

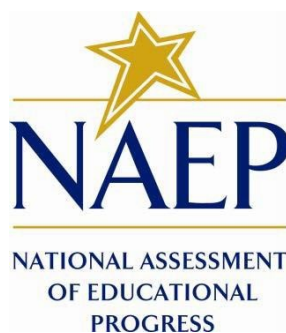
*NATIONAL CENTER FOR EDUCATION STATISTICS NATIONAL  
ASSESSMENT OF EDUCATIONAL PROGRESS*

*National Assessment of Education Progress (NAEP) 2022  
Materials Update #2*

*Appendix A-C*

*External Advisory Committees*

*OMB# 1850-0928 v.25*



September 2021

## Table of Contents

**Appendix A- Committees and Panels (Approved v.23) 2**

**Appendix B- Weighting Procedures (Approved v.10) 13**

The 2013 Weighting Procedures documentation is the most current version available to the public. At this time, there is not a timeline for when the details for later assessment years will be publicly available.

**Appendix C- 2022 Sampling Memo (New) 65**

# Appendix A

## Appendix A-1: NAEP Design and Analysis Committee (DAC)

<b>Name</b>	<b>Affiliation</b>
Betsy Becker	Florida State University, FL
Peter Behuniak	Criterion Consulting, LLC, CT
Dan Bolt	University of Wisconsin, Madison, WI
Lloyd Bond	University of North Carolina, Greensboro, NC (Emeritus)/Carnegie Foundation (retired)
Derek Briggs	University of Colorado, Boulder, CO
Richard Duran	University of California, Santa Barbara, CA
Ben Hansen	University of Michigan, MI
Brian Junker	Carnegie Mellon University, PA
David Kaplan	University of Wisconsin-Madison, WI
Kenneth Koedinger	Carnegie Mellon University, PA
Sophia Rabe-Hesketh	University of California, Berkeley, CA
Michael Rodriguez	University of Minnesota, MN
S. Lynne Stokes	Southern Methodist University, TX
Chun Wang	University of Washington, WA

## Appendix A-2: NAEP Validity Studies Panel (NVS)

<b>Name</b>	<b>Affiliation</b>
Keena Arbuthnot	Office of Research and Economic Development Louisiana State University, LA
Peter Behuniak	Criterion Consulting, LLC, CT
Jack Buckley	Panel Chair American Institutes for Research, Washington, DC
Jim Chromy	RTI International (Emeritus Fellow), Raleigh, NC
Phil Daro	Strategic Education Research Partnership (SERP) Institute, Washington, DC
Richard Duran	Gevirtz Graduate School of Education University of California, Santa Barbara, CA
David Grissmer	Curry School of Education University of Virginia, VA
Larry Hedges	Institute for Policy Research Northwestern University, IL
Gerunda Hughes	Washington, DC
Ina Mullis	TIMSS & PIRLS International Study Ctr, Boston College, MA
Scott Norton	Deputy Executive Director, Programs Council of Chief State School Officers, Washington, DC
Jim Pellegrino	University of Illinois at Chicago/Learning Sciences Research Institute, IL
Gary Phillips	Cambium Assessment, Washington, DC
Lorrie Shepard	School of Education University of Colorado at Boulder, CO
David Thissen	Dept. of Psychology University of North Carolina at Chapel Hill, NC
Gerald Tindal	University of Oregon, Eugene, OR
Sheila Valencia	Washington, WA
Denny Way	College Board. Washington, DC.

### **Appendix A-3: NAEP National Indian Education Study Technical Review Panel (NIES)**

<b>Name</b>	<b>Affiliation</b>
Mandy Smoker Broaddus	Education Northwest, Portland, OR
Doreen E. Brown	ASD Education Center, Anchorage, AK
Robert B. Cook	Teach for America, Summerset, SD
Steve Andrew Culpepper	University of Illinois at Urbana-Champaign, IL
Dr. Susan C. Faircloth	Panel Chair, Colorado State University, Fort Collins, CO
Dr. Chris Gordon	JKL Bahweting Anishinaabe PSA, Sault Ste. Marie, MI
Dr. Jameson D. Lopez	University of Arizona. Tucson, AZ
Jeremy MacDonald	Rocky Boy Elementary, Box, Elder, MT
Dr. Holly Jonel Mackey	North Dakota State University, ND
Jeannette Muskett Miller	Central Consolidated School District, Gallup, AZ
Debora Norris	Arizona School Facilities Board, Phoenix, AZ
Sedelta Oosahwee	National Education Association, DC
Dr. Martin Reinhardt	Northern Michigan University, MI

## Appendix A-4: NAEP Mathematics Standing Committee

<b>Name</b>	<b>Affiliation</b>
June Ahn	University of California, Irvine, CA
Scott Baldrige	Louisiana State University, Baton Rouge, LA
Joe Garofalo	University of Virginia, Charlottesville, VA
Mark Howell	Gonzaga College High School, Washington, DC
Jennifer Langer-Osuna	Stanford University, Stanford, CA
Michele Mailhot	Maine Department of Education, Augusta, ME
Kayonna Pitchford	University of North Carolina, Pembroke, NC
Angelica Niño	De Zavala Elementary School, San Antonio, TX
Allan Rossman	California Polytechnic State University, College of Mathematics and Science, San Luis Obispo, CA
Amy Roth McDuffie	Washington State University, Pullman, WA
Edward Silver	University of Michigan, Ann Arbor, MI
Lya Snell	Georgia Department of Education, Atlanta, GA
Zalman Usiskin	University of Chicago, Chicago, IL
Vivian Valencia	Eutimio “Tim” Salazar III Elementary, Española Public Schools, Española, NM

## Appendix A-5: NAEP Reading Standing Committee

<b>Name</b>	<b>Affiliation</b>
Patricia Alexander	University of Maryland, College Park, MD
Alison Bailey	University of California, Los Angeles, CA
Jensa Bushey	Shelburne Community Schools, Shelburne, VT
Bridget Dalton	University of Colorado, Boulder, CO
Christy Howard	East Carolina University, Greenville, NC
Jeanette Mancilla-Martinez	Vanderbilt University, Nashville, TN
Pamela Mason	Harvard Graduate School of Education, Cambridge, MA
Frank Serafini	Arizona State University, Phoenix, AZ
Kris Shaw	Kansas State Department of Education, Topeka, KS
Ana Taboada Barber	University of Maryland, College Park, MD
Diana Townsend	University of Nevada, Reno, NV
Brandon Wallace	Montgomery College, Takoma Park, MD



## **Appendix A-6: NAEP Survey Questionnaire Standing Committee**

<b>Name</b>	<b>Affiliation</b>
Flávio Cunha	Rice University, Houston, TX
Hunter Gehlbach	Johns Hopkins School of Education, Baltimore, MD
Cassandra Guarino	University of California, Riverside, CA
Jori Hall	University of Georgia, Athens, GA
Henry Levin	Teachers College, Columbia University, NY, NY
Laura Moore	Obama Foundation, Chicago, IL
Stanley Presser	University of Maryland, College Park, MD
Leslie Rutkowski	Indiana University Bloomington, IN
Akane Zusho	Fordham University, NY, NY

## Appendix A-7: NAEP Mathematics Translation Review Committee

<b>Name</b>	<b>Affiliation</b>
Mayra Aviles	Puerto Rico Department of Education, Hato Rey, PR
David Feliciano	The Melrose School (P.S./M.S 29), Bronx, NY
Yvonne Fuentes	University of West Georgia, Carrollton, GA
Marco Martinez-Leandro	Sandia High School, Albuquerque, NM
Jose Antonio (Tony) Paulino	Nathan Straus Preparatory School (P.S. 140M), New York, NY
Evelisse Rosado Rivera	Puerto Rico Department of Education, Hato Rey, PR
Myrna Rosado-Rasmussen	Austin Independent School District, Austin, TX
Gloria Rosado Vazquez	Puerto Rico Department of Education, Hato Rey, PR
Enid Valle	Kalamazoo College, Kalamazoo, MI

**Appendix A-8: NAEP Grade 4 and 8 Survey Questionnaires and eNAEP DBA System Translation Committee**

<b>Name</b>	<b>Affiliation</b>
Daniel Berdugo	Wilton Elementary School (PS 30X), Bronx, NY
Yvonne Fuentes	University of West Georgia, Carrollton, GA
Marco Martinea-Leandro	Sandia High School, Albuquerque, NM
Jose Antonio (Tony) Paulino	Nathan Straus Preparatory School (P.S. 140M), New York, NY
Evelisse Rosado Rivera	Puerto Rico Department of Education, Hato Rey, PR
Myrna Rosado-Rasmussen	Austin Independent School District, Austin, TX
Gloria M. Rosado Vazquez	Puerto Rico Department of Education, Hato Rey, PR
Enid Valle	Kalamazoo College, Kalamazoo, MI

## Appendix A-9: NAEP Principals' Panel Standing Committee

<b>Name</b>	<b>Affiliation</b>
David Atherton	Clear Creek Middle School, Gresham, OR
Williams Carozza	Harold Martin Elementary School, Hopkinton, NH
Rita Graves	Pin Oak Middle School, Bellaire, TX
Stephen Jackson	Principal Consultant and Chair, NAEP Principals' Panel
Anthony Lockhart	Fulton-Holland Educational Services Center West Palm Beach, FL
Lillie McMillan	Porter Elementary School, San Diego, CA
Kourtney Miller	Chavez Prep Middle School, Washington, DC
Jason Mix	Howard Lake–Waverly–Winsted High School, Howard Lake, MN
Leon Oo-Sah-We	Saint Francis Indian School, Saint Francis, SD
Ardith Bates Stanford	Murray County Schools, Chattanooga, TN
Sylvia Rodriguez Vargas	The Hill School, Pottstown, PA

# Appendix B

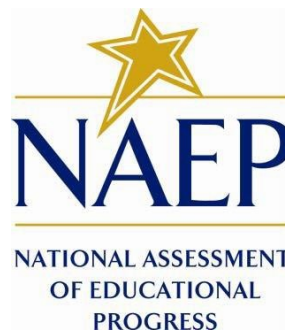
*NATIONAL CENTER FOR EDUCATION STATISTICS NATIONAL  
ASSESSMENT OF EDUCATIONAL PROGRESS*

*National Assessment of Educational Progress (NAEP)  
2022*

*Appendix B*

*NAEP 2013 Weighting Procedures*

*OMB# 1850-0928 v.25*



August 2021  
No changes since v.10

The 2013 Weighting Procedures documentation is the most current version available to the public. At this time, there is not a timeline for when the details for later assessment years will be publicly available.

## NAEP Technical Documentation Website

# NAEP Technical Documentation Weighting Procedures for the 2013 Assessment

NAEP assessments use complex sample designs to create student samples that generate population and subpopulation estimates with reasonably high precision. Student sampling weights ensure valid inferences from the student samples to their respective populations. In 2013, weights were developed for students sampled at grades 4, 8, and 12 for assessments in mathematics and reading.

Each student was assigned a weight to be used for making inferences about students in the target population. This weight is known as the final full-sample student weight and contains the following major components:

- the student base weight;
- school nonresponse adjustments;
- student nonresponse adjustments;
- school weight trimming adjustments;
- student weight trimming adjustments; and
- student raking adjustment.

The student base weight is the inverse of the overall probability of selecting a student and assigning that student to a particular assessment. The sample design that determines the base weights is discussed in the NAEP 2013 sample design section.

The student base weight is adjusted for two sources of nonparticipation: school level and student level. These weighting adjustments seek to reduce the potential for bias from such nonparticipation by

- increasing the weights of students from participating schools similar to those schools not participating; and
- increasing the weights of participating students similar to those students from within participating schools who did not attend the assessment session (or makeup session) as scheduled.

Furthermore, the final weights reflect the trimming of extremely large weights at both the school and student level. These weighting adjustments seek to reduce variances of survey estimates.

An additional weighting adjustment was implemented in the state and Trial Urban District Assessment (TUDA) samples so that estimates for key student-level characteristics were in agreement across assessments in reading and mathematics. This adjustment was implemented using a raking procedure.

