The Nation's Report Card

Report for Colorado: Background & Visuals

Math 2005

The National Assessment of Educational Progress
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Overview of the NAEP 2005 Mathematics Assessment

Who was assessed?

- The NAEP 2005 assessment was administered to a stratified random sample of fourth-, eighth-, and twelfth-graders at the national level and to a stratified random sample of fourth- and eighth-graders at the state level.
- Both public and nonpublic school students were assessed at the national level.
- At the state or jurisdiction level, only the results for public school students are reported.
- Fifty-two jurisdictions participated, including the 50 states, the District of Columbia, and the Department of Defense Schools (Domestic and Overseas).
- National (public and nonpublic) and state (public only) samples include the following:
  - Grade 4
    - Approximately 172,000 students
    - Approximately 9,500 schools
  - Grade 8
    - Approximately 161,600 students
    - Approximately 7,200 schools
- Colorado sample number assessed:
  - Grade 4
    - Approximately 2,800 students
    - Approximately 160 schools
  - Grade 8
    - Approximately 2,500 students
    - Approximately 140 schools

What is assessed?

- The NAEP Frameworks specify what is assessed and how it is to be assessed.
- The Mathematics Framework for NAEP was revised in 1996 and again in 2005. The new framework reflects current curricular emphases and objectives, while continuing a connection to previous frameworks. The connection allows the trend line at grades 4 and 8 that started with the 1990 assessment to be maintained.
- The Mathematics Framework for NAEP describes the content and format of the 2005 assessments (http://www.nagb.org/pubs/m_framework_05/toc.html). Revisions to the framework maintain the short-term trend, and results are comparable across all assessment years.
- The NAEP Mathematics Framework describes content in five strands and the percentage of questions that should be devoted to each

Target percentage distribution of questions		
Content Strand	Grade 4	Grade 8
Number properties and operations	40	20
Measurement	20	15
Geometry	15	20
Data analysis and probability	10	15
Algebra	15	30

- The Mathematics Framework for NAEP 2005 also describes three levels of mathematical complexity that include aspects of knowing and doing mathematics.
- Low Complexity
  - Relies heavily on the recall and recognition of previously learned concepts and principles (recall, recognize, compute, perform)
- Moderate Complexity
  - Involve more flexibility of thinking and choice among alternatives; require a response that goes beyond the habitual.
- High Complexity
  - Require student to think in abstract and sophisticated ways; involves planning, analysis, judgment, and creative thought.

- Approximately half of the score on the assessment is based on items of moderate complexity, with the remainder of the score based equally on items of low and high complexity.

How is mathematics assessed?

- Mathematics is assessed using three types of questions:
  - Multiple-choice questions—
    - make up 50 percent of the assessment, and
    - four choices are presented.
  - Short, constructed-response questions—
    - "…require students to give either a numerical result or the correct name or classification for a group of mathematical objects, draw an example of a given concept, or perhaps write a brief explanation for a given result."
  - Extended, constructed-response questions—
    - demand more than a numerical or short verbal response; and
    - require students to carefully consider a problem, plan an approach, solve the problem, and interpret their solution in terms of the original problem.

- In 2005, the distribution of types of questions across all blocks was as follows:

Type of Question	Grade 4	Grade 8
Multiple-choice	111	122
Short, constructed response	52	49
Extended, constructed response	7	7
Total	170	178

- *Calculators* were provided for about one-third of the assessment (one-third of the blocks).
  - Not all items in a calculator available assessment block require the use of a calculator.
  - NAEP provides the calculators:
    - Grade 4—four-function calculator
    - Grade 8—scientific calculator

    - Items in non-calculator blocks require students to demonstrate computation or estimation skills *without* a calculator.
- Some items use *manipulatives,* e.g., rulers, protractors, spinners, and geometric shapes. The manipulatives are provided by NAEP.

How are constructed-response questions scored?

- Unique scoring guides are developed for each constructed-response question.
- Scoring guides describe the specific criteria for assigning a score level for student responses.
- Extended, constructed-response questions had four- and five-level scoring guides.
- Many short, constructed-response questions had three-level guides that allowed for partial credit, while others were rated as either acceptable or unacceptable.

Scoring process:

    - Expert scorers are extensively trained to apply the scoring criteria consistently and fairly.
    - Scoring is monitored to ensure the scoring standards are being adhered to reliably.
    - Monitoring measures the consistency of scoring to the same items administered in different assessments—therefore, ensuring consistency of the application of scoring standards across assessment years.
- Over 4,435,831 mathematics constructed responses were scored for the 2005 assessment.

