Instructional Resources

Overview

The quality and availability of instructional resources is a major factor in science, mathematics, and computer science teaching. The 2018 NSSME+ included a series of items on textbooks and instructional programs—which ones teachers use and how teachers use them. Teachers were also asked about the availability and use of a number of other instructional resources, including various types of computing devices and Internet capabilities. The following sections present these results.

Use of Textbooks and Other Instructional Resources

The 2018 NSSME+ collected data on the use of various instructional resources, including commercially published textbooks or programs, both print and electronic. Of particular interest is how much latitude teachers have in selecting instructional resources. Table 6.1 shows that instructional materials are designated by the district for most science and mathematics classes. The likelihood of having designated materials decreases from elementary school to high school in mathematics. Also, mathematics classes are generally more likely to have designated materials, perhaps due to the greater accountability emphasis in mathematics. High school computer science classes are very unlikely to have designated materials; only about a quarter have materials designated for them.

Table 6.1
Classes for Which the District Designates Instructional Materials to Be Used, by Subject

	PERCENT OF CLASSES		
	SCIENCE	MATHEMATICS	COMPUTER SCIENCE
Elementary	72 (2.4)	91 (1.3)	n/a
Middle	66 (2.8)	80 (2.1)	n/a
High	58 (2.0)	66 (1.7)	26 (3.7)

When teachers responded that their randomly selected class had a designated instructional material, the survey presented them with a list of possible types of materials. Despite the increasing variety of instructional materials, it is clear that in science, the textbook still dominates, with the most commonly designated materials being commercially published textbooks and modules (see Table 6.2). The percentage of elementary and middle grades classes (39 percent each) that have fee-based websites as the designated material is considerably larger than in high school (16 percent). State- and district-developed resources are also relatively common in elementary grades. The data also indicate that for many classes, multiple types of materials are designated by the district.

Table 6.2
Science Classes for Which Various Types of Instructional Resources Are Designated,† by Grade Range

	PERCENT OF CLASSES		
	ELEMENTARY	MIDDLE	HIGH
Commercially published textbooks (printed or electronic), including the supplementary materials (e.g., worksheets, laboratory handouts) that accompany the textbooks	67 (2.9)	87 (1.8)	95 (0.9)
State, county, district, or diocese-developed units or lessons	43 (2.2)	32 (2.3)	27 (1.7)
Lessons or resources from websites that are free (e.g., Khan Academy, PhET)	20 (1.9)	26 (2.2)	25 (2.0)
Commercially published kits/modules (printed or electronic)	51 (2.7)	36 (3.1)	22 (2.0)
Lessons or resources from websites that have a subscription fee or per lesson cost (e.g., BrainPOP, Discovery Ed, Teachers Pay Teachers)	39 (2.7)	39 (2.8)	16 (1.5)
Online units or courses that students work through at their own pace (e.g., i-Ready, Edgenuity)	9 (1.2)	15 (2.0)	11 (1.8)

† Includes only those teachers who indicated that their randomly selected science class had an instructional material designated by the state, district, or diocese.

The textbook is just as prominent in mathematics as in science (see Table 6.3). In addition, almost half of elementary classes have a material developed by their education agency as the designated material, and close to one-third have fee-based or free websites as the designated material. One-third of elementary and middle grades mathematics classes have online materials that students work through at their own pace.

Table 6.3
Mathematics Classes for Which Various Types of Instructional Resources Are Designated,† by Grade Range

	PERCENT OF CLASSES		
	ELEMENTARY	MIDDLE	HIGH
Commercially published textbooks (printed or electronic), including the supplementary materials (e.g., worksheets) that accompany the textbooks	89 (1.4)	88 (1.9)	91 (1.3)
State, county, district, or diocese-developed units or lessons	44 (2.2)	37 (2.5)	32 (1.9)
Lessons or resources from websites that are free (e.g., Khan Academy, Illustrative Math)	28 (1.8)	30 (2.5)	24 (1.7)
Lessons or resources from websites that have a subscription fee or per lesson cost (e.g., BrainPOP, Discovery Ed, Teachers Pay Teachers)	31 (2.0)	22 (2.0)	15 (1.5)
Online units or courses that students work through at their own pace (e.g., i-Ready, Edgenuity)	33 (2.0)	33 (2.9)	13 (1.7)

† Includes only those teachers who indicated that their randomly selected mathematics class had an instructional material designated by the state, district, or diocese.

As reported above, teachers of only about a quarter of high school computer science classes indicate having instructional materials designated. Among these classes, free, web-based resources are just as prominent as the textbook (see Table 6.4).

Table 6.4
High School Computer Science Classes for Which Various Types of Instructional Resources Are Designated†

	PERCENT OF CLASSES
Lessons or resources from websites that are free (e.g., Khan Academy, code.org)	59 (9.8)
Commercially published textbooks (printed or electronic), including the supplementary materials (e.g., worksheets) that accompany the textbooks	54 (11.3)
Lessons or resources from websites that have a subscription fee or per lesson cost (e.g., BrainPOP, Discovery Ed, Teachers Pay Teachers)	33 (10.1)
Online units or courses that students work through at their own pace (e.g., MOOCs, EdX, IMACS)	16 (4.6)
State, county, district, or diocese-developed units or lessons	10 (3.9)

† Includes only those teachers who indicated that their randomly selected computer science class had an instructional material designated by the state, district, or diocese.

Regardless of whether instructional materials had been designated for their class, teachers were asked how often instruction was based on various types of materials. As can be seen in Table 6.5, teacher-created units or lessons are very likely to be used on a weekly basis in science, and their prominence increases considerably with grade range, from 47 percent of elementary science classes to 86 percent of high school classes. In high school, after teacher-created lessons, commercially published textbooks and units or lessons from any other source are a distant second, with all the rest being relatively uncommon. In middle school science classes, the pattern is similar but less pronounced. In elementary science classes, fee-based websites and teacher-created units and lessons share roughly equal influence, followed by the textbook.

Table 6.5
Science Classes Basing Instruction on Various Instructional Resources at Least Once a Week, by Grade Range

	PERCENT OF CLASSES		
	ELEMENTARY	MIDDLE	HIGH
Units or lessons you created (either by yourself or with others)	47 (2.4)	76 (2.0)	86 (1.0)
Commercially published textbooks (printed or electronic), including the supplementary materials (e.g., worksheets, laboratory handouts) that accompany the textbooks	38 (1.9)	45 (2.6)	50 (1.7)
Units or lessons you collected from any other source (e.g., conferences, journals, colleagues, university or museum partners)	28 (2.0)	43 (2.4)	49 (1.7)
Lessons or resources from websites that are free (e.g., Khan Academy, PhET)	23 (2.1)	31 (1.8)	31 (1.8)
Commercially published kits/modules (printed or electronic)	29 (2.1)	21 (2.4)	21 (1.5)
Lessons or resources from websites that have a subscription fee or per lesson cost (e.g., BrainPOP, Discovery Ed, Teachers Pay Teachers)	49 (2.2)	34 (1.9)	16 (1.1)
State, county, district, or diocese-developed units or lessons	32 (2.4)	21 (1.9)	14 (1.2)
Online units or courses that students work through at their own pace (e.g., i-Ready, Edgenuity)	7 (1.0)	9 (1.0)	9 (1.0)

In mathematics, the influence of teacher-created units and lessons is much more prominent in high school than in elementary school classes (78 and 44 percent, respectively; see Table 6.6). The textbook is especially prominent at the elementary level, where three-fourths of classes are frequently based on this type of instructional resource, considerably more than any other resource. Also, elementary mathematics classes are much more likely than those at other levels to rely on fee-based websites and, to a lesser extent, on online self-paced materials.