In addition to the final full-sample weight, a set of replicate weights was provided for each student. These replicate weights are used to calculate the variances of survey estimates using the jackknife repeated replication method. The methods used to derive these weights were aimed at reflecting the features of the sample design, so that when the jackknife variance estimation procedure is implemented, approximately unbiased estimates of sampling variance are obtained. In addition, the various weighting procedures were repeated on each set of replicate weights to appropriately reflect the impact of the weighting adjustments on the sampling variance of a survey estimate. A finite population correction (fpc) factor was incorporated into the replication scheme so that it could be reflected in the variance estimates for the reading and mathematics assessments. See Computation of Replicate Weights for Variance Estimation for details.

Quality control checks were carried out throughout the weighting process to ensure the accuracy of the full-sample and replicate weights. See Quality Control for Weighting Procedures for the various checks implemented and main findings of interest.

In the linked pages that follow, please note that Vocabulary, Reading Vocabulary, and Meaning Vocabulary refer to the same reporting scale and are interchangeable.

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/naep\\_assessment\\_weighting\\_procedures.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/naep_assessment_weighting_procedures.aspx)

## NAEP Technical Documentation Computation of Full-Sample Weights for the 2013 Assessment

The full-sample or final student weight is the sampling weight used to derive NAEP student estimates of population and subpopulation characteristics for a specified grade (4, 8, or 12) and assessment subject (reading or mathematics). The full-sample student weight reflects the number of students that the sampled student represents in the population for purposes of estimation. The summation of the final student weights over a particular student group provides an estimate of the total number of students in that group within the population.

### Computation of Base Weights

School and Student Nonresponse Weight Adjustments

School and Student Weight Trimming Adjustments

Student Weight Raking Adjustment

The full-sample weight, which is used to produce survey estimates, is distinct from a replicate weight that is used to estimate variances of survey estimates. The full-sample weight is assigned to participating students and reflects the student base weight after the application of the various weighting adjustments. The full-sample weight for student  $k$  from school  $s$  in stratum  $j$  ( $FSTUWGT_{jsk}$ ) can be expressed as follows:

$$FSTUWGT_{jsk} = STU\_BWT_{jsk} \times SCH\_NRAF_{js} \times STU\_NRAF_{jsk} \times SCH\_TRIM_{js} \times STU\_TRIM_{jsk} \times STU\_RAKE_{jsk}$$

where

- $STU\_BWT_{jsk}$  is the student base weight;
- $SCH\_NRAF_{js}$  is the school-level nonresponse adjustment factor;
- $STU\_NRAF_{jsk}$  is the student-level nonresponse adjustment factor;
- $SCH\_TRIM_{js}$  is the school-level weight trimming adjustment factor;
- $STU\_TRIM_{jsk}$  is the student-level weight trimming adjustment factor; and
- $STU\_RAKE_{jsk}$  is the student-level raking adjustment factor.

School sampling strata for a given assessment vary by school type and grade. See the links below for descriptions of the school strata for the various assessments.

- Public schools at grades 4 and 8
- Public schools at grade 12
- Private schools at grades 4, 8 and 12

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/computation\\_of\\_full\\_sample\\_weights\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/computation_of_full_sample_weights_for_the_2013_assessment.aspx)



## NAEP Technical Documentation Computation of Base Weights for the 2013 Assessment

Every sampled school and student received a base weight equal to the reciprocal of its probability of selection. Computation of a school base weight varies by

School Base Weights

Student Base Weights

- type of sampled school (original or substitute); and
- sampling frame (new school frame or not).

Computation of a student base weight reflects

- the student's overall probability of selection accounting for school and student sampling;
- assignment to session type at the school- and student-level; and
- the student's assignment to the reading or mathematics assessment.

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/computation\\_of\\_base\\_weights\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/computation_of_base_weights_for_the_2013_assessment.aspx)

---

## NAEP Technical Documentation

# NAEP Technical Documentation School Base Weights for the 2013 Assessment

The school base weight for a sampled school is equal to the inverse of its overall probability of selection. The overall selection probability of a sampled school differs by

- type of sampled school (original or substitute);
- sampling frame (new school frame or not).

The overall selection probability of an originally selected school in a reading or mathematics sample is equal to its probability of selection from the NAEP public/private school frame.

The overall selection probability of a school from the new school frame in a reading or mathematics sample is the product of two quantities:

- the probability of selection of the school's district into the new-school district sample, and
- the probability of selection of the school into the new school sample.

Substitute schools are preassigned to original schools and take the place of original schools if they refuse to participate. For weighting purposes, they are treated as if they were the original schools that they replaced; so substitute schools are assigned the school base weight of the original schools.

Learn more about substitute schools for the 2013 private school national assessment and substitute schools for the 2013 twelfth grade public school assessment.

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/school\\_base\\_weights\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/school_base_weights_for_the_2013_assessment.aspx)

---

## NAEP Technical Documentation Student Base Weights for the 2013 Assessment

Every sampled student received a student base weight, whether or not the student participated in the assessment. The student base weight is the reciprocal of the probability that the student was sampled to participate in the assessment for a specified subject. The student base weight for student  $k$  from school  $s$  in stratum  $j$  ( $STU\_BWT_{j sk}$ ) is the product of seven weighting components and can be expressed as follows:

$$STU\_BWT_{j sk} = SCH\_BWT_{js} \times SCHSESWT_{js} \times WINSCHWT_{js} \times STUSESWT_{j sk} \times SUBJFAC_{j sk} \times SUBADJ_{js} \times YRRND\_AF_{js}$$

where

- $SCH\_BWT_{js}$  is the school base weight;
- $SCHSESWT_{js}$  is the school-level session assignment weight that reflects the conditional probability, given the school, that the particular session type was assigned to the school;
- $WINSCHWT_{js}$  is the within-school student weight that reflects the conditional probability, given the school, that the student was selected for the NAEP assessment;
- $STUSESWT_{j sk}$  is the student-level session assignment weight that reflects the conditional probability, given that the particular session type was assigned to the school, that the student was assigned to the session type;
- $SUBJFAC_{j sk}$  is the subject spiral adjustment factor that reflects the conditional probability, given that the student was assigned to a particular session type, that the student was assigned the specified subject;
- $SUBADJ_{js}$  is the substitution adjustment factor to account for the difference in enrollment size between the substitute and original school; and
- $YRRND\_AF_{js}$  is the year-round adjustment factor to account for students in year-round schools on scheduled break at the time of the NAEP assessment and thus not available to be included in the sample.

The within-school student weight ( $WINSCHWT_{js}$ ) is the inverse of the student sampling rate in the school.

The subject spiral adjustment factor ( $SUBJFAC_{j sk}$ ) adjusts the student weight to account for the spiral pattern used in distributing reading or mathematics booklets to the students. The subject factor varies by grade, subject, and school type (public or private), and it is equal to the inverse of the booklet proportions (reading or mathematics) in the overall spiral for a specific sample.

For cooperating substitutes of nonresponding original sampled schools, the substitution adjustment factor ( $SUBADJ_{js}$ ) is equal to the ratio of the estimated grade enrollment for the original sampled school to the estimated grade enrollment for the substitute school. The student sample from the substitute school then "represents" the set of grade-eligible students from the original sampled school.

The year-round adjustment factor ( $YRRND\_AF_{js}$ ) adjusts the student weight for students in year-round schools who do not attend school during the time of the assessment. This situation typically arises in overcrowded schools. School administrators in year-round schools randomly assign students to portions of the year in which they attend school and portions of the year in which they do not attend. At the time of assessment, a certain percentage of students (designated as  $OFF_{js}$ ) do not attend school and thus cannot be assessed. The  $YRRND\_AF_{js}$  for a school is calculated as  $1/(1-OFF_{js}/100)$ .

## NAEP Technical Documentation School and Student Nonresponse Weight Adjustments for the 2013 Assessment

Nonresponse is unavoidable in any voluntary survey of a human population. Nonresponse leads to the loss of sample data that must be compensated for in the weights of the responding sample members. This differs from ineligibility, for which no adjustments are necessary. The purpose of the nonresponse adjustments is to reduce the mean square error of survey estimates. While the nonresponse adjustment reduces the bias from the loss of sample, it also increases variability among the survey weights leading to increased variances of the sample estimates. However, it is presumed that the reduction in bias more than compensates for the increase in

the variance, thereby reducing the mean square error and thus improving the accuracy of survey estimates. Nonresponse adjustments are made in the NAEP surveys at both the school and the student levels: the responding (original and substitute) schools receive a weighting adjustment to compensate for nonresponding schools, and responding students receive a weighting adjustment to compensate for nonresponding students.

School Nonresponse  
Weight Adjustment

Student Nonresponse  
Weight Adjustment

The paradigm used for nonresponse adjustment in NAEP is the quasi-randomization approach (Oh and Scheuren 1983). In this approach, school response cells are based on characteristics of schools known to be related to both response propensity and achievement level, such as the locale type (e.g., large principal city of a metropolitan area) of the school. Likewise, student response cells are based on characteristics of the schools containing the students and student characteristics, which are known to be related to both response propensity and achievement level, such as student race/ethnicity, gender, and age.

Under this approach, sample members are assigned to mutually exclusive and exhaustive response cells based on predetermined characteristics. A nonresponse adjustment factor is calculated for each cell as the ratio of the sum of adjusted base weights for all eligible units to the sum of adjusted base weights for all responding units. The nonresponse adjustment factor is then applied to the base weight of each responding unit. In this way, the weights of responding units in the cell are "weighted up" to represent the full set of responding and nonresponding units in the response cell.

The quasi-randomization paradigm views nonresponse as another stage of sampling. Within each nonresponse cell, the paradigm assumes that the responding sample units are a simple random sample from the total set of all sample units. If this model is valid, then the use of the quasi-randomization weighting adjustment will eliminate any nonresponse bias. Even if this model is not valid, the weighting adjustments will eliminate bias if the achievement scores are homogeneous within the response cells (i.e., bias is eliminated if there is homogeneity either in response propensity or in achievement levels). See, for example, chapter 4 of Little and Rubin (1987).

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/school\\_and\\_student\\_nonresponse\\_weight\\_adjustments\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/school_and_student_nonresponse_weight_adjustments_for_the_2013_assessment.aspx)

---

## NAEP Technical Documentation School Nonresponse Weight Adjustment

The school nonresponse adjustment procedure inflates the weights of cooperating schools to account for eligible noncooperating schools for which no substitute schools participated. The adjustments are computed within nonresponse cells and are based on the assumption that the cooperating and noncooperating schools within the same cell are more similar to each other than to schools from different cells. School nonresponse adjustments were carried out separately by sample; that is, by

- sample level (state, national),
- school type (public, private), and
- grade (4, 8, 12).

Development of Initial School Nonresponse Cells

Development of Final School Nonresponse Cells

School Nonresponse Adjustment Factor Calculation

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/school\\_nonresponse\\_weight\\_adjustment\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/school_nonresponse_weight_adjustment_for_the_2013_assessment.aspx)

---

## NAEP Technical Documentation Development of Initial School Nonresponse Cells

The cells for nonresponse adjustments are generally functions of the school sampling strata for the individual samples. School sampling strata usually differ by assessment subject, grade, and school type (public or private). Assessment subjects that are administered together by way of spiraling have the same school samples and stratification schemes. Subjects that are not spiraled with any other subjects have their own separate school sample. In NAEP 2015, all operational assessments were spiraled together.

The initial nonresponse cells for the various NAEP 2015 samples are described below.

### Public School Samples for Reading and Mathematics at Grades 4 and 8

For these samples, initial weighting cells were formed within each jurisdiction using the following nesting cell structure:

- Trial Urban District Assessment (TUDA) district vs. the balance of the state for states with TUDA districts,
- urbanicity (urban-centric locale) stratum; and
- race/ethnicity classification stratum, or achievement level, or median income, or grade enrollment.

In general, the nonresponse cell structure used race/ethnicity classification stratum as the lowest level variable. However, where there was only one race/ethnicity classification stratum within a particular urbanicity stratum, categorized achievement, median income, or enrollment data were used instead.

