2012 National Survey of Science and Mathematics Education

Status of Middle School Science

September 2013

Aaron M. Weis

Horizon Research, Inc.
Chapel Hill, NC

Disclaimer

The *2012 National Survey of Science and Mathematics Education: Status of Middle School Science* was prepared with support from the National Science Foundation under grant number DRL-1008228. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

Suggested Citation

Weis, A. M. (2013). *2012 National Survey of Science and Mathematics Education: Status of middle school science.* Chapel Hill, NC: Horizon Research, Inc.

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

INTRODUCTION

The 2012 National Survey of Science and Mathematics Education was designed to provide up-to-date information and to identify trends in the areas of teacher background and experience, curriculum and instruction, and the availability and use of instructional resources. A total of 7,752 science and mathematics teachers in schools across the United States participated in this survey, a response rate of 77 percent. The research questions addressed by the study are:

1. To what extent do science and mathematics instruction and ongoing assessment mirror current understanding of learning?

2. What influences teachers' decisions about content and pedagogy?

3. What are the characteristics of the science/mathematics teaching force in terms of race, gender, age, content background, beliefs about teaching and learning, and perceptions of preparedness?

4. What are the most commonly used textbooks/programs, and how are they used?

5. What formal and informal opportunities do science/mathematics teachers have for ongoing development of their knowledge and skills?

6. How are resources for science/mathematics education, including well-prepared teachers and course offerings, distributed among schools in different types of communities and different socioeconomic levels?

The 2012 National Survey is based on a national probability sample of schools and science and mathematics teachers in grades K–12 in the 50 states and the District of Columbia. The sample was designed to allow national estimates of science and mathematics course offerings and enrollment; teacher background preparation; textbook usage; instructional techniques; and availability and use of science and mathematics facilities and equipment. Every eligible school and teacher in the target population had a known, positive probability of being drawn into the sample. This report describes the status of middle school (grades 6–8) science instruction based on the responses of 958 middle school teachers.[1]

Technical detail on the survey sample design, as well as data collection and analysis procedures, is included in the *Report of the 2012 National Survey of Science and Mathematics Education*.[2] The standard errors for the estimates presented in this report are included in parentheses in the tables. The narrative sections of the report generally point out only those differences that are substantial as well as statistically significant at the 0.05 level.

[1] A middle school science teacher is defined as someone whose randomly selected class was a grades 6–8 science course.

[2] Banilower, E. R., Smith, P. S., Weiss, I. R., Malzahn, K. A., Campbell, K. M., & Weis, A. M. (2013). *Report of the 2012 national survey of science and mathematics education.* Chapel Hill, NC: Horizon Research, Inc.

This status report of middle school science teaching is organized into major topical areas:

- Characteristics of the middle school science teaching force;
- Professional development of middle school science teachers;
- Middle school science classes offered;
- Middle school science instruction, in terms of time spent, objectives, and class activities;
- Resources available for middle school science instruction; and
- Factors affecting middle school science instruction.

CHARACTERISTICS OF THE MIDDLE SCHOOL SCIENCE TEACHING FORCE

General Demographics

Middle school science teachers are much more likely to be female than male (see Table 1), and the overwhelming majority are white. Judging by the age of middle school science teachers, it appears that as many as one-third may be nearing retirement in the next 10 years.

A third of middle school science teachers have five or fewer years of experience teaching science. Nearly 8 of 10 middle school science teachers teach a single subject (e.g., general science, life science, physical science) within science.

Table 1
Characteristics of the Middle School Science Teaching Force

	Percent of Teachers	
Sex		
Male	30	(2.1)
Female	70	(2.1)
Race		
White	90	(1.4)
Black or African American	6	(1.2)
Hispanic or Latino	5	(1.0)
Asian	2	(0.8)
American Indian or Alaska Native	0	(0.2)
Native Hawaiian or Other Pacific Islander	0	(0.1)
Two or more races	1	(0.3)
Age		
≤ 30	11	(1.0)
31–40	28	(2.2)
41–50	28	(2.1)
51–60	26	(2.5)
61+	7	(1.5)
Experience Teaching Science at the K–12 Level		
0–2 years	14	(1.7)
3–5 years	19	(1.9)
6–10 years	26	(2.6)
11–20 years	26	(2.1)
≥ 21 years	16	(2.4)
Number of Science Subjects Taught		
1	78	(2.0)
2	17	(1.9)
3 or more	4	(1.0)

The majority of middle school science teachers earned their college degree in areas other than science/engineering or science education; as can be seen in Table 2, about 40 percent of middle school science teachers have a degree in science/engineering or science education. The vast majority have had formal preparation for teaching leading to a teacher credential, with roughly half receiving their teaching credential as part of their undergraduate degree and the other half through a master's or post-baccalaureate program (see Table 3).

Table 2
Middle School Science Teacher Degrees

	Percent of Teachers	
Science/Engineering	25	(2.0)
Science Education	27	(1.9)
Science/Engineering or Science Education	41	(2.5)

Table 3
Middle School Science Teachers' Paths to Certification

	Percent of Teachers
An undergraduate program leading to a bachelor's degree and a teaching credential	47 (3.6)
A master's program that also awarded a teaching credential	26 (3.1)
A post-baccalaureate credentialing program (no master's degree awarded)	23 (2.5)
No formal teacher preparation	4 (1.5)

Content Preparedness

Some middle school science teachers teach classes focused on a single discipline (e.g., physical science). Others teach general or integrated science classes. Clearly, the two types of classes place different demands on teachers' content knowledge. Among those who teach discipline-specific courses, the vast majority of middle school science teachers do not have a science degree in the science discipline they teach (see Table 4). However, the majority of those who teach life science either hold a degree in the field or have taken three or more advanced courses in that field. Nearly two-thirds of those teaching Earth science have not taken any college Earth science courses beyond the introductory level.

Table 4
Middle School Teachers of
Discipline-Specific Classes with Different Backgrounds in Subject†

	Percent of Teachers			
	Degree in Field	No Degree in Field, but 3+ Courses beyond Introductory	No Degree in Field, but 1–2 Courses beyond Introductory	No Degree in Field or Courses beyond Introductory
Life science	27 (4.1)	31 (4.3)	21 (4.3)	21 (3.9)
Earth science	10 (2.7)	16 (2.9)	10 (3.6)	65 (5.1)
Physical science	7 (3.5)	24 (3.9)	28 (5.0)	42 (5.8)

† Teachers assigned to teach classes in more than one subject area are included in each category.