Table 6.6
Mathematics Classes Basing Instruction on Various Instructional Resources at Least Once a Week, by Grade Range

	PERCENT OF CLASSES		
	ELEMENTARY	MIDDLE	HIGH
Units or lessons you created (either by yourself or with others)	44 (2.0)	65 (2.5)	78 (1.5)
Commercially published textbooks (printed or electronic), including the supplementary materials (e.g., worksheets) that accompany the textbooks	76 (2.0)	65 (2.5)	61 (1.7)
Units or lessons you collected from any other source (e.g., conferences, journals, colleagues, university or museum partners)	30 (1.8)	31 (1.9)	35 (1.6)
Lessons or resources from websites that are free (e.g., Khan Academy, Illustrative Math)	37 (1.9)	39 (2.4)	27 (1.4)
State, county, district, or diocese-developed units or lessons	41 (1.8)	26 (1.9)	23 (1.3)
Lessons or resources from websites that have a subscription fee or per lesson cost (e.g., BrainPOP, Discovery Ed, Teachers Pay Teachers)	54 (2.1)	34 (2.4)	19 (1.2)
Online units or courses that students work through at their own pace (e.g., i-Ready, Edgenuity)	36 (2.1)	24 (1.9)	12 (1.2)

In high school computer science, like science and mathematics, classes are most likely to be based on teacher-created lessons (64 percent at least once a week; see Table 6.7), with lessons from free websites a distant second (43 percent). Compared to high school classes in the other subjects, computer science instruction is much less likely to be based on a commercially published textbook and considerably more likely to be based on free websites and online self-paced materials.

Table 6.7
High School Computer Science Classes Basing Instruction on Various Instructional Resources at Least Once a Week

	PERCENT OF CLASSES
Units or lessons you created (either by yourself or with others)	64 (3.9)
Lessons or resources from websites that are free (e.g., Khan Academy, code.org)	43 (4.0)
Online units or courses that students work through at their own pace (e.g., MOOCs, EdX, IMACS)	32 (4.6)
Units or lessons you collected from any other source (e.g., conferences, journals, colleagues, university or museum partners)	28 (3.6)
Commercially published textbooks (printed or electronic), including the supplementary materials (e.g., worksheets) that accompany the textbooks	26 (3.4)
Lessons or resources from websites that have a subscription fee or per lesson cost (e.g., BrainPOP, Discovery Ed, Teachers Pay Teachers)	9 (2.2)
State, county, district, or diocese-developed units or lessons	7 (2.8)

Table 6.8, showing the percentage of high school classes that never base instruction on these resources, highlights differences between computer science and the other two subjects. Computer science classes are considerably more likely to never base instruction on state/district-developed materials, fee-based resources from websites, and commercially published textbooks. In contrast, high school science and mathematics classes are much more likely to never base instruction on online self-paced materials.

Table 6.8
High School Classes Never Basing Instruction on Various Instructional Resources, by Subject

	PERCENT OF CLASSES		
	SCIENCE	MATHEMATICS	COMPUTER SCIENCE
State, county, district, or diocese-developed units or lessons	46 (1.7)	39 (1.8)	69 (4.4)
Lessons or resources from websites that have a subscription fee or per lesson cost	47 (2.0)	42 (1.4)	63 (4.0)
Commercially published textbooks, including the supplementary materials that accompany the textbooks	9 (1.0)	13 (1.4)	36 (3.6)
Online units or courses that students work through at their own pace	59 (1.9)	59 (1.8)	33 (3.2)
Lessons or resources from websites that are free	10 (1.2)	16 (1.0)	14 (2.8)
Units or lessons you collected from any other source	6 (0.9)	13 (1.2)	14 (2.9)
Units or lessons you created	1 (0.2)	3 (0.6)	6 (2.2)
Commercially published kits/modules	18 (1.2)	n/a	n/a

Teachers who indicated that instruction in their randomly selected class was based substantially on a commercially published textbook or module were asked to record the title, author, year, and ISBN of the material used most often in the class. Using this information, the publisher of the material was identified. Tables 6.9–6.11 show the market share held by each of the major science, mathematics, and computer science textbook publishers. It is interesting to note that three publishers—Pearson, McGraw-Hill, and Houghton Mifflin Harcourt—account for instructional materials used in more than 75 percent of middle school and high school science classes and more than 70 percent of all mathematics classes. The only other publishers with a substantial share of the market are Delta Education in elementary science and Great Minds in elementary mathematics. In high school computer science, Pearson again has a considerable market share, followed closely by Cengage.

Table 6.9
Market Share of Commercial Textbook Publishers Used in Science Classes, by Grade Range

	PERCENT OF CLASSES		
	ELEMENTARY	MIDDLE	HIGH
Pearson	16 (2.6)	27 (2.2)	43 (2.0)
McGraw-Hill Education	16 (2.3)	25 (2.5)	20 (2.1)
Houghton Mifflin Harcourt	27 (3.5)	27 (2.9)	19 (1.6)
Cengage	2 (1.0)	0 (0.2)	5 (0.7)
Macmillan	0 ---†	0 ---†	2 (0.4)
Alpha Omega Publications	0 (0.1)	1 (0.7)	1 (0.5)
Frey Scientific	0 ---†	1 (0.7)	1 (0.4)
Continental Press	0 ---†	0 ---†	1 (0.8)
Kendall Hunt	0 (0.3)	0 ---†	1 (0.3)
OpenStax	0 ---†	0 ---†	1 (0.4)
Wiley	0 ---†	0 ---†	1 (0.3)
Accelerate Learning	4 (1.3)	4 (1.1)	0 (0.1)
Lab-Aids	0 ---†	3 (1.1)	0 (0.1)
Delta Education	13 (2.2)	2 (0.9)	0 ---†
Carolina Biological Supply Company	4 (1.3)	2 (0.8)	0 ---†
Abeka	0 (0.1)	1 (1.0)	0 ---†
Activate Learning	0 (0.0)	1 (0.5)	0 (0.1)
CK-12	0 ---†	1 (0.4)	0 (0.0)
Kindle Direct Publishing	0 (0.2)	1 (0.7)	0 (0.0)
Wieser Educational	0 ---†	1 (0.3)	0 ---†
Museum of Science, Boston	4 (2.9)	0 ---†	0 ---†
Knowing Science	2 (1.4)	0 ---†	0 ---†
Amplify	1 (0.8)	0 ---†	0 ---†
Learning Design Group	1 (0.5)	0 ---†	0 ---†
Mystery Science	1 (0.6)	0 ---†	0 ---†
NSTA Press	1 (0.4)	0 ---†	0 (0.3)
Project Lead The Way	1 (0.6)	0 (0.2)	0 (0.1)
Studies Weekly	1 (0.3)	0 ---†	0 ---†
TCI	1 (1.2)	0 ---†	0 ---†

† No teachers at this grade level in the sample reported using materials from this publisher. Thus, it is not possible to calculate the standard error of this estimate.