### Public School Sample at Grade 12

The initial weighting cells for this sample were formed using the following nesting cell structure:

- census division stratum,
- urbanicity stratum (urban-centric locale), and
- race/ethnicity classification stratum.

### Private School Samples at Grades 4, 8 and 12

The initial weighting cells for these samples were formed within each grade using the following nesting cell structure:

- affiliation,
- census division stratum,
- urbanicity stratum (urban-centric locale), and
- race/ethnicity classification stratum.

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/development\\_of\\_initial\\_school\\_nonresponse\\_cells\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/development_of_initial_school_nonresponse_cells_for_the_2013_assessment.aspx)

---

## NAEP Technical Documentation Development of Final School Nonresponse Cells

Limits were placed on the magnitude of cell sizes and adjustment factors to prevent unstable nonresponse adjustments and unacceptably large nonresponse factors. All initial weighting cells with fewer than six cooperating schools or adjustment factors greater than 3.0 for the full sample weight were collapsed with suitable adjacent cells. Simultaneously, all initial weighting cells for any replicate with fewer than four cooperating schools or adjustment factors greater than the maximum of 3.0 or two times the full sample nonresponse adjustment factor were collapsed with suitable adjacent cells. Initial weighting cells were generally collapsed in reverse order of the cell structure; that is, starting at the bottom of the nesting structure and working up toward the top level of the nesting structure.

### Public School Samples at Grades 4 and 8

For the grade 4 and 8 public school samples, cells with the most similar race/ethnicity classification within a given jurisdiction/Trial Urban District Assessment (TUDA) district and urbanicity (urban-centric locale) stratum were collapsed first. If further collapsing was required after all levels of race/ethnicity strata were collapsed, cells with the most similar urbanicity strata were combined next. Cells were never permitted to be collapsed across jurisdictions or TUDA districts.

### Public School Sample at Grades 12

For the grade 12 public school sample, race/ethnicity classification cells within a given census division stratum and urbanicity stratum were collapsed first. If further collapsing was required after all levels of race/ethnicity classification were collapsed, cells with the most similar urbanicity strata were combined next. Any further collapsing occurred across census division strata but never across census regions.

### Private School Samples at Grades 4, 8, and 12

For the private school samples, cells with the most similar race/ethnicity classification within a given affiliation, census division, and urbanicity stratum were collapsed first. If further collapsing was required after all levels of race/ethnicity strata were collapsed, cells with the most similar urbanicity classification were combined. Any further collapsing occurred across census division strata but never across affiliations.

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/development\\_of\\_final\\_school\\_nonresponse\\_cells\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/development_of_final_school_nonresponse_cells_for_the_2013_assessment.aspx)

---

## NAEP Technical Documentation School Nonresponse Adjustment Factor Calculation

In each final school nonresponse adjustment cell  $c$ , the school nonresponse adjustment factor  $SCH\_NRAF_c$  was computed as follows:

$$SCH\_NRAF_c = \frac{\sum_{s \in S_c} SCH\_BWT_s \times SCH\_TRIM_s \times SCHSESWT_s \times X_s}{\sum_{s \in R_c} SCH\_BWT_s \times SCH\_TRIM_s \times SCHSESWT_s \times X_s}$$

where

- $S_c$  is the set of all eligible sampled schools (cooperating original and substitute schools and refusing original schools with noncooperating or no assigned substitute) in cell  $c$ ,
- $R_c$  is the set of all cooperating schools within  $S_c$ ,
- $SCH\_BWT_s$  is the school base weight,
- $SCH\_TRIM_s$  is the school-level weight trimming factor,
- $SCHSESWT_s$  is the school-level session assignment weight, and
- $X_s$  is the estimated grade enrollment corresponding to the original sampled school.

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/school\\_nonresponse\\_adjustment\\_factor\\_calculation\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/school_nonresponse_adjustment_factor_calculation_for_the_2013_assessment.aspx)

---



## NAEP Technical Documentation Student Nonresponse Weight Adjustment

The student nonresponse adjustment procedure inflates the weights of assessed students to account for eligible sampled students who did not participate in the assessment. These inflation factors offset the loss of data associated with absent students. The adjustments are computed within nonresponse cells and are based on the assumption that the assessed and absent students within the same cell are more similar to one another than to students from different cells. Like its counterpart at the school level, the student nonresponse adjustment is

intended to reduce the mean square error and thus improve the accuracy of NAEP assessment estimates. Also, like its counterpart at the school level, student nonresponse adjustments were carried out separately by sample; that is, by

- grade (4, 8, 12),
- school type (public, private), and
- assessment subject (mathematics, reading, science, meaning vocabulary).

Development of Initial Student Nonresponse Cells

Development of Final Student Nonresponse Cells

Student Nonresponse Adjustment Factor Calculation

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/student\\_nonresponse\\_weight\\_adjustment\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/student_nonresponse_weight_adjustment_for_the_2013_assessment.aspx)

---

## NAEP Technical Documentation Development of Initial Student Nonresponse Cells for the 2013 Assessment

Initial student nonresponse cells are generally created within each sample as defined by grade, school type (public, private), and assessment subject. However, when subjects are administered together by way of spiraling, the initial student nonresponse cells are created across the subjects in the same spiral. The rationale behind this decision is that spiraled subjects are in the same schools and the likelihood of whether an eligible student participates in an assessment is more related to its school than the subject of the assessment booklet. In NAEP 2013, there was only one spiral, with the reading and mathematics assessments spiraled together. The initial student nonresponse cells for the various NAEP 2013 samples are described below.

Nonresponse adjustment procedures are not applied to excluded students because they are not required to complete an assessment.

### Public School Samples for Reading and Mathematics at Grades 4 and 8

The initial student nonresponse cells for these samples were defined within grade, jurisdiction, and Trial Urban District Assessment (TUDA) district using the following nesting cell structure:

- students with disabilities (SD)/English language learners (ELL) by subject,
- school nonresponse cell,
- age (classified into "older"<sup>1</sup> student and "modal age or younger" student),
- gender, and
- race/ethnicity.

The highest level variable in the cell structure separates students who were classified either as having disabilities (SD) or as English language learners (ELL) from those who are neither, since SD or ELL students tend to score lower on assessment tests than non-SD/non-ELL students. In addition, the students in the SD or ELL groups are further broken down by subject, since rules for excluding students from the assessment differ by subject. Non-SD and non-ELL students are not broken down by subject, since the exclusion rules do not apply to them.

### Public School Samples for Reading and Mathematics at Grade 12

The initial weighting cells for these samples were formed hierarchically within state for the state-reportable samples and the balance of the country for remaining states as follows:

- SD/ELL,
- school nonresponse cell,
- age (classified into "older"<sup>1</sup> student and "modal age or younger" student),
- gender, and
- race/ethnicity.

### Private School Samples for Reading and Mathematics at Grades 4, 8, and 12

The initial weighting cells for these private school samples were formed hierarchically within grade as follows:

- SD/ELL,
- school nonresponse cell,
- age (classified into "older"<sup>1</sup> student and "modal age or younger" student),
- gender, and
- race/ethnicity.

Although exclusion rules differ by subject, there were not enough SD or ELL private school students to break out by subject as was done for the public schools.

<sup>1</sup>Older students are those born before October 1, 2002, for grade 4; October 1, 1998, for grade 8; and October 1, 1994, for grade 12.

## NAEP Technical Documentation Development of Final Student Nonresponse Cells for the 2013 Assessment

Similar to the school nonresponse adjustment, cell and adjustment factor size constraints are in place to prevent unstable nonresponse adjustments or unacceptably large adjustment factors. All initial weighting cells with either fewer than 20 participating students or adjustment factors greater than 2.0 for the full sample weight were collapsed with suitable adjacent cells. Simultaneously, all initial weighting cells for any replicate with either fewer than 15 participating students or an adjustment factor greater than the maximum of 2.0 or 1.5 times the full sample nonresponse adjustment factor were collapsed with suitable adjacent cells.

Initial weighting cells were generally collapsed in reverse order of the cell structure; that is, starting at the bottom of the nesting structure and working up toward the top level of the nesting structure. Race/ethnicity cells within SD/ELL groups, school nonresponse cell, age, and gender classes were collapsed first. If further collapsing was required after collapsing all race/ethnicity classes, cells were next combined across gender, then age, and finally school nonresponse cells. Cells are never collapsed across SD and ELL groups for any sample.

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/development\\_of\\_final\\_student\\_nonresponse\\_cells\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/development_of_final_student_nonresponse_cells_for_the_2013_assessment.aspx)

---

## NAEP Technical Documentation Student Nonresponse Adjustment Factor Calculation

In each final student nonresponse adjustment cell  $c$  for a given sample, the student nonresponse adjustment factor  $STU\_NRAF_c$  was computed as follows:

$$STU\_NRAF_c = \frac{\sum_{k \in S_c} STU\_BWT_k \times SCH\_TRIM_k \times SCH\_NRAF_k / SUBJFAC_k}{\sum_{k \in R_c} STU\_BWT_k \times SCH\_TRIM_k \times SCH\_NRAF_k / SUBJFAC_k}$$

where

- $S_c$  is the set of all eligible sampled students in cell  $c$  for a given sample,
- $R_c$  is the set of all assessed students within  $S_c$ ,
- $STU\_BWT_k$  is the student base weight for a given student  $k$ ,
- $SCH\_TRIM_k$  is the school-level weight trimming factor for the school associated with student  $k$ ,
- $SCH\_NRAF_k$  is the school-level nonresponse adjustment factor for the school associated with student  $k$ , and
- $SUBJFAC_k$  is the subject factor for a given student  $k$ .

The student weight used in the calculation above is the adjusted student base weight, without regard to subject, adjusted for school weight trimming and school nonresponse.

Nonresponse adjustment procedures are not applied to excluded students because they are not required to complete an assessment. In effect, excluded students were placed in a separate nonresponse cell by themselves and all received an adjustment factor of 1. While excluded students are not included in the analysis of the NAEP scores, weights are provided for excluded students in order to estimate the size of this group and its population characteristics.

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/student\\_nonresponse\\_adjustment\\_factor\\_calculation\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/student_nonresponse_adjustment_factor_calculation_for_the_2013_assessment.aspx)

---

## NAEP Technical Documentation School and Student Weight Trimming Adjustments for the 2013 Assessment

Weight trimming is an adjustment procedure that involves detecting and reducing extremely large weights. "Extremely large weights" generally refer to large sampling weights that were not anticipated in the design of the sample. Unusually large weights are likely to produce large sampling variances for statistics of interest, especially when the large weights are associated with sample cases reflective of rare or atypical characteristics. To reduce the impact of these large weights on variances, weight reduction methods are typically employed. The goal of employing weight reduction methods is to reduce the mean square error of survey estimates.

While the

trimming of large weights reduces variances, it also introduces some bias. However, it is presumed that the reduction in the variances more than compensates for the increase in the bias, thereby reducing the mean square error and thus improving the accuracy of survey estimates (Potter 1988). NAEP employs weight trimming at both the school and student levels.

Trimming of School  
Base Weights

Trimming of Student  
Weights

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/school\\_and\\_student\\_weight\\_trimming\\_adjustments\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/school_and_student_weight_trimming_adjustments_for_the_2013_assessment.aspx)

---

## NAEP Technical Documentation Trimming of School Base Weights

Large school weights can occur for schools selected from the NAEP new-school sampling frame and for private schools. New schools that are eligible for weight trimming are schools with a disproportionately large student enrollment in a particular grade from a school district that was selected with a low probability of selection. The school base weights for such schools may be large relative to what they would have been if they had been selected as part of the original sample.

