Wyoming

Grade 8 Public Schools

The Nation's Report Card

State
Science 2011

This report provides selected results for Wyoming's public school students at grade 8 from the National Assessment of Educational Progress (NAEP) assessment in science. Results are reported by average scale scores and by achievement levels (*Basic, Proficient,* and *Advanced*).

All 50 states, the District of Columbia, and the Department of Defense Education Activity schools (DoDEA) participated in the 2011 science assessment at grade 8.

For more information about the assessment, visit the NAEP website at http://nces.ed.gov/nationsreportcard/ which contains

- *The Nation's Report Card: Science 2011*
- The full set of national and state results in an interactive database
- Released test questions, scoring guides, and question-level performance data

NAEP is a project of the National Center for Education Statistics (NCES), reporting on the academic achievement of elementary and secondary students in the United States.

KEY FINDINGS FOR 2011

Grade 8:

- In 2011, the average science score for eighth-grade students in Wyoming was 160. This was higher than that of the nation's public schools (151).
- The average score for students in Wyoming in 2011 (160) was higher than that in 2009 (158).
- In 2011, the percentage of students in Wyoming who performed at or above *Proficient* was 38 percent. This was greater than that for the nation's public schools (31 percent).
- The percentage of students in Wyoming who performed at or above *Proficient* in 2011 (38 percent) was not significantly different from that in 2009 (36 percent).
- In 2011, the percentage of students in Wyoming who performed at or above *Basic* was 78 percent. This was greater than that for the nation's public schools (64 percent).
- The percentage of students in Wyoming who performed at or above *Basic* in 2011 (78 percent) was greater than that in 2009 (74 percent).

Introduction

What Was Assessed?

The content for each NAEP assessment is determined by the National Assessment Governing Board. The framework for each assessment documents the content and process areas to be measured and sets guidelines for the types of questions to be used. The development process for the science framework required the active participation of teachers, curriculum specialists, subject-matter specialists, local school administrators, parents, and other members of the general public. The current framework is available at the Governing Board's website at http://nagb.org/publications/frameworks/science-2011.pdf.

The 2009 NAEP science framework approved by the Governing Board replaced the framework used for the 1996, 2000, and 2005 science assessments. A variety of factors made it necessary to create a new framework to guide the assessment of science in 2009 and beyond: the publication of *National Standards* for science literacy, advances in both science and cognitive research, the growth in national and international science assessments, advances in innovative assessment approaches, and the need to fairly assess the widest possible range of students. The framework is unchanged for 2011.

Assessment Criteria

Each question in the 2011 science assessment was classified based on two criteria: *science content* and *science practices*. By considering these two criteria for each question, the framework ensures that NAEP assesses an appropriate balance of content along with a variety of ways of knowing and doing science.

SCIENCE CONTENT

The science content for the 2011 NAEP is defined by a series of statements that describe key facts, concepts, principles, laws, and theories in three broad areas:

- Physical Science
- Life Science
- Earth and Space Sciences

Physical Science deals with matter, energy, and motion; Life Science with structures and functions of living systems and changes in living systems; and Earth and Space Sciences with Earth in space and time, Earth structures, and Earth systems.

SCIENCE PRACTICES

The second aspect of the framework is defined by four science practices, which focus on what students should know and be able to do in science:

- Identifying Science Principles
- Using Science Principles

- Using Scientific Inquiry
- Using Technological Design

Assessment Design

The assessment design allowed for broad coverage of the three science content areas and four science practices, while minimizing the time burden for any one student. Each student in the state assessment was asked to complete two 25-minute sections. Each section contained between 14 and 18 questions depending on the balance between multiple-choice and constructed-response questions. Released NAEP science questions, along with student performance data by state, are available on the NAEP website at http://nces.ed.gov/nationsreportcard/itmrls/.

Who Was Assessed?

All 50 states, the District of Columbia, and the Department of Defense Education Activity schools participated in the 2011 science assessment at grade 8.

The overall participation rates for schools and students must meet guidelines established by the National Center for Education Statistics (NCES) and the National Assessment Governing Board for assessment results to be reported publicly. A participation rate of at least 85 percent for schools was required. Participation rates for the 2011 science assessment are available on the NAEP website at http://nationsreportcard.gov/science_2011/participation.asp.