Teachers of general/integrated science are typically responsible for instruction across science disciplines. Accordingly, the National Science Teachers Association (NSTA) has recommended coursework in both chemistry and physics, as well as in the life and Earth sciences for these teachers. Forty-five percent of middle grades teachers assigned to classes in general and/or integrated science meet that standard, and another 28 percent have had coursework in 3 of the 4 areas (see Table 5).

Table 5
Middle School Teachers of General/Integrated Science Meeting NSTA Course-Background Standards

	Percent of Teachers	
Coursework in life science, Earth science, physics, and chemistry	45	(2.4)
Three of four recommended courses	28	(2.3)
Two of four recommended courses	22	(2.4)
One of four recommended courses	5	(0.9)
None of four recommended courses	1	(0.7)

As can be seen in Table 6, the large majority of middle school science teachers have had college coursework in science education and a student teaching experience that included science. A majority have also had coursework in one or more of the natural sciences, though typically only introductory courses. Very few have had coursework in engineering.

Table 6
Middle School Science Teachers Completing Various College Courses

	Percent of Teachers[†]	
Science Education	90	(1.7)
Student teaching in science	72	(2.3)
Biology/Life Science		
Introductory	96	(0.9)
Advanced	65	(2.6)
Earth/Space Science		
Introductory	75	(2.3)
Advanced	28	(1.9)
Chemistry		
Introductory	72	(2.3)
Advanced	35	(2.3)
Physics		
Introductory	61	(2.3)
Advanced	15	(1.5)
Environmental Science		
Introductory	57	(2.6)
Advanced	23	(1.7)
Engineering	7	(1.1)

[†] The percentage of teachers taking any college course in each of the natural sciences is the same as that taking an introductory course.

The survey also asked middle school science teachers to rate how well prepared they feel to teach each of a number of topics related to their randomly selected course. Approximately half of the middle school science teachers that teach chemistry feel very well prepared to teach about states, classes, and properties of matter; elements, compounds, and mixtures; the periodic table; and atomic structure (see Table 7). Roughly half of middle school teachers of biology/life science feel very well prepared to teach about structures and functions of organisms and cell biology.

Very few middle school science teachers feel very well prepared to teach engineering concepts. This finding is not surprising given that the vast majority have not had college coursework in

engineering (see Table 5), and engineering has not traditionally been part of the school curriculum. As the *Next Generation Science Standards* include engineering concepts for K–12, there will likely be a need for a major professional development effort focused on engineering.

Table 7
Middle School Science Teacher Preparedness to Teach Each of a Number of Topics

	Percent of Teachers[†]							
	Not Adequately Prepared		Somewhat Prepared		Fairly Well Prepared		Very Well Prepared	
Biology/Life Science								
Structures and functions of organisms	5	(1.4)	11	(2.0)	32	(2.5)	52	(3.1)
Cell biology	7	(1.8)	13	(1.8)	31	(2.8)	49	(2.6)
Ecology/ecosystems	3	(1.3)	16	(2.0)	33	(2.6)	48	(2.6)
Genetics	8	(1.5)	20	(2.6)	31	(2.2)	41	(2.5)
Evolution	13	(2.2)	23	(2.2)	32	(2.4)	33	(2.5)
Earth/Space Science								
Earth's features and physical processes	2	(0.4)	9	(1.7)	38	(2.6)	51	(2.9)
Climate and weather	6	(1.1)	16	(2.5)	36	(2.6)	42	(3.0)
The solar system and the universe	6	(0.9)	19	(2.6)	39	(3.0)	36	(2.6)
Chemistry								
States, classes, and properties of matter	3	(0.6)	8	(1.4)	32	(2.5)	58	(2.5)
Elements, compounds, and mixtures	6	(1.1)	16	(2.8)	26	(2.5)	53	(2.6)
The periodic table	5	(0.9)	16	(2.4)	30	(2.5)	49	(2.3)
Atomic structure	10	(1.9)	17	(2.4)	29	(2.2)	45	(2.4)
Properties of solutions	7	(1.3)	23	(2.4)	36	(2.6)	33	(2.3)
Chemical bonding, equations, nomenclature, and reactions	18	(2.4)	23	(2.3)	28	(2.6)	31	(2.0)
Physics								
Forces and motion	3	(0.6)	20	(2.7)	34	(2.7)	42	(2.7)
Energy transfers, transformations, and conservation	6	(1.4)	21	(2.5)	36	(2.5)	37	(2.6)
Properties and behaviors of waves	9	(1.3)	32	(2.6)	37	(2.8)	23	(2.5)
Electricity and magnetism	9	(1.4)	35	(2.7)	33	(2.6)	23	(2.5)
Modern physics (for example: special relativity)	37	(2.8)	39	(3.0)	19	(1.7)	5	(1.3)
Other								
Environmental and resource issues (e.g., land and water use, energy resources and consumption, sources and impacts of pollution)	5	(1.4)	28	(3.4)	33	(3.0)	35	(3.0)
Engineering (e.g., nature of engineering and technology, design processes, analyzing and improving technological systems, interactions between technology and society)	42	(2.2)	36	(2.4)	16	(1.6)	6	(1.0)

[†] Each teacher was asked about one set of science topics based on the discipline of his/her randomly selected class, and all were asked about engineering.

Data from items asking teachers how well prepared they feel to teach the content of a randomly selected course were combined into a composite variable called Perceptions of Preparedness to Teach Science Content.[3] As can be seen in Table 8, middle school science teachers of Earth and

[3] The body of this report includes data on selected composite variables. Data for all composite variables are available in the Appendix.

life science feel slightly better prepared to teach their subject than teachers of general/integrated science, perhaps because general/integrated science teachers need to cover a broader range of topics.

Table 8
Middle School Science Teacher Mean Scores for the Perceptions of Preparedness to Teach Science Content† Composite

	Mean Score	
Earth Science	78	(2.8)
Life Science	75	(3.5)
Physical Science	69	(3.5)
General or Integrated Science	66	(1.1)

† Composite score is based on the content of each teacher's randomly selected class.

