in the sample selected this response option. Thus, it is impossible to calculate the standard error of this estimate.

\*\* Includes responses where teachers wrote "FOSS" as the publisher.

\*\*\* Between the time data were collected and this report was released, Dale Seymour Publications was bought by Prentice Hall.

Teachers were also asked to provide the title, author, and publication year of the textbook/program used most often in the selected class. Tables 6.4 and 6.5 list the most commonly used science and mathematics textbooks in each grade range; secondary textbooks are shown by course type, as well.

**Table 6.4**  
**Most Commonly Used Science Textbooks, by Grade Range and Course**

	<b>Publisher</b>	<b>Title</b>
<b>Grades K–5</b> Elementary Science	Silver Burdett Ginn Addison Wesley Longman, Inc./Scott Foresman Addison Wesley Longman, Inc./Scott Foresman Silver Burdett Ginn	<i>Horizons in Science</i> <i>Discover Science</i> <i>Discover the Wonder</i> <i>Discovery Works</i>
<b>Grades 6–8</b> Life Science	McGraw-Hill/Merrill Co. Prentice Hall, Inc. Prentice Hall, Inc.	<i>Life Science</i> <i>Prentice Hall Science</i> <i>Exploring Life Science</i>
Earth Science	McGraw-Hill/Merrill Co. Addison Wesley Longman, Inc./Scott Foresman Prentice Hall, Inc.	<i>Earth Science</i> <i>Science Insights: Exploring Earth &amp; Space</i> <i>Exploring Earth's Weather</i>
Physical Science	Prentice Hall, Inc. Prentice Hall, Inc. McGraw-Hill/Merrill Co.	<i>Physical Science</i> <i>Exploring Physical Science</i> <i>Physical Science</i>
General/Integrated Science	McGraw-Hill/Merrill Co.	<i>Glencoe Science Interactions</i>
<b>Grades 9–12</b> Biology	Holt, Rinehart and Winston, Inc. McGraw-Hill/Merrill Co. Prentice Hall, Inc.	<i>Modern Biology</i> <i>Biology—The Dynamics of Life</i> <i>Prentice Hall Biology</i>
Chemistry	Addison Wesley Longman, Inc./Scott Foresman Holt, Rinehart and Winston, Inc. Prentice Hall, Inc.	<i>Addison-Wesley—Chemistry</i> <i>Modern Chemistry</i> <i>Chemistry: Connections to Our Changing World</i>
Physical Science	McGraw-Hill/Merrill Co. McGraw-Hill/Merrill Co.	<i>Physical Science</i> <i>Glencoe Physical Science</i>
Physics	McGraw-Hill/Merrill Co.	<i>Physics—Principles and Problems</i>
Earth Science	Houghton Mifflin Company/McDougal Littell/ D.C. Heath	<i>Earth Science</i>

**Table 6.5**  
**Most Commonly Used Mathematics Textbooks, by Grade Range and Course**

	<b>Publisher</b>	<b>Title</b>
<b>Grades K–5</b> Elementary Mathematics	Harcourt Brace/Harcourt, Brace & Jovanovich Addison Wesley Longman, Inc./Scott Foresman Everyday Learning Corporation Silver Burdett Ginn Addison Wesley Longman, Inc./Scott Foresman McGraw-Hill/Merrill Co.	<i>Math Advantage</i> <i>Addison-Wesley Math</i> <i>Everyday Math</i> <i>Mathematics, The Path to Math Success</i> <i>Exploring Mathematics</i> <i>Math in My World</i>
<b>Grades 6–8</b> Middle School Mathematics	McGraw-Hill/Merrill Co. Saxon Publishers Harcourt Brace/Harcourt, Brace & Jovanovich Dale Seymour Publications	<i>Mathematics Applications &amp; Connections</i> <i>Math 76</i> <i>Math Advantage</i> <i>Connected Math</i>
<b>Grades 9–12</b> Algebra I	Prentice Hall, Inc. McGraw-Hill/Merrill Co. Houghton Mifflin Company/McDougal Littell/ D.C. Heath	<i>Algebra Tools for a Changing World</i> <i>Algebra 1</i> <i>Algebra 1: An Integrated Approach</i>
Geometry	Houghton Mifflin Company/McDougal Littell/ D.C. Heath Prentice Hall, Inc. Houghton Mifflin Company/McDougal Littell/ D.C. Heath McGraw-Hill/Merrill Co. Key Curriculum Press	<i>Geometry: An Integrated Approach</i> <i>Geometry Tools for a Changing World</i> <i>Geometry</i> <i>Geometry</i> <i>Discovering Geometry</i>
Algebra II	Prentice Hall, Inc.  Houghton Mifflin Company/McDougal Littell/ D.C. Heath McGraw-Hill/Merrill Co.  McGraw-Hill/Merrill Co.	<i>Advanced Mathematics: A Pre-calculus Approach</i> <i>Algebra 2: An Integrated Approach</i> <i>Algebra 2 with Trig: Applications and Connections</i> <i>Algebra 2</i>
Algebra III	McGraw-Hill/Merrill Co.  Prentice Hall, Inc.	<i>Advanced Mathematical Concepts: Pre-Calculus with Applications</i> <i>Advanced Mathematics: A Pre-calculus Approach</i>