The schools and students participating in NAEP assessments are selected to be representative both nationally and for public schools at the state level. The comparisons between national and state results in this report present the performance of public school students only. In the figures and tables shown in this report, the category "nation (public)" does not include private, Department of Defense Education Activity, or Bureau of Indian Education schools.

How Is Student Science Performance Reported?

The 2011 state results are compared to results from the nation at grade 8.

Average Scores: Student performance is reported as an average score based on the NAEP science scale, which ranges from 0 to 300. Because NAEP scales are developed independently for each subject and for each content area within a subject, the scores cannot be compared across subjects or across content areas within the same subject. Results are also reported at five percentiles (10th, 25th, 50th, 75th, and 90th) to show trends in performance for lower-, middle-, and higher-performing students.

Achievement Levels: Based on recommendations from policymakers, educators, and members of the general public, the Governing Board sets specific achievement levels for each subject area and grade. Achievement levels are performance standards indicating what students should know and be able to do. They provide another perspective with which to interpret student performance. NAEP results are reported in terms of three achievement levels—*Basic*, *Proficient*, and *Advanced*—and are expressed in terms of the percentage of students who attained each level. The three achievement levels are defined as follows:

- *Basic* denotes partial mastery of prerequisite knowledge and skills that are fundamental for proficient work at each grade.
- *Proficient* represents solid academic performance for each grade assessed. Students reaching this level have demonstrated competency over challenging subject matter, including subject-matter knowledge, application of such knowledge to real-world situations, and appropriate analytical skills.
- *Advanced* represents superior performance.

The achievement levels are cumulative; therefore, students performing at the *Proficient* level also display the competencies associated with the *Basic* level, and students at the *Advanced* level also demonstrate the competencies associated with both the *Basic* and the *Proficient* levels.

As provided by law, NCES, upon review of congressionally mandated evaluations of NAEP, has determined that achievement levels are to be used on a trial basis and should be interpreted with caution. The NAEP achievement levels have been widely used by national and state officials. The science achievement-level descriptions are summarized in figure 1.

Figure 1	The Nation's Report Card 2011 State Assessment
	Descriptions of eighth-grade achievement levels for 2011 NAEP science assessment

Basic Level (141)	Students performing at the *Basic* level should be able to state or recognize correct science principles. They should be able to explain and predict observations of natural phenomena at multiple scales, from microscopic to global. They should be able to describe properties and common physical and chemical changes in materials; describe changes in potential and kinetic energy of moving objects; describe levels of organization of living systems—cells, multicellular organisms, and ecosystems; identify related organisms based on hereditary traits; describe a model of the solar system; and describe the processes of the water cycle. They should be able to design observational and experimental investigations employing appropriate tools for measuring variables. They should be able to propose and critique the scientific validity of alternative individual and local community responses to design problems.

Science Practices: Students performing at the *Basic* level should be able to state or recognize correct science principles; explain and predict observations of natural phenomena at multiple scales, from microscopic to global, using evidence to support their explanations and predictions; design investigations employing appropriate tools for measuring variables; and propose and critique the scientific validity of alternative individual and local community responses to design problems.

In the physical sciences, students at the *Basic* level should be able to recognize a class of chemical compounds by its properties; design an investigation to show changes in properties of reactants and products in a chemical process such as burning or rusting; describe the changes in kinetic and potential energy of an object such as a swinging pendulum; describe and compare the motions of two objects moving at different speeds from a table of their position and time data; describe the direction of all forces acting on an object; and suggest an example of a system in which forces are acting on an object but the motion of the object does not change.

In the life sciences, students at the *Basic* level should be able to identify levels of organization within cells, multicellular organisms, and ecosystems; describe how changes in an environment relate to an organism's survival; describe types of interdependence in ecosystems; identify related organisms based on hereditary traits; discuss the needs of animals and plants to support growth and metabolism; and analyze and display data showing simple patterns in population growth.

In the Earth and space sciences, students at the *Basic* level should be able to

describe a Sun-centered model of the solar system that illustrates how gravity keeps the objects in regular motion; describe how fossils and rock formations can be used as evidence to infer events in Earth's history; relate major geologic events, such as earthquakes, volcanoes, and mountain building to the movement of lithospheric plates; use weather data to identify major weather events; and describe the processes of the water cycle including changes in the physical state of water.

