

Section Four

Instructional Objectives and Activities

The 1993 and 2000 National Surveys provide three sources of information about science and mathematics teaching. One series of items listed various instructional strategies and asked teachers to indicate the frequency with which they used each in a randomly selected class. A second item listed a number of activities and asked teachers to indicate which occurred in the most recent lesson in their randomly selected class. Finally, a third item asked teachers to indicate the number of minutes devoted to each of several activities in their most recent lesson. The data for science instruction from these three items are presented in Tables 4.1–4.4. While several of the differences between 1993 and 2000 are statistically significant, science instruction does not appear to have changed substantially in the last seven years.

There has been a reduction in the frequency of some “traditional” activities. A smaller proportion of teachers in each grade range in 2000 reported students spending class time reading about science. The decrease is evident both in teachers’ reports of the frequency of their instructional activities (Table 4.1) and in their description of activities used in their most recent lesson (Table 4.2). This change is most apparent in science instruction in grades 1–4, where the percentage of teachers reporting that students read about science in their most recent lesson decreased from 62 in 1993, to 45 in 2000.

Roughly half of the teachers in each grade range reported in 2000 that their students completed textbook/worksheet problems in the most recent lesson, representing a small decrease from 1993. (See Table 4.2.)

Data on trends in the use of lecture in science instruction are less clear. The percentage of classes in which students “listen and take notes during a presentation by the teacher” on a weekly basis suggests that the use of lecture has decreased since 1993. (See Table 4.1.) At the same time, teachers’ reports of the amount of class time spent on whole class lecture/discussion indicate no change except in grades 5–8 science. (See Table 4.3.) Further, the percent of classes reporting *any* whole class lecture/discussion in the most recent lesson has not changed since 1993. (See Table 4.4.) The fact that lecture and discussion are included in the same item, in this instance, prevent inferences about trends in the use of the individual strategies.

The use of computers in science instruction is striking in its lack of change. Even in 2000, 10 percent or fewer of science lessons included students using computers. (See Table 4.2.) With one exception, there was also no change in the frequency of students doing hands-on/laboratory activities; grade 1–4 teachers were more likely in 2000 to report using this strategy at least weekly. (See Table 4.1.) However, Figure 4.1 shows that there was no increase between 1993 and 2000 in teachers’ report of using hands-on activities in their most recent lesson.

Table 4.1
Science Classes Where Teachers Report that Students Take Part in Various Instructional Activities at Least Once a Week, by Grade Range: 1993 and 2000

	Percent of Classes			
	1993		2000	
Grades 1–4				
Do hands-on/laboratory science activities	41	(2.6)	50*	(3.1)
Listen and take notes during presentation by teacher	25	(2.3)	17*	(1.7)
Prepare written science reports	8	(2.0)	4	(0.9)
Read from a science textbook in class	51	(3.6)	34*	(2.7)
Use computers as a tool ²⁸	38	(2.5)	6*	(1.3)
Watch a science demonstration ²⁸	30	(2.5)	30	(2.9)
Work in groups ²⁸	60	(3.5)	66	(2.9)
Grades 5–8				
Do hands-on/laboratory science activities	59	(2.3)	65	(2.7)
Listen and take notes during presentation by teacher	67	(2.3)	54*	(2.6)
Prepare written science reports	15	(2.1)	16	(2.0)
Read from a science textbook in class	55	(3.2)	46*	(3.2)
Use computers as a tool ²⁸	18	(2.0)	11*	(1.7)
Watch a science demonstration ²⁸	48	(3.1)	42	(3.3)
Work in groups ²⁸	74	(2.5)	80	(2.0)
Grades 9–12				
Do hands-on/laboratory science activities	67	(2.6)	71	(2.5)
Listen and take notes during presentation by teacher	93	(1.0)	86*	(1.4)
Prepare written science reports	25	(2.1)	24	(2.1)
Read from a science textbook in class	39	(2.2)	28*	(2.2)
Use computers as a tool ²⁸	4	(0.7)	16*	(2.2)
Watch a science demonstration ²⁸	53	(2.1)	43*	(2.0)
Work in groups ²⁸	74	(3.1)	80	(2.0)

* p < 0.05

Table 4.2
Science Classes Participating in Various Activities
in Most Recent Lesson, by Grade Range: 1993 and 2000