How is the NAEP mathematics assessment administered?

- Each student took two, 25-minute sets of mathematics questions (also referred to as blocks), one set of general background questions, and one set of background questions related to mathematics.
- In order to provide a comprehensive assessment of mathematics and to minimize the burden on any individual student, NAEP uses matrix sampling. Each student takes a subset of the total set of questions, i.e., two blocks out of ten total blocks per grade level.
- Because each block is spiraled with other blocks and is administered to a representative sample of students, the results can be combined to produce average group and subgroup results based on the entire assessment.

How long does the NAEP assessment take?

- No more than about 1 hour per student to actually take the assessment—about 50 minutes on mathematics questions, and a few more minutes on background questions.

[1] Sources:
Appendix A. *Overview of Procedures Used for the NAEP 2005 Mathematics Assessment*, State Report Generator.
NAGB (2004) *Mathematics Framework for the 2005 National Assessment of Educational Progress.* Washington, DC: Author

Variables/Factors Available in NAEP Reporting

NAEP started in 1964 through a grant from the Carnegie Corporation; that set up the Exploratory Committee for the Assessment of Progress in Education. The first national assessments were conducted in 1969 under the U.S. Department of Education. Voluntary assessments for states began in 1990. In 2003, NCLB mandated NAEP grades 4 and 8 Reading and Mathematics Assessments.

NAEP is not designed to report individual students, school or district data due to a number of reasons including: sample size, students do not take the entire test and the data are only estimates of selected sample population subgroups. Therefore only state and national results are available.

NAEP/Westat, the contractor for NAEP data submittal uses a number of student variables to report on the subject-matter achievement of selected sample population subgroups. These variables are:

- Gender
- National School Lunch Program status
- Race/ethnicity
- Limited English Proficiency status
- Individualized Educational Plan or 504 status

In addition, NAEP surveys the school administrator, teachers of assessed students and the participating students on a number of factors including but not limited to:

- School Location and Demographics
- Teacher Demographics
- Teacher Preparation, Credentials, Experiences
- Student Time Use Outside of School
- Parental Education Level

A number of these variables/factors are reported for Colorado grades 4 and 8 in this document and are certainly not inclusive of the vast quantity of data available from NAEP. For access to more data please visit the NAEP Data Explorer tool on-line at http://nces.ed.gov/nationsreportcard/nde/

Types of Scoring

Two different ways NAEP reports scores is represented in this document: Average Scale Score and Achievement Levels. Following is a brief description of each.

Average Scale Score

- Scale scores—indicate how much students *know and can do.*
  - Range is 0-500
  - The Average Scale Score reflects the subgroup as a whole and is not necessarily the Average Scale Score achieved by those students at or above Proficient.

NAEP Mathematics Cut Scores – 4th Grade	
Advanced (A)	282 - 500
Proficient (P)	249 - 281
Basic (B)	214 - 248
Below Basic (BB)	0 - 213

NAEP Mathematics Cut Scores – 8th Grade	
Advanced (A)	333 - 500
Proficient (P)	299 - 332
Basic (B)	262 - 298
Below Basic (BB)	0 - 261