Pedagogical Beliefs

Teachers were asked about their beliefs regarding effective teaching and learning in science. As can be seen in Table 9, middle school science teachers hold a number of views that are in alignment with what is known about effective science instruction. For example, a large majority of middle school science teachers agree that: (1) most class periods should provide opportunities for students to share their thinking and reasoning, (2) most class periods should conclude with a summary of the key ideas addressed, (3) students should be provided with the purpose for a lesson as it begins, (4) most class periods should include some review of previously covered ideas and skills, and (5) it is better for science instruction to focus on ideas in depth, even if that means covering fewer topics.

However, many middle school science teachers also hold views that are inconsistent with effective science instruction. More than three-quarters of middle school science teachers agree that students should be provided with definitions for new vocabulary at the beginning of instruction on a science idea; about half believe that students learn best in classes with students of similar abilities. In addition, a substantial portion agree that hands-on/laboratory activities should be used primarily to reinforce a science idea that the students have already learned, and that teachers should explain an idea to students before having them consider evidence that relates to the idea.

Table 9
Middle School Science Teachers Agreeing† with Various Statements about Teaching and Learning

	Percent of Teachers	
Most class periods should provide opportunities for students to share their thinking and reasoning	95	(1.1)
Most class periods should conclude with a summary of the key ideas addressed	93	(1.1)
Students should be provided with the purpose for a lesson as it begins	90	(1.3)
Inadequacies in students' science background can be overcome by effective teaching	89	(1.9)
Most class periods should include some review of previously covered ideas and skills	89	(1.5)
At the beginning of instruction on a science idea, students should be provided with definitions for new scientific vocabulary that will be used	78	(2.1)
It is better for science instruction to focus on ideas in depth, even if that means covering fewer topics	77	(1.9)
Hands-on/laboratory activities should be used primarily to reinforce a science idea that the students have already learned	57	(2.8)
Students learn science best in classes with students of similar abilities	48	(2.3)
Teachers should explain an idea to students before having them consider evidence that relates to the idea	41	(2.3)
Students should be assigned homework most days	33	(2.4)

† Includes teachers indicating "strongly agree" or "agree" on a 5-point scale ranging from 1 "strongly disagree" to 5 "strongly agree."

Pedagogical Preparedness

The survey asked teachers two series of items focused on their preparedness for a number of tasks associated with instruction. First, they were asked how well prepared they feel to address diverse learners in their instruction. Second, they were asked how well prepared they feel to monitor and address student understanding, focusing on a specific unit in the randomly selected class.

As can be seen in Table 10, the vast majority of middle school science teachers feel very well prepared to: (1) manage classroom discipline, (2) encourage the participation of females in science/engineering, (3) encourage students' interest in science/engineering, (4) encourage participation of students from low socioeconomic backgrounds in science and/or engineering, and (5) plan instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity. In addition, about three-quarters of middle school science teachers feel very well prepared to encourage participation of racial or ethnic minorities in science and/or engineering. Although 80 percent of middle school science teachers feel very well prepared to plan instruction for students at different level of achievement, fewer feel very well prepared to teach students with special needs (e.g., students with disabilities, English-language learners).

Table 10
Middle School Science Teachers Considering
Themselves Very Well Prepared for Each of a Number of Tasks

	Percent of Teachers	
Manage classroom discipline	95	(1.8)
Encourage participation of females in science and/or engineering	87	(2.1)
Encourage students' interest in science and/or engineering	86	(3.1)
Encourage participation of students from low socioeconomic backgrounds in science and/or engineering	85	(1.9)
Plan instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity	80	(3.1)
Encourage participation of racial or ethnic minorities in science and/or engineering	76	(2.9)
Teach science to students who have learning disabilities	65	(3.5)
Provide enrichment experiences for gifted students	64	(4.2)
Teach science to students who have physical disabilities	55	(3.6)
Teach science to English-language learners	37	(3.2)

Table 11 shows the percentage of classes taught by teachers who feel very well prepared for each of a number of tasks related to instruction. In the majority of middle school science classes, teachers feel very well prepared to assess student understanding at the end of a unit, implement their designated textbook, and monitor student understanding during instruction. Teachers feel very well prepared to elicit students' initial ideas or anticipate student difficulties in less than half of middle school science classes.

Table 11
Middle School Science Classes in which Teachers Feel
Very Well Prepared for Each of a Number of Tasks in the Most Recent Unit

	Percent of Classes	
Assess student understanding at the conclusion of this unit	60	(2.4)
Implement the science textbook/module to be used during this unit[†]	52	(3.8)
Monitor student understanding during this unit	52	(2.2)
Find out what students thought or already knew about the key science ideas	42	(2.4)
Anticipate difficulties that students may have with particular science ideas and procedures in this unit	39	(2.2)

[†] This item was presented only to teachers who indicated using commercially published textbooks/modules in the most recent unit.

PROFESSIONAL DEVELOPMENT OF MIDDLE SCHOOL SCIENCE TEACHERS

One important measure of teachers' continuing education is how long it has been since they participated in professional development. As can be seen in Table 12, over 80 percent of middle school science teachers have participated in science-focused professional development (i.e., focused on science content or the teaching of science) in the last three years.

Table 12
Middle School Science Teachers' Most Recent Participation in Science-Focused† Professional Development

	Percent of Teachers	
In the last 3 years	82	(2.3)
4–6 years ago	6	(1.2)
7–10 years ago	3	(1.0)
More than 10 years ago	4	(1.3)
Never	5	(1.4)

† Includes professional development focused on science or science teaching.

However, middle school science teachers report low levels of participation in professional development specific to science teaching. Only about a quarter of middle school science teachers have spent more than 35 hours in science-related professional development in the last three years (see Table 13).

Table 13
Time Spent on Professional Development in the Last Three Years

	Percent of Teachers	
Less than 6 hours	30	(2.6)
6–15 hours	24	(2.0)
16–35 hours	19	(2.0)
More than 35 hours	27	(2.0)

As to how this time is spent, the workshop is the most common form of professional development, with 91 percent of middle school science teachers having attended one in the previous three years (see Table 14). Three-fourths of middle school science teachers have participated in a professional learning community or other type of teacher study group.

Table 14
Middle School Science Teachers Participating in Various Professional Development Activities in the Last Three Years

	Percent of Teachers	
Attended a workshop on science or science teaching	91	(1.7)
Participated in a professional learning community/lesson study/teacher study group focused on science or science teaching	75	(2.4)
Received feedback about your science teaching from a mentor/coach formally assigned by the school/district/diocese†	47	(3.5)
Attended a national, state, or regional science teacher association meeting	36	(2.8)

† This item was asked of all teachers whether or not they had participated in professional development in the last three years.