Table 6.10
Market Share of Commercial Textbook Publishers Used in Mathematics Classes, by Grade Range

	PERCENT OF CLASSES		
	ELEMENTARY	MIDDLE	HIGH
Pearson	21 (3.1)	17 (2.5)	27 (2.2)
Houghton Mifflin Harcourt	39 (3.2)	37 (3.1)	26 (1.9)
McGraw-Hill Education	19 (2.6)	26 (2.8)	19 (1.9)
Cengage	0 ---†	0 ---†	9 (1.1)
CPM Educational Program	0 (0.1)	3 (1.4)	3 (0.9)
Larson Texts	0 ---†	2 (0.8)	2 (0.5)
Macmillan	0 ---†	0 ---†	2 (0.4)
Great Minds	10 (1.9)	6 (1.7)	1 (0.6)
Carnegie Learning	0 ---†	3 (1.0)	1 (0.4)
The College Board	0 ---†	1 (0.6)	1 (0.4)
Wiley	3 (0.9)	0 (0.3)	1 (0.3)
Birkhäuser	0 ---†	0 ---†	1 (0.6)
eMATHinstruction	0 ---†	0 ---†	1 (0.6)
Haese Mathematics	0 ---†	0 ---†	1 (0.2)
Key Curriculum Press	0 ---†	0 ---†	1 (0.4)
Oxford University Press	0 ---†	0 ---†	1 (0.3)
Curriculum Associates	2 (0.7)	2 (0.5)	0 ---†
Sadlier	0 (0.2)	2 (0.7)	0 ---†
Marshall Cavendish Education	1 (0.6)	1 (0.3)	0 ---†
AgileMind	0 ---†	1 (0.6)	0 ---†
Origo Education	2 (1.0)	0 ---†	0 ---†
Sharon Wells Mathematics	1 (0.1)	0 ---†	0 ---†
The Math Learning Center	1 (0.4)	0 ---†	0 ---†

† No teachers at this grade level in the sample reported using materials from this publisher. Thus, it is not possible to calculate the standard error of this estimate.

Table 6.11
Market Share of Commercial Textbook Publishers Used in High School Computer Science Classes

	PERCENT OF CLASSES
Pearson	24 (5.6)
Cengage	23 (5.9)
Skylight	12 (4.6)
Wiley	8 (3.8)
Project Lead The Way	6 (2.5)
Jones & Bartlett Learning	5 (3.2)
D&S Marketing Systems	3 (2.9)
Goodheart-Wilcox	3 (2.0)
Stacey Armstrong	3 (2.2)
Apple Inc. Education	2 (1.6)
EMC Publishing	2 (2.1)
Microsoft Press	2 (1.6)
O'Reilly Media	2 (1.4)
Virtualbookworm.com Publishing	2 (1.4)
Barron's Educational Series	1 (1.3)
McGraw-Hill Education	1 (0.5)
Oracle	1 (0.8)
Oxford University Press	1 (1.0)
Springer Nature	1 (0.9)

Tables 6.12 and 6.13 list the science and mathematics textbooks in each grade range used by at least 10 percent of classes; secondary textbooks are shown by course type, as well.

Table 6.12
Most Commonly Used Science Textbooks in Each Grade Range and Course

	PUBLISHER	TITLE
Elementary		
Science	Houghton Mifflin Harcourt	*Science Fusion*
	Delta Education	*FOSS*
	Houghton Mifflin Harcourt	*Harcourt Science*
	Pearson	*Interactive Science*
Middle		
Earth/Space Science	Houghton Mifflin Harcourt	*Science Fusion*
	McGraw-Hill Education	*Glencoe iScience*
General/Integrated Science	Pearson	*Interactive Science*
	Houghton Mifflin Harcourt	*Science Fusion*
	McGraw-Hill Education	*Glencoe iScience*
	McGraw-Hill Education	*Glencoe Science*
	Houghton Mifflin Harcourt	*Holt Science & Technology*
Life Science	Pearson	*Interactive Science*
	Houghton Mifflin Harcourt	*Science Fusion*
	McGraw-Hill Education	*Glencoe iScience*
	Houghton Mifflin Harcourt	*Life Science*
	Houghton Mifflin Harcourt	*Holt Science & Technology*
Physical Science	McGraw-Hill Education	*Glencoe iScience*
	Houghton Mifflin Harcourt	*Physical Science*
High		
Biology/Life Science	Pearson	*Biology*
	Houghton Mifflin Harcourt	*Biology*
Chemistry	Pearson	*Chemistry*
	Houghton Mifflin Harcourt	*Modern Chemistry*
	McGraw-Hill Education	*Chemistry Matter and Change*
Earth/Space Science	Pearson	*Earth Science*
	McGraw-Hill Education	*Earth Science*
Environmental Science/Ecology	Houghton Mifflin Harcourt	*Environmental Science*
	Cengage	*Living in the Environment*
Multi-discipline	McGraw-Hill Education	*Physical Science*
	Houghton Mifflin Harcourt	*Physical Science*
Physics	Pearson	*Conceptual Physics*
	Houghton Mifflin Harcourt	*Physics*

Table 6.13
Most Commonly Used Mathematics Textbooks in Each Grade Range and Course