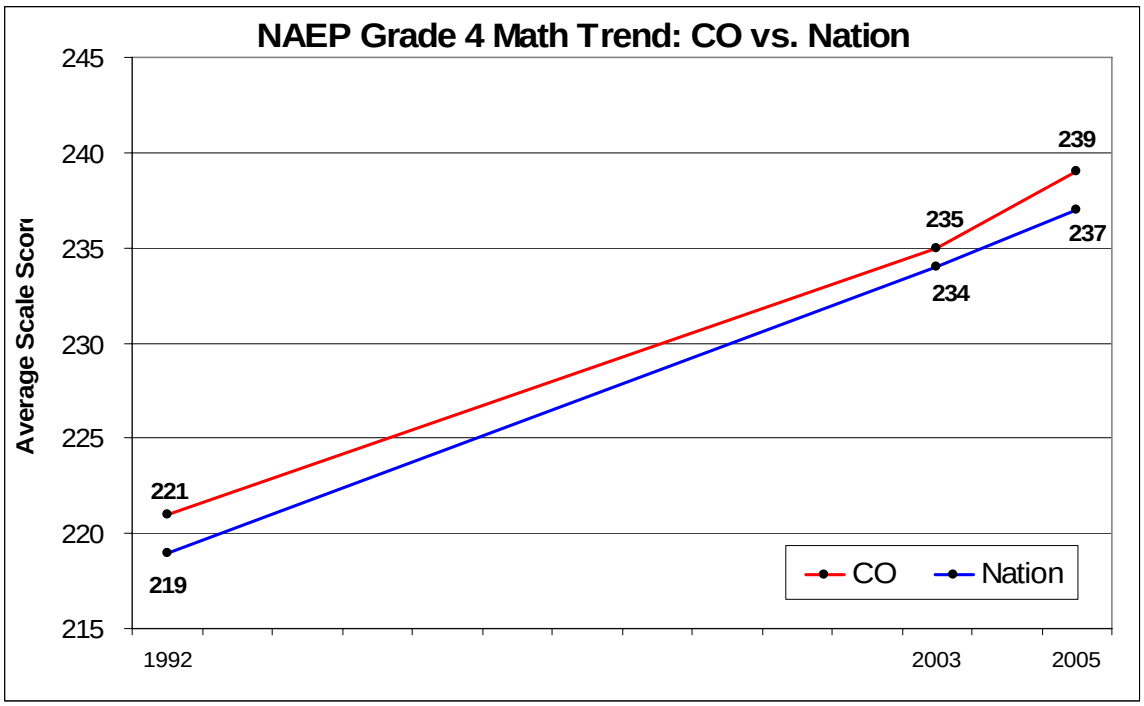
Achievement Levels

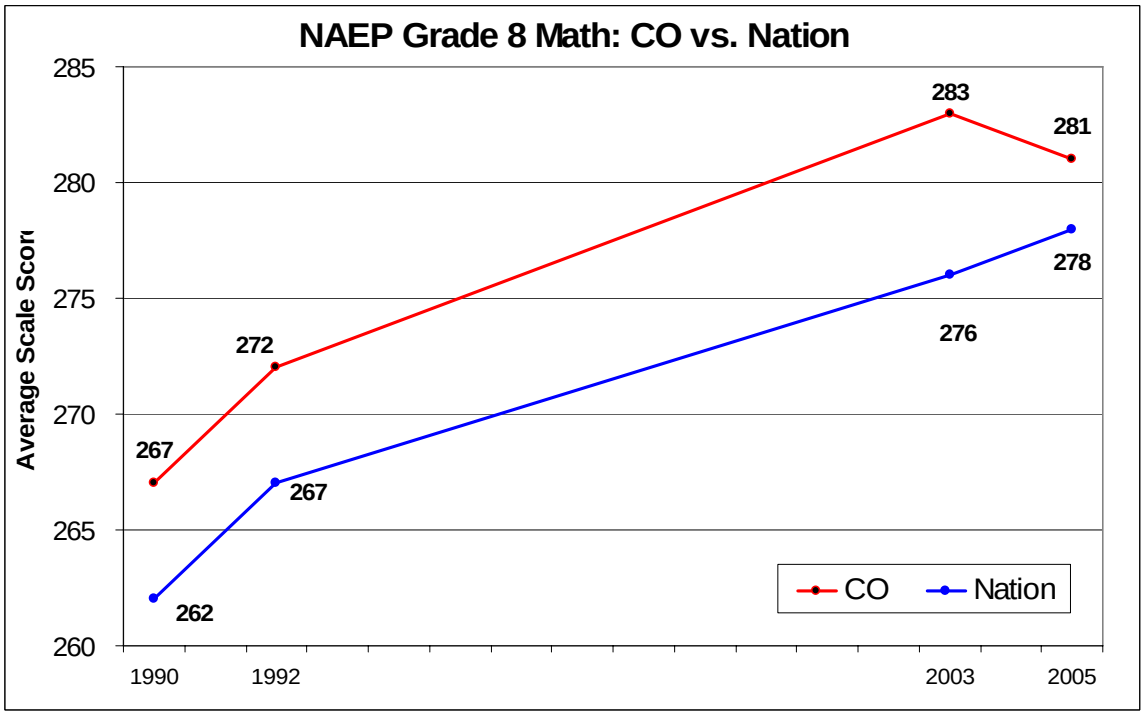
Policy definitions of NAEP Achievement Levels:

- *Basic:* This level denotes partial mastery of prerequisite knowledge and skills that are fundamental for proficient work at each grade.
- *Proficient:* This level 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 analytical skills appropriate to the subject matter.
- *Advanced:* This level signifies superior performance.

