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|  | 2011 NAEP Science:  Summary of State Results |
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| June 2012  Massachusetts Department of Elementary and Secondary Education  75 Pleasant Street, Malden, MA 02148  Phone 781-338-3000 TTY: N.E.T. Relay 800-439-2370  [www.doe.mass.edu](http://www.doe.mass.edu) |
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# I. Executive Summary of the 2011 NAEP State Results in Science

Fifty states took part in the 2011 state administration of the National Assessment of Educational Progress (NAEP) science assessment at grade 8. In Massachusetts, 2,300 grade 8 students from 165 schools participated in the 2011 NAEP Science state assessments. This report provides state-level results for the science assessment.

□ **Interpreting This Report**

When reviewing this report, it is important to keep in mind that the NAEP results are based on a *sample* of students across Massachusetts and not on the *population* of Massachusetts students. In analyzing the results, tests of significance were used to determine differences in the data that could be confidently characterized as *not occurring by chance*. This type of difference is commonly referred to as a statistically *significant* difference. In the report’s tables, an asterisk is used to denote a value that is significantly different from the value for the nation’s public schools.

□ **Overall Performance**

*Massachusetts tied for second on the grade 8 science assessment.*

* Based on average scale scores, Massachusetts tied for second in the nation with 13 states. One state (North Dakota) had an average scale score that was significantly higher than the average scale score for Massachusetts.
* The percentage of Massachusetts students scoring at or above the *Proficient* levelin science was higher than the percentage of students at or above the *Proficient* levelin 39 states and no different from the percentage of students at or above the *Proficient* level in the remaining 10 states.

*Students in Massachusetts outperformed students nationally on the NAEP science tests.*

* The average scale score of Massachusetts eighth-grade students on the science assessment was 161, higher than the national average of 151.
* Forty-four percent of Massachusetts eighth-grade students scored at or above the *Proficient* level. These percentages were higher than the comparable percentage of students nationally who scored at or above the *Proficient* level (31 percent).

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□ **Students Performing at or above the *Proficient* Level in the Top Performing States**

The following table lists the top performing states on the 2011 science assessment according to the ordinal rank of the percentage of students in each state who scored at or above the *Proficient* level.

**Table 1. 2011 NAEP Science Assessment**

**Top Performing States**

|  |  |
| --- | --- |
| State | Percent At or Above Proficient |
| Massachusetts | 44 |
| Montana | 44 |
| North Dakota | 44 |
| Utah | 43 |
| Vermont | 43 |
| Colorado | 42 |
| Minnesota | 42 |
| New Hampshire | 42 |
| South Dakota | 42 |
| Virginia | 40 |

□ **Student Subgroup Performance in Science in Massachusetts Compared to the Nation**

* Race/Ethnicity: In 2011, Massachusetts White and Asian students outperformed their counterparts nationally. The performance of Massachusetts Black students did not differ significantly from the performance of their counterparts nationally; however, the performance of Massachusetts Hispanic students was significantly lower than the nation.
* Gender: Both female and male students in Massachusetts outscored their counterparts nationally.
* Student Status: Students with disabilities and students eligible for free/reduced lunch in Massachusetts scored higher than their counterparts nationally, but the performance of English language learner students in Massachusetts was lower than the nation.

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**II. Background Information on the NAEP Science Assessment**

Although participation in NAEP state assessments in reading and mathematics at grades 4 and 8 is mandated by the No Child Left Behind (NCLB) Act, participation in NAEP state science assessments is voluntary, depending upon applicable state laws. Students from all 50 states participated in the 2011 NAEP state assessments in science at grade 8. Across the nation, 122,000 eighth-grade students were assessed in science in 2011.

□ **Test Content of the Science Assessment**

The 2011 NAEP science assessment was based on the 2009 NAEP science framework which 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 of national and international science assessments, advances in innovative assessment approaches, and the need to fairly assess the widest possible range of students.

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: Earth and Space Sciences, Physical Science, and Life Science.

|  |  |
| --- | --- |
| **Field of Science** | Grade 8 |
| **Earth and space sciences** include concepts related to objects in the universe, the history of the earth, properties of Earth materials, tectonics, energy in Earth systems, climate and weather, and biogeochemical cycles.  **Physical science** includes concepts related to properties and changes of matter, forms of energy, energy transfer and conservation, position and motion of objects, and forces affecting motion.  **Life science** includes concepts related to organization and development, matter and energy transformations, interdependence, heredity and reproduction, and evolution and diversity. | 40%  30%  30% |

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□ **Type of Questions on the Science Assessment**

The NAEP science assessment contained three types of questions, or items: multiple-choice, short constructed-response, and extended constructed-response.