	PUBLISHER	TITLE
Elementary		
Mathematics	Houghton Mifflin Harcourt	*Go Math!*
	Pearson	*Envision Math*
	McGraw-Hill Education	*My Math*
Middle		
6th Grade Mathematics	Houghton Mifflin Harcourt	*Go Math!*
	Pearson	*Envision Math*
	McGraw-Hill Education	*Math Course 1*
7th Grade Mathematics	Houghton Mifflin Harcourt	*Go Math!*
	Houghton Mifflin Harcourt	*Big Ideas Math*
	McGraw-Hill Education	*Math Course 2*
8th Grade Mathematics	Houghton Mifflin Harcourt	*Go Math!*
Algebra 1, Grade 7 or 8	Pearson	*Algebra 1*
	Houghton Mifflin Harcourt	*Algebra 1*
	McGraw-Hill Education	*Algebra 1*
High		
Non-College Prep Mathematics	McGraw-Hill Education	*Algebra 1*
Formal/College Prep Mathematics Level 1	Pearson	*Algebra 1*
	Houghton Mifflin Harcourt	*Algebra 1*
	McGraw-Hill Education	*Algebra 1*
	Houghton Mifflin Harcourt	*Big Ideas Math*
Formal/College Prep Mathematics Level 2	Houghton Mifflin Harcourt	*Geometry*
	Pearson	*Geometry*
	McGraw-Hill Education	*Geometry*
Formal/College Prep Mathematics Level 3	Houghton Mifflin Harcourt	*Algebra 2*
	McGraw-Hill Education	*Algebra 2*
	Pearson	*Algebra 2*
Formal/College Prep Mathematics Level 4	McGraw-Hill Education	*Precalculus*
Courses that might qualify for college credit	Macmillan	*The Practice of Statistics*
	Pearson	*Calculus: Graphical, Numerical, Algebraic*
	Cengage	*Calculus of a Single Variable*

In high school computer science, only one textbook is used by more than 10 percent of classes: HTML and CSS, by Pearson. If computer science teachers reported that their class was sometimes based on lessons from free or fee-based websites, they were asked to list up to three online sources of lessons or activities they use most frequently. Only one online source—code.org—is used in more than 10 percent of high school computer science classes.

Table 6.14 shows the publication year of science, mathematics, and computer science textbooks. In 2018, 43–51 percent of science classes used textbooks published in 2009 or earlier. Science classes are considerably more likely than mathematics classes to use older textbooks. For example, 51 percent of middle grades science classes are using textbooks published in 2009 or earlier, compared to only 15 percent of middle grades mathematics classes. Given the growing presence of computer science classes, it is surprising that a third of them are using textbooks published in 2009 or earlier, but it is important to remember that a relatively small proportion of these classes use published materials at all.

Table 6.14
Publication Year of Textbooks/Programs, by Grade Range

	PERCENT OF CLASSES		
	ELEMENTARY	MIDDLE	HIGH
Science			
2009 or earlier	45 (4.4)	51 (3.7)	43 (2.1)
2010–12	26 (4.7)	27 (2.9)	27 (1.9)
2013–15	21 (3.9)	12 (1.8)	20 (1.8)
2016–18	9 (1.6)	11 (2.4)	9 (1.4)
Mathematics			
2009 or earlier	13 (2.0)	15 (2.5)	29 (1.9)
2010–12	32 (2.4)	21 (2.7)	31 (2.1)
2013–15	46 (3.1)	51 (3.0)	29 (2.1)
2016–18	9 (1.8)	13 (2.5)	10 (1.3)
Computer Science			
2009 or earlier	n/a	n/a	33 (7.3)
2010–12	n/a	n/a	26 (5.9)
2013–15	n/a	n/a	24 (6.5)
2016–18	n/a	n/a	17 (5.1)

Teachers were also asked whether the most recent unit in their randomly selected class was based primarily on either a commercially published textbook or materials developed by the state or district. (Computer science teachers were asked about commercially published online courses in addition.) As shown in Table 6.15, more than half of classes—mathematics classes in particular—are based on such materials.

Table 6.15
Classes in Which the Most Recent Unit Was Based on a Commercially Published Textbook or a Material Developed by the State or District, by Grade Range

	PERCENT OF CLASSES		
	ELEMENTARY	MIDDLE	HIGH
Science	65 (2.1)	54 (2.3)	54 (1.9)
Mathematics	81 (1.5)	70 (2.3)	73 (1.8)
Computer Science	n/a	n/a	63 (5.4)

When teachers responded that their most recent unit was based on one of these materials, they were asked how they used the material (see Table 6.16). Two important findings emerge from these data. First, when classes use commercially published and state/district-developed materials, the materials heavily influence instruction in all subjects at all grade ranges. Teachers in more than 70 percent of classes in the various subject and grade-level categories use the textbook substantially to guide the overall structure and content emphasis of their units. Second, it is clear that teachers modify their materials substantially when designing instruction. In roughly half or more of classes, teachers incorporate activities from other sources substantially, "pick and choose" from the material, and modify activities from the materials.

Table 6.16
Ways Teachers Substantially† Used Their Materials in Most Recent Unit,‡ by Grade Range

	PERCENT OF CLASSES		
	ELEMENTARY	MIDDLE	HIGH
Science			
I incorporated activities (e.g., problems, investigations, readings) from other sources to supplement what these materials were lacking.	65 (2.7)	78 (2.8)	78 (2.1)
I used these materials to guide the structure and content emphasis of the unit.	77 (3.1)	72 (2.8)	76 (2.0)
I modified activities from these materials.	59 (2.9)	69 (3.0)	71 (2.7)
I picked what is important from these materials and skipped the rest.	51 (3.1)	54 (3.4)	53 (2.6)
Mathematics			
I incorporated activities (e.g., problems, investigations, readings) from other sources to supplement what these materials were lacking.	69 (1.9)	65 (3.1)	64 (2.0)
I used these materials to guide the structure and content emphasis of the unit.	87 (1.6)	82 (1.9)	81 (1.5)
I modified activities from these materials.	61 (2.4)	62 (2.9)	60 (1.9)
I picked what is important from these materials and skipped the rest.	49 (2.5)	52 (2.8)	52 (1.9)
Computer Science			
I incorporated activities (e.g., problems, investigations, readings) from other sources to supplement what these materials were lacking.	n/a	n/a	70 (5.2)
I used these materials to guide the structure and content emphasis of the unit.	n/a	n/a	84 (3.6)
I modified activities from these materials.	n/a	n/a	56 (6.4)
I picked what is important from these materials and skipped the rest.	n/a	n/a	49 (7.3)

† Includes teachers indicating 4 or 5 on a five-point scale ranging from 1 "not at all" to 5 "to a great extent."
‡ Includes only those classes in which the most recent unit was based on a commercially published or state/district-developed material.

Teachers in roughly half of science, mathematics, and computer science classes skip activities in the material substantially. As can be seen in Table 6.17, in all subjects, some of the most frequently selected reasons for skipping parts of the materials are: (1) having another activity that works better than the one skipped, (2) the science ideas addressed not being included in pacing guides or standards, (3) not having enough instructional time, and (4) the activities skipped being too difficult for the students. In more than 40 percent of classes, teachers skip activities that they deem unnecessary (students either already knew the ideas or could learn them without the activities). Differences across grades, however, are also apparent. For example, in mathematics, teachers in 38 percent of elementary classes cite the difficulty of the activity as the reason for skipping it, compared to 55 percent in high school mathematics classes. A similar pattern is evident in science. Also, not having materials for an activity is much more likely to be cited as a reason in science classes (54–62 percent) than in mathematics classes (24–27 percent) or high school computer science classes (28 percent).