For more details on the NAEP *Achievement Level descriptions for mathematics—set separately by grade* see the following indicated source.

Source: National Assessment Governing Board. (2004) *Mathematics Framework for the 2005 National Assessment of Educational Progress.* Washington, DC: Author
http://www.nagb.org/pubs/m_framework_05/toc.html





NOTE: The NAEP Mathematics scale ranges from 0 to 500. Observed differences are not necessarily statistically significant. SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1990, 1992, 1996, 2000, 2003 and 2005 Mathematics Assessments.

Stem and Leaf Table Comparing Colorado's
Grade 4 Percentage of Students At and Above Proficient
NAEP 2005 Mathematics

Previous Years	% At or Above Proficient	States and Other Jurisdictions
	49	Massachusetts (48.8)
	48	
	47	Minnesota (47.3), New Hampshire (46.9), Kansas (46.8)
	46	
	45	New Jersey (45.4)
	44	Vermont (43.5)
	43	Wyoming (42.6), Ohio (42.5), Connecticut (42.5)
	42	Washington (41.6), Pennsylvania (41.5)
	41	South Dakota (40.6)
	40	Idaho (40.4), North Dakota (40.4), Wisconsin (40.3), Texas (40), North Carolina (39.9)
COLORADO 2005	39	Virginia (39.3), Maine (38.8)
	38	Montana (38.3), Indiana (38.2), Maryland (38), Michigan (37.7)
	37	Iowa (37.3), Oregon (37), Utah (36.8), Florida (36.6)
	36	Delaware (36.1), Nebraska (36.1), New York (36.1), South Carolina (35.9)
National 2005	35	Dept of Defense (34.8)
COLORADO 2003	34	
	33	
	32	Illinois (31.6)
National 2003	31	Missouri (31.1), Rhode Island (30.5)
	30	Georgia (29.5)
	29	Oklahoma (28.6)
	28	California, Arizona (27.9), Tennessee (27.7)
	27	Hawaii (26.7),
	26	Nevada (26.1), Kentucky (26.1)
	25	West Virginia (25.1)
	24	Louisiana (23.9)
National 2000	23	
	21	Alabama (20.9)
	20	
National 1996	19	Mississippi (19.4), New Mexico (19)
COLORADO 1992	18	
National 1992	17	
	16	
	15	
	14	
	13	
National 1990	12	
	11	
	10	District of Columbia (9.6)

Higher than **COLORADO**	Not significantly different from **COLORADO**	Lower than **COLORADO**

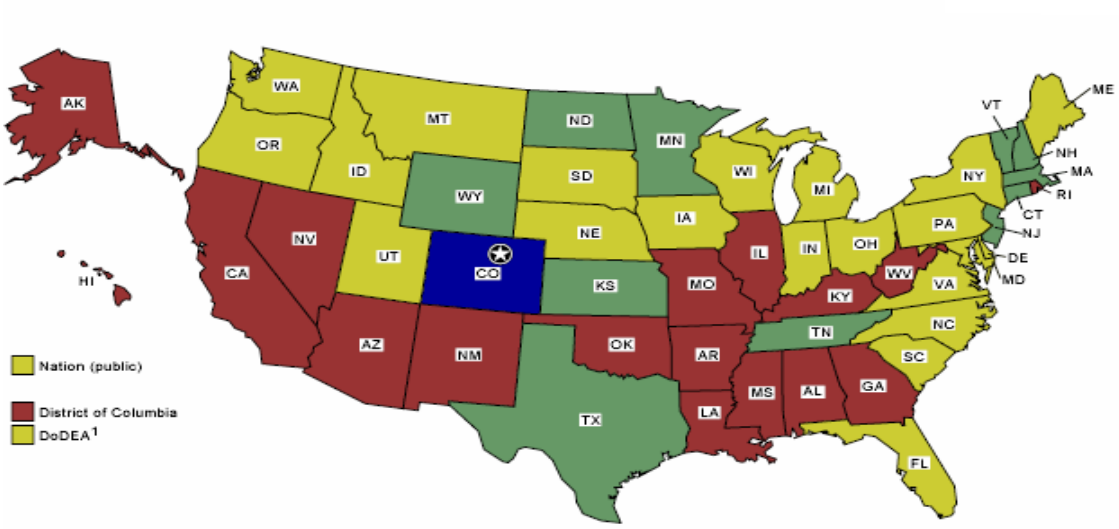
Stem and Leaf Table Comparing Colorado's
Grade 8 Percentage of Students At and Above Proficient
NAEP 2005 Mathematics