The emerging consensus about effective professional development suggests that teachers need opportunities to work with colleagues who face similar challenges, including other teachers from their school and those who have similar teaching assignments. Other recommendations include

engaging teachers in investigations, both to learn disciplinary content and to experience inquiry-oriented learning; to examine student work and other classroom artifacts for evidence of what students do and do not understand; and to apply what they have learned in their classrooms and subsequently discuss how it went.[4] Accordingly, teachers who had participated in professional development in the last three years were asked a series of additional questions about the nature of those experiences.

As can be seen in Table 15, more than half of middle school science teachers have had substantial opportunity to work closely with other teachers from their school or who teach the same subject. Less than half have had opportunities to examine classroom artifacts as part of their professional development.

Table 15
Middle School Science Teachers Whose Professional Development in the Last Three Years Had Each of a Number of Characteristics to a Substantial Extent†

	Percent of Teachers	
Worked closely with other science teachers from your school	61	(3.4)
Worked closely with other science teachers who taught the same grade and/or subject whether or not they were from your school	53	(3.9)
Had opportunities to engage in science investigations	51	(3.0)
Had opportunities to try out what you learned in your classroom and then talk about it as part of the professional development	50	(4.4)
Had opportunities to examine classroom artifacts (e.g., student work samples)	40	(3.4)
The professional development was a waste of time	5	(1.1)

† Includes teachers indicating 4 or 5 on a 5-point scale ranging from 1 "Not at all" to 5 "To a great extent."

College courses have the potential to address content in more depth than may be possible in other professional development venues, such as workshops. As another indicator of the extent to which teachers are staying current in their field, the 2012 National Survey asked teachers when they had last taken a formal course for college credit in both science and how to teach science. As can be seen in Table 16, 40 percent of middle school science teachers have not taken a course for college credit in either science or the teaching of science in the last 10 years.

[4] Elmore, R. F. (2002). *Bridging the gap between standards and achievement: The imperative for professional development in education.* Washington, DC: Albert Shanker Institute.

Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal, 38*(4), 915–945.

Table 16
Middle School Science Teachers' Most Recent College Coursework

	Percent of Teachers	
Science		
In the last 3 years	22	(2.4)
4–6 years ago	15	(1.4)
7–10 years ago	19	(2.1)
More than 10 years ago	44	(2.7)
Never	1	(0.4)
The Teaching of Science		
In the last 3 years	21	(2.1)
4–6 years ago	14	(1.5)
7–10 years ago	16	(1.8)
More than 10 years ago	38	(2.6)
Never	11	(1.7)
Science or the Teaching of Science		
In the last 3 years	27	(2.6)
4–6 years ago	16	(1.7)
7–10 years ago	17	(2.0)
More than 10 years ago	39	(2.8)
Never	1	(0.5)

Another series of items asked about the focus of the opportunities teachers had to learn about content and the teaching of that content in the last three years, whether through professional development or college coursework. Nearly two-thirds of middle school science teachers have had professional growth opportunities that gave heavy emphasis to planning instruction so students at different levels of achievement can increase their understanding of targeted ideas (see Table 17). About half have had professional growth opportunities that gave heavy emphasis to assessment, at the beginning, during, or at the conclusion of instruction on a topic. Relatively few middle school science teachers have had professional development with a heavy emphasis on providing alternative experiences for students with special needs or teaching science to English-language learners.

Table 17
Middle School Science Teachers Reporting that their Professional Development/ Coursework in the Last Three Years Gave Heavy Emphasis† to Various Areas

	Percent of Teachers	
Planning instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity	64	(3.5)
Assessing student understanding at the conclusion of instruction on a topic	54	(3.6)
Monitoring student understanding during science instruction	54	(3.3)
Deepening your own science content knowledge	51	(4.0)
Finding out what students think or already know about the key science ideas prior to instruction on those ideas	46	(3.8)
Learning about difficulties that students may have with particular science ideas and procedures	42	(3.1)
Implementing the science textbook/module to be used in your classroom	30	(2.9)
Providing enrichment experiences for gifted students	30	(3.0)
Providing alternative science learning experiences for students with special needs	26	(2.7)
Teaching science to English-language learners	18	(2.4)

† Includes teachers responding 4 or 5 on a 5-point scale ranging from 1 "Not at all" to 5 "To a great extent."

In addition to asking teachers about their involvement as participants in professional development, the survey asked teachers whether they had served in various leadership roles in the profession in the last three years. As can be seen in Table 18, about a quarter of middle school science teachers have supervised a student teacher. Fewer than 1 in 5 led a teacher study group or workshop, or served as a mentor/coach.

Table 18
Middle School Science Teachers Serving in Various Leadership Roles in the Last Three Years

	Percent of Teachers	
Supervised a student teacher	24	(2.4)
Led a teacher study group focused on science teaching	19	(2.5)
Served as a formally assigned mentor/coach for science teaching	17	(2.2)
Taught in-service workshops on science or science teaching	15	(2.1)

MIDDLE SCHOOL SCIENCE CLASSES OFFERED

Middle schools were asked whether they offered single-discipline science courses (e.g., life science, physical science), coordinated/integrated science courses, or both in each grade 6–8 contained in the school. As can be seen in Table 19, single-discipline courses are slightly less common than coordinated/integrated science courses in 6th grade; this pattern is reversed in grades 7 and 8.

Table 19
Type of Middle School Science Courses Offered

	Percent of Schools†		
	6th Grade	7th Grade	8th Grade
Single-discipline science courses (e.g., life science)	36 (3.6)	46 (3.8)	47 (3.8)
Coordinated or Integrated science courses	45 (4.1)	38 (3.7)	36 (3.7)
Both single-discipline and coordinated or integrated science courses	19 (3.5)	15 (3.6)	18 (3.5)

† Includes all schools containing the specified grade.

The typical middle school science class has approximately 24 students; two-thirds of the classes have between 17 and 29 students. Demographic data for middle school science students are shown Table 20.