Proficient Level (170)	Students performing at the *Proficient* level should be able to demonstrate relationships among closely related science principles. They should be able to identify evidence of chemical changes; explain and predict motions of objects using position-time graphs; explain metabolism, growth, and reproduction in cells, organisms, and ecosystems; use observations of the Sun, Earth, and Moon to explain visible motions in the sky; and predict surface and groundwater movements in different regions of the world. They should be able to explain and predict observations of phenomena at multiple scales, from microscopic to macroscopic and local to global, and to suggest examples of observations that illustrate a science principle. They should be able to use evidence from investigations in arguments that accept, revise, or reject scientific models. They should be able to use scientific criteria to propose and critique alternative individual and local community responses to design problems.

Science Practices: Students performing at the *Proficient* level should be able to demonstrate relationships among closely related science principles; explain and predict observations of phenomena at multiple scales, from microscopic to macroscopic and local to global, and suggest examples of observations that illustrate a science principle; design investigations requiring control of variables to test a simple model, employing appropriate sampling techniques and data quality review processes, and use the evidence to communicate an argument that accepts, revises, or rejects the model; and propose and critique solutions and predict the scientific validity of alternative individual and local community responses to design problems.

In the physical sciences, students at the *Proficient* level should be able to demonstrate the relationship between the properties of chemical elements and their position on the periodic table; use empirical evidence to demonstrate that a chemical change has occurred; demonstrate the relationship of the motion of an object that experiences multiple forces with the representation of the motion on a position-time graph; predict the position of a moving object based on the position-time data presented in a table; and suggest examples of systems in which potential energy is converted into other forms of energy.

In the life sciences, students at the *Proficient* level should be able to explain metabolism, growth, and reproduction at multiple levels of living systems: cells, multicellular organisms, and ecosystems; predict the effects of heredity and environment on an organism's characteristics and survival; use sampling

strategies to estimate population sizes in ecosystems; and suggest examples of sustainable systems for multiple organisms.

In the Earth and space sciences, students at the *Proficient* level should be able to explain how gravity accounts for the visible patterns of motion of the Earth, Sun, and Moon; explain how fossils and rock formations are used for relative dating; use models of Earth's interior to explain lithospheric plate movement; explain the formation of Earth's materials using the properties of rocks and soils; identify recurring patterns of weather phenomena; and predict surface and groundwater movement in different regions of the world.

Advanced Level (215)	Students performing at the *Advanced* level should be able to develop alternative representations of science principles and explanations of observations. They should be able to use information from the periodic table to compare families of elements; explain changes of state in terms of energy flow; trace matter and energy through living systems at multiple scales; predict changes in populations through natural selection and reproduction; use lithospheric plate movement to explain geological phenomena; and identify relationships among regional weather and atmospheric and ocean circulation patterns. They should be able to design and critique investigations involving sampling processes, data quality review processes, and control of variables. They should be able to propose and critique alternative solutions that reflect science-based trade-offs for addressing local and regional problems.

Science Practices: Students performing at the *Advanced* level should be able to demonstrate relationships among different representations of science principles. They should be able to explain and predict observations of phenomena at multiple scales, from microscopic to macroscopic and local to global, and develop alternative explanations of observations, using evidence to support their thinking. They should be able to design control of variable investigations employing appropriate sampling techniques and data quality review processes that strengthen the evidence used to argue for one alternate model over another. They should be able to propose and critique alternative solutions that reflect science-based trade-offs for addressing local and regional problems.

In the physical sciences, students at the *Advanced* level should be able to interpret diagrams, graphs, and data to demonstrate the relationship between the particulate nature of matter and state changes (for instance, melting and freezing); demonstrate relationships between position on the periodic table and the characteristics of families of the chemical elements; explain changes of state in terms of energy flow in and out of a system; identify possible scientific trade-offs in making decisions on the design of an electrical energy power plant; suggest examples of systems in which objects are undergoing transitional, vibrational, and rotational motion; and suggest examples of systems in which forces are acting both through contact and at a distance.

In the life sciences, students at the *Advanced* level should be able to explain movement and transformations of matter and energy in living systems at cellular, organismal, and ecosystem levels; predict changes in populations through natural selection and reproduction; and describe an ecosystem's populations and propose an analysis for changes based on energy flow through the system.