Previous Years	% At or Above Proficient	States and Other Jurisdictions
	44	
	43	Massachusetts (43.3), Minnesota (42.7)
	42	
	41	
	40	
	39	
	38	Vermont
	37	South Dakota (36.5)
	36	Montana | Washington, New Jersey (35.9), Wisconsin (35.8)
	35	Nebraska (34.9), North Dakota (34.6), Connecticut (34.6), New Hampshire (34.6)
COLORADO 2003	34	Kansas (34.2), Iowa (33.7), Oregon (33.7),
	33	Virginia (33.4), Ohio (33.1), D of Defense (32.6)
COLORADO 2005	32	North Carolina (31.9)
	31	Pennsylvania (30.9), New York (30.8), Texas (30.7)
	30	Indiana (30.4), Idaho, South Carolina (29.9), Maine (29.9) Delaware (29.7), Maryland (29.6), Utah (29.5)
	29	Michigan (29.3), Wyoming, Alaska (28.7), Illinois (28.6)
	28	
National 2003	27	
	26	Missouri, Arizona (25.7), Florida (25.6)
National 2000 | **COLORADO 1996**	25	
	24	Rhode Island
National 1996	23	Georgia (23.2), Kentucky (22.5)
COLORADO 1992	22	Arkansas, California (21.7)
	21	Nevada (21.4) | Oklahoma (20.6), Tennessee (20.6)
National 1992	20	
	19	
	18	Hawaii (18.2), West Virginia (17.9)
COLORADO 1990	17	
	16	Louisiana
	15	Alabama
	14	New Mexico, Mississippi (13.6)
	13	
	12	
	11	
	10	
	9	
	8	
	7	District of Columbia

Higher than **COLORADO** | Not significantly different from **COLORADO** | Lower than **COLORADO**

ALL STUDENTS - AVERAGE SCALE SCORE

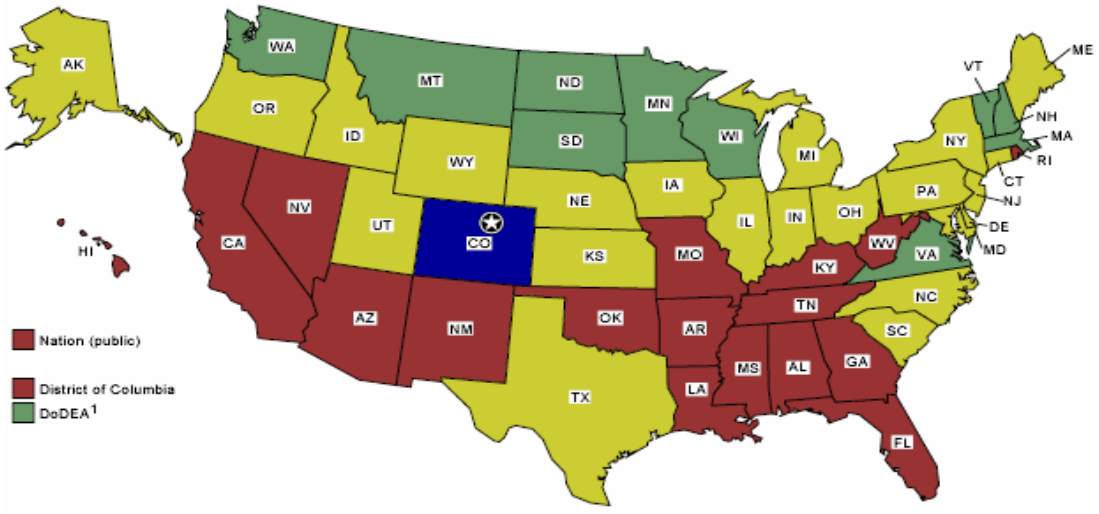
Math Grade 4



Focal state/jurisdiction (Colorado)
Higher average scale score than Colorado (10 jurisdictions)
Not significantly different from Colorado (nation and 22 jurisdictions)
Lower average scale score than Colorado (19 jurisdictions)

[1] Department of Defense Education Activity schools (domestic and overseas).
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Mathematics Assessment.