Table 6.6 shows the distribution of publication years of science and mathematics textbooks. In 2000, most science classes were using textbooks published prior to 1997, with 1 in 5 high school science classes, 1 in 4 middle school science classes, and 1 in 3 in grades K–4 using textbooks published in 1991 or earlier. In contrast, about half of the mathematics classes utilized books or programs published in 1997 or later, and roughly 1 in 5 in each grade range used books published in 1991 or earlier.

**Table 6.6**  
**Publication Year of Science and**  
**Mathematics Textbooks/Programs, by Grade Range**

	Percent of Classes					
	Grades K–4		Grades 5–8		Grades 9–12	
<b>Science</b>						
1986 or earlier	5	(1.8)	4	(1.0)	3	(0.7)
1987–1991	28	(3.6)	21	(3.1)	15	(1.6)
1992–1996	50	(4.2)	47	(3.0)	49	(2.3)
1997 or later	16	(3.4)	27	(2.5)	33	(2.2)
<b>Mathematics</b>						
1986 or earlier	3	(1.3)	2	(0.6)	4	(0.7)
1987–1991	11	(2.2)	12	(2.4)	14	(1.4)
1992–1996	34	(3.4)	32	(3.0)	34	(2.6)
1997 or later	51	(3.6)	54	(3.0)	49	(2.5)

Table 6.7 shows the percentages of science and mathematics classes in grades K–4, 5–8, and 9–12 which use published textbooks/programs that “cover” various proportions of their textbooks. Note that in each grade range mathematics classes are more likely than science classes to go through a substantial portion of their textbook, with 66–79 percent of the mathematics classes, compared to 39–50 percent of the science classes, covering 75 percent or more of their textbooks.

**Table 6.7**  
**Percentage of Science and Mathematics Textbooks/Programs**  
**Covered During the Course,\* by Grade Range**

	Percent of Classes					
	Grades K–4		Grades 5–8		Grades 9–12	
<b>Science Classes</b>						
Less than 25 percent	5	(1.2)	8	(1.5)	3	(0.6)
25–49 percent	16	(2.2)	19	(2.2)	13	(1.4)
50–74 percent	30	(3.1)	33	(2.7)	38	(2.3)
75–90 percent	24	(2.4)	28	(2.5)	37	(2.2)
More than 90 percent	26	(2.9)	11	(1.7)	9	(1.1)
<b>Mathematics</b>						
Less than 25 percent	1	(0.4)	1	(0.5)	1	(0.2)
25–49 percent	3	(1.0)	5	(1.1)	6	(0.8)
50–74 percent	17	(2.2)	27	(2.5)	28	(2.0)
75–90 percent	38	(2.7)	46	(3.3)	47	(2.4)
More than 90 percent	41	(3.0)	21	(2.2)	19	(1.5)

\* Only classes using published textbooks/programs were included in these analyses

It is interesting to note that while national experts in science and mathematics education are often critical of textbook quality (American Association for the Advancement of Science, 200a; 2000b), most teachers consider their textbooks to be of relatively high quality. As can be seen in Table 6.8, the majority of science and mathematics teachers in each grade range consider their textbooks/programs to be good or better, including 56–78 percent of science teachers and 76–79 percent of mathematics teachers at the various grade ranges.