In the Earth and space sciences, students at the *Advanced* level should be able to explain the seasons, Moon phases, and lunar and solar eclipses; illustrate how fossils and rock formations can provide evidence of changes in environmental conditions over time; use lithospheric plate movement to explain geological phenomena; identify relationships among regional weather and atmospheric and ocean circulation patterns; and use the water cycle to propose and critique ways for obtaining drinkable water.

NOTE: The scores in parentheses in the shaded boxes indicate the lowest point on the 0–300 scale at which the achievement-level range begins.
SOURCE: National Assessment Governing Board. (2010). *Science Framework for the 2011 National Assessment of Educational Progress*. Washington, DC: Author.

Interpreting Results

The scores and percentages in this report are estimates based on samples of students rather than on entire populations. In addition, the collection of questions used is only a sample of the many questions that could have been asked to assess the skills and abilities described in the NAEP framework. Comparisons between groups are based on statistical tests that consider both the size of the differences and the standard errors of the two statistics being compared. Standard errors are margins of error, and estimates based on smaller groups are likely to have larger margins of error. The size of the standard errors may also be influenced by other factors such as how representative the assessed students are of the entire population. Statistical tests that factor in these standard errors are used to determine whether the differences between average scores or percentages are significant. All differences were tested for statistical significance at the .05 level using unrounded numbers.

Differences between scores or between percentages are discussed in this report only when they are significant from a statistical perspective. Significant differences are marked with a notation (*) in the tables. Any differences in scores that are mentioned in the text as "higher," "lower," "greater," or "smaller" are statistically significant.

Score or percentage differences or gaps cited in this report are calculated based on differences between unrounded numbers. Therefore, the reader may find that the score or percentage difference cited in the text or tables may not be identical to the difference obtained from subtracting the rounded values shown in the accompanying tables or figures.

The reader is cautioned against making simple causal inferences between student performance and the other variables (e.g., race/ethnicity, gender, and type of school location) discussed in this report. A statistically significant relationship between a variable and measures of student performance does not imply that the variable causes differences in how well students perform. The relationship may be influenced by a number of other variables not accounted for in this report, such as family income, parental involvement, or student attitudes.

NAEP 2011 Science Overall Average Score and Achievement-Level Results for Public School Students

Overall science results for public school students from Wyoming are reported in this section, as well as regional and national results. The regions defined by the U.S. Census Bureau are Northeast, South, Midwest, and West (http://nces.ed.gov/nationsreportcard/hsts/tabulations/regions.asp).

Overall Average Score Results

Student performance is reported as an average score based on the NAEP science scale, which ranges from 0 to 300.

Table 1 shows the overall performance results of grade 8 public school students in Wyoming, the nation (public), and the region in which the jurisdiction is located. The first column of results presents the average score on the NAEP science scale. The remaining columns show the scores at selected percentiles. A percentile is a score point at or below which a certain percentage of students fall. For example, the 25th percentile demarks the cut point for the lowest 25 percent of students within the distribution of scale scores.

Grade 8 Scale Score Results

- In 2011, the average scale score for students in Wyoming was 160. This was higher than that of students across the nation (151).
- In Wyoming, the average scale score for students in 2011 was higher than that in 2009 (158). Similarly, the average scale score for students in public schools across the nation in 2011 was higher than that in 2009 (149).

Table 1

The Nation's Report Card 2011 State Assessment

Average scale scores and selected percentile scores in NAEP science for eighth-grade public school students, by year and jurisdiction: 2009 and 2011

Year and jurisdiction		Average scale score	10th percentile	25th percentile	50th percentile	75th percentile	90th percentile
2009	Nation (public)	149*	102*	127*	152*	174*	191
	West[1]	143*	94	120*	146*	170*	188
	Wyoming	158*	120	140*	160	178	193
2011	Nation (public)	151	105	129	154	175	192
	West[1]	146	98	124	150	172	190
	Wyoming	160	125	144	162	179	193

* Value is significantly different ($p < .05$) from the value for the same jurisdiction in 2011.

[1] Region in which jurisdiction is located.

NOTE: The NAEP grade 8 science scale ranges from 0 to 300. All differences were calculated and tested using unrounded numbers.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2009 and 2011 Science Assessments.