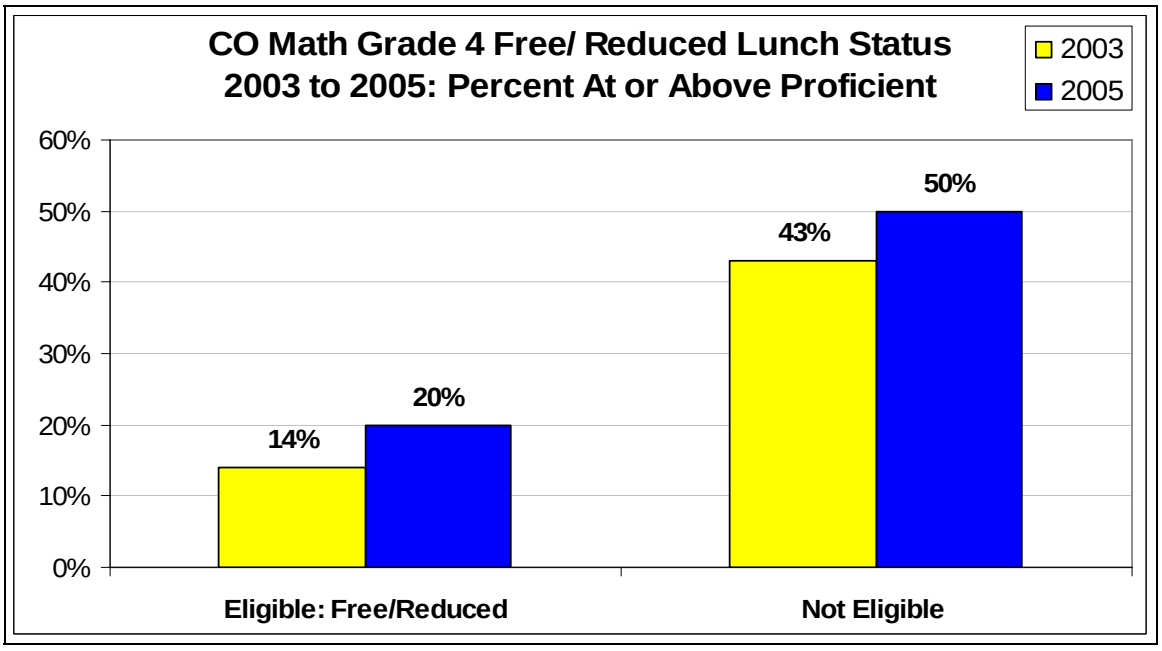
Math Grade 8

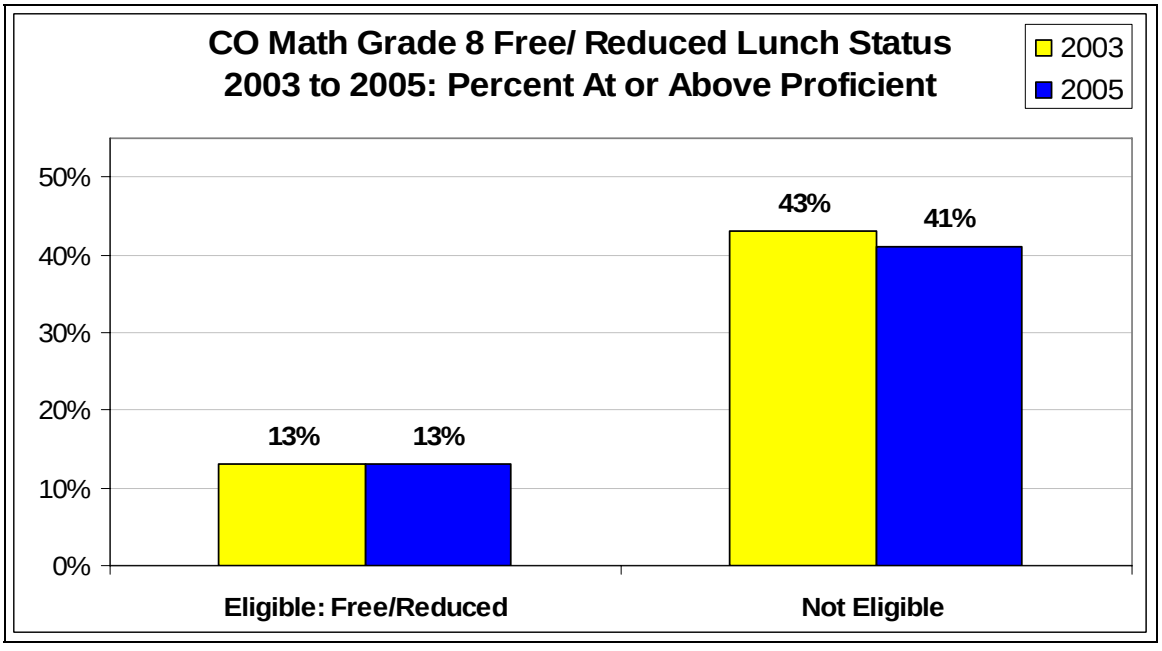


Focal state/jurisdiction (Colorado)
Higher average scale score than Colorado (11 jurisdictions)
Not significantly different from Colorado (22 jurisdictions)