**Table 6.8**  
**Teachers' Perceptions of Quality of Textbooks/Programs**  
**Used in Science and Mathematics Classes,\* by Grade Range**

	Percent of Classes					
	Grades K-4		Grades 5-8		Grades 9-12	
<b>Science</b>						
Very Poor	4	(1.2)	3	(0.9)	1	(0.3)
Poor	7	(1.6)	8	(2.6)	4	(0.8)
Fair	33	(3.1)	28	(2.6)	18	(1.8)
Good	33	(3.3)	32	(2.7)	39	(2.2)
Very Good	19	(2.6)	22	(2.6)	31	(2.1)
Excellent	4	(1.2)	6	(1.5)	8	(1.1)
<b>Mathematics</b>						
Very Poor	1	(0.5)	2	(0.7)	1	(0.2)
Poor	3	(0.9)	5	(1.3)	3	(0.6)
Fair	18	(2.3)	16	(1.7)	19	(1.7)
Good	35	(2.8)	33	(2.4)	34	(2.1)
Very Good	36	(2.7)	33	(2.6)	34	(2.1)
Excellent	8	(1.5)	10	(1.9)	9	(1.2)

\*Only classes using published textbooks/programs were included in these analyses.

## C. Facilities and Equipment

Science and mathematics teachers were given a list of equipment and asked to indicate the approximate number of times per semester each type of equipment is used in the randomly selected class. Tables 6.9–6.14 show the percentage of grade K–4, 5–8, and 9–12 science and mathematics classes reporting at least some use of each type of equipment, as well as the percentages of classes where each is “needed, but not available” or “not needed.”

Note that overhead projectors are commonly used in K–12 science and mathematics instruction, with 87–92 percent of science and mathematics classes in the various grade ranges making use of them. Videotape players are far more likely to be used in science instruction, with 90–95 percent of classes reporting usage, compared to 42–48 percent of the mathematics classes. Similarly, science classes are more likely than mathematics classes to use videodisc players. Perhaps due to the more varied offerings on CD-ROM software, use of that technology is fairly high across both subjects, though use in mathematics classes is lower in grades 5–8 than in grades K–4, and lower still in grades 9–12.

The majority of science and mathematics classes at each grade range use computers at some point in the class. Use in science classes ranges from 69 to 91 percent, with grades 5–8 most likely to use computers. Mathematics classes range from 60 to 89 percent, with teachers in grades K–4 most likely to report computer use.

Four-function calculators are used by roughly 60 percent of the classes in most subject/grade range categories, with grade K–4 science classes least likely (30 percent) and grade 5–8 mathematics classes most likely to report their use (82 percent). As expected, more sophisticated calculators are more likely to be used in the higher grades. For example, 49 percent of grade 5–8

mathematics classes and 78 percent of grade 9–12 mathematics classes use scientific calculators at some point during the year; comparable figures for science are 29 percent in grades 5–8 and 58 percent in grades 9–12.

Science teachers were also asked about the use of specific laboratory facilities and equipment. Use of electric outlets in laboratory work is high across all grade levels (87–97 percent), as is use of running water (80–96 percent). Fewer classes make use of gas for burners or hoods/air hoses in their science classes, with use increasing with grade level.