Table 6.17
Reasons Why Parts of Materials Are Skipped,† by Grade Range

	PERCENT OF CLASSES		
	ELEMENTARY	MIDDLE	HIGH
Science			
I have different activities for those science ideas that work better than the ones I skipped.	69 (3.9)	83 (3.4)	77 (4.0)
I did not have enough instructional time for the activities I skipped.	74 (4.5)	73 (3.6)	74 (3.5)
The science ideas addressed in the activities I skipped are not included in my pacing guide/standards.	63 (3.9)	76 (3.4)	73 (3.2)
The activities I skipped were too difficult for my students.	38 (3.7)	43 (3.9)	59 (3.4)
I did not have the materials needed to implement the activities I skipped.	62 (4.5)	56 (4.1)	54 (3.7)
My students already knew the science ideas or were able to learn them without the activities I skipped.	49 (3.5)	52 (4.4)	52 (3.5)
I did not have the knowledge needed to implement the activities I skipped.	24 (3.3)	25 (4.4)	20 (2.6)
Mathematics			
I have different activities for those mathematical ideas that work better than the ones I skipped.	80 (2.2)	80 (2.5)	74 (2.2)
I did not have enough instructional time for the activities I skipped.	61 (3.1)	71 (3.1)	69 (2.4)
The mathematical ideas addressed in the activities I skipped are not included in my pacing guide/standards.	65 (2.8)	72 (3.1)	73 (2.1)
The activities I skipped were too difficult for my students.	38 (2.8)	44 (3.6)	55 (2.5)
I did not have the materials needed to implement the activities I skipped.	26 (2.3)	27 (3.0)	24 (2.2)
My students already knew the mathematical ideas or were able to learn them without the activities I skipped.	67 (2.9)	59 (3.5)	54 (2.5)
I did not have the knowledge needed to implement the activities I skipped.	9 (2.5)	11 (2.4)	9 (1.6)
Computer Science			
I have different activities for those computer science ideas that work better than the ones I skipped.	n/a	n/a	68 (5.6)
I did not have enough instructional time for the activities I skipped.	n/a	n/a	60 (5.8)
The computer science ideas addressed in the activities I skipped are not included in my pacing guide/standards.	n/a	n/a	49 (6.7)
The activities I skipped were too difficult for my students.	n/a	n/a	51 (7.2)
I did not have the materials needed to implement the activities I skipped.	n/a	n/a	28 (7.0)
My students already knew the computer science ideas or were able to learn them without the activities I skipped.	n/a	n/a	44 (6.2)
I did not have the knowledge needed to implement the activities I skipped.	n/a	n/a	35 (7.5)

† Includes only those classes in which the most recent unit was based on a commercially published or state/district-developed material.

Given that teachers often skip activities in their materials because they know of better ones, it is perhaps not surprising that teachers in well more than half of science, mathematics, and computer science classes supplement their materials. Of the reasons listed on the questionnaire, three stand out above the rest: (1) teachers having additional activities that they like, (2) providing students with additional practice, and (3) differentiating instruction for students at different achievement levels (see Table 6.18). The influence of standardized testing is also evident, with teachers in anywhere from about half to almost three-fourths of classes across subjects supplementing for test-preparation purposes. Finally, in 34–49 percent of classes, depending on subject and grade level, teachers supplement their published material because their pacing guide indicates that they should. This finding both speaks to the prevalence of pacing guides and suggests that supplementing is at least to some extent sanctioned or prescribed by schools and districts.

Table 6.18
Reasons Why Materials Are Supplemented,† by Grade Range

	PERCENT OF CLASSES		
	ELEMENTARY	MIDDLE	HIGH
Science			
I had additional activities that I liked.	82 (3.2)	86 (2.6)	88 (2.6)
Supplemental activities were needed so students at different levels of achievement could increase their understanding of the ideas targeted in each activity.	84 (2.4)	90 (2.6)	86 (3.5)
Supplemental activities were needed to provide students with additional practice.	77 (2.8)	90 (2.3)	86 (3.7)
Supplemental activities were needed to prepare students for standardized tests.	47 (3.7)	60 (3.9)	53 (3.6)
My pacing guide indicated that I should use supplemental activities.	42 (3.6)	49 (3.9)	46 (3.3)
Mathematics			
I had additional activities that I liked.	80 (2.0)	85 (2.3)	80 (1.9)
Supplemental activities were needed so students at different levels of achievement could increase their understanding of the ideas targeted in each activity.	94 (1.3)	97 (1.0)	89 (1.9)
Supplemental activities were needed to provide students with additional practice.	95 (1.0)	94 (1.3)	91 (1.6)
Supplemental activities were needed to prepare students for standardized tests.	60 (2.9)	72 (3.4)	56 (2.6)
My pacing guide indicated that I should use supplemental activities.	45 (3.0)	37 (3.7)	41 (2.6)
Computer Science			
I had additional activities that I liked.	n/a	n/a	79 (5.7)
Supplemental activities were needed so students at different levels of achievement could increase their understanding of the ideas targeted in each activity.	n/a	n/a	73 (5.6)
Supplemental activities were needed to provide students with additional practice.	n/a	n/a	79 (5.0)
Supplemental activities were needed to prepare students for standardized tests.	n/a	n/a	52 (6.9)
My pacing guide indicated that I should use supplemental activities.	n/a	n/a	34 (6.3)

† Includes only those classes in which the most recent unit was based on a commercially published or state/district-developed material.

Finally, when teachers reported that they modified their published material (which over half did), they rated each of several factors that may have contributed to their decision (see Table 6.19). Two factors stand out: teachers do not have enough time to implement the activities as designed (52–71 percent of classes), and the activities are too difficult for students (43–58 percent of classes). In science, teachers are also likely to cite not having the necessary materials or supplies for the original activities (53–62 percent of classes). Teachers are about equally likely to point to the structure of activities (either too much or too little) across subjects and grade ranges as the reason for modifications.