To detect extremely large weights among new schools, a comparison was made between a new school's school base weight and its ideal weight (i.e., the weight that would have resulted had the school been selected from the original school sampling frame). If the school base weight was more than three times the ideal weight, a trimming factor was calculated for that school that scaled the base weight back to three times the ideal weight. The calculation of the school-level trimming factor for a new school  $s$  is expressed in the following formula:

$$SCH\_TRIM_s = \begin{cases} \frac{3 \times EXP\_WT_s}{SCH\_BWT_s}, & \text{if } \frac{SCH\_BWT_s}{EXP\_WT_s} > 3 \\ 1, & \text{otherwise} \end{cases}$$

where

- $EXP\_WT_s$  is the ideal base weight the school would have received if it had been on the NAEP public school sampling frame, and
- $SCH\_BWT_s$  is the actual school base weight the school received as a sampled school from the new school frame.

Thirty-seven (37) schools out of 377 selected from the new-school sampling frame had their weights trimmed: eight at grade 4, 29 at grade 8, and zero at grade 12.

Private schools eligible for weight trimming were Private School Universe Survey (PSS) nonrespondents who were found subsequently to have either larger enrollments than assumed at the time of sampling, or an atypical probability of selection given their affiliation, the latter being unknown at the time of sampling. For private school  $s$ , the formula for computing the school-level weight trimming factor  $SCH\_TRIM_s$  is identical to that used for new schools. For private schools,

- $EXP\_WT_s$  is the ideal base weight the school would have received if it had been on the NAEP private school sampling frame with accurate enrollment and known affiliation, and
- $SCH\_BWT_s$  is the actual school base weight the school received as a sampled private school.

No private schools had their weights trimmed.

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/trimming\\_of\\_school\\_base\\_weights\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/trimming_of_school_base_weights_for_the_2013_assessment.aspx)

## NAEP Technical Documentation Trimming of Student Weights

Large student weights generally come from compounding nonresponse adjustments at the school and student levels with artificially low school selection probabilities, which can result from inaccurate enrollment data on the school frame used to define the school size measure. Even though measures are in place to limit the number and size of excessively large weights—such as the implementation of adjustment factor size constraints in both the school and student nonresponse procedures and the use of the school trimming procedure—large student weights can occur due to compounding effects of the various weighting components.

The student weight trimming procedure uses a multiple median rule to detect excessively large student weights. Any student weight within a given trimming group greater than a specified multiple of the median weight value of the given trimming group has its weight scaled back to that threshold. Student weight trimming was implemented separately by grade, school type (public or private), and subject. The multiples used were 3.5 for public school trimming groups and 4.5 for private school trimming groups. Trimming groups were defined by jurisdiction and Trial Urban District Assessment (TUDA) districts for the public school samples at grades 4 and 8; by dichotomy of low/high percentage of Black and Hispanic students (15 percent and below, above 15 percent) for the public school sample at grade 12; and by affiliation (Catholic, Non-Catholic) for private school samples at grades 4, 8 and 12.

The procedure computes the median of the nonresponse-adjusted student weights in the trimming group  $g$  for a given grade and subject sample. Any student  $k$  with a weight more than  $M$  times the median received a trimming factor calculated as follows:

$$STU\_TRIM_{gk} = \begin{cases} \frac{M \times MEDIAN_g}{STUWGT_{gk}}, & STUWGT_{gk} > M \times MEDIAN_g \\ 1, & \text{otherwise} \end{cases}$$

where

- $M$  is the trimming multiple,
- $MEDIAN_g$  is the median of nonresponse-adjusted student weights in trimming group  $g$ , and
- $STUWGT_{gk}$  is the weight after student nonresponse adjustment for student  $k$  in trimming group  $g$ .

In the 2013 assessment, relatively few students had weights considered excessively large. Out of the approximately 840,000 students included in the combined 2013 assessment samples, 226 students had their weights trimmed.

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/trimming\\_of\\_student\\_weights\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/trimming_of_student_weights_for_the_2013_assessment.aspx)

## NAEP Technical Documentation Student Weight Raking Adjustment for the 2013 Assessment

Weighted estimates of population totals for student-level subgroups for a given grade will vary across subjects even though the student samples for each subject generally come from the same schools. These differences are the result of sampling error associated with the random assignment of subjects to students through a process known as spiraling. For state assessments in particular, any

difference in demographic estimates between subjects, no matter how small, may raise concerns about data quality. To remove these random differences and potential data quality concerns, a new step was added to the NAEP weighting procedure starting in 2009. This step adjusts the student weights in such a way that the weighted sums of population totals for specific subgroups are the same across all subjects. It was implemented using a raking procedure and applied only to state-level assessments.

[Development of Final Raking Dimensions](#)

[Raking Adjustment Control Totals](#)

[Raking Adjustment Factor Calculation](#)

Raking is a weighting procedure based on the iterative proportional fitting process developed by Deming and Stephan (1940) and involves simultaneous ratio adjustments to two or more marginal distributions of population totals. Each set of marginal population totals is known as a dimension, and each population total in a dimension is referred to as a control total. Raking is carried out in a sequence of adjustments. Sampling weights are adjusted to one marginal distribution and then to the second marginal distribution, and so on. One cycle of sequential adjustments to the marginal distributions is called an iteration. The procedure is repeated until convergence is achieved. The criterion for convergence can be specified either as the maximum number of iterations or an absolute difference (or relative absolute difference) from the marginal population totals. More discussion on raking can be found in Oh and Scheuren (1987).

For NAEP 2013, the student raking adjustment was carried out separately in each state for the reading and mathematics public school samples at grades 4 and 8, and in the 13 states with state-reportable samples for the reading and mathematics public school samples at grade 12. The dimensions used in the raking process were National School Lunch Program (NSLP) eligibility, race/ethnicity, SD/ELL status, and gender. The control totals for these dimensions were obtained from the NAEP student sample weights of the reading and mathematics samples combined.

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/student\\_weight\\_raking\\_adjustment\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/student_weight_raking_adjustment_for_the_2013_assessment.aspx)



## NAEP Technical Documentation Development of Final Raking Dimensions

The raking procedure involved four dimensions. The variables used to define the dimensions are listed below along with the categories making up the initial raking cells for each dimension.

- National School Lunch Program (NSLP) eligibility
  1. Eligible for free or reduced-price lunch
  2. Otherwise
- Race/Ethnicity
  1. White, not Hispanic
  2. Black, not Hispanic
  3. Hispanic
  4. Asian
  5. American Indian/Alaska Native
  6. Native Hawaiian/Pacific Islander
  7. Two or More
- Races SD/ELL status
  1. SD, but not ELL
  2. ELL, but not SD
  3. SD and ELL
  4. Neither SD nor
- ELL Gender
  1. Male
  2. Female

In states containing districts that participated in Trial Urban District Assessments (TUDA) districts at grades 4 and 8, the initial cells were created separately for each TUDA district and the balance of the state. Similar to the procedure used for school and student nonresponse adjustments, limits were placed on the magnitude of the cell sizes and adjustment factors to prevent unstable raking adjustments that could have resulted in unacceptably large or small adjustment factors. Levels of a dimension were combined whenever there were fewer than 30 assessed or excluded students (20 for any of the replicates) in a category, if the smallest adjustment was less than 0.5, or if the largest adjustment was greater than 2 for the full sample or for any replicate.

If collapsing was necessary for the race/ethnicity dimension, the following groups were combined first: American Indian/Alaska Native with Black, not Hispanic; Hawaiian/Pacific Islander with Black, not Hispanic; Two or More Races with White, not Hispanic; Asian with White, not Hispanic; and Black, not Hispanic with Hispanic. If further collapsing was necessary, the five categories American Indian/Alaska Native; Two or More Races; Asian; Native Hawaiian/Pacific Islander; and White, not Hispanic were combined. In some instances, all seven categories had to be collapsed.

If collapsing was necessary for the SD/ELL dimension, the SD/not ELL and SD/ELL categories were combined first, followed by ELL/not SD if further collapsing was necessary. In some instances, all four categories had to be collapsed.

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/development\\_of\\_final\\_raking\\_dimensions\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/development_of_final_raking_dimensions_for_the_2013_assessment.aspx)

## NAEP Technical Documentation Raking Adjustment Control Totals for the 2013 Assessment

The control totals used in the raking procedure for NAEP 2013 grades 4, 8, and 12 were estimates of the student population derived from the set of assessed and excluded students pooled across subjects. The control totals for category  $c$  within dimension  $d$  were computed as follows:

$$TOTAL_{c(d)} = \sum_{R_{c(d)} \cup E_{c(d)}} \frac{STU\_BWT_k \times SCH\_TRIM_k \times SCH\_NRAF_k \times STU\_NRAF_k}{SUBJFAC_k}$$

where

- $R_{c(d)}$  is the set of all assessed students in category  $c$  of dimension  $d$ ,
- $E_{c(d)}$  is the set of all excluded students in category  $c$  of dimension  $d$ ,
- $STU\_BWT_k$  is the student base weight for a given student  $k$ ,
- $SCH\_TRIM_k$  is the school-level weight trimming factor for the school associated with student  $k$ ,
- $SCH\_NRAF_k$  is the school-level nonresponse adjustment factor for the school associated with student  $k$ ,
- $STU\_NRAF_k$  is the student-level nonresponse adjustment factor for student  $k$ , and
- $SUBJFAC_k$  is the subject factor for student  $k$ .

The student weight used in the calculation of the control totals above is the adjusted student base weight, without regard to subject, adjusted for school weight trimming, school nonresponse, and student nonresponse. Control totals were computed for the full sample and for each replicate independently.

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/raking\\_adjustment\\_control\\_totals\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/raking_adjustment_control_totals_for_the_2013_assessment.aspx)

---

## NAEP Technical Documentation Raking Adjustment Factor Calculation for the 2013 Assessment

For assessed and excluded students in a given subject, the raking adjustment factor  $STU\_RAKE_k$  was computed as follows:

First, the weight for student  $k$  was initialized as follows:

$$STUSAWT_k^{adj(0)} = STU\_BWT_k \times SCH\_TRIM_k \times SCH\_NRAF_k \times STU\_NRAF_k \times SUBJFAC_k$$

where

- $STU\_BWT_k$  is the student base weight for a given student  $k$ ,
- $SCH\_TRIM_k$  is the school-level weight trimming factor for the school associated with student  $k$ ,
- $SCH\_NRAF_k$  is the school-level nonresponse adjustment factor for the school associated with student  $k$ ,
- $STU\_NRAF_k$  is the student-level nonresponse adjustment factor for student  $k$ , and
- $SUBJFAC_k$  is the subject factor for student  $k$ .

Then, the sequence of weights for the first iteration was calculated as follows for student  $k$  in category  $c$  of dimension  $d$ :

For dimension 1:

$$STUSAWT_k^{adj(1)} = \frac{TOTAL_{c(1)}}{\sum_{R_{c(1)} \cup E_{c(1)}} STUSAWT_k^{adj(0)}} \times STUSAWT_k^{adj(0)}$$

For dimension 2:

$$STUSAWT_k^{adj(2)} = \frac{TOTAL_{c(2)}}{\sum_{R_{c(2)} \cup E_{c(2)}} STUSAWT_k^{adj(1)}} \times STUSAWT_k^{adj(1)}$$

For dimension 3:

$$STUSAWT_k^{adj(3)} = \frac{TOTAL_{c(3)}}{\sum_{R_{c(3)} \cup E_{c(3)}} STUSAWT_k^{adj(2)}} \times STUSAWT_k^{adj(2)}$$

NAEP Technical Documentation  
For dimension 4:

$$STUSAWT_k^{adj(4)} = \frac{TOTAL_{c(4)}}{\sum_{R_{c(4)} \cup E_{c(4)}} STUSAWT_k^{adj(3)}} \times STUSAWT_k^{adj(3)}$$

where

- $R_{c(d)}$  is the set of all assessed students in category c of dimension d,
- $E_{c(d)}$  is the set of all excluded students in category c of dimension d, and
- $Total_{c(d)}$  is the control total for category c of dimension d.

The process is said to converge if the maximum difference between the sum of adjusted weights and the control totals is 1.0 for each category in each dimension. If after the sequence of adjustments the maximum difference was greater than 1.0, the process continues to the next iteration, cycling back to the first dimension with the initial weight for student k equaling  $STUSAWT_k^{adj(4)}$  from the previous iteration. The process continued until convergence was reached.