Overall Achievement-Level Results

Student results are reported as the percentages of students performing relative to performance standards set by the National Assessment Governing Board. These performance standards for what students should know and be able to do were based on the recommendations of broadly representative panels of educators and members of the public.

Table 2 shows the percentage of students at grade 8 who performed below *Basic*, at or above *Basic*, at or above *Proficient*, and at *Advanced*. Because the percentages are cumulative from *Basic* to *Proficient* to *Advanced*, they will sum to more than 100 percent. Only the percentage of students performing at or above *Basic* (which includes the students at *Proficient* and *Advanced)* plus the students below *Basic* will sum to 100 percent.

Grade 8 Achievement-Level Results

- In 2011, the percentage of Wyoming's students who performed at or above *Proficient* was 38 percent. This was greater than the percentage of the nation's public school students who performed at or above *Proficient* (31 percent).
- In Wyoming, the percentage of students who performed at or above *Proficient* in 2011 was not significantly different from the percentage in 2009 (36). However, the percentage of students who performed at or above *Proficient* in the nation in 2011 was greater than the percentage in 2009 (29).
- In 2011, the percentage of Wyoming's students who performed at or above *Basic* was 78 percent. This was greater than the percentage of the nation's public school students who performed at or above *Basic* (64 percent).
- In Wyoming, the percentage of students who performed at or above *Basic* in 2011 was greater than the percentage in 2009 (74). Similarly, the percentage of students who performed at or above *Basic* in the nation in 2011 was greater than the percentage in 2009 (62).

Table 2

The Nation's Report Card 2011 State Assessment

Percentage of eighth-grade public school students at or above NAEP science achievement levels, by year and jurisdiction: 2009 and 2011

Year and jurisdiction		Below *Basic*	At or above *Basic*	At or above *Proficient*	At *Advanced*
2009	Nation (public)	38 *	62 *	29 *	1
	West[1]	44 *	56 *	25 *	1
	Wyoming	26 *	74 *	36	1
2011	Nation (public)	36	64	31	2
	West[1]	41	59	27	1
	Wyoming	22	78	38	1

* Value is significantly different ($p < .05$) from the value for the same jurisdiction in 2011.

[1] Region in which jurisdiction is located.

NOTE: The NAEP grade 8 science scale ranges from 0 to 300. Achievement levels correspond to the following points on the NAEP science scales: below *Basic*, 140 or lower; *Basic*, 141–169; *Proficient*, 170–214; and *Advanced*, 215 and above. At or above *Basic* includes *Basic*, *Proficient*, and *Advanced*. At or above *Proficient* includes *Proficient* and *Advanced*. Detail may not sum to totals because of rounding. All differences were calculated and tested using unrounded numbers.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2009 and 2011 Science Assessments.

Comparisons Between Wyoming, the Nation, and Participating States and Jurisdictions

All 50 states, the District of Columbia, and the Department of Defense Schools participated in the 2011 science assessment at grade 8. References to "jurisdictions" in the results statements may include states, the District of Columbia, and/or Department of Defense Schools.

Comparisons by Average Scores

Figure 2 compares Wyoming's 2011 overall science average scores at grade 8 with those of public schools in the nation and all other participating states and jurisdictions. The different shadings indicate whether the average score of the nation (public), a state, or a jurisdiction was found to be higher than, not significantly different from, or lower than that of Wyoming in the NAEP 2011 science assessment.