□ **Student Participation**

Each student selected for NAEP participates in only one subject-area test, and he/she takes only a portion of the entire test in that subject area. For instance, a student chosen for the 2011 science test took two 25-minute blocks or sets of test items out of a total of 13 blocks of items.

NAEP spirals blocks of items into different test booklets, administers them to representative samples of students, and combines the results in order to produce average scale scores for the entire group and for subgroups of student populations. This approach reduces the burden on each individual student.

□ **Reporting**

Student performance on NAEP is indicated in two ways—scale scores and achievement levels. The NAEP science assessment scale ranges from 0 to 300. Performance for each grade is scaled separately. Therefore, average scale scores cannot be compared across grades.

Achievement levels are used to describe expectations for student performance according to a set of standards for what students should know and be able to do. The three achievement levels are *Basic*, *Proficient*, and *Advanced*.

* *Basic* denotes partial mastery of prerequisite knowledge and skills that are fundamental for proficient work at a given grade. Examples of skills demonstrated by students performing at the *Basic* level:

▪ Explain the benefit of an adaptation for an organism.

▪ Recognize how the Sun affects the Earth’s surface.

▪ Predict the relative motion of an object based on a diagram.

* *Proficient* represents solid academic performance. Students reaching this level have demonstrated competency over challenging subject matter. Examples of skills demonstrated by students performing at the *Proficient* level:

▪ Predict an environmental effect of the use of a chemical.

▪ Recognize the cycle of Moon phases.

▪ Predict the motion of an object when different forces act on it.

* *Advanced* represents superior performance. Examples of skills demonstrated by students performing at the *Advanced* level:

▪ Identify what an organism needs to live.

▪ Predict the shape of the Moon.

▪ Investigate the speed of a runner.

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**III. 2011 NAEP Science Results for Massachusetts by Subgroup**

Student performance data are reported for public school students in Massachusetts and the nation according to the following demographic characteristics:

* race/ethnicity
* gender
* student eligibility for the National School Lunch Program
* type of school location
* parents’ highest level of education

Results for each of the variables are reported in tables that include the percentage of students in each subgroup in the first column. The columns to the right show the average scale score and the percentage of students at each achievement level.

The reader is cautioned against making causal inferences about subgroup differences, as a complex mix of educational and socioeconomic factors may affect student performance.

□ **Race/Ethnicity**

The race/ethnicity of each student was reported by the schools. Table 3 shows the population percentages for public school students, averages scale scores, and achievement level data at grade 8 in Massachusetts and the nation by race/ethnicity.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 3. 2011 NAEP Science Assessment**  **Grade 8 Performance by Race/Ethnicity** | | | | | | | |
|  |  |  |  | **Percentage of Students** | | | |
| **Race/ethnicity** |  | **Percentage of Students** | **Average Scale Score** | **Below Basic** | **At or above Basic** | **At or above Proficient** | **At Advanced** |
| **White** |  |  |  |  |  |  |  |
|  | Nation | 54 | 163\* | 21\* | 79\* | 43\* | 2\* |
|  | Massachusetts | 73 | 169 | 16 | 84 | 52 | 5 |
| **African American/Black** |  |  |  |  |  |  |  |
|  | Nation | 16 | 128 | 64\* | 36\* | 9\* | # |
|  | Massachusetts | 8 | 133 | 54 | 46 | 15 | # |
| **Hispanic** |  |  |  |  |  |  |  |
|  | Nation | 22 | 136\* | 52\* | 48\* | 16 | # |
|  | Massachusetts | 13 | 130 | 61 | 39 | 12 | # |
| **Asian/Pacific Islander** |  |  |  |  |  |  |  |
|  | Nation | 5 | 159\* | 26\* | 74\* | 41 | 3 |
|  | Massachusetts | 4 | 170 | 18 | 82 | 55 | 9 |

# Rounds to zero

\* Value is significantly different from the value for the same subgroup in Massachusetts due to the larger national sample size.