Once the process converged, the adjustment factor was computed as follows:

$$STU\_RAKE_k = \frac{STUSAWT_k}{STU\_BWT_k \times SCH\_TRIM_k \times SCH\_NRAF_k \times STU\_NRAF_k \times SUBJFAC_k}$$

where  $STUSAWT_k$  is the weight for student k after convergence.

The process was done independently for the full sample and for each replicate.

[http://nces.ed.gov/nationsreportcard/dw/weighting/2013/raking\\_adjustment\\_factor\\_calculation\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/dw/weighting/2013/raking_adjustment_factor_calculation_for_the_2013_assessment.aspx)

## NAEP Technical Documentation Computation of Replicate Weights for the 2013 Assessment

In addition to the full-sample weight, a set of 62 replicate weights was provided for each student. These replicate weights are used in calculating the sampling variance of estimates obtained from the data, using the jackknife repeated replication method. The method of deriving these weights was aimed at reflecting the features of the sample design appropriately for each sample, so that when the jackknife variance estimation procedure is implemented, approximately unbiased estimates of sampling variance are obtained. This section gives the specifics for generating the replicate weights for the 2013 assessment samples. The theory that underlies the jackknife variance estimators used in NAEP studies is discussed in the section Replicate Variance Estimation.

Defining Variance Strata and Forming Replicates

Computing School-Level Replicate Factors

Computing Student-Level Replicate Factors

Replicate Variance Estimation

In general, the process of creating jackknife replicate weights takes place at both the school and student level. The precise implementation differs between those samples that involve the selection of Primary Sampling Units (PSUs) and those where the school is the first stage of sampling. The procedure for this second kind of sample also differed starting in 2011 from all previous NAEP assessments. The change that was implemented permitted the introduction of a finite population correction factor at the school sampling stage, developed by [Rizzo and Rust \(2011\)](#). In assessments prior to 2011, this adjustment factor has always been implicitly assumed equal to 1.0, resulting in some overestimation of the sampling variance.

For each sample, the calculation of replicate weighting factors at the school level was conducted in a series of steps. First, each school was assigned to one of 62 variance estimation strata. Then, a random subset of schools in each variance estimation stratum was assigned a replicate factor of between 0 and 1. Next, the remaining subset of schools in the same variance stratum was assigned a complementary replicate factor greater than 1. All schools in the other variance estimation strata were assigned a replicate factor of exactly 1. This process was repeated for each of the 62 variance estimation strata so that 62 distinct replicate factors were assigned to each school in the sample.

This process was then repeated at the student level. Here, each individual sampled student was assigned to one of 62 variance estimation strata, and 62 replicate factors with values either between 0 and 1, greater than 1, or exactly equal to 1 were assigned to each student.

For example, consider a single hypothetical student. For replicate 37, that student's student replicate factor might be 0.8, while for the school to which the student belongs, for replicate 37, the school replicate factor might be 1.6. Of course, for a given student, for most replicates, either the student replicate factor, the school replicate factor, or (usually) both, is equal to 1.0.

A replicate weight was calculated for each student, for each of the 62 replicates, using weighting procedures similar to those used for the full-sample weight. Each replicate weight contains the school and student replicate factors described above. By repeating the various weighting procedures on each set of replicates, the impact of these procedures on the sampling variance of an estimate is appropriately reflected in the variance estimate.

Each of the 62 replicate weights for student  $k$  in school  $s$  in stratum  $j$  can be expressed as follows:

$$FSTUWGT_{j,sk}(r) = STU\_BWT_{j,sk} \times SCH\_REPFAC_{j,s}(r) \times SCH\_NRAF_{j,s}(r) \times STU\_REPFAC_{j,sk}(r) \times STU\_NRAF_{j,sk}(r) \times SCH\_TRIM_{j,s} \times STU\_TRIM_{j,sk} \times STU\_RAKE_{j,sk}(r)$$

where

- $STU\_BWT_{j,sk}$  is the student base weight;
- $SCH\_REPFAC_{j,s}(r)$  is the school-level replicate factor for replicate  $r$ ;
- $SCH\_NRAF_{j,s}(r)$  is the school-level nonresponse adjustment factor for replicate  $r$ ;
- $STU\_REPFAC_{j,sk}(r)$  is the student-level replicate factor for replicate  $r$ ;
- $STU\_NRAF_{j,sk}(r)$  is the student-level nonresponse adjustment factor for replicate  $r$ ;
- $SCH\_TRIM_{j,s}$  is the school-level weight trimming adjustment factor;
- $STU\_TRIM_{j,sk}$  is the student-level weight trimming adjustment factor; and
- $STU\_RAKE_{j,sk}(r)$  is the student-level raking adjustment factor for replicate  $r$ .

Specific school and student nonresponse and student-level raking adjustment factors were calculated separately for each replicate, thus the use of the index ( $r$ ), and applied to the replicate student base weights. Computing separate nonresponse and raking adjustment factors for each replicate allows resulting variances from the use of the final student replicate weights to reflect components of variance due to these various weight adjustments.

School and student weight trimming adjustments were not replicated, that is, not calculated separately for each replicate. Instead, each replicate used the school and student trimming adjustment factors derived for the full sample. Statistical theory for replicating trimming adjustments under the jackknife approach has not been developed in the literature. Due to the absence of a statistical framework, and since relatively few school and student weights in NAEP require trimming, the weight trimming adjustments were not replicated.

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/computation\\_of\\_replicate\\_weights\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/computation_of_replicate_weights_for_the_2013_assessment.aspx)

---

## NAEP Technical Documentation Defining Variance Strata and Forming Replicates for the 2013 Assessment

In the NAEP 2013 assessment, replicates were formed separately for each sample indicated by grade (4, 8, 12), school type (public, private), and assessment subject (mathematics, reading). To reflect the school-level finite population corrections in the variance estimators for the two-stage samples used for the mathematics and reading assessments, replication was carried out at both the school and student levels.

The first step in forming replicates was to create preliminary variance strata in each primary stratum. This was done by sorting the appropriate sampling unit (school or student) in the order of its selection within the primary stratum and then pair off adjacent sampling units into preliminary variance strata. Sorting sample units by their order of sample selection reflects the implicit stratification and systematic sampling features of the sample design. Within each primary stratum with an even number of sampling units, all of the preliminary variance strata consisted of pairs of sampling units. However, within primary strata with an odd number of sampling units, all but one variance strata consisted of pairs of sampling units, while the last one consisted of three sampling units.

The next step is to form the final variance strata by combining preliminary strata if appropriate. If there were more than 62 preliminary variance strata within a primary stratum, the preliminary variance strata were grouped to form 62 final variance strata. This grouping effectively maximized the distance in the sort order between grouped preliminary variance strata. The first 62 preliminary variance strata, for example, were assigned to 62 different final variance strata in order (1 through 62), with the next 62 preliminary variance strata assigned to final variance strata 1 through 62, so that, for example, preliminary variance stratum 1, preliminary variance stratum 63, preliminary variance stratum 125 (if in fact there were that many), etc., were all assigned to the first final variance stratum.

If, on the other hand, there were fewer than 62 preliminary variance strata within a primary stratum, then the number of final variance strata was set equal to the number of preliminary variance strata. For example, consider a primary stratum with 111 sampled units sorted in their order of selection. The first two units were in the first preliminary variance stratum; the next two units were in the second preliminary variance stratum, and so on, resulting in 54 preliminary variance strata with two sample units each (doublets). The last three sample units were in the 55th preliminary variance stratum (triplet). Since there are no more than 62 preliminary variance strata, these were also the final variance strata.

Within each preliminary variance stratum containing a pair of sampling units, one sampling unit was randomly assigned as the first variance unit and the other as the second variance unit. Within each preliminary variance stratum containing three sampling units, the three first-stage units were randomly assigned variance units 1 through 3.

### Reading and Mathematics Assessments

At the school-level for these samples, formation of preliminary variance strata did not pertain to certainty schools, since they are not subject to sampling variability, but only to noncertainty schools. The primary stratum for noncertainty schools was the highest school-level sampling stratum variable listed below, and the order of selection was defined by sort order on the school sampling frame.

- Trial Urban District Assessment (TUDA) districts, remainder of states (for states with TUDAs), or entire states for the public school samples at grades 4, 8, and 12; and
- Private school affiliation (Catholic, non-Catholic) for the private school samples at grades 4, 8, and 12.

At the student-level, all students were assigned to variance strata. The primary stratum was school, and the order of selection was defined by session number and position on the administration schedule.

Within each pair of preliminary variance strata, one first-stage unit, designated at random, was assigned as the first variance unit and the other first-stage unit as the second variance unit. Within each triplet preliminary variance stratum, the three schools were randomly assigned variance units 1 through 3.

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/defining\\_variance\\_strata\\_and\\_forming\\_replicates\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/defining_variance_strata_and_forming_replicates_for_the_2013_assessment.aspx)



## NAEP Technical Documentation Computing School-Level Replicate Factors for the 2013 Assessment

The replicate variance estimation approach for the mathematics and reading assessments involved finite population corrections at the school level. The calculation of school-level replicate factors for these assessments depended upon whether or not a school was selected with certainty. For certainty schools, the school-level replicate factors for all replicates are set to unity – this is true regardless of whether or not the variance replication method uses finite population corrections – since certainty schools are not subject to sampling variability. Alternatively, one can view the finite population correction factor for such schools as being equal to zero. Thus, for each certainty school in a given assessment, the school-level replicate factor for each of the 62 replicates ( $r = 1, \dots, 62$ ) was assigned as follows:

$$SCH\_REPFAC_{js}(r) = 1$$

where  $SCH\_REPFAC_{js}(r)$  is the school-level replicate factor for school  $s$  in primary stratum  $j$  for the  $r$ -th replicate.

For noncertainty schools, where preliminary variance strata were formed by grouping schools into pairs or triplets, school-level replicate factors were calculated for each of the 62 replicates based on this grouping. For schools in variance strata comprising pairs of schools, the school-level replicate factors,  $SCH\_REPFAC_{js}(r), r = 1, \dots, 62$ , were calculated as follows:

$$SCH\_REPFAC_{js}(r) = \begin{cases} 1 + \sqrt{1 - \min(\pi_{j1}, \pi_{j2})}, & \text{for } js \in R_{jr}, U_{js} = 1 \\ 1 - \sqrt{1 - \min(\pi_{j1}, \pi_{j2})}, & \text{for } js \in R_{jr}, U_{js} = 2 \\ 1, & \text{for } js \notin R_{jr} \end{cases}$$

where

- $\min(\pi_{j1}, \pi_{j2})$  is the smallest school probability between the two schools comprising  $R_{jr}$ ,
- $R_{jr}$  is the set of schools within the  $r$ -th variance stratum for primary stratum  $j$ , and
- $U_{js}$  is the variance unit (1 or 2) for school  $s$  in primary stratum  $j$ .

For noncertainty schools in preliminary variance strata comprising three schools, the school-level replicate factors  $SCH\_REPFAC_{js}(r), r = 1, \dots, 62$  were calculated as follows:

For school  $s$  from primary stratum  $j$ , variance stratum  $r$ ,

$$SCH\_REPFAC_{js}(r) = \begin{cases} 1 + \frac{\sqrt{1 - \min(\pi_{j1}, \pi_{j2}, \pi_{j3})}}{2}, & \text{for } js \in R_{jr}, U_{js} = 1 \\ 1 + \frac{\sqrt{1 - \min(\pi_{j1}, \pi_{j2}, \pi_{j3})}}{2}, & \text{for } js \in R_{jr}, U_{js} = 2 \\ 1 - \sqrt{1 - \min(\pi_{j1}, \pi_{j2}, \pi_{j3})}, & \text{for } js \in R_{jr}, U_{js} = 3 \end{cases}$$

while for  $r' = r + 31 \pmod{62}$ :

$$SCH\_REPFAC_{js}(r') = \begin{cases} 1 + \frac{\sqrt{1 - \min(\pi_{j1}, \pi_{j2}, \pi_{j3})}}{2}, & \text{for } js \in R_{jr}, U_{js} = 1 \\ 1 - \sqrt{1 - \min(\pi_{j1}, \pi_{j2}, \pi_{j3})}, & \text{for } js \in R_{jr}, U_{js} = 2 \\ 1 + \frac{\sqrt{1 - \min(\pi_{j1}, \pi_{j2}, \pi_{j3})}}{2}, & \text{for } js \in R_{jr}, U_{js} = 3 \end{cases}$$

and for all other  $r^*$  other than  $r$  and  $r'$  :

$$SCH\_REPFAC_{jz}(r^*)=1;$$

where

- $\min(\pi_{j1}, \pi_{j2}, \pi_{j3})$  is the smallest school probability among the three schools comprising  $R_{jr}$ ,
- $R_{jr}$  is the set of schools within the  $r$ -th variance stratum for primary stratum  $j$ , and
- $U_{js}$  is the variance unit (1, 2, or 3) for school  $s$  in primary stratum  $j$ .