Table 6.19
Reasons Why Materials Are Modified,† by Grade Range

	PERCENT OF CLASSES		
	ELEMENTARY	MIDDLE	HIGH
Science			
I did not have enough instructional time to implement the activities as designed.	70 (3.9)	70 (3.5)	71 (2.8)
The original activities were too difficult conceptually for my students.	46 (4.1)	54 (3.9)	58 (3.3)
I did not have the necessary materials/supplies for the original activities.	60 (3.8)	62 (3.6)	53 (3.4)
The original activities were too easy conceptually for my students.	35 (3.5)	46 (4.0)	44 (3.6)
The original activities were not structured enough for my students.	42 (4.3)	41 (3.8)	40 (3.5)
The original activities were too structured for my students.	36 (4.2)	33 (4.0)	38 (3.1)
Mathematics			
I did not have enough instructional time to implement the activities as designed.	52 (2.7)	68 (2.7)	58 (2.6)
The original activities were too difficult conceptually for my students.	50 (3.1)	55 (3.2)	54 (2.8)
I did not have the necessary materials/supplies for the original activities.	27 (2.4)	29 (3.0)	28 (2.0)
The original activities were too easy conceptually for my students.	52 (3.2)	44 (3.2)	38 (2.1)
The original activities were not structured enough for my students.	31 (2.5)	39 (3.1)	35 (2.0)
The original activities were too structured for my students.	32 (2.4)	35 (3.2)	31 (2.2)
Computer Science			
I did not have enough instructional time to implement the activities as designed.	n/a	n/a	54 (6.5)
The original activities were too difficult conceptually for my students.	n/a	n/a	43 (6.5)
I did not have the necessary materials/supplies for the original activities.	n/a	n/a	32 (7.1)
The original activities were too easy conceptually for my students.	n/a	n/a	33 (6.3)
The original activities were not structured enough for my students.	n/a	n/a	37 (7.3)
The original activities were too structured for my students.	n/a	n/a	31 (6.6)

† Includes only those classes in which the most recent unit was based on a commercially published or state/district-developed material.

Facilities and Equipment

Given the increased emphasis on computing in instruction across STEM disciplines, the 2018 NSSME+ included several questions about availability of computing resources. As shown in Table 6.20, virtually all schools have school-wide Wi-Fi. Laptop/tablet carts and computer labs are also present in a large majority of schools. Perhaps most striking is the percentage of schools (35–44 percent) where every student has a laptop or tablet. Obviously, these initiatives represent a substantial investment.

Table 6.20
Schools With Various Computing Resources, by Grade Range

	PERCENT OF SCHOOLS		
	ELEMENTARY	MIDDLE	HIGH
School-wide Wi-Fi	98 (0.8)	99 (0.4)	99 (0.4)
Laptop/tablet carts available for teachers to use with their classes	89 (1.7)	87 (1.9)	76 (2.5)
One or more computer labs available for teachers to schedule for their classes	69 (2.9)	68 (3.2)	74 (2.7)
A 1-to-1 initiative (every student is provided with a laptop or tablet)	35 (2.4)	40 (2.9)	44 (3.2)

Because of the potential inequities inherent in students using their own computing devices, policies governing device use are also of interest. Virtually no schools require students to provide their own computers (see Table 6.21). The extent to which students are allowed to bring their laptops and tablets to school and use them in classes increases with grade range. The likelihood that students are not allowed to bring their computers to school follows an opposite trend.

Table 6.21
Schools With Various Policies About Students Bringing Their Own Computers to School, by Grade Range

	PERCENT OF SCHOOLS		
	ELEMENTARY	MIDDLE	HIGH
School has a 1-to-1 initiative (every student is provided with a laptop or tablet).	35 (2.4)	40 (2.9)	44 (3.2)
Students are not required but are allowed to bring their own laptops or tablets for use in classes.	14 (2.1)	22 (2.3)	39 (3.2)
Students are not allowed to use their own laptops or tablets in classes.	51 (2.6)	38 (2.8)	15 (2.3)
Students are required to provide their own laptops or tablets for use in classes.	0 (0.1)	0 (0.2)	1 (0.4)

Regarding computer science instruction specifically, high school computer science teachers were asked about school policies related to provision of instructional resources in their randomly selected class. Typically, if a particular technology is required, the school provides it for students (see Table 6.22). It is somewhat surprising that any classes require students to provide their own computers or mobile computing devices, but a small percentage do. Even data storage devices (which 13 percent of high school computer science classes require students to provide) can present a financial obstacle to students.

Table 6.22
Provision of Technologies in High School Computer Science Classes

	PERCENT OF CLASSES		
	COMPUTERS	MOBILE COMPUTING DEVICES	DATA STORAGE DEVICES
Not required for this class	n/a	57 (4.2)	46 (3.3)
Provided by the school, and students are not allowed to use their own	35 (4.5)	9 (2.2)	9 (2.8)
Provided by the school, but students are allowed to use their own	58 (4.5)	15 (2.3)	26 (3.4)
Students are expected to provide their own, but the school has some available for use	2 (0.7)	10 (2.9)	7 (2.2)
Students are required to provide their own	5 (1.6)	8 (3.4)	13 (2.4)

Science teachers were presented with a list of more general instructional technologies as indicators of whether classes have access to basic resources for science instruction and asked about availability in their randomly selected class. The three response options were:

- Not available;
- Available upon request; and
- Always available in your classroom.

The percentages of science classes with at least some availability of these resources (either in the classroom or upon request) are shown in Table 6.23. More than 80 percent of classes at all levels have access to balances. The availability of probes for collecting data increases with grade range, and microscopes are much more available in middle and high school classes than in elementary classes.

Table 6.23
Availability† of Instructional Technologies in Science Classes, by Grade Range

	PERCENT OF CLASSES		
	ELEMENTARY	MIDDLE	HIGH
Balances (e.g., pan, triple beam, digital scale)	80 (2.0)	96 (1.0)	97 (0.8)
Microscopes	56 (2.7)	93 (1.3)	94 (1.0)
Probes for collecting data (e.g., motion sensors, temperature probes)	39 (2.7)	68 (2.4)	81 (2.3)

† Includes only those teachers indicating the resource is always available in their classroom or available upon request.

Computer science teachers were asked a similar question.[21] Almost all high school computer science classes have access to projection devices (e.g., Smartboard, document camera, LCD projector), and more than half have access to robotics equipment (see Table 6.24). It is particularly interesting that only 40 percent of computer science classes have access to probes for collecting data but 81 percent of high school science classes do. Perhaps these two groups of teachers define the technology differently, or perhaps computer science teachers simply are not aware that the technology exists in the school.

Table 6.24
Availability† of Instructional Technologies in High School Computer Science Classes

	PERCENT OF CLASSES
Projection devices (e.g., Smartboard, document camera, LCD projector)	99 (0.5)
Robotics equipment	57 (3.3)
Probes for collecting data (e.g., motion sensors, temperature probes)	40 (3.9)

† Includes only those high school computer science teachers indicating the resource is always available in their classroom or available upon request.

Science teachers were also asked about the availability of laboratory facilities, using the same response options they used for instructional technologies. Electrical outlets and running water are widely available in all grade ranges (see Table 6.25). Fewer than a third of elementary classes have access to lab tables, but they are widespread in middle school and especially high school classrooms.

[21] The Mathematics Teacher Questionnaire did not include questions about instructional technologies.

Table 6.25

Availability† of Laboratory Facilities in Science Classes, by Grade Range

	PERCENT OF CLASSES		
	ELEMENTARY	MIDDLE	HIGH
Electric outlets	93 (1.1)	98 (0.7)	98 (0.6)
Faucets and sinks	83 (2.0)	89 (1.5)	95 (0.9)
Lab tables	29 (3.1)	81 (2.0)	94 (1.1)
Gas for burners	n/a	n/a	85 (1.7)
Fume hoods	n/a	n/a	82 (1.8)

† Includes only those science teachers indicating the resource is either located in the classroom or available in another room.