Lower average scale score than Colorado (nation and 18 jurisdictions)

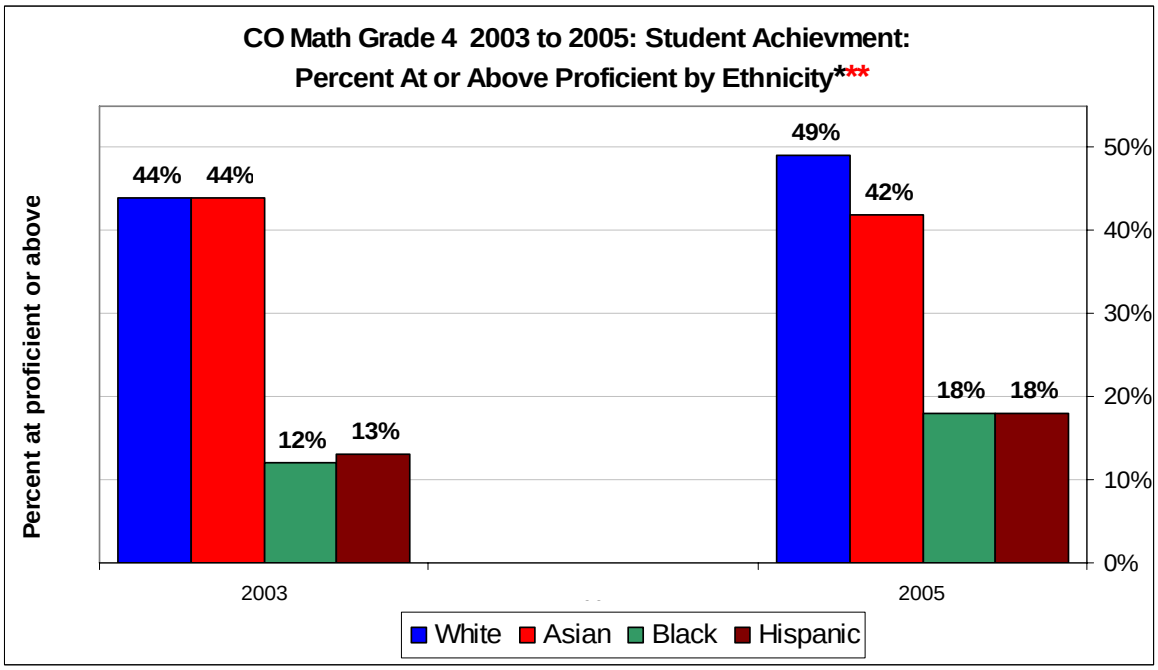
[1] Department of Defense Education Activity schools (domestic and overseas).
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2005 Mathematics Assessment.