In primary strata with fewer than 62 variance strata, the replicate weights for the “unused” variance strata (the remaining ones up to 62) for these schools were set equal to the school base weight (so that those replicates contribute nothing to the variance estimate).

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/computing\\_school\\_level\\_replicate\\_factors\\_for\\_the\\_2013\\_assessment\\_.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/computing_school_level_replicate_factors_for_the_2013_assessment_.aspx)

## NAEP Technical Documentation Computing Student-Level Replicate Factors for the 2013 Assessment

For the mathematics and reading assessments, which involved school-level finite population corrections, the student-level replication factors were calculated the same way regardless of whether or not the student was in a certainty school.

For students in student-level variance strata comprising pairs of students, the student-level replicate factors,  $STU\_REPFAC_{jsk}(r)$ ,  $r = 1, \dots, 62$ , were calculated as follows:

$$STU\_REPFAC_{jsk}(r) = \begin{cases} 1 + \sqrt{\pi_s}, & \text{for } jsk \in R_{jsr}, U_{jsk} = 1 \\ 1 - \sqrt{\pi_s}, & \text{for } jsk \in R_{jsr}, U_{jsk} = 2 \\ 1, & \text{for } jsk \notin R_{jsr} \end{cases}$$

where

- $\pi_s$  is the probability of selection for school  $s$ ,
- $R_{jsr}$  is the set of students within the  $r$ -th variance stratum for school  $s$  in primary stratum  $j$ , and
- $U_{jsk}$  is the variance unit (1 or 2) for student  $k$  in school  $s$  in stratum  $j$ .

For students in variance strata comprising three students, the student-level replicate factors  $STU\_REPFAC_{jsk}(r)$ ,  $r = 1, \dots, 62$ , were calculated as follows:

$$STU\_REPFAC_{jsk}(r) = \begin{cases} 1 + \frac{\sqrt{\pi_s}}{2}, & \text{for } jsk \in R_{jsr}, U_{jsk} = 1 \\ 1 + \frac{\sqrt{\pi_s}}{2}, & \text{for } jsk \in R_{jsr}, U_{jsk} = 2 \\ 1 - \sqrt{\pi_s}, & \text{for } jsk \in R_{jsr}, U_{jsk} = 3 \end{cases}$$

while for  $r' = r + 31 \pmod{62}$ :

$$STU\_REPFAC_{jsk}(r') = \begin{cases} 1 + \frac{\sqrt{\pi_s}}{2}, & \text{for } jsk \in R_{jsr'}, U_{jsk} = 1 \\ 1 - \sqrt{\pi_s}, & \text{for } jsk \in R_{jsr'}, U_{jsk} = 2 \\ 1 + \frac{\sqrt{\pi_s}}{2}, & \text{for } jsk \in R_{jsr'}, U_{jsk} = 3 \end{cases}$$

and for all other  $r^*$  other than  $r$  and  $r'$ :

$$STU\_REPFAC_{jsk}(r^*) = 1$$

where

- $\pi_s$  is the probability of selection for school  $s$ ,
- $R_{jsr}$  is the set of students within the  $r$ -th replicate stratum for school  $s$  in stratum  $j$ , and
- $U_{jsk}$  is the variance unit (1, 2, or 3) for student  $k$  in school  $s$  in stratum  $j$ .

Note, for students in certainty schools, where  $\pi_s = 1$ , the student replicate factors are 2 and 0 in the case of pairs, and 1.5, 1.5, and 0 in the case of triples.

## NAEP Technical Documentation Replicate Variance Estimation for the 2013 Assessment

Variances for NAEP assessment estimates are computed using the paired jackknife replicate variance procedure. This technique is applicable for common statistics, such as means and ratios, and differences between these for different subgroups, as well as for more complex statistics such as linear or logistic regression coefficients.

In general, the paired jackknife replicate variance procedure involves initially pairing clusters of first-stage sampling units to form H variance strata ( $h = 1, 2, 3, \dots, H$ ) with two units per stratum. The first replicate is formed by assigning, to one unit at random from the first variance stratum, a replicate weighting factor of less than 1.0, while assigning the remaining unit a complementary replicate factor greater than 1.0, and assigning all other units from the other ( $H - 1$ ) strata a replicate factor of 1.0. This procedure is carried out for each variance stratum resulting in H replicates, each of which provides an estimate of the population total.

In general, this process is repeated for subsequent levels of sampling. In practice, this is not practicable for a design with three or more stages of sampling, and the marginal improvement in precision of the variance estimates would be negligible in all such cases in the NAEP setting. Thus in NAEP, when a two-stage design is used – sampling schools and then students – beginning in 2011 replication is carried out at both stages. (See [Rizzo and Rust \(2011\)](#) for a description of the methodology.) When a three-stage design is used, involving the selection of geographic Primary Sampling Units (PSUs), then schools, and then students, the replication procedure is only carried out at the first stage of sampling (the PSU stage for noncertainty PSUs, and the school stage within certainty PSUs). In this situation, the school and student variance components are correctly estimated, and the overstatement of the between-PSU variance component is relatively very small.

The jackknife estimate of the variance for any given statistic is given by the following formula:

$$v(\hat{t}) = \sum_{h=1}^H (\hat{t}_h - \hat{t})^2$$

where

- $\hat{t}$  represents the full sample estimate of the given statistic, and
- $\hat{t}_h$  represents the corresponding estimate for replicate h.

Each replicate undergoes the same weighting procedure as the full sample so that the jackknife variance estimator reflects the contributions to or reductions in variance resulting from the various weighting adjustments.

The NAEP jackknife variance estimator is based on 62 variance strata resulting in a set of 62 replicate weights assigned to each school and student.

The basic idea of the paired jackknife variance estimator is to create the replicate weights so that use of the jackknife procedure results in an unbiased variance estimator for simple totals and means, which is also reasonably efficient (i.e., has a low variance as a variance estimator). The jackknife variance estimator will then produce a consistent (but not fully unbiased) estimate of variance for (sufficiently smooth) nonlinear functions of total and mean estimates such as ratios, regression coefficients, and so forth (Shao and Tu, 1995).

The development below shows why the NAEP jackknife variance estimator returns an unbiased variance estimator for totals and means, which is the cornerstone to the asymptotic results for nonlinear estimators. See for example Rust (1985). This paper also discusses why this variance estimator is generally efficient (i.e., more reliable than alternative approaches requiring similar computational resources).

The development is done for an estimate of a mean based on a simplified sample design that closely approximates the sample design for first-stage units used in the NAEP studies. The sample design is a stratified random sample with H strata with population weights  $W_h$ , stratum sample sizes  $n_h$ , and stratum sample means  $\bar{y}_h$ . The population estimator  $\hat{Y}$  and standard unbiased variance estimator  $v(\hat{Y})$  are:

$$\hat{Y} = \sum_{h=1}^H W_h \bar{y}_h \quad v(\hat{Y}) = \sum_{h=1}^H W_h^2 \frac{s_h^2}{n_h}$$

with

$$s_h^2 = \frac{1}{n_h - 1} \sum_{i=1}^{n_h} (y_{hi} - \bar{y}_h)^2$$

The paired jackknife replicate variance estimator assigns one replicate  $h=1, \dots, H$  to each stratum, so that the number of replicates equals  $H$ . In NAEP, the replicates correspond generally to pairs and triplets (with the latter only being used if there are an odd number of sample units within a particular primary stratum generating replicate strata). For pairs, the process of generating replicates can be viewed as taking a simple random sample ( $J$ ) of size  $n_h/2$  within the replicate stratum, and assigning an increased weight to the sampled elements, and a decreased weight to the unsampled elements. In certain applications, the increased weight is double the full sample weight, while the decreased weight is in fact equal to zero. In this simplified case, this assignment reduces to replacing  $\bar{y}_h$  with  $\bar{y}_h(J)$ , the latter being the sample mean of the sampled  $n_h/2$  units. Then the replicate estimator corresponding to stratum  $r$  is

$$\hat{Y}(r) = \sum_{h \neq r}^H W_h \bar{y}_h + W_r \bar{y}_r(J)$$

The  $r$ -th term in the sum of squares for  $v_j(\hat{Y})$  is thus:

$$(\hat{Y}(r) - \hat{Y})^2 = W_r^2 (\bar{y}_r(J) - \bar{y}_r)^2$$

In stratified random sampling, when a sample of size  $n_r/2$  is drawn without replacement from a population of size  $n_r$ , the sampling variance is

$$\begin{aligned} E(\bar{y}_r(J) - \bar{y}_r)^2 &= \frac{1}{(n_r/2)} \frac{n_r - n_r/3}{n_r} \frac{1}{n_r - 1} \sum_{i=1}^{n_r} (y_{ri} - \bar{y}_r)^2 \\ &= \frac{1}{n_r(n_r - 1)} \sum_{i=1}^{n_r} (y_{ri} - \bar{y}_r)^2 = \frac{s_r^2}{n_r} \end{aligned}$$

See for example Cochran (1977), Theorem 5.3, using  $n_r$  as the "population size,"  $n_r/2$  as the "sample size," and  $s_r^2$  as the "population variance" in the given formula. Thus,

$$E\{W_r^2 (\bar{y}_r(J) - \bar{y}_r)^2\} = W_r^2 \frac{s_r^2}{n_r}$$

Taking the expectation over all of these stratified samples of size  $n_r/2$ , it is found that

$$E(v_j(\hat{Y})) = v(\hat{Y})$$

In this sense, the jackknife variance estimator "gives back" the sample variance estimator for means and totals as desired under the theory.

In cases where, rather than doubling the weight of one half of one variance stratum and assigning a zero weight to the other, the weight of one unit is multiplied by a replicate factor of  $(1+\delta)$ , while the other is multiplied by  $(1-\delta)$ , the result is that

$$E(\hat{y}(r) - \hat{y})^2 = W_r^2 \delta^2 \frac{s_r^2}{n_r}$$

In this way, by setting  $\delta$  equal to the square root of the finite population correction factor, the jackknife variance estimator is able to incorporate a finite population correction factor into the variance estimator.

In practice, variance strata are also grouped to make sure that the number of replicates is not too large (the total number of variance strata is usually 62 for NAEP). The randomization from the original sample distribution guarantees that the sum of squares contributed by each replicate will be close to the target expected value.

For triples, the replicate factors are perturbed to something other than 1.0 for two different replicate factors, rather than just one as in the case of pairs. Again in the simple case where replicate factors that are less than 1 are all set to 0, with the replicate weight factors calculated as follows.

For unit  $i$  in variance stratum  $r$

$$w_i(r) = \begin{cases} 1.5w_i & i = \text{variance unit 1} \\ 1.5w_i & i = \text{variance unit 2} \\ 0 & i = \text{variance unit 3} \end{cases}$$

where weight  $w_i$  is the full sample base weight.

Furthermore, for  $r' = r + 31 \pmod{62}$ :

$$w_i(r') = \begin{cases} 1.5w_i & i = \text{variance unit 1} \\ 0 & i = \text{variance unit 2} \\ 1.5w_i & i = \text{variance unit 3} \end{cases}$$

And for all other values  $r^*$ , other than  $r$  and  $r'$ ,  $w_i(r^*) = 1$ .