The 2018 NSSME+ also asked science and mathematics program representatives how much money their schools spent during the most recently completed school year on three kinds of resources: equipment (excluding computers), consumable supplies (e.g., chemicals, graph paper), and software specific to science and mathematics instruction. By dividing these amounts by school enrollment, per-pupil estimates were generated (see Table 6.26). In science, per-pupil spending on equipment and supplies increases sharply from elementary school to high school, as does overall per-pupil spending. In mathematics, total per-pupil spending is substantially higher in elementary schools than in middle and high schools. Clearly, median per-pupil spending for software is the least of the three categories.

Table 6.26

Median Amount Schools Spent Per Pupil on Science and Mathematics Equipment, Consumable Supplies, and Software, by Grade Range

	MEDIAN AMOUNT		
	ELEMENTARY	MIDDLE	HIGH
Science			
Equipment	$0.35 (0.1)	$1.02 (0.2)	$2.25 (0.3)
Consumable supplies	$1.03 (0.2)	$1.42 (0.2)	$3.26 (0.3)
Software	$0.00 ---†	$0.00 ---†	$0.00 ---†
Total	**$1.98 (0.5)**	**$3.27 (0.6)**	**$6.88 (0.7)**
Mathematics			
Non-consumable items	$0.92 (0.2)	$0.80 (0.1)	$0.93 (0.2)
Consumable supplies	$1.46 (0.2)	$0.97 (0.2)	$0.56 (0.1)
Software	$0.05 (0.4)‡	$0.00 ---†	$0.09 (0.2)‡
Total	**$6.45 (1.1)**	**$3.43 (0.5)**	**$2.74 (0.4)**

† It was not possible to compute a standard error using either the Woodruff or the replication methods.

‡ Standard errors for medians are typically computed in Wesvar 5.1 using the Woodruff method. Wesvar was unable to compute a standard error for this estimate using this method; thus, the potentially less-consistent replication standard error is reported.

Expenditures for science and mathematics are not distributed equally across all schools. For example, in science, schools with the lowest percentage of students who are eligible for free/ reduced-price lunch spend considerably more per pupil on equipment and supplies than those with the highest percentage (see Table 6.27). Schools in the South spend considerably less than schools in the Northeast. In mathematics, the smallest schools spend more overall per pupil than the largest schools (see Table 6.28). Regional differences are also apparent, with schools in the Northeast spending the most overall per pupil.

Table 6.27
Equity Analyses of Median Amount Schools Spent Per Pupil on Science Equipment and Consumable Supplies

	MEDIAN AMOUNT		
	EQUIPMENT	CONSUMABLE SUPPLIES	TOTAL†
Percent of Students in School Eligible for FRL			
Lowest Quartile	$1.26 (0.3)	$2.24 (0.2)	$5.62 (0.8)
Second Quartile	$0.90 (0.2)	$1.59 (0.4)	$3.44 (0.7)
Third Quartile	$0.46 (0.3)	$1.14 (0.2)	$2.55 (0.6)
Highest Quartile	$0.42 (0.2)	$1.09 (0.2)	$2.05 (0.7)
School Size			
Smallest Schools	$0.90 (0.4)	$1.75 (0.4)	$4.61 (1.2)
Second Group	$0.98 (0.3)	$1.98 (0.3)	$3.62 (0.6)
Third Group	$0.66 (0.2)	$1.23 (0.2)	$2.48 (0.6)
Largest Schools	$0.65 (0.2)	$1.17 (0.2)	$2.34 (0.4)
Community Type			
Rural	$1.03 (0.2)	$1.85 (0.5)	$4.06 (0.7)
Suburban	$0.84 (0.2)	$1.49 (0.2)	$3.25 (0.5)
Urban	$0.48 (0.2)	$1.14 (0.3)	$2.06 (0.6)
Region			
Midwest	$1.06 (0.3)	$2.00 (0.6)	$4.41 (0.7)
Northeast	$1.41 (0.4)	$2.92 (0.7)	$6.62 (1.9)
South	$0.39 (0.1)	$1.06 (0.2)	$1.70 (0.3)
West	$0.98 (0.3)	$1.27 (0.3)	$3.11 (1.0)

† The “Total” column includes spending on software.

Table 6.28
Equity Analyses of Median Amount Schools Spent Per Pupil on Mathematics Equipment and Consumable Supplies

	MEDIAN AMOUNT		
	EQUIPMENT	CONSUMABLE SUPPLIES	TOTAL†
Percent of Students in School Eligible for FRL			
Lowest Quartile	$0.68 (0.1)	$1.10 (0.3)	$4.20 (1.1)
Second Quartile	$1.11 (0.2)	$0.98 (0.4)	$4.59 (1.2)
Third Quartile	$1.03 (0.2)	$1.13 (0.2)	$4.87 (1.1)
Highest Quartile	$1.16 (0.3)	$0.95 (0.3)	$5.38 (1.3)
School Size			
Smallest Schools	$1.36 (0.3)	$1.50 (0.5)	$7.39 (1.5)
Second Group	$0.93 (0.2)	$0.79 (0.3)	$4.79 (1.1)
Third Group	$0.98 (0.2)	$1.06 (0.3)	$3.91 (0.9)
Largest Schools	$0.76 (0.1)	$0.75 (0.2)	$3.85 (0.6)
Community Type			
Rural	$0.98 (0.3)	$0.69 (0.2)	$4.68 (1.1)
Suburban	$0.97 (0.2)	$1.35 (0.2)	$5.39 (0.8)
Urban	$0.83 (0.3)	$0.75 (0.3)	$3.94 (1.0)
Region			
Midwest	$0.95 (0.2)	$0.86 (0.3)	$4.22 (1.2)
Northeast	$1.23 (0.6)	$1.90 (0.5)	$7.16 (1.4)
South	$0.82 (0.2)	$0.81 (0.2)	$4.94 (0.8)
West	$0.86 (0.2)	$0.92 (0.2)	$2.93 (1.1)

† The "Total" column includes spending on software.

Expenditures for science instruction seem to be reflected in teachers' ratings of the adequacy of resources they have on hand. As can be seen in Table 6.29, the overall pattern is that teachers of classes in the higher grade ranges are generally more likely than those in lower ones to rate the availability of resources as adequate. In elementary grades, teachers of fewer than half of classes rate the availability of resources as adequate, compared to two-thirds or more at the high school level.