Table 20
Demographics of Students in Middle School Science Courses

	Percent of Students
Sex	
Male	54 (0.7)
Female	46 (0.7)
Race/Ethnicity	
White	59 (1.8)
Black or African American	16 (1.2)
Hispanic or Latino	16 (1.1)
Asian	4 (0.7)
American Indian or Alaska Native	1 (0.2)
Native Hawaiian or Other Pacific Islander	1 (0.2)
Two or more races	3 (0.4)

Nearly 40 percent of middle school science classes are heterogeneously grouped, containing students with a mixture of prior achievement levels; the remaining classes are grouped by prior-achievement level of the students (see Table 21). Although the question was asked slightly differently on the 2000 National Survey, these data indicate a substantial increase in the use of tracking in middle school science classes. This phenomenon may be a result of increased tracking in mathematics (likely due to the push to increase Algebra 1 enrollment at the middle school level).

Table 21
Prior-Achievement Grouping in Middle School Science Classes

	Percent of Classes
Mostly low achievers	14 (1.9)
Mostly average achievers	33 (2.1)
Mostly high achievers	13 (1.6)
A mixture of levels	39 (2.3)

MIDDLE SCHOOL SCIENCE INSTRUCTION

The next three sections draw on teachers' descriptions of what transpires in middle school science classrooms, in terms of teachers' autonomy for making decisions regarding the content and pedagogy of their classes, instructional objectives, and class activities.

Teachers' Perceptions of Their Decision Making Autonomy

Teachers were asked the extent to which they have control over a number of curriculum and instruction decisions for their classes. In a majority of middle school science classes, teachers perceive themselves as having strong control over pedagogical decisions such as determining the amount of homework to be assigned, selecting teaching techniques, and choosing criteria for grading student performance (see Table 22). In fewer classes, teachers perceive themselves as having strong control in determining course goals and objectives, selecting what content/skills to teach, and selecting textbooks/modules.

Table 22
Middle School Science Classes in which Teachers Report Having Strong Control Over Various Curriculum and Instruction Decisions

	Percent of Classes
Determining the amount of homework to be assigned	75 (3.3)
Selecting teaching techniques	66 (3.7)
Choosing criteria for grading student performance	59 (3.5)
Determining course goals and objectives	20 (2.9)
Selecting content, topics, and skills to be taught	20 (2.9)
Selecting textbooks/modules	14 (2.7)

These items were combined into two composite variables: Curriculum Control and Pedagogical Control. The scores on the composites show that teachers of middle school science classes have much more control over how they teach their class compared to their control over what curriculum is used in their classroom (see Table 23).

Table 23
Middle School Science Class Mean Scores for Curriculum Control and Pedagogical Control Composites

	Mean Score
Pedagogical Control	88 (1.3)
Curriculum Control	45 (2.2)

Instructional Objectives

Teachers were given a list of potential objectives and asked to rate each in terms of the emphasis they receive in the randomly selected class. As can be seen in Table 24, a large majority of middle school science classes are likely to have a heavy emphasis on deepening students' conceptual understanding and are unlikely to emphasize memorization of vocabulary/facts or

learning test taking skills. About half of middle school science classes have a heavy emphasis on increasing students' interest in science, learning science process skills, and understanding of real-life applications of science. Teachers in 40 percent of classes report a heavy emphasis on preparing students for further study in science.

Table 24
Middle School Science Classes with
Heavy Emphasis on Various Instructional Objectives

	Percent of Classes
Understanding science concepts	80 (2.1)
Increasing students' interest in science	57 (2.2)
Learning science process skills (e.g., observing, measuring)	54 (2.2)
Learning about real-life applications of science	45 (2.3)
Preparing for further study in science	40 (2.0)
Learning test taking skills/strategies	24 (1.7)
Memorizing science vocabulary and/or facts	11 (1.4)

Class Activities

The 2012 National Survey included several items that provide information about how science is taught at the middle school level. 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. As can be seen in Table 25, the vast majority of middle school science classes include the teacher explaining science ideas, whole class discussions, and students working in small groups on a weekly basis. About 3 in 5 classes require students to supply evidence in support of their claims and engage students in hands-on/laboratory activities at least once a week. It is interesting that fewer than half of middle school science classes have students write reflections on what they are learning, given what is known from research on learning about the importance of reflection.

Table 25
Middle School Science Classes in which Teachers Report Using Various Activities at Least Once a Week

	Percent of Classes	
Explain science ideas to the whole class	96	(0.9)
Engage the whole class in discussions	92	(1.0)
Have students work in small groups	79	(1.9)
Require students to supply evidence in support of their claims	63	(2.3)
Do hands-on/laboratory activities	62	(2.4)
Have students read from a science textbook, module, or other science-related material in class, either aloud or to themselves	57	(2.3)
Have students represent and/or analyze data using tables, charts, or graphs	54	(1.8)
Focus on literacy skills (e.g., informational reading or writing strategies)	44	(2.3)
Give tests and/or quizzes that are predominantly short-answer (e.g., multiple choice, true/false, fill in the blank)	44	(2.4)
Have students write their reflections (e.g., in their journals) in class or for homework	44	(2.2)
Give tests and/or quizzes that include constructed-response/open-ended items	36	(2.2)
Engage the class in project-based learning (PBL) activities	23	(1.9)
Have students practice for standardized tests	23	(1.9)
Have students make formal presentations to the rest of the class (e.g., on individual or group projects)	10	(1.4)
Have students attend presentations by guest speakers focused on science and/or engineering in the workplace	3	(0.8)

Overall, middle school science classes do not appear to utilize instructional technology to a great extent. As can be seen in Table 26, only 32 percent of middle school science classes use the Internet, and 23 percent use personal computers weekly. Less than 10 percent of classes use a classroom response system, hand-held computers, probes for collecting data, or graphing calculators at least once a week.

Table 26
Middle School Science Classes in which Teachers Report that Students Use Various Instructional Technologies at Least Once a Week

	Percent of Classes	
Internet	32	(2.7)
Personal computers, including laptops	23	(2.2)
Classroom response system or "Clickers"	6	(1.0)
Hand-held computers	4	(1.2)
Graphing calculators	2	(0.5)
Probes for collecting data	2	(0.6)

In addition to asking about class activities in the course as a whole, the 2012 National Survey asked teachers about activities that took place during their most recent science lesson in the randomly selected class. Roughly 9 in 10 middle school science classes include the teacher explaining a science idea to the whole class in the most recent lesson (see Table 27). Whole class discussion occurs in about three-quarters of lessons, and students completing textbook/ worksheet problems, reading about science, and doing hands-on activities occur in about half of middle school science lessons.