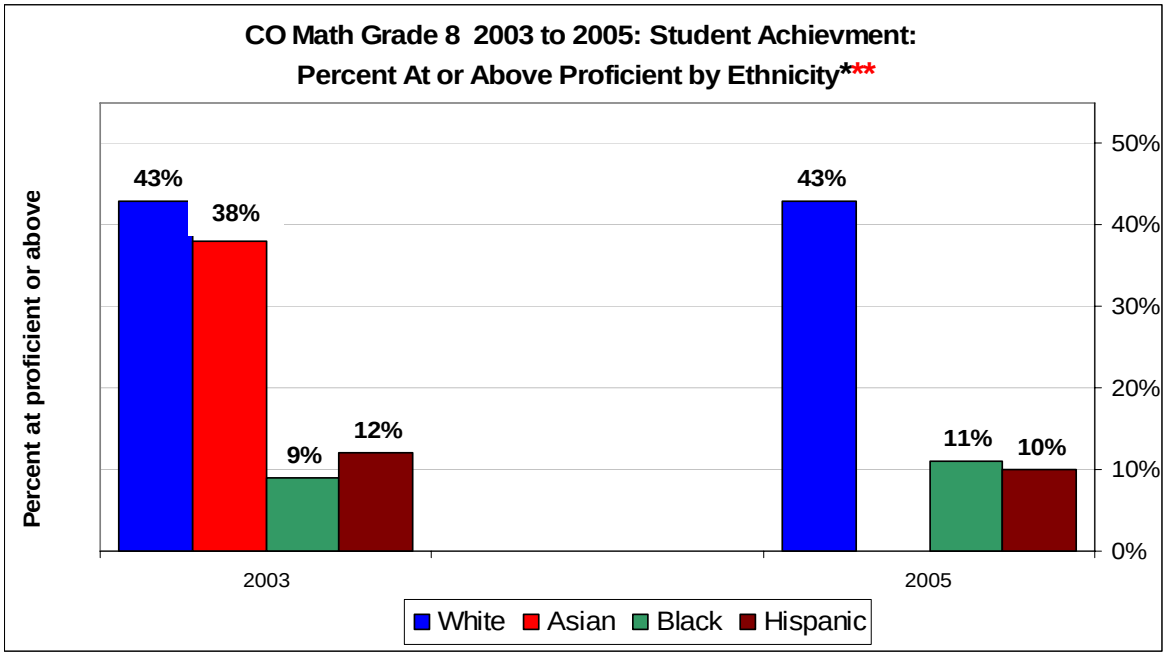
NAEP Achievement by National School Lunch Eligibility





Achievement by Ethnicity from 2003 to 2005





***There is no statistically significant difference within any of the groups from 2003 to 2005.**
****There was not a representative number of Asians in 2005 to report results for them.**
In both 2003 and 2005, there was not a representative number of Native Americans to report results for them.

Description of Geographic Locations

The bar graphs on the next page compare the results for the different types of geographic locations in Colorado.

Results from the 2005 assessment are reported for students attending schools in three mutually exclusive location types: central city, urban fringe/large town, and rural/ small town.

Central city: Following standard definitions established by the Federal Office of Management and Budget, the Census Bureau (see http://www.census.gov/) defines "central city" as the largest city of a Metropolitan Statistical Area (MSA) or a Consolidated Metropolitan Statistical Area (CMSA). Typically, an MSA contains a city with a population of at least 50,000 and includes its adjacent areas. An MSA becomes a CMSA if it meets the requirements to qualify as an MSA, has a population of 1,000,000 or more, its component parts are recognized as primary MSAs, and local opinion favors the designation. In the NCES Common Core of Data (CCD), locale codes are assigned to schools.

For the definition of central city used in this report, two locale codes of the survey are combined. The definition of each school's type of location is determined by the size of the place where the school is located and whether or not it is in an MSA or a CMSA. School locale codes are assigned by the Census Bureau. For the definition of central city, NAEP reporting uses data from two CCD locale codes: large city (a central city of an MSA or CMSA with the city having a population greater than or equal to 25,000) and mid-size city (a central city of an MSA or CMSA having a population less than 25,000). Central city is a geographical term and is not synonymous with "inner city."

Urban fringe/large town: The urban fringe category includes any incorporated place, census designated place, or non-place territory within a CMSA or an MSA of a large or mid-sized city and defined as urban by the Census Bureau, but which does not qualify as a central city. A large town is defined as a place outside a CMSA or an MSA with a population greater than or equal to 25,000.

Rural/small town: Rural includes all places and areas with populations of less than 2,500 that are classified as rural by the Census Bureau. A small town is defined as a place outside a CMSA or an MSA with a population of less than 25,000, but greater than or equal to 2,500. Results for each type of location are only compared across years 2000 and after. This is due to new methods used by NCES to identify the type of location assigned to each school in the CCD. The new methods were put into place by NCES in order to improve the quality of the assignments, and they take into account more information about the exact physical location of the school. The variable was revised in NAEP beginning with the 2000 assessments.

NAEP Math by Location