	Percent of Classes			
	1993		2000	
Grades 1-4				
Students completing textbook/workbook problems	58	(3.1)	47*	(2.7)
Students doing hands-on/laboratory activities	60	(2.7) ²⁹	59	(2.9)
Students reading about science	62	(2.6)	45*	(2.8)
Students using calculators	2	(0.8)	1	(0.6)
Student using computers	3	(0.6)	4	(0.9)
Students using other technologies	15	(2.2)	5*	(1.0)
Test or quiz	12	(1.7)	8	(1.6)
Grades 5-8				
Students completing textbook/workbook problems	59	(2.8)	50*	(3.0)
Students doing hands-on/laboratory activities	51	(3.5) ²⁹	50	(3.2)
Students reading about science	51	(3.4)	41*	(2.6)
Students using calculators	6	(1.5)	8	(1.4)
Student using computers	4	(0.9)	10*	(1.6)
Students using other technologies	19	(2.1)	9*	(1.4)
Test or quiz	13	(1.8)	11	(1.6)
Grades 9-12				
Students completing textbook/workbook problems	62	(2.3)	52*	(2.3)
Students doing hands-on/laboratory activities	44	(2.9) ²⁹	42	(2.2)
Students reading about science	39	(2.3)	26*	(2.2)
Students using calculators	28	(1.7)	27	(1.9)
Student using computers	4	(1.1)	7*	(1.0)
Students using other technologies	19	(2.2)	9*	(1.2)
Test or quiz	20	(1.9)	12*	(1.2)

* $p < 0.05$

Table 4.3
Average Percentage of Science Class Time Spent on
Different Types of Activities, by Grade Range: 1993 and 2000