Table 27
Middle School Science Classes Participating in Various Activities in the Most Recent Lesson

	Percent of Classes	
Teacher explaining a science idea to the whole class	89	(1.4)
Whole class discussion	77	(1.8)
Students completing textbook/worksheet problems	51	(2.2)
Students reading about science	51	(2.2)
Students doing hands-on/laboratory activities	49	(2.2)
Teacher conducting a demonstration while students watched	32	(2.4)
Students using instructional technology	30	(2.1)
Test or quiz	22	(2.0)
Practicing for standardized tests	9	(1.2)

The survey also asked teachers to estimate the time spent on each of a number of types of activities in this most recent science lesson. An average of 40 percent of class time is spent on whole class activities, 31 percent on small group work, and 20 percent on students working individually (see Table 28). Non-instructional activities, including attendance taking and interruptions, account for 10 percent of science class time.

Table 28
Average Percentage of Time Spent on Different Activities in the Most Recent Middle School Science Lesson

	Average Percent of Class Time	
Whole class activities (e.g., lectures, explanations, discussions)	40	(0.9)
Small group work	31	(1.2)
Students working individually (e.g., reading textbooks, completing worksheets, taking a test or quiz)	20	(0.9)
Non-instructional activities (e.g., attendance taking, interruptions)	10	(0.3)

Homework and Assessment Practices

Teachers were asked about the amount of homework assigned per week in the randomly selected class. As can be seen in Table 29, the vast majority of middle school science classes assign 60 minutes or fewer of homework per week.

Table 29
Amount of Homework Assigned in Middle School Science Classes per Week

	Percent of Classes	
Fewer than 15 minutes per week	22	(2.2)
15–30 minutes per week	29	(2.7)
31–60 minutes per week	30	(2.6)
61–90 minutes per week	14	(2.1)
91–120 minutes per week	3	(0.8)
More than 120 minutes per week	2	(1.6)

Teachers were also given a list of ways that they might assess student progress and asked to describe which practices they used in the most recently completed unit in the randomly selected class. The vast majority of middle school science classes included informal assessment practices during the unit to see if students were "getting it" (see Table 30). For example, 95 percent of middle school science classes involved the teacher questioning students during activities to monitor understanding. Using whole class informal assessments such as "thumbs up/thumbs down" was another common practice, which occurred in 87 percent of classes.

In addition, the use of formal assessment techniques such as grading student work, quizzes, and tests, as well as reviewing the correct answers to assignments were also prevalent features of science units. Administering a test or quiz to assign grades and assigning grades to student work each occurred in 90 percent or more of classes. Probing student thinking at the beginning of a unit was included in 63 percent of middle school science classes.

Table 30
Middle School Science Classes in which Teachers Report Assessing Students Using Various Methods in the Most Recent Unit

	Percent of Classes	
Questioned individual students during class activities to see if they were "getting it"	95	(1.4)
Reviewed student work (e.g., homework, notebooks, journals, portfolios, projects) to see if they were "getting it"	95	(0.9)
Assigned grades to student work (e.g., homework, notebooks, journals, portfolios, projects)	94	(0.9)
Administered one or more quizzes and/or tests to assign grades	90	(1.5)
Went over the correct answers to assignments, quizzes, and/or tests with the class as a whole	89	(1.7)
Used information from informal assessments of the entire class (e.g., asking for a show of hands, thumbs up/thumbs down, clickers, exit tickets) to see if students were "getting it"	87	(1.8)
Administered one or more quizzes and/or tests to see if students were "getting it"	82	(1.7)
Administered an assessment, task, or probe at the beginning of the unit to find out what students thought or already knew about the key science ideas	63	(2.1)
Had students use rubrics to examine their own or their classmates' work	28	(2.0)

The survey asked how often students in the randomly selected class were required to take assessments the teachers did not develop, such as state or district benchmark assessments. More than three-quarters of classes are required to take such an assessment at least once a year (see Table 31).

Table 31
Frequency of Required External Testing in Middle School Science Classes

	Percent of Classes
Never	22 (1.7)
Once a year	27 (2.2)
Twice a year	13 (1.8)
Three or four times a year	23 (1.9)
Five or more times a year	15 (1.4)

RESOURCES AVAILABLE FOR MIDDLE SCHOOL SCIENCE INSTRUCTION

Instructional Materials

The 2012 National Survey collected data on the use of instructional materials in science classes. As can be seen in Table 32, 4 out of 5 middle school science classes use commercially published materials. The survey also asked if one material is used all or most of the time, or if multiple materials are used; only about one-third of middle school science classes use a single textbook.

Table 32
Instructional Materials Used in Middle School Science Classes

	Percent of Classes
Mainly commercially published textbook(s)	
One textbook	34 (2.3)
Multiple textbooks	12 (1.3)
Mainly commercially published modules	
Modules from a single publisher	11 (1.8)
Modules from multiple publishers	3 (0.6)
Other	
A roughly equal mix of commercially published textbooks and commercially published modules most of the time	20 (2.0)
Non-commercially published materials most of the time	20 (1.9)

Teachers who indicated that the randomly selected class used commercially published materials 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. The most commonly used materials in middle school science classes are shown in Table 33.

Table 33
Most Commonly Used Middle School Science Instructional Materials, by Course

Course	Publisher	Title
Life Science	Houghton Mifflin Harcourt McGraw-Hill Lab-Aids	*Life Science* *Life Science* *Issues and Life Science*
Earth Science	Pearson Houghton Mifflin Harcourt Pearson	*Earth Science* *Earth Science* *Earth Science the Physical Setting*
Physical Science	Houghton Mifflin Harcourt Pearson McGraw-Hill	*Physical Science* *Focus on Physical Science* *Physical Science*
General/Integrated Science	McGraw-Hill Houghton Mifflin Harcourt Pearson	*Glencoe Science* *Holt Science & Technology* *Science Explorer*

Table 34 shows the publication year of commercially published instructional materials used. In 2012, more than half of middle school science classes were using materials published prior to 2007.

Table 34
Publication Year of
Instructional Materials in Middle School Science Classes

	Percent of Classes[†]
2006 or earlier	52 (2.6)
2007–09	35 (2.9)
2010–12	13 (2.0)

[†] Only classes using commercially published textbooks/modules 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,[5] most middle school science teachers consider their instructional materials to be of relatively high quality, as those in roughly three-quarters of middle school science classes rated their materials as good or better (see Table 35).