**Table 6.9**  
**Science Classes Where Various Equipment**  
**Is Used During Instruction, by Grade Range**

	Percent of Classes					
	Grades K–4		Grades 5–8		Grades 9–12	
Videotape player	90	(1.6)	94	(1.6)	95	(0.9)
Overhead projector	87	(2.0)	92	(2.0)	88	(2.7)
Videodisc player	25	(2.9)	47	(3.4)	55	(2.4)
CD-ROM player	51	(3.2)	59	(3.0)	57	(2.5)
Four-function calculators	30	(2.8)	62	(3.0)	59	(2.3)
Fraction calculators	2	(0.7)	17	(2.8)	27	(2.7)
Graphing calculators	1	(0.3)	12	(1.7)	35	(2.6)
Scientific calculators	1	(0.6)	29	(2.7)	58	(2.6)
Electric outlets in labs/classrooms	87	(2.2)	96	(1.0)	97	(0.9)
Running water in labs/classrooms	80	(2.4)	91	(1.9)	96	(0.9)
Gas for burners in labs/classrooms	6	(1.2)	36	(2.9)	72	(2.1)
Hoods or air hoses in labs/classrooms	2	(0.8)	22	(2.7)	56	(2.4)
Computers	69	(2.8)	91	(1.5)	85	(1.7)
Calculator/computer lab interfacing devices	7	(1.4)	28	(2.8)	42	(2.5)
Computers with Internet connection	64	(3.3)	83	(2.3)	77	(1.9)

**Table 6.10**  
**Mathematics Classes Where Various Equipment**  
**Is Used During Instruction, by Grade Range**

	Percent of Classes					
	Grades K–4		Grades 5–8		Grades 9–12	
Videotape player	46	(3.1)	48	(2.3)	42	(2.2)
Overhead projector	89	(1.7)	91	(2.2)	88	(1.5)
Videodisc player	10	(1.7)	10	(1.9)	4	(1.0)
CD-ROM player	52	(2.9)	39	(3.3)	22	(2.2)
Four-function calculators	62	(2.5)	82	(1.8)	65	(1.9)
Fraction calculators	4	(0.9)	54	(2.8)	61	(2.1)
Graphing calculators	2	(0.7)	26	(2.2)	77	(2.0)
Scientific calculators	3	(0.9)	49	(3.1)	78	(1.6)
Computers	89	(1.9)	78	(2.6)	60	(2.3)
Calculator/computer lab interfacing devices	22	(2.2)	29	(2.4)	32	(2.2)
Computers with Internet connection	47	(3.3)	58	(3.2)	42	(2.2)



Many science teachers reported needing particular types of equipment and not having them available. Calculator/computer lab interfacing devices were most frequently noted as “needed, but not available,” especially in the higher grades. (See Tables 6.11 and 6.12.)

**Table 6.11**  
**Science Classes Where Various Equipment Is**  
**Needed for Instruction, But Not Available, by Grade Range**

	Percent of Classes					
	Grades K–4		Grades 5–8		Grades 9–12	
Videotape player	2	(1.0)	0	(0.4)	0	(0.1)
Overhead projector	1	(0.4)	0	(0.3)	0	(0.1)
Videodisc player	7	(1.7)	11	(1.9)	7	(1.2)
CD-ROM player	6	(1.2)	7	(1.5)	8	(1.2)
Four-function calculators	3	(1.0)	3	(1.1)	5	(0.9)
Fraction calculators	4	(1.0)	4	(1.3)	4	(1.1)
Graphing calculators	3	(1.0)	8	(1.7)	5	(0.9)
Scientific calculators	3	(1.0)	4	(1.0)	4	(0.9)
Electric outlets in labs/classrooms	1	(0.5)	0	(0.2)	1	(0.7)
Running water in labs/classrooms	6	(1.1)	7	(1.8)	2	(0.4)
Gas for burners in labs/classrooms	8	(1.6)	11	(2.0)	5	(1.0)
Hoods or air hoses in labs/classrooms	6	(1.3)	15	(1.8)	11	(1.4)
Computers	2	(1.2)	3	(0.8)	6	(1.0)
Calculator/computer lab interfacing devices	5	(1.0)	16	(2.0)	18	(2.1)
Computers with Internet connection	7	(1.7)	9	(2.0)	8	(1.1)

**Table 6.12**  
**Mathematics Classes Where Various Equipment Is**  
**Needed for Instruction, But Not Available, by Grade Range**