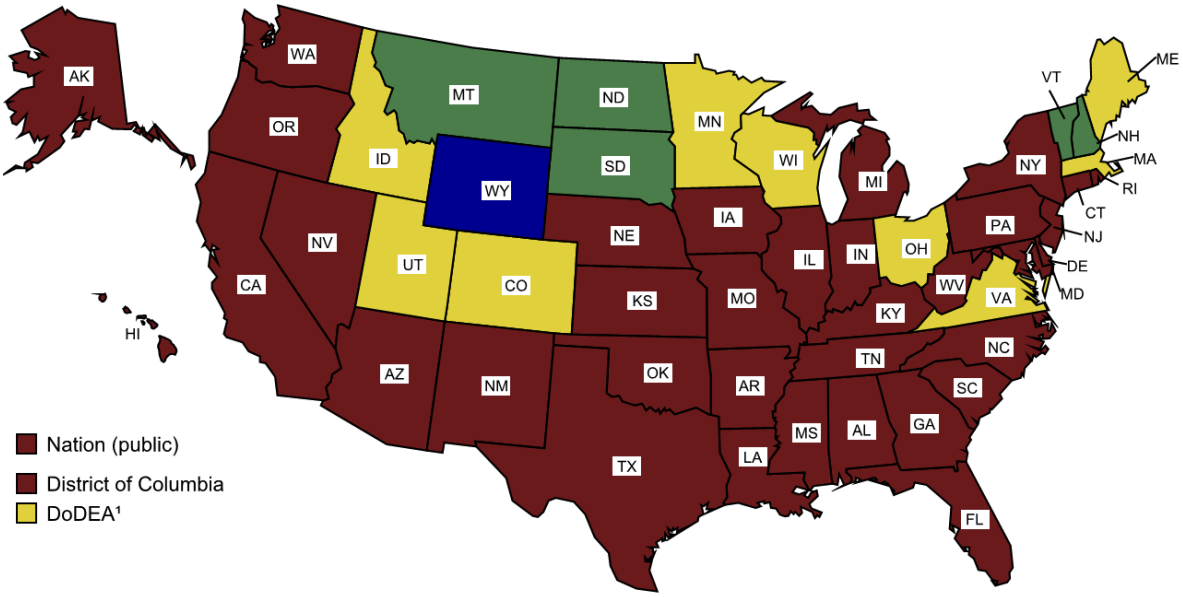
Grade 8 Scale Score Comparison Results

- The average score for students in Wyoming was higher than 36 jurisdictions, not significantly different from 10 jurisdictions, and lower than 5 jurisdictions.

Figure 2

The Nation's Report Card 2011 State Assessment

Wyoming's average scale score in NAEP science for eighth-grade public school students compared with scores for the nation and other participating jurisdictions: 2011



★	Focal state/jurisdiction (Wyoming)
	Higher average scale score than Wyoming (5 jurisdictions)
	Not significantly different from Wyoming (10 jurisdictions)
	Lower average scale score than Wyoming (nation and 36 jurisdictions)

¹ Department of Defense Education Activity (overseas and domestic schools).
NOTE: Significance tests used a multiple-comparison procedure based on all jurisdictions that participated.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2011 Science Assessment.

Comparisons by Achievement Levels

Figure 3 permits comparisons of all jurisdictions (and the nation) participating in the NAEP 2011 science assessment in terms of percentages of grade 8 students performing at or above *Proficient*. The participating states and jurisdictions are grouped into categories reflecting whether the percentage of their students performing at or above *Proficient* (including *Advanced*) was found to be higher than, not significantly different from, or lower than the percentage in Wyoming.

Note that the selected state is listed first in its category, and the other states and jurisdictions within each category are listed alphabetically; statistical comparisons among jurisdictions in each of the three categories are not included in this report. However, statistical comparisons among states by achievement level can be calculated online by using the NAEP Data Explorer at http://nces.ed.gov/nationsreportcard/naepdata/.