[5] For example, American Association for the Advancement of Science (2000). *Middle grades mathematics textbooks: A benchmarks-based evaluation.* Washington, DC: American Association for the Advancement of Science.

Table 35
Perceived Quality of Instructional Materials Used in Middle School Science Classes

	Percent of Classes[†]
Very Poor	2 (1.5)
Poor	3 (1.0)
Fair	18 (2.5)
Good	32 (3.5)
Very Good	36 (3.3)
Excellent	8 (2.6)

[†] Only classes using commercially published textbooks/modules were included in these analyses.

Despite these ratings, there does seem to be an issue with the number of topics in middle school science materials. Only 47 percent of middle school science classes address three-fourths or more of their instructional materials, possibly a reflection of publishers' efforts to meet as many state and district criteria as possible by including all of the content anyone might seek (see Table 36). Furthermore, nearly half of middle school science classes spend less than 50 percent of their instructional time using the materials (see Table 37), which may also explain why a large portion of middle school science materials typically go unused.

Table 36
Percentage of Instructional Materials Covered during Middle School Science Courses

	Percent of Classes[†]
Less than 25 percent	3 (1.3)
25–49 percent	15 (3.9)
50–74 percent	35 (4.7)
75 percent or more	47 (5.7)

[†] Only classes using commercially published textbooks/modules were included in these analyses.

Table 37
Percentage of Instructional Time Spent Using Textbooks/Modules during the Course

	Percent of Classes[†]
Less than 25 percent	25 (5.1)
25–49 percent	22 (3.3)
50–74 percent	26 (3.2)
75 percent or more	26 (4.8)

[†] Only classes using commercially published textbooks/modules were included in these analyses.

A similar story emerges from responses to questions asking teachers to describe how they used their textbook/module in their most recent unit. As can be seen in Table 38, while teachers in 66 percent of classes indicated they used the textbook/module to guide the overall structure and content emphasis of the unit, 74 percent supplemented the materials, and 48 percent picked what was important from their textbook/module and skipped the rest.

Table 38
Ways Middle School Science Teachers Substantially[†]
Used their Instructional Materials in the Most Recent Unit

	Percent of Classes[‡]	
You incorporated activities (e.g., problems, investigations, readings) from other sources to supplement what the textbook/module was lacking	74	(2.6)
You used the textbook/module to guide the overall structure and content emphasis of the unit	66	(2.7)
You followed the textbook/module to guide the detailed structure and content emphasis of the unit	52	(3.0)
You picked what is important from the textbook/module and skipped the rest	48	(3.2)

[†] Includes those responding 4 or 5 on a 5-point scale ranging from 1 "not at all" to 5 "to a great extent."
[‡] Only classes using commercially published textbooks/modules in the most recent unit were included in these analyses.

Teachers in nearly all middle school science classes who supplement their textbook/module do so to help students at different levels of achievement learn the targeted ideas or to provide students with additional practice (see Table 39). Many supplement to prepare students for standardized tests or because the pacing guide indicates that supplemental activities should be used.

Table 39
Reasons Why Middle School Science Instructional Materials Are Supplemented

	Percent of Classes[†]	
Supplemental activities were needed so students at different levels of achievement could increase their understanding of the ideas targeted in each activity	96	(1.2)
Supplemental activities were needed to provide students with additional practice	94	(2.4)
Supplemental activities were needed to prepare students for standardized tests	63	(5.4)
Your pacing guide indicated that you should use supplemental activities	49	(4.6)

[†] Only classes using commercially published textbooks/modules in the most recent unit and whose teachers reported supplementing some activities were included in these analyses.

Teachers were also asked why they skipped parts of their textbook/module. As can be seen in Table 40, teachers in the vast majority of middle school science classes skip activities because they have other ones that work better. Other common reasons for skipping activities include the ideas addressed by the activities not being in the pacing guide and/or current state standards, a lack of materials, students already knowing science ideas, being able to learn ideas without the activities, or activities being too difficult for the students.

Table 40
Reasons Why Parts of Middle School Science Instructional Materials Are Skipped

	Percent of Classes[†]	
You have different activities for those science ideas that work better than the ones you skipped	89	(3.2)
The science ideas addressed in the activities you skipped are not included in your pacing guide and/or current state standards	65	(5.0)
You did not have the materials needed to implement the activities you skipped	61	(5.2)
Your students already knew the science ideas or were able to learn them without the activities you skipped	56	(4.1)
The activities you skipped were too difficult for your students	47	(5.0)

[†] Only classes using commercially published textbooks/modules in the most recent unit and whose teachers reported skipping some activities were included in these analyses.

Facilities and Equipment

Teachers were presented with a list of instructional technologies and asked about their availability in the randomly selected class. The three response options were:

- Do not have one per group available;
- At least one per group available upon request or in another room; and
- At least one per group located in your classroom.

As can be seen in Table 41, the vast majority of middle school science classes have access to the internet, non-graphing calculators, microscopes, and personal computers. Teachers in nearly half of middle school science classes have access to classroom response systems and probes for collecting data. Graphing calculators are available in 30 percent of middle school science classes.

Table 41
Availability[†] of Instructional Technologies in Middle School Science Classes

	Percent of Classes	
Internet access	85	(2.4)
Non-graphing calculators	83	(2.3)
Microscopes	82	(1.9)
Personal computers, including laptops	75	(2.9)
Classroom response system or "Clickers" (handheld devices used to respond electronically to questions in class)	46	(2.7)
Probes for collecting data (e.g., motion sensors, temperature probes)	43	(2.9)
Graphing calculators	30	(2.9)
Hand-held computers (e.g., PDAs, tablets, smartphones, iPads)	19	(2.2)

[†] Includes only those rating the availability as at least one per group available, either in the classroom, upon request, or in another room.

Although the majority of middle school science classes have access to non-graphing calculators, 24 percent expect students to provide their own (see Table 42). Very few middle school science classes expect students to provide their own graphing calculators, hand-held computers, or laptop computers.

Table 42
Expectations that Students will
Provide their Own Instructional Technologies

	Percent of Classes
Non-graphing calculators	24 (2.5)
Graphing calculators	7 (1.6)
Hand-held computers	3 (1.3)
Laptop computers	2 (0.9)

When asked about the adequacy of resources for instruction, teachers in the majority of middle school science classes consider their facilities adequate (see Table 43). However, teachers in less than half of middle school science classes consider their access to equipment, consumable supplies, and instructional technology adequate.