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□ **Gender**

Information on student gender is reported by schools when rosters of the students eligible to be assessed are submitted to NAEP. Table 4 shows population percentages for public school students, average scale scores, and achievement level data and at grade 8 in Massachusetts and the nation by gender.

**Table 4. 2011 NAEP Science Assessment:**

**Grade 8 Performance by Gender**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | **Percentage of Students** | | | |
| **Gender** |  | **Percentage of Students** | **Average Scale Score** | **Below Basic** | **At or above Basic** | **At or above Proficient** | **At Advanced** |
| **Male** |  |  |  |  |  |  |  |
|  | Nation | 51 | 153\* | 34\* | 66\* | 34\* | 2\* |
|  | Massachusetts | 51 | 164 | 22 | 78 | 47 | 4 |
| **Female** |  |  |  |  |  |  |  |
|  | Nation | 49 | 148\* | 38\* | 62\* | 27\* | 1\* |
|  | Massachusetts | 49 | 159 | 27 | 73 | 40 | 3 |

# Rounds to zero

\* Value is significantly different from the value for the same subgroup in Massachusetts

□ **Free/Reduced-Price Lunch**

NAEP collects data on eligibility for the federal program providing free or reduced-price school lunches. The free/reduced-price lunch component of the National School Lunch Program (NSLP) offered through the U.S. Department of Agriculture (USDA) is designed to ensure that children near or below the poverty line receive nourishing meals. Eligibility is determined through the USDA’s Income Eligibility Guidelines, and is included as an indicator of lower family income. Table 5 shows population percentages for public school students, average scale scores, and achievement level data at grade 8 in Massachusetts and the nation by eligibility for the NSLP.

**Table 5. 2011 NAEP Science Assessment:**

**Grade 8 Performance by Free/Reduced Lunch Eligibility**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | **Percentage of Students** | | | |
| **Eligibility Status** |  | **Percentage of Students** | **Average Scale Score** | **Below Basic** | **At or above Basic** | **At or above Proficient** | **At Advanced** |
| **Eligible** |  |  |  |  |  |  |  |
|  | Nation | 48\* | 137\* | 52\* | 48\* | 16\* | # |
|  | Massachusetts | 33 | 141 | 46 | 54 | 21 | 1 |
| **Not Eligible** |  |  |  |  |  |  |  |
|  | Nation | 52\* | 164\* | 20\* | 80\* | 44\* | 3\* |
|  | Massachusetts | 67 | 171 | 14 | 86 | 55 | 6 |

# Rounds to zero

\* Value is significantly different from the value for the same subgroup in Massachusetts

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□ **Students with Disabilities and/or English Language Learners**

To ensure that samples are representative, NAEP has established policies and procedures to maximize the inclusion of all students in the assessment. Every effort is made to ensure that all selected students who are capable of participating meaningfully in the assessment are assessed. While some students with disabilities (SD) and/or English language learner (ELL) students can be assessed without any special procedures, others require accommodations to participate in NAEP. Still other SD and/or ELL students selected by NAEP may not be able to participate.

Table 6 shows population percentages for public school students, average scale scores, and achievement level data at grade 8 in Massachusetts and the nation by disability status. Table 7 shows population percentages for public school students, average scale scores, and achievement level data at grade 8 in Massachusetts and the nation by ELL status.

**Table 6. 2011 NAEP Science Assessment:**

**Grade 8 Performance by Disability Status**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | **Percentage of Students** | | | |
| **Disability Status** |  | **Percentage of Students** | **Average Scale Score** | **Below Basic** | **At or above Basic** | **At or above Proficient** | **At Advanced** |
| **SD** |  |  |  |  |  |  |  |
|  | Nation | 11\* | 124\* | 66\* | 34\* | 11 | # |
|  | Massachusetts | 16 | 143 | 49 | 51 | 24 | 2 |
| **Not SD** |  |  |  |  |  |  |  |
|  | Nation | 89\* | 154\* | 32\* | 68\* | 33\* | 2\* |
|  | Massachusetts | 84 | 165 | 20 | 80 | 47 | 4 |

# Rounds to zero

\* Value is significantly different from the value for the same subgroup in Massachusetts