Table 6.29
Adequacy† of Resources for Science Instruction, by Grade Range

	PERCENT OF CLASSES		
	ELEMENTARY	MIDDLE	HIGH
Equipment (e.g., thermometers, magnifying glasses, microscopes, beakers, photogate timers, Bunsen burners)	39 (2.5)	58 (2.9)	73 (1.9)
Facilities (e.g., lab tables, electric outlets, faucets and sinks)	38 (2.6)	62 (2.7)	72 (2.0)
Instructional technology (e.g., calculators, computers, probes/sensors)	49 (2.8)	57 (2.5)	70 (2.1)
Consumable supplies (e.g., chemicals, living organisms, batteries)	30 (2.8)	45 (2.7)	67 (2.1)

† Includes science teachers indicating 4 or 5 on a five-point scale ranging from 1 "not adequate" to 5 "adequate."

In mathematics, the patterns are much more varied (see Table 6.30). Teachers of high school classes are more likely than their elementary counterparts to rate the availability of instructional technology as adequate, but the pattern is reversed for manipulatives. These data suggest that substantial proportions of secondary mathematics teachers want to use manipulative materials but do not have adequate access to them. Ratings of the availability of measurement tools are similar, and high, across grade ranges.

Table 6.30
Adequacy† of Resources for Mathematics Instruction, by Grade Range

	PERCENT OF CLASSES		
	ELEMENTARY	MIDDLE	HIGH
Instructional technology (e.g., calculators, computers, probes/ sensors)	67 (2.0)	79 (2.3)	85 (1.6)
Measurement tools (e.g., protractors, rulers)	79 (1.7)	82 (2.1)	80 (1.6)
Consumable supplies (e.g., graphing paper, batteries)	65 (2.5)	75 (2.4)	77 (1.6)
Manipulatives (e.g., pattern blocks, algebra tiles)	87 (1.8)	63 (2.8)	51 (2.3)

† Includes mathematics teachers indicating 4 or 5 on a five-point scale ranging from 1 "not adequate" to 5 "adequate."

These items were combined into a composite variable named Adequacy of Resources for Instruction. As shown in Table 6.31, perceptions of the adequacy of resources vary substantially by content area in elementary and middle school classrooms but are essentially the same in high school classrooms. This aggregate view reflects other findings reported in this section, suggesting that science instruction in the earlier grades is under resourced from teachers' point of view.

Table 6.31
Class Mean Scores for the
Adequacy of Resources for Instruction Composite, by Subject

	MEAN SCORE	
	SCIENCE	MATHEMATICS
Elementary	52 (1.7)	80 (1.0)
Middle	65 (1.4)	80 (1.0)
High	76 (1.1)	78 (0.9)

In science, teachers of classes with mostly high-achieving students have the most positive views about their resources, compared to classes with average/mixed prior achievers and those with mostly low-achieving students (see Table 6.32). Similarly, teachers of classes with the lowest percentage of students from race/ethnicity groups historically underrepresented in STEM have more positive views than those with the highest percentage, as do teachers of classes with the lowest percentage of students eligible for free/reduced-price lunch, compared to those with the highest percentage. Mathematics teachers' views of the adequacy of their resources do not tend to differ substantially by various equity factors.

Table 6.32
Equity Analyses of Class Mean Scores for the Adequacy of Resources for Instruction Composite, by Subject

	MEAN SCORE	
	SCIENCE	MATHEMATICS
Prior Achievement Level of Class		
Mostly High	74 (1.6)	82 (1.0)
Average/Mixed	60 (1.1)	79 (0.8)
Mostly Low	54 (2.5)	76 (1.4)
Percent of Historically Underrepresented Students in Class		
Lowest Quartile	65 (1.7)	81 (1.0)
Second Quartile	64 (1.7)	82 (1.0)
Third Quartile	60 (1.4)	78 (1.2)
Highest Quartile	56 (2.9)	76 (1.4)
Percent of Students in School Eligible for FRL		
Lowest Quartile	66 (2.1)	81 (1.1)
Second Quartile	63 (2.0)	81 (0.9)
Third Quartile	61 (2.8)	79 (1.2)
Highest Quartile	54 (1.6)	76 (1.2)

High school computer science teachers were asked how great a problem each of several factors presents in their instruction (see Table 6.33). Given the extent to which high school computer science classes rely on web-based instructional materials, it is perhaps not surprising that one of the most frequently cited problems is school restrictions on Internet content (37 percent of classes). Lack of support to maintain technology is a similarly prominent problem. It is also surprising that teachers in almost 1 in 5 classes rate lack of reliable Internet access as a problem given the ubiquity of Internet in schools.

Table 6.33
Factors Perceived as Problems† in High School Computer Science Classes

	PERCENT OF CLASSES
School restrictions on Internet content that is allowed	37 (4.3)
Lack of support to maintain technology (e.g., repair broken devices, install software)	34 (4.4)
Lack of functioning computing devices (e.g., desktop computers, laptop computers, tablets, smartphones)	27 (4.5)
Lack of reliable access to the Internet	19 (4.4)
Insufficient power sources for devices (e.g., electrical outlets, charging stations)	14 (3.1)

† Includes high school computer science teachers indicating "somewhat of a problem" or "serious problem" on a three-point scale from 1 "not a significant problem" to 3 "serious problem."

Summary

Analysis of data on the textbooks and equipment teachers use with their classes reveals a great deal about the learning environment experienced by grade K–12 students in 2018. The majority of science and mathematics classes have instructional materials designated for them, and the textbook is still the most commonly designated material. In contrast, only about one-fourth of high school computer science classes have designated materials, and among them, free, web-based resources are just as common as commercially published materials. Commercially published materials and materials developed by the state, county, or district play a prominent role in unit-level planning; however, at the lesson level, regardless of whether materials have been designated, teacher-created units and lessons heavily influence instruction, especially in middle school and high school.

Across both science and mathematics, the same three publishers—Pearson, McGraw-Hill, and Houghton Mifflin Harcourt—dominate, accounting for more than two-thirds of the market at each level. Science classes are more likely than mathematics classes to use older textbooks.

Commercially published materials and materials developed by the state or district exert substantial influence on instruction, from the frequency with which instruction is based on them to the ways teachers use them to plan for and organize instruction. At the same time, it is clear that teachers modify their published materials substantially, skipping parts of the text (often because teachers know of something better), supplementing with other materials (most often to provide additional practice or to differentiate instruction), and modifying them in other ways (often because teachers did not have enough time).

Computer and Internet resources, including school-wide Wi-Fi and computers or tablets for students, are widespread. However, the amount of money schools spend on instructional resources more broadly seems quite inadequate, especially viewed as a per-pupil expenditure. In science, the problem is especially pronounced in elementary grades, where median per-pupil spending is considerably less than that spent in middle schools and especially in high schools. The lack of spending is likely related to the finding that elementary science teachers are less likely than their middle school and high school counterparts to view their resources as adequate. No such disparity by grade level exists in mathematics. Analyses of spending and resource adequacy by equity factors point to disparities, particularly in relation to the prior achievement level of students, the percentage of students from race/ethnicity groups historically underrepresented in STEM, and the percentage of students eligible for free/reduced-price lunch.