	Percent of Classes					
	Grades K–4		Grades 5–8		Grades 9–12	
Videotape player	0	(0.3)	1	(0.4)	0	(0.1)
Overhead projector	1	(0.4)	0	(0.2)	0	(0.3)
Videodisc player	3	(0.8)	6	(1.3)	3	(0.7)
CD-ROM player	5	(1.4)	4	(0.8)	3	(0.8)
Four-function calculators	2	(0.9)	1	(0.5)	1	(0.3)
Fraction calculators	6	(1.3)	7	(1.1)	1	(0.4)
Graphing calculators	4	(0.9)	9	(1.6)	2	(0.9)
Scientific calculators	3	(1.0)	6	(1.4)	1	(0.3)
Computers	2	(0.6)	4	(0.9)	5	(0.9)
Calculator/computer lab interfacing devices	8	(1.5)	14	(2.0)	10	(1.1)
Computers with Internet connection	7	(1.7)	6	(1.2)	5	(0.8)

The large percentages of science and mathematics teachers reporting they did not need particular types of equipment for their instruction were somewhat surprising, given the recommendations of national standards documents. (See Tables 6.13 and 6.14.) For example, teachers in 36 percent of grade K–4 mathematics classes indicated that they did not need four-function calculators and 20 percent of high school mathematics classes were reported as not needing graphing calculators. Similarly, 40 percent of high school science classes and 56 percent of those in grades 5–8 were reported as not needing calculator/computer lab interfacing devices.

**Table 6.13**  
**Science Classes Where Various Equipment**  
**Is Not Needed for Instruction, by Grade Range**

	Percent of Classes					
	Grades K–4		Grades 5–8		Grades 9–12	
Videotape player	8	(1.2)	6	(1.6)	5	(0.9)
Overhead projector	13	(2.0)	8	(1.8)	12	(2.7)
Videodisc player	68	(3.0)	42	(3.2)	39	(2.1)
CD-ROM player	43	(3.3)	34	(3.2)	36	(2.3)
Four-function calculators	67	(2.9)	34	(2.9)	37	(2.3)
Fraction calculators	95	(1.2)	79	(3.1)	70	(2.8)
Graphing calculators	96	(1.1)	80	(2.0)	60	(2.7)
Scientific calculators	96	(1.2)	67	(2.6)	38	(2.6)
Electric outlets in labs/classrooms	12	(2.0)	4	(1.0)	2	(0.7)
Running water in labs/classrooms	14	(2.1)	3	(0.7)	2	(0.7)
Gas for burners in labs/classrooms	87	(2.1)	53	(3.0)	22	(2.0)
Hoods or air hoses in labs/classrooms	92	(1.7)	64	(2.9)	33	(2.0)
Computers	28	(3.0)	6	(1.4)	9	(1.3)
Calculator/computer lab interfacing devices	88	(1.8)	56	(3.2)	40	(2.7)
Computers with Internet connection	29	(3.1)	8	(1.3)	14	(1.7)

**Table 6.14**  
**Mathematics Classes Where Various Equipment**  
**Is Not Needed for Instruction, by Grade Range**

	Percent of Classes					
	Grades K–4		Grades 5–8		Grades 9–12	
Videotape player	54	(3.1)	51	(2.2)	57	(2.2)
Overhead projector	10	(1.7)	9	(2.2)	12	(1.5)
Videodisc player	87	(2.0)	84	(2.3)	94	(1.2)
CD-ROM player	43	(2.8)	57	(3.2)	75	(2.2)
Four-function calculators	36	(2.4)	16	(1.8)	34	(1.9)
Fraction calculators	90	(1.5)	39	(3.0)	38	(2.1)
Graphing calculators	94	(1.2)	66	(2.7)	20	(1.9)
Scientific calculators	93	(1.4)	46	(3.1)	21	(1.6)
Computers	10	(1.9)	18	(2.4)	35	(2.2)
Calculator/computer lab interfacing devices	70	(2.4)	56	(2.8)	58	(2.5)
Computers with Internet connection	46	(3.3)	35	(3.3)	54	(2.3)

Factor analysis was performed on respondents' answers to questions about use of the equipment listed in Table 6.15. The composite variables generated from that procedure were named Use of Multimedia, Use of Calculators, and for science classes only, Use of Laboratory Facilities. (For a detailed description of the creation of composites, definitions of all composite variables, and reliability information, please see Appendix E.) Each composite has a minimum possible score of 0 and a maximum of 100.