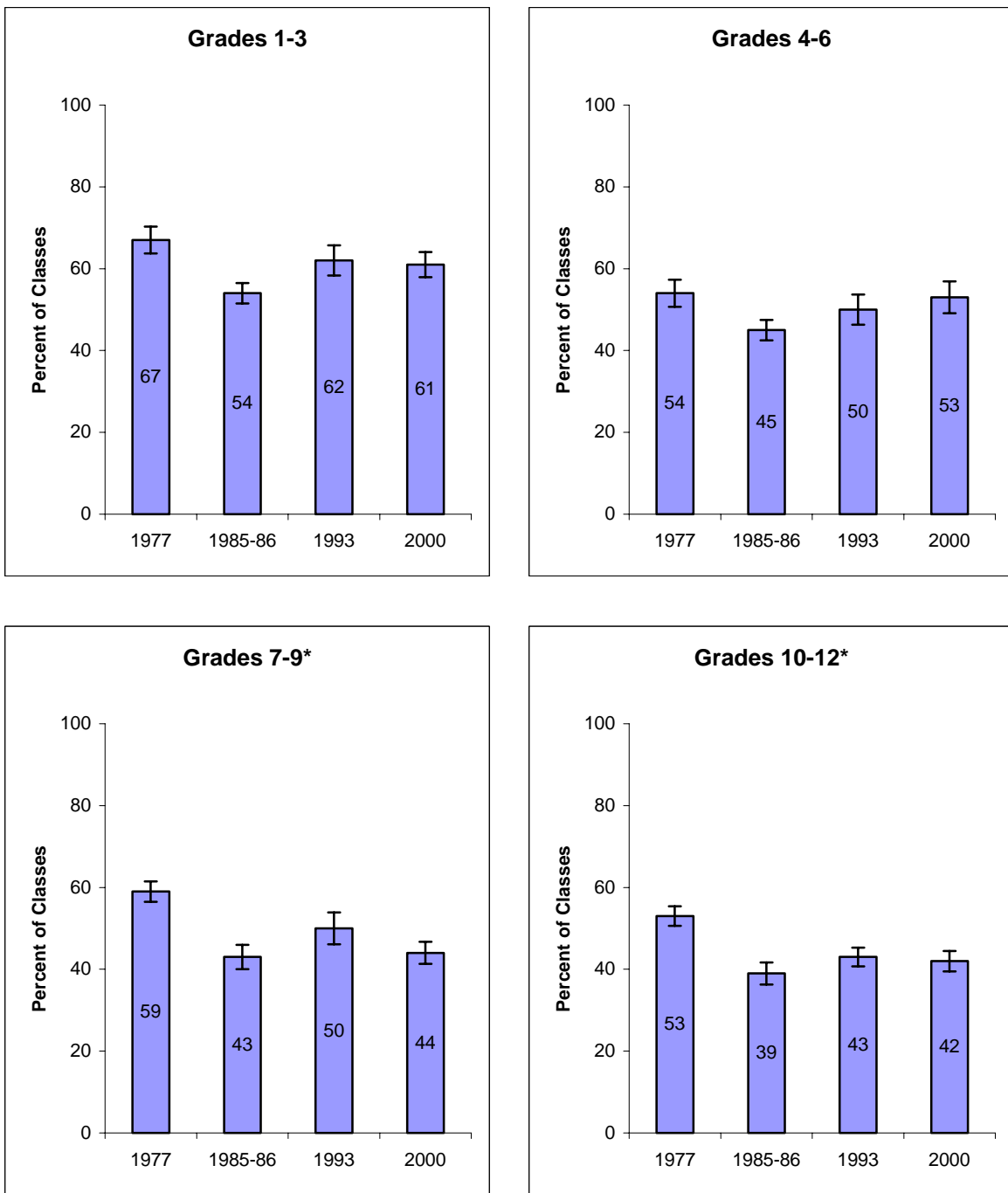
	Percent of Time			
	1993		2000	
Grades 1-4				
Daily routines, interruptions, and other non-instructional activities	8	(0.5)	10*	(0.6)
Whole class lecture/discussion	36	(1.2)	34	(1.1)
Individual students reading textbooks, completing worksheets, etc.	21	(0.8)	18*	(1.0)
Working with hands-on, manipulative, or laboratory materials	26	(1.5)	30*	(1.8)
Non-laboratory small group work	9	(0.7)	8	(0.9)
Grades 5-8				
Daily routines, interruptions, and other non-instructional activities	11	(0.5)	13	(1.2)
Whole class lecture/discussion	36	(1.1)	31*	(1.2)
Individual students reading textbooks, completing worksheets, etc.	18	(1.2)	19	(1.0)
Working with hands-on, manipulative, or laboratory materials	23	(1.2)	25	(1.6)
Non-laboratory small group work	12	(1.0)	11	(1.2)
Grades 9-12				
Daily routines, interruptions, and other non-instructional activities	11	(0.3)	13*	(0.4)
Whole class lecture/discussion	42	(1.3)	40	(1.2)
Individual students reading textbooks, completing worksheets, etc.	17	(0.7)	15	(1.0)
Working with hands-on, manipulative, or laboratory materials	21	(1.2)	22	(1.3)
Non-laboratory small group work	10	(1.2)	10	(0.8)

* $p < 0.05$

Table 4.4
Science Classes Including Whole Class Lecture/Discussion
in Most Recent Lesson, by Grade Range: 1993 and 2000

	Percent of Classes			
	1993 ³⁰		2000	
Grades 1-4	93	(1.2)	93	(1.6)
Grades 5-8	92	(2.1)	90	(2.5)
Grades 9-12	93	(1.3)	91	(1.3)

Science Classes Using Hands-On Activities in Most Recent Lesson



* Grades 7-9: 2000 ≠ 1977; Grades 10-12: 2000 ≠ 1977, $p < 0.05$

Figure 4.1

Data for mathematics instruction (Tables 4.5–4.7; Figure 4.2) indicate only a couple of substantial changes. Teachers in each grade range were less likely in 2000 to report that their students read about mathematics in the most recent lesson, a change most noticeable in grades 5–8, where the percentage decreased from 47 percent in 1993 to 26 percent in 2000 (Table 4.6).

The data on use of technology in mathematics instruction are mixed. In grades 9–12, teachers were more likely to report calculator or computer use on at least a weekly basis than in 1993, while grade 1–4 teachers were *less* likely to report use of these technologies on a weekly basis. (See Table 4.5.) This same pattern (an increase among grade 9–12 classes; a decrease among grade 1–4 classes) was also evident when teachers were asked if they used calculators in their most recent lesson. (See Table 4.6.) When asked about computer use, teachers reported that well under 10 percent of their most recent lessons in 2000 included computer use, unchanged from 1993. (See Table 4.6.)