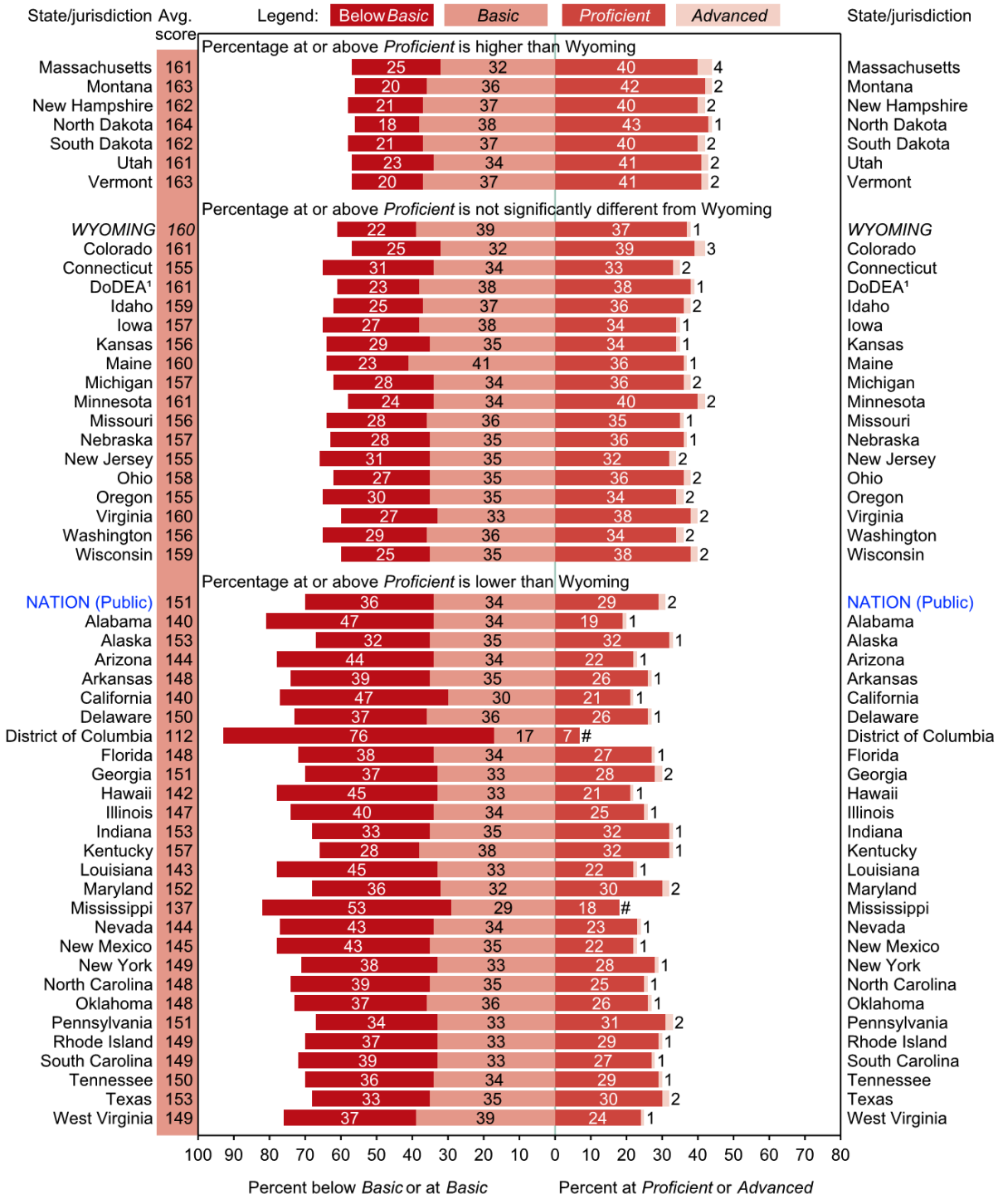
Grade 8 Achievement-Level Comparison Results

- The percentage of students performing at or above the *Proficient* level in Wyoming was greater than the percentage in 27 jurisdictions, not significantly different from those in 17 jurisdictions, and smaller than those in 7 jurisdictions.
- The percentage of students performing at or above the *Basic* level in Wyoming was greater than the percentage in 38 jurisdictions, not significantly different from those in 12 jurisdictions, and smaller than those in 1 jurisdiction (data not shown).

Figure 3

The Nation's Report Card 2011 State Assessment

Average scale scores in NAEP science for eighth-grade public school students, percentage within each achievement level, and Wyoming's percentage at or above *Proficient* compared with the nation and other participating states/jurisdictions: 2011



Rounds to zero.

1 Department of Defense Education Activity (overseas and domestic schools).

NOTE: The NAEP grade 8 science scale ranges from 0 to 300. Achievement levels correspond to the following points on the NAEP science scales: below *Basic*, 140 or lower; *Basic*, 141–169; *Proficient*, 170–214; and *Advanced*, 215 and above. The bars above contain percentages of students in each NAEP science achievement level. Achievement levels corresponding to each population of students are aligned at the point where the *Proficient* category begins, so that they may be compared at *Proficient* and above. Detail may not sum to totals because of rounding. All differences were calculated and tested using unrounded numbers. The shaded bars are graphed using unrounded numbers. Significance tests used a multiple-comparison procedure based on all jurisdictions that participated.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2011 Science Assessment.