The Use of Multimedia composite contains the same items across both subjects, including teachers' reports on their use of:

- Videotape players,
- Videodisc players,
- CD-ROM players, and
- Computers with Internet Connection.

While Use of Calculators composites were created for both science and mathematics based on the results of factor analysis, they are composed of somewhat different items. For example, in science classes calculator use typically occurs when students "use mathematics as a tool in problem-solving." (Details of all types of classroom activities are addressed in Chapter Five.) Therefore, this item was included in the composite variable.

The items comprising Use of Calculators are:

**Science**

- Four-function calculators;
- Fraction calculators;
- Scientific calculators;
- Graphing calculators;
- Use mathematics as a tool in problem-solving; and
- Calculator/computer lab interfacing devices.

**Mathematics**

- Four-function calculators;
- Fraction calculators; and
- Scientific calculators.

The structure of a science classroom or laboratory (Use of Laboratory Facilities) also constitutes a composite examining the presence of the following equipment:

- Running water;
- Electric outlets;
- Gas for burners; and
- Hoods or air hoses.

Table 6.15 presents the composite scores for science and mathematics classes by grade range. The scores at each grade level reflect the percentages reported for the separate questions about equipment use. There is a clear pattern of increased calculator use in mathematics and science

classes, and laboratory facilities use in science classes, with increasing grade levels. At each grade level, multimedia are more likely to be used in science classes than in mathematics classes.

**Table 6.15**  
**Science and Mathematics Composite Scores**  
**Related to Classroom Equipment Use, by Grade Range**

	Mean Score					
	Grades K-4		Grades 5-8		Grades 9-12	
<b>Science</b>						
Use of Multimedia	30	(1.7)	41	(1.4)	42	(1.1)
Use of Calculators	15	(0.7)	26	(0.8)	38	(1.3)
Use of Laboratory Facilities	28	(0.9)	42	(1.3)	61	(1.3)
<b>Mathematics</b>						
Use of Multimedia	19	(1.0)	19	(1.0)	13	(0.8)
Use of Calculators	12	(0.6)	41	(1.5)	53	(1.7)

The school and teacher surveys also included a number of questions about the amount of money spent on science and mathematics equipment and supplies. As can be seen in Table 6.16, the typical elementary school reported spending only \$250 on science equipment and \$250 on consumable science supplies in their most recently completed budget year. Middle schools spent somewhat more (a median of \$400 each on science equipment and science supplies) and high schools considerably more (a median of \$1,000 on science equipment and \$1,500 on science supplies). In contrast, in mathematics there was relatively little difference by grade range in the median amount spent on equipment and consumable supplies. Median amounts schools spent on software were small across the board, ranging from \$0 to \$150.

**Table 6.16**  
**Median Amount Schools Spent Per Year on Science and**  
**Mathematics Equipment, Consumable Supplies, and Software**

	Median Amount		
	Equipment	Consumable Supplies	Software
<b>Science</b>			
Elementary Schools	\$ 250	\$ 250	\$ 0
Middle Schools	\$ 400	\$ 400	\$ 0
High Schools	\$ 1,000	\$ 1,500	\$ 100
<b>Mathematics</b>			
Elementary Schools	\$ 300	\$ 500	\$ 150
Middle Schools	\$ 300	\$ 300	\$ 50
High Schools	\$ 575	\$ 300	\$ 100

Table 6.17 shows the amount elementary, middle, and high schools reported spending on science and mathematics equipment, consumable supplies, and software, expressed as a per pupil amount. The typical elementary school spent only 79¢ per student in their most recently completed budget year on consumable science supplies such as chemicals, glassware, batteries, etc. and \$1.58 per student on mathematics manipulative materials/supplies in the same time

period. These amounts are clearly insufficient at a time when a single meter stick costs \$4.00 and a set of mathematics pattern blocks costs \$20.00. Note that the amount spent on mathematics supplies per student is lower at the middle and high school levels, while the amount spent on science supplies increases with grade level. As can be seen in Table 6.18, while schools were likely to make at least some purchases to replenish consumable supplies, this was by no means universal. For example, 11 percent of the elementary schools reported spending *no* money in any of these categories in the previous year.