There has been no change in the percentage of mathematics classes incorporating hands-on/manipulative activities since 1993 (Figure 4.2), and with the exception of an increase in grades 1–3, no difference from 1977 levels.

Table 4.5
Mathematics Classes Where Teachers Report that Students Take Part in Various Instructional Activities at Least Once a Week, by Grade Range: 1993 and 2000

	Percent of Classes			
	1993		2000	
Grades 1–4				
Listen and take notes during presentation by teacher	18	(1.5)	23	(2.4)
Work in groups ³¹	84	(2.5)	71*	(2.6)
Use calculators or computers to develop conceptual understanding ³¹	37	(2.1)	21*	(2.2)
Grades 5–8				
Listen and take notes during presentation by teacher	66	(2.5)	69	(3.1)
Work in groups ³¹	70	(2.8)	65	(2.4)
Use calculators or computers to develop conceptual understanding ³¹	39	(2.9)	44	(2.3)
Grades 9–12				
Listen and take notes during presentation by teacher	94	(1.4)	93	(1.2)
Work in groups ³¹	64	(2.3)	62	(2.1)
Use calculators or computers to develop conceptual understanding ³¹	40	(3.0)	61*	(2.0)

* $p < 0.05$

Table 4.6
Mathematics Classes Participating in Various Activities
in Most Recent Lesson, by Grade Range: 1993 and 2000

	Percent of Classes			
	1993		2000	
Grades 1–4				
Students completing textbook/worksheet problems	86	(1.9)	82	(2.3)
Students doing hands-on/ manipulative activities	73	(2.4) ³²	74	(2.2)
Student reading about mathematics	28	(2.9)	19*	(1.8)
Students using calculators	11	(1.5)	6*	(1.0)
Students using computers	9	(1.1)	7	(1.2)
Student using other technologies	16	(2.3)	3*	(0.6)
Test or quiz	12	(1.5)	14	(1.9)
Grades 5–8				
Students completing textbook/worksheet problems	87	(2.1)	80*	(1.8)
Students doing hands-on/ manipulative activities	38	(3.2) ³¹	36	(2.9)
Student reading about mathematics	47	(3.6)	26*	(2.0)
Students using calculators	37	(3.4)	39	(2.1)
Students using computers	6	(1.5)	5	(1.0)
Student using other technologies	13	(1.5)	4*	(0.9)
Test or quiz	14	(1.8)	15	(1.8)
Grades 9–12				
Students completing textbook/worksheet problems	84	(1.5)	81	(1.6)
Students doing hands-on/ manipulative activities	24	(2.1) ³¹	19	(1.5)
Student reading about mathematics	32	(2.3)	17*	(1.6)
Students using calculators	67	(1.6)	80*	(1.5)
Students using computers	2	(0.4)	3	(0.7)
Student using other technologies	7	(1.3)	1*	(0.2)
Test or quiz	17	(1.3)	15	(1.3)