Table 43
Middle School Science Classes with Adequate† Resources for Instruction

	Percent of Classes
Facilities (e.g., lab tables, electric outlets, faucets and sinks)	58 (2.9)
Equipment (e.g., microscopes, beakers, photogate timers, Bunsen burners)	47 (2.8)
Consumable supplies (e.g., chemicals, living organisms, batteries)	39 (2.4)
Instructional technology (e.g., calculators, computers, probes/sensors)	38 (2.7)

† Includes those responding 4 or 5 on a 5-point scale ranging from 1 "not adequate" to 5 "adequate."

FACTORS AFFECTING MIDDLE SCHOOL SCIENCE INSTRUCTION

Teachers were asked about factors that affect instruction in their randomly selected class. As can be seen in Table 44, in the majority of middle school science classes, teachers think that many of these factors promote effective instruction. For example, in over three quarters of middle school science classes, principal support promotes effective science instruction. Current state standards, student motivation, and district/diocese curriculum frameworks are seen as promoting effective instruction in about two-thirds of classes. Parent expectations/involvement and state/district testing/accountability policies promote effective instruction in less than half of classes.

Table 44
Factors Promoting† Effective Instruction in Middle School Science Classes

	Percent of Classes	
Principal support	77	(2.4)
Current state standards	67	(3.1)
Students' motivation, interest, and effort in science	67	(3.3)
District/Diocese curriculum frameworks‡	64	(3.4)
Time for you to plan, individually and with colleagues	63	(3.6)
Time available for your professional development	55	(3.8)
District/Diocese/School pacing guides	51	(3.3)
Textbook/module selection policies	51	(3.8)
Community views on science instruction	50	(3.8)
Teacher evaluation policies	50	(3.6)
Students' reading abilities	49	(2.9)
Parent expectations and involvement	44	(3.8)
District/Diocese testing/accountability policies‡	38	(3.6)
State testing/accountability policies	37	(3.5)

† Includes those responding 4 or 5 on a 5-point scale ranging from 1 "inhibits effective instruction" to 5 "promotes effective instruction."

‡ Item presented only to public and catholic school teachers.

The teacher survey also included a series of items about technology-related issues. Teachers were asked to indicate how great a problem each posed for instruction in their randomly selected class. As can be seen in Table 45, these resources are generally not seen as problematic in the vast majority of middle school science classes.

Table 45
Extent to Which Technology Quality Is a Serious Problem for Instruction in Middle School Science Classes

	Percent of Classes	
Old age of computers	25	(3.1)
Lack of access to computers	21	(2.9)
Lack of availability of appropriate computer software	15	(2.3)
Slow speed of the Internet connection	15	(2.7)
Lack of availability of technology support	14	(2.0)
Lack of access to the Internet	11	(2.4)
Unreliability of the Internet connection	9	(2.0)

Composites from these two series of questionnaire items were created to summarize the extent to which various factors support effective instruction. The means are shown in Table 46. Overall, these data indicate that the climate is generally supportive for middle school science instruction.

Table 46
Class Mean Scores for the Factors Affecting Instruction Composites

	Mean Score
Extent to which School Support Promotes Effective Instruction	66 (2.5)
Extent to which the Policy Environment Promotes Effective Instruction	64 (1.7)
Extent to which Stakeholder Support Promotes Effective Instruction	63 (1.5)
Extent to which IT Quality is Problematic for Instruction	30 (1.9)

SUMMARY

Nearly all middle school science teachers are white, and 7 in 10 are female. Less than half have a degree in science and/or science education, and those teaching life science generally have a more in-depth background than those responsible for teaching Earth or physical science. In addition, although middle school science teachers hold a number of beliefs about teaching and learning that are in alignment with what is known about effective science instruction (e.g., it is better for instruction to focus on ideas in depth, even if that means covering fewer topics), they also hold views that are inconsistent with this research. For example, 78 percent of middle school science teachers believe that students should be provided with definitions for new vocabulary at the beginning of instruction on an idea.

Asked about their professional development experiences, the vast majority of middle school science teachers have participated in science-focused professional development in the last three years. However, only about a quarter have had sustained professional development (more than 35 hours) in that time period. In addition, only about half had opportunities to engage in science investigations in those professional development experiences.

Data on middle school science courses indicate that most schools offer either single-discipline or coordinated/integrated science courses, but not both types of these courses. However, single-discipline science courses seem to be more prevalent in 7^{th} and 8^{th} grades than in 6^{th} grade.

Instruction in these courses relies heavily on lecture and discussion, with students often completing textbook/worksheet problems. However, the data also indicate that students are engaged in hands-on laboratory activities and required to use evidence to support claims fairly regularly. Teachers in the vast majority of middle school classes report assigning an hour or less of homework per week. In addition, although 80 percent of middle school science classes use commercially published instructional materials, less than 50 percent cover three-fourths or more of the material in their textbook. Teachers in almost all middle school science classes that supplement their textbook/module do so because they need activities to provide learning opportunities for students at different levels of achievement, or to provide students with additional practice.

APPENDIX

Table A-1
Teacher Mean Scores for Composites

	Mean Score
Perceptions of Preparedness to Teach Science Content	71 (1.2)
Perceptions of Preparedness to Encourage Students' Interest in Science	73 (1.4)
Perceptions of Preparedness to Teach Students from Diverse Backgrounds	57 (1.6)
Quality of Professional Development	65 (1.6)
Extent to which PD/Coursework Focused on Student-Centered Instruction	64 (1.4)

Table A-2
Class Mean Scores for Composites

	Mean Score
Perceptions of Preparedness to Implement Instruction in Particular Unit	79 (0.8)
Curriculum Control	45 (2.2)
Pedagogical Control	88 (1.3)
Reform-Oriented Instructional Objectives	83 (0.6)
Use of Reform-Oriented Teaching Practices	63 (0.6)
Use of Instructional Technology	26 (0.9)
Adequacy of Resources for Instruction	58 (1.4)
Extent to which Stakeholder Support Promotes Effective Instruction	63 (1.5)
Extent to which the Policy Environment Promotes Effective Instruction	64 (1.7)
Extent to which School Support Promotes Effective Instruction	66 (2.5)
Extent to which IT Quality is Problematic for Instruction	30 (1.9)