In the case of stratified random sampling, this formula reduces to replacing  $\bar{y}_r$  with  $\bar{y}_r(J)$  for replicate  $r$ , where  $\bar{y}_r(J)$  is the sample mean from a "2/3" sample of  $2n_r/3$  units from the  $n_r$  sample units

in the replicate stratum, and replacing  $\bar{y}_r$  with  $\bar{y}_{r'}(J)$  for replicate  $r'$ , where  $\bar{y}_{r'}(J)$  is the sample mean from another overlapping "2/3" sample of  $2n_r/3$  units from the  $n_r$  sample units in the replicate stratum.

The  $r$ -th and  $r'$ -th replicates can be written as:

$$\hat{Y}(r) = \sum_{h \neq r}^H W_h \bar{y}_h + W_r \bar{y}_r(J)$$

$$\hat{Y}(r') = \sum_{h \neq r'}^H W_h \bar{y}_h + W_{r'} \bar{y}_{r'}(J)$$

From these formulas, expressions for the  $r$ -th and  $r'$ -th components of the jackknife variance estimator are obtained (ignoring other sums of squares from other grouped components attached to those replicates):

$$(\hat{Y}(r) - \hat{Y})^2 = W_r^2 (\bar{y}_r(J) - \bar{y}_r)^2$$

$$(\hat{Y}(r') - \hat{Y})^2 = W_{r'}^2 (\bar{y}_{r'}(J) - \bar{y}_r)^2$$

These sums of squares have expectations as follows, using the general formula for sampling variances:

$$E(\bar{y}_r(J) - \bar{y}_r)^2 = \frac{1}{(2n_r/3)} \frac{n_r - (2n_r/3)}{n_r} \frac{1}{n_r - 1} \sum_{i=1}^{n_r} (y_{ri} - \bar{y}_r)^2$$

$$= \frac{1}{2n_r(n_r - 1)} \sum_{i=1}^{n_r} (y_{ri} - \bar{y}_r)^2 = \frac{s_r^2}{2n_r}$$

$$E(\bar{y}_{r'}(J) - \bar{y}_r)^2 = \frac{1}{(2n_r/3)} \frac{n_r - (2n_r/3)}{n_r} \frac{1}{n_r - 1} \sum_{i=1}^{n_r} (y_{ri} - \bar{y}_r)^2$$

$$= \frac{1}{2n_r(n_r - 1)} \sum_{i=1}^{n_r} (y_{ri} - \bar{y}_r)^2 = \frac{s_r^2}{2n_r}$$

Thus,

$$\begin{aligned} E\left\{W_r^2(\bar{y}_r(J) - \bar{y}_r)^2 + W_r^2(\bar{y}_{r^*}(J) - \bar{y}_r)^2\right\} &= W_r^2\left(\frac{s_r^2}{2n_r} + \frac{s_r^2}{2n_r}\right) \\ &= W_r^2 \frac{s_r^2}{n_r} \end{aligned}$$

as desired again.

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/replicate\\_variance\\_estimation\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/replicate_variance_estimation_for_the_2013_assessment.aspx)

---

## NAEP Technical Documentation Quality Control on Weighting Procedures for the 2013 Assessment

Given the complexity of the weighting procedures utilized in NAEP, a range of quality control (QC) checks was conducted throughout the weighting process to identify potential problems with collected student-level demographic data or with specific weighting procedures. The QC processes included

Final Participation, Exclusion, and  
Accommodation Rates

Nonresponse Bias Analyses

- checks performed within each step of the weighting process;
- checks performed across adjacent steps of the weighting process;
- review of participation, exclusion, and accommodation rates;
- checking demographic data of individual schools;
- comparisons with 2011 demographic data; and
- nonresponse bias analyses.

To validate the weighting process, extensive tabulations of various school and student characteristics at different stages of the process were conducted. The school-level characteristics included in the tabulations were minority enrollment, median income (based on the school ZIP code area), and urban-centric locale. At the student level, the tabulations included race/ethnicity, gender, relative age, students with disability (SD) status, English language learners (ELL) status, and participation status in National School Lunch Program (NSLP).

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/quality\\_control\\_on\\_weighting\\_procedures\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/quality_control_on_weighting_procedures_for_the_2013_assessment.aspx)

---



## NAEP Technical Documentation Final Participation, Exclusion, and Accommodation Rates for the 2013 Assessment

Final participation, exclusion, and accommodation rates are presented in quality control tables for each grade and subject by geographic domain and school type. School-level participation rates have been calculated according to National Center for Education Statistics (NCES) standards as they have been for previous assessments.

School-level participation rates were below 85 percent for private schools at all three grades (4, 8, and 12). Student-level participation rates were also below 85 percent for grade 12 public school student sample overall and in specific states: Connecticut, Florida, Illinois, Iowa, Massachusetts, New Hampshire, New Jersey, and West Virginia. As required by NCES standards, nonresponse bias analyses were conducted on each reporting group falling below the 85 percent participation threshold.

Grade 4 Mathematics  
Grade 4 Reading

Grade 8 Mathematics  
Grade 8 Reading

Grade 12 Mathematics  
Grade 12 Reading

[http://nces.ed.gov/nationsreportcard/dw/weighting/2013/final\\_participation\\_exclusion\\_and\\_accommodation\\_rates\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/dw/weighting/2013/final_participation_exclusion_and_accommodation_rates_for_the_2013_assessment.aspx)

---

## NAEP Technical Documentation Participation, Exclusion, and Accommodation Rates for Grade 4 Mathematics for the 2013 Assessment

The following table displays the school- and student-level response, exclusion, and accommodation rates for the grade 4 mathematics assessment by school type and jurisdiction. Various weights were used in the calculation of the rates, as indicated in the column headings of the table.

The participation rates reflect the participation of the original sample schools only and do not reflect any effect of substitution. The rates weighted by the base weight and enrollment show the approximate proportion of the student population in the jurisdiction that is represented by the responding schools in the sample. The rates weighted by just the base weight show the proportion of the school population that is represented by the responding schools in the sample. These rates differ because schools differ in size.

Participation, exclusion, and accommodation rates, grade 4 mathematics assessment, by school type and jurisdiction: 2013

School type and jurisdiction	Number of schools in original sample, rounded	School participation rates (percent) before substitution (weighted by base weight and enrollment)	School participation rates (percent) before substitution (weighted by base weight only)	Number of students sampled, rounded	Weighted percent of students excluded	Weighted student participation rates (percent) after makeups	Weighted percent of students accommodated
All	8,760	97.30	90.45	214,900	1.40	94.57	13.55
National all <sup>1</sup>	8,590	97.27	90.32	209,800	1.41	94.57	13.44
Northeast all	1,480	95.63	85.22	34,500	1.29	93.85	15.68
Midwest all	2,190	97.27	88.80	47,300	1.32	94.84	12.87
South all	2,740	98.20	93.44	73,600	1.37	94.71	14.38
West all	2,120	96.86	91.04	51,800	1.62	94.57	10.98
National public	8,060	99.69	99.54	202,700	1.52	94.49	14.22
Alabama	120	100.00	100.00	3,200	1.10	94.82	5.15
Alaska	200	99.48	96.56	3,100	1.14	93.18	21.85
Arizona	120	100.00	100.00	3,400	1.20	95.07	12.97
Arkansas	120	100.00	100.00	3,400	1.24	94.66	15.16
California	300	99.17	98.75	9,000	1.93	94.79	8.78
Colorado	120	100.00	100.00	3,400	1.15	92.34	12.11
Connecticut	120	97.22	97.25	3,200	1.36	93.85	15.52
Delaware	100	100.00	100.00	3,400	2.10	94.36	13.58
District of Columbia	140	100.00	100.00	2,300	1.37	95.09	17.59
Florida	240	100.00	100.00	6,900	1.84	94.11	20.24
Georgia	170	100.00	100.00	5,300	1.43	94.18	11.22
Hawaii	120	100.00	100.00	3,500	1.25	94.70	10.64
Idaho	130	100.00	100.00	3,500	1.29	95.24	9.58
Illinois	200	97.98	98.40	5,100	1.00	94.40	15.44
Indiana	120	100.00	100.00	3,300	1.52	95.18	17.03
Iowa	140	100.00	100.00	3,100	0.70	95.16	14.50
Kansas	150	100.00	100.00	3,400	1.62	94.79	15.16
Kentucky	160	100.00	100.00	4,700	1.45	94.67	11.30
Louisiana	130	100.00	100.00	3,300	1.08	94.49	18.38
Maine	160	100.00	100.00	3,400	2.11	93.95	17.44

School type and jurisdiction	Number of schools in original sample, rounded	School participation rates (percent) before substitution (weighted by base weight and enrollment)	School participation rates (percent) before substitution (weighted by base weight only)	Number of students sampled, rounded	Weighted percent of students excluded	Weighted student participation rates (percent) after makeups	Weighted percent of students accommodated
Maryland	170	100.00	100.00	4,700	0.99	94.22	17.30
Massachusetts	190	100.00	100.00	5,200	2.03	93.74	17.18
Michigan	190	100.00	100.00	4,600	1.96	94.14	11.02
Minnesota	130	100.00	100.00	3,500	1.37	94.85	10.62
Mississippi	120	100.00	100.00	3,300	0.76	95.44	6.73
Missouri	130	100.00	100.00	3,600	1.41	95.42	11.20
Montana	200	99.85	98.28	3,400	1.68	93.92	8.56
Nebraska	170	100.00	100.00	3,500	1.72	95.37	14.37
Nevada	120	100.00	100.00	3,500	1.41	95.75	22.90
New Hampshire	130	100.00	100.00	3,400	1.22	93.74	14.78
New Jersey	120	100.00	100.00	3,300	1.17	94.85	16.62
New Mexico	150	99.69	99.48	4,200	1.22	95.06	16.90
New York	160	98.84	96.79	4,500	1.23	92.27	20.02
North Carolina	160	100.00	100.00	4,800	1.24	94.19	14.17
North Dakota	270	99.86	99.19	3,700	2.56	95.57	9.78
Ohio	210	100.00	100.00	4,700	1.33	94.29	13.52
Oklahoma	140	100.00	100.00	3,600	1.85	94.35	13.95
Oregon	130	100.00	100.00	3,500	2.12	94.18	15.23
Pennsylvania	170	100.00	100.00	4,500	1.64	94.30	12.95
Rhode Island	120	100.00	100.00	3,400	1.12	94.98	15.17
South Carolina	120	100.00	100.00	3,200	1.08	96.08	11.87
South Dakota	190	100.00	100.00	3,400	1.42	95.36	10.56
Tennessee	120	100.00	100.00	3,400	1.34	94.21	13.54
Texas	310	100.00	100.00	9,200	1.65	95.36	17.92
Utah	120	99.08	99.32	3,600	1.25	94.79	12.66
Vermont	220	100.00	100.00	3,000	1.37	95.04	15.72
Virginia	110	100.00	100.00	3,300	1.51	94.35	13.07
Washington	120	99.09	99.35	3,600	2.17	93.50	14.12
West Virginia	150	100.00	100.00	3,200	1.71	94.77	10.03
Wisconsin	190	100.00	100.00	4,400	1.79	95.42	16.21
Wyoming	200	100.00	100.00	3,500	1.01	94.65	12.76
DoDEA <sup>2</sup>	120	99.23	98.08	3,700	1.66	95.05	12.20
Trial Urban (TUDA) Districts and Other Jurisdictions							
Albuquerque	50	100.00	100.00	1,700	1.15	94.71	20.47
Atlanta	60	100.00	100.00	2,000	0.98	95.42	9.76
Austin	60	100.00	100.00	1,700	2.04	93.69	30.80
Baltimore City	70	100.00	100.00	1,600	1.59	94.32	19.27
Boston	80	100.00	100.00	2,000	3.69	93.72	19.59
Charlotte	50	100.00	100.00	1,700	1.19	94.18	12.81
Chicago	100	100.00	100.00	2,500	1.07	94.85	19.30
Cleveland	90	100.00	100.00	1,500	4.26	93.62	22.29
Dallas	50	100.00	100.00	1,700	2.33	95.79	35.42
Detroit	70	100.00	100.00	1,300	4.88	90.92	14.80
Fresno	50	100.00	100.00	1,800	0.90	93.58	7.51
Hillsborough	60	100.00	100.00	1,700	1.17	95.74	23.30
Houston	80	100.00	100.00	2,600	1.88	96.62	27.25

School type and jurisdiction	Number of schools in original sample, rounded	School participation rates (percent) before substitution (weighted by base weight and enrollment)	School participation rates (percent) before substitution (weighted by base weight only)	Number of students sampled, rounded	Weighted percent of students excluded	Weighted student participation rates (percent) after makeups	Weighted percent of students accommodated
Jefferson County, KY	50	100.00	100.00	1,700	1.74	94.66	11.61
Los Angeles	80	100.00	100.00	2,500	1.96	95.80	9.83
Miami	90	100.00	100.00	2,300	2.35	95.07	28.05
Milwaukee	70	100.00	100.00	1,500	3.40	94.68	26.55
New York City	80	100.00	100.00	2,500	1.33	91.74	27.56
Philadelphia	60	100.00	100.00	1,600	3.45	94.71	15.82
San Diego	50	100.00	100.00	1,500	1.48	95.18	11.80
District of Columbia (TUDA) 90		100.00	100.00	1,500	1.97	95.52	18.06

National private	430	88.19	64.50	3,700	0.00	95.60	4.98
Catholic private	280	56.94	52.97	1,600	0.11	95.62	3.92
Puerto Rico	170	100.00	100.00	5,100	0.24	94.47	27.19

1 Includes national public, national private, and Bureau of Indian Education schools located in the United States and all Department of Defense Education Activity schools, but not schools in Puerto Rico.