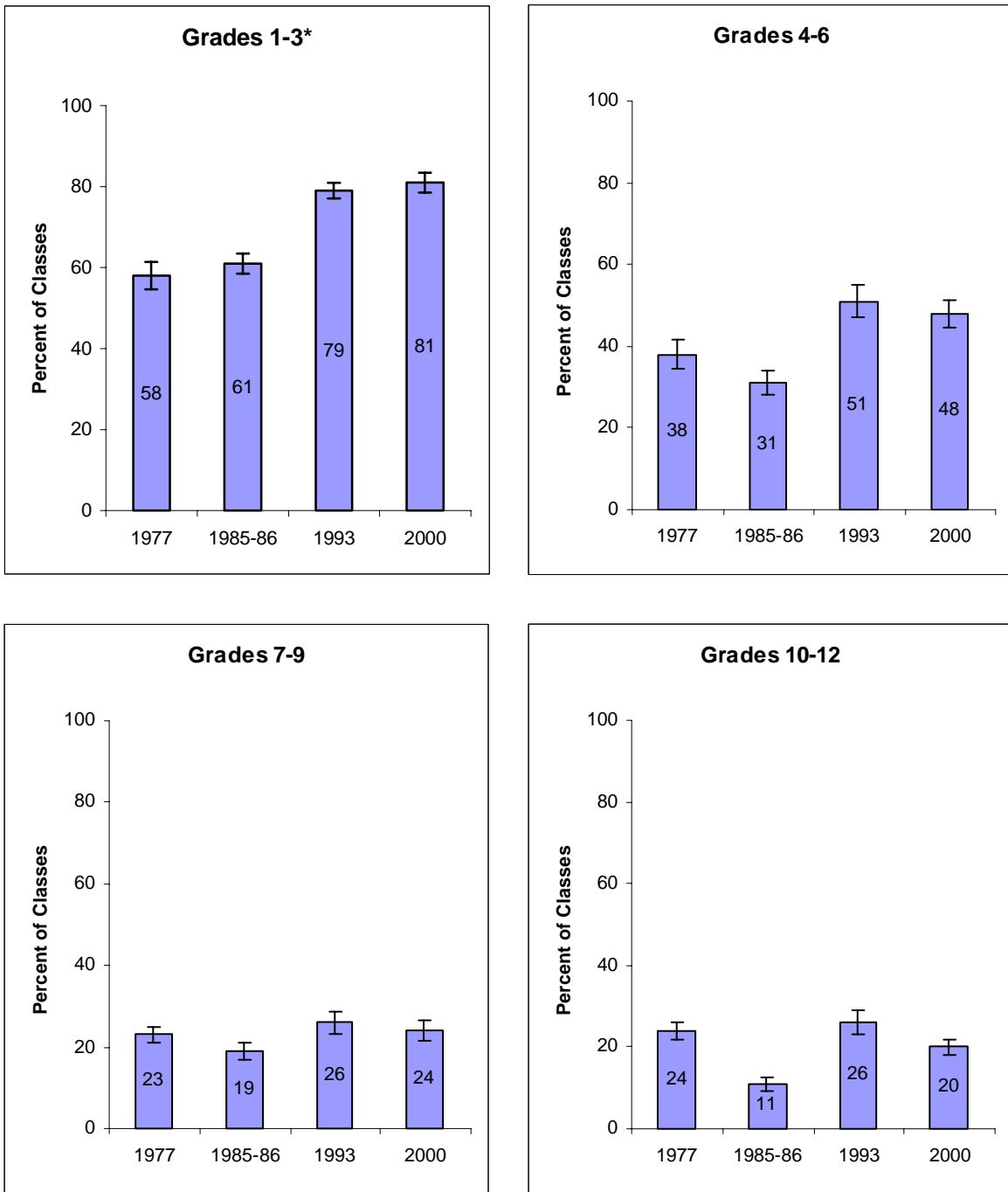
* p < 0.05

Table 4.7
Average Percentage of Mathematics Class Time Spent on
Different Types of Activities, by Grade Range: 1993 and 2000

	Percent of Time			
	1993		2000	
Grades 1–4				
Daily routines, interruptions, and other non-instructional activities	9	(0.6)	11*	(0.5)
Whole class lecture/discussion	26	(0.9)	29*	(0.8)
Individual students reading textbooks, completing worksheets, etc.	26	(0.6)	26	(1.0)
Working with hands-on or manipulative materials	29	(1.1)	26	(1.3)
Non-manipulative small group work	9	(0.7)	8	(0.9)
Grades 5–8				
Daily routines, interruptions, and other non-instructional activities	11	(0.5)	13*	(0.5)
Whole class lecture/discussion	37	(1.1)	38	(0.9)
Individual students reading textbooks, completing worksheets, etc.	26	(1.1)	26	(1.1)
Working with hands-on, manipulative, or laboratory materials	12	(0.9)	11	(1.0)
Non-laboratory small group work	15	(1.3)	11*	(0.9)
Grades 9–12				
Daily routines, interruptions, and other non-instructional activities	11	(0.3)	13*	(0.3)
Whole class lecture/discussion	48	(1.0)	45*	(0.9)
Individual students reading textbooks, completing worksheets, etc.	19	(0.8)	22*	(0.8)
Working with hands-on, manipulative, or laboratory materials	7	(0.9)	5*	(0.4)
Non-laboratory small group work	14	(0.6)	16*	(0.8)

* p < 0.05

Mathematics Classes Using Hands-On Activities in Most Recent Lesson



* Grades 1-3: 2000 ≠ 1977, $p < 0.05$

Figure 4.2