**Table 6.17**  
**Median Amount Schools Spent Per Pupil on Science and Mathematics Equipment, Consumable Supplies, and Software**

	Median Amount		
	Equipment	Consumable Supplies	Software
<b>Science</b>			
Elementary Schools	\$ 1.10	\$ 0.79	\$ 0.00
Middle Schools	\$ 1.10	\$ 1.33	\$ 0.00
High Schools	\$ 2.05	\$ 3.12	\$ 0.19
<b>Mathematics</b>			
Elementary Schools	\$ 0.99	\$ 1.58	\$ 0.66
Middle Schools	\$ 1.16	\$ 0.94	\$ 0.14
High Schools	\$ 1.32	\$ 0.61	\$ 0.18

**Table 6.18**  
**Schools Purchasing Science and Mathematics Equipment, Consumable Supplies, Software, or Any Purchase in Previous Year**

	Percent of Schools			
	Equipment	Consumable Supplies	Software	Any Purchase
<b>Science</b>				
Elementary Schools	75 (3.5)	83 (2.7)	48 (4.0)	89 (2.2)
Middle Schools	70 (4.0)	84 (3.3)	43 (3.6)	87 (2.9)
High Schools	83 (3.4)	96 (1.7)	58 (4.1)	97 (1.6)
<b>Mathematics</b>				
Elementary Schools	78 (3.8)	90 (2.4)	65 (4.3)	94 (1.9)
Middle Schools	84 (3.0)	89 (2.4)	52 (4.3)	96 (1.7)
High Schools	85 (3.1)	86 (2.3)	56 (3.7)	98 (0.6)

Either because school funds are scarce and/or ordering procedures are cumbersome, most teachers wind up spending some of their own money for supplies for their science and mathematics classes, with a median amount ranging from \$30 to \$55 per class. (See Table 6.19.) The typical self-contained elementary teacher spends a total of about \$70 per year on science and mathematics supplies; the typical high school mathematics teacher spends a total of \$250 for five classes; and the typical high school science teacher, a total of \$275 for five classes.

**Table 6.19**  
**Amount of Own Money Science and**  
**Mathematics Teachers Spent on Supplies Per Class**

	Median Amount	
	Science	Mathematics
Grades K–4	\$ 30	\$ 40
Grades 5–8	\$ 50	\$ 50
Grades 9–12	\$ 55	\$ 50

## D. Summary

An investigation of the textbooks and equipment teachers use with their classes reveals a great deal about the learning-environment experienced by grade K–12 students in 2000.

Science classes are more likely to use multiple textbooks than are mathematics classes. However, with the exception of grades 9–12, science classes are also more likely to use no textbook or program in their instruction. Across both science and mathematics, at all grade levels, publication of textbooks used by classes in 2000 was dominated by three publishers who accounted for at least 50 percent of the market at each level (though there was a different group of publishers depending on subject and grade level). In mathematics classes, about half of the classes are using a textbook published since 1997, compared to a third or fewer of science classes, depending on grade range. Interestingly, most teachers in both subjects rate their textbooks as good or better.

Measures of equipment use between the two subjects reveal that science classes are more likely to use multimedia devices such as videodisc and CD-ROM players than are their mathematics counterparts. Computer use is higher in grade K–4 mathematics than the corresponding grade range in science. At the 5–8 and 9–12 grade levels the pattern changes, however, as science classes are more likely to use the computer in some capacity. Calculator use is higher in mathematics classes, especially at the grade K–4 level, though a substantial proportion of grade 5–8 and 9–12 science classes also use these tools for instruction.

No specific type of instructional equipment was reported by a high percentage of teachers in either subject as being “needed for instruction, but not available” to them. The rather high percentages indicating equipment as unnecessary to instruction seems surprising in light of current recommendations for science and mathematics instruction. Similarly, the amount of money schools report spending on instructional resources seems quite inadequate, especially viewed as a per pupil expenditure. It is not surprising that teachers across subjects and grade ranges report spending a good deal of their own money on class supplies each year.