**Table 7. NAEP 2011 Science Assessment:**

**Grade 8 Performance by ELL Status**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | **Percentage of Students** | | | |
| **ELL Status** |  | **Percentage of Students** | **Average Scale Score** | **Below Basic** | **At or above Basic** | **At or above Proficient** | **At Advanced** |
| **ELL** |  |  |  |  |  |  |  |
|  | Nation | 6\* | 106 | 83 | 17 | 2 | # |
|  | Massachusetts | 4 | 92 | 87 | 13 | 3 | # |
| **Not ELL** |  |  |  |  |  |  |  |
|  | Nation | 94\* | 153\* | 33\* | 67\* | 33\* | 2\* |
|  | Massachusetts | 96 | 164 | 22 | 78 | 45 | 4 |

# Rounds to zero

\* Value is significantly different from the value for the same subgroup in Massachusetts

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**IV. 2011 NAEP Science Results for Massachusetts by School Location**

Schools that participated in the assessment were classified as being located in four mutually exclusive types of communities: city, suburb, town, and rural. These categories indicate the geographic locations of schools. Table 8 shows population percentages for public school students, average scale scores, and achievement-level data at grade 8 in Massachusetts and the nation, by type of location.

**Table 8. NAEP 2011 Science Assessment:**

**Grade 8 Performance by School Location**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | **Percentage of Students** | | | |
| **Location** |  | **Percentage of Students** | **Average Scale Score** | **Below Basic** | **At or above Basic** | **At or above Proficient** | **At Advanced** |
| **City** |  |  |  |  |  |  |  |
|  | Nation | 29\* | 142 | 47 | 53 | 23 | 1 |
|  | Massachusetts | 18 | 143 | 45 | 55 | 25 | 1 |
| **Suburb** |  |  |  |  |  |  |  |
|  | Nation | 36\* | 155\* | 31\* | 69\* | 35\* | 2\* |
|  | Massachusetts | 64 | 165 | 21 | 79 | 47 | 5 |
| **Town** |  |  |  |  |  |  |  |
|  | Nation | 13\* | 152 | 34 | 66 | 30 | 1 |
|  | Massachusetts | 2 | ‡ | ‡ | ‡ | ‡ | # |
| **Rural** |  |  |  |  |  |  |  |
|  | Nation | 23\* | 156\* | 29\* | 71\* | 35\* | 1 |
|  | Massachusetts | 15 | 167 | 16 | 84 | 50 | 3 |

# Rounds to zero

\* Value is significantly different from the value for the same subgroup in Massachusetts

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**V. 2011 NAEP Science Results for Massachusetts by Parents’ Level of Education**

Eighth-grade students who participated in the NAEP 2011 assessment were asked to indicate the highest level of education they thought their father and mother had completed. Five response options—did not finish high school, graduated from high school, graduated from college, and “I don’t know”—were offered. The highest level of education reported for either parent was used in the analysis. The results by highest level of parental education are shown in Table 9.

**Table 9. NAEP 2011 Science Assessment:**

**Grade 8 Performance by Parents’ Level of Education**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | | **Percentage of Students** | | | |
| **Parent Education** | **Percentage of Students** | **Average Scale Score** | **Below Basic** | **At or above Basic** | **At or above Proficient** | **At Advanced** |
| **Did Not Finish High School** |  |  |  |  |  |  |
| Nation | 8\* | 133 | 57\* | 43 | 12 | # |
| Massachusetts | 5 | 134 | 53 | 47 | 18 | # |
| **Graduated High School** |  |  |  |  |  |  |
| Nation | 17 | 140\* | 48\* | 52\* | 18\* | # |
| Massachusetts | 14 | 149 | 37 | 63 | 25 | 1 |
| **Graduated College** |  |  |  |  |  |  |
| Nation | 48\* | 162\* | 23\* | 77\* | 43\* | 3\* |
| Massachusetts | 59 | 171 | 15 | 85 | 56 | 6 |
| **Unknown** |  |  |  |  |  |  |
| Nation | 11\* | 132\* | 58\* | 42\* | 14\* | # |
| Massachusetts | 9 | 140 | 48 | 52 | 20 | 1 |

# Rounds to zero

\* Value is significantly different from the value for the same subgroup in Massachusetts

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**VI. 2011 NAEP Science Achievement Level Descriptions for Grade 8**

|  |  |
| --- | --- |
| Achievement Level | Description |
| *Basic*  (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, multi-cellular organisms, 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. |
| *Proficient*  (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. |
| *Advanced*  (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. |

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