2 Department of Defense Education Activity schools.

NOTE: Numbers of schools are rounded to nearest ten, and numbers of students are rounded to nearest hundred. Detail may not sum to totals because of rounding.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2013 Mathematics Assessment.

[http://nces.ed.gov/nationsreportcard/dw/weighting/2013/participation\\_exclusion\\_and\\_accommodation\\_rates\\_for\\_grade\\_4\\_mathematics\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/dw/weighting/2013/participation_exclusion_and_accommodation_rates_for_grade_4_mathematics_for_the_2013_assessment.aspx)

## NAEP Technical Documentation Participation, Exclusion, and Accommodation Rates for Grade 4 Reading for the 2013 Assessment

The following table displays the school- and student-level response, exclusion, and accommodation rates for the grade 4 reading assessment by school type and jurisdiction. Various weights were used in the calculation of the rates, as indicated in the column headings of the table.

The participation rates reflect the participation of the original sample schools only and do not reflect any effect of substitution. The rates weighted by the base weight and enrollment show the approximate proportion of the student population in the jurisdiction that is represented by the responding schools in the sample. The rates weighted by just the base weight show the proportion of the school population that is represented by the responding schools in the sample. These rates differ because schools differ in size.

Participation, exclusion, and accommodation rates, grade 4 reading assessment, by school type and jurisdiction: 2013

School type and jurisdiction	Number of schools in original sample, rounded	School participation rates (percent) before substitution (weighted by base weight and enrollment)	School participation rates (percent) before substitution (weighted by base weight only)	Number of students sampled, rounded	Weighted percent of students excluded	Weighted student participation rates (percent) after makeups	Weighted percent of students accommodated
All	8,590	97.27	90.32	216,400	2.52	94.78	12.17
National all <sup>1</sup>	8,590	97.27	90.32	216,400	2.52	94.78	12.17
Northeast all	1,480	95.63	85.22	35,600	1.72	93.97	15.30
Midwest all	2,190	97.27	88.80	48,700	2.01	95.04	12.22
South all	2,740	98.20	93.44	76,000	3.39	95.00	12.25
West all	2,120	96.86	91.04	53,500	2.13	94.71	9.92
National public	8,060	99.69	99.54	209,100	2.69	94.70	12.87
Alabama	120	100.00	100.00	3,400	1.14	95.49	5.39
Alaska	200	99.48	96.56	3,300	1.45	93.65	20.65
Arizona	120	100.00	100.00	3,500	1.08	95.46	13.24
Arkansas	120	100.00	100.00	3,600	1.11	95.16	15.34
California	300	99.17	98.75	9,300	2.50	94.88	7.73
Colorado	120	100.00	100.00	3,500	1.52	93.66	12.61
Connecticut	120	97.22	97.25	3,400	1.58	94.29	15.33
Delaware	100	100.00	100.00	3,500	4.70	94.34	10.38
District of Columbia	140	100.00	100.00	2,400	1.65	94.46	17.41
Florida	240	100.00	100.00	7,100	2.96	93.98	19.02
Georgia	170	100.00	100.00	5,400	4.90	95.34	8.13
Hawaii	120	100.00	100.00	3,600	1.80	93.97	10.48
Idaho	130	100.00	100.00	3,600	1.49	94.99	9.32
Illinois	200	97.98	98.40	5,200	1.24	95.13	14.76
Indiana	120	100.00	100.00	3,500	2.43	94.40	16.31
Iowa	140	100.00	100.00	3,200	1.08	95.11	14.42
Kansas	150	100.00	100.00	3,500	1.82	95.07	13.41
Kentucky	160	100.00	100.00	4,800	2.99	94.97	9.74
Louisiana	130	100.00	100.00	3,400	1.16	94.73	18.61
Maine	160	100.00	100.00	3,500	1.69	93.65	17.87
Maryland	170	100.00	100.00	4,900	12.86	94.40	5.70
Massachusetts	190	100.00	100.00	5,300	2.66	93.77	15.53
Michigan	190	100.00	100.00	4,800	3.81	94.64	9.66
Minnesota	130	100.00	100.00	3,600	2.71	94.93	9.61

School type and jurisdiction	Number of schools in original sample, rounded	School participation rates (percent) before substitution (weighted by base weight and enrollment)	School participation rates (percent) before substitution (weighted by base weight only)	Number of students sampled, rounded	Weighted percent of students excluded	Weighted student participation rates (percent) after makeups	Weighted percent of students accommodated
Mississippi	120	100.00	100.00	3,400	0.53	94.99	6.85
Missouri	130	100.00	100.00	3,700	1.23	95.26	11.16
Montana	200	99.85	98.28	3,500	2.86	94.40	7.33
Nebraska	170	100.00	100.00	3,600	3.57	95.83	14.26
Nevada	120	100.00	100.00	3,700	1.50	95.10	22.73
New Hampshire	130	100.00	100.00	3,500	2.56	93.45	13.48
New Jersey	120	100.00	100.00	3,400	1.72	94.87	15.27
New Mexico	150	99.69	99.48	4,300	1.02	94.55	15.04
New York	160	98.84	96.79	4,600	1.35	93.06	20.15
North Carolina	160	100.00	100.00	5,000	1.80	94.88	13.06
North Dakota	270	99.86	99.19	3,800	4.06	96.28	8.73
Ohio	210	100.00	100.00	4,800	2.61	94.58	12.80
Oklahoma	140	100.00	100.00	3,700	1.72	94.58	14.35
Oregon	130	100.00	100.00	3,700	2.49	93.98	12.20
Pennsylvania	170	100.00	100.00	4,600	2.29	94.42	12.53
Rhode Island	120	100.00	100.00	3,500	1.34	94.78	14.43
South Carolina	120	100.00	100.00	3,300	1.73	94.64	9.74
South Dakota	190	100.00	100.00	3,500	2.22	95.69	9.26
Tennessee	120	100.00	100.00	3,500	3.10	95.34	12.29
Texas	310	100.00	100.00	9,500	4.90	95.50	14.40
Utah	120	99.08	99.32	3,700	3.05	93.71	10.29
Vermont	220	100.00	100.00	3,100	1.17	95.05	15.65
Virginia	110	100.00	100.00	3,400	1.54	94.93	12.21
Washington	120	99.09	99.35	3,700	2.81	93.71	12.45
West Virginia	150	100.00	100.00	3,300	1.78	93.62	8.89
Wisconsin	190	100.00	100.00	4,500	1.61	94.97	16.63
Wyoming	200	100.00	100.00	3,600	1.25	94.38	13.00
DoDEA <sup>2</sup>	120	99.23	98.08	3,800	5.95	95.48	7.39
Trial Urban (TUDA) Districts and Other Jurisdictions							
Albuquerque	50	100.00	100.00	1,800	0.74	93.43	17.51
Atlanta	60	100.00	100.00	2,000	1.12	95.96	9.39
Austin	60	100.00	100.00	1,700	3.90	94.12	27.06
Baltimore City	70	100.00	100.00	1,700	15.85	93.62	4.33
Boston	80	100.00	100.00	2,000	4.33	94.03	17.64
Charlotte	50	100.00	100.00	1,700	0.90	94.49	11.72
Chicago	100	100.00	100.00	2,600	1.45	94.58	18.56
Cleveland	90	100.00	100.00	1,500	4.70	94.08	22.22
Dallas	50	100.00	100.00	1,700	17.11	96.08	24.30
Detroit	70	100.00	100.00	1,300	5.51	92.09	13.44
Fresno	50	100.00	100.00	1,800	2.36	94.94	6.04
Hillsborough	60	100.00	100.00	1,800	1.07	94.92	23.00
Houston	80	100.00	100.00	2,700	6.41	96.63	23.90
Jefferson County, KY	50	100.00	100.00	1,800	5.28	95.03	7.56
Los Angeles	80	100.00	100.00	2,500	2.10	94.63	10.75
Miami	90	100.00	100.00	2,400	4.51	95.37	26.36
Milwaukee	70	100.00	100.00	1,500	4.08	93.65	25.71
New York City	80	100.00	100.00	2,500	1.62	92.44	27.13

School type and jurisdiction	Number of schools in original sample, rounded	School participation rates (percent) before substitution (weighted by base weight and enrollment)	School participation rates (percent) before substitution (weighted by base weight only)	Number of students sampled, rounded	Weighted percent of students excluded	Weighted student participation rates (percent) after makeups	Weighted percent of students accommodated
------------------------------	---	---	---	-------------------------------------	---------------------------------------	--	---

School type and jurisdiction	Number of schools in original sample, rounded	School participation rates (percent) before substitution (weighted by base weight and enrollment)	School participation rates (percent) before substitution (weighted by base weight only)	Number of students sampled, rounded	Weighted percent of students excluded	Weighted student participation rates (percent) after makeups	Weighted percent of students accommodated
Philadelphia	60	100.00	100.00	1,600	3.83	94.61	15.31
San Diego	50	100.00	100.00	1,600	2.32	94.74	10.45
District of Columbia (TUDA)	90	100.00	100.00	1,600	2.26	94.50	17.21
National private	410	71.19	64.52	3,400	0.53	95.85	4.05
Catholic	130	88.65	89.70	1,700	0.23	95.75	3.84
Non-Catholic private	280	56.94	52.97	1,600	0.79	95.96	4.22

<sup>1</sup> Includes national public, national private, and Bureau of Indian Education schools located in the United States and all Department of Defense Education Activity schools, but not schools in Puerto Rico.

<sup>2</sup> Department of Defense Education Activity schools.

NOTE: Numbers of schools are rounded to nearest ten, and numbers of students are rounded to nearest hundred. Detail may not sum to totals because of rounding.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2013 Reading Assessment.

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/participation\\_exclusion\\_and\\_accommodation\\_rates\\_for\\_grade\\_4\\_reading\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/participation_exclusion_and_accommodation_rates_for_grade_4_reading_for_the_2013_assessment.aspx)



## NAEP Technical Documentation Participation, Exclusion, and Accommodation Rates for Grade 8 Mathematics for the 2013 Assessment

The following table displays the school- and student-level response, exclusion, and accommodation rates for the grade 8 mathematics assessment by school type and jurisdiction. Various weights were used in the calculation of the rates, as indicated in the column headings of the table.

The participation rates reflect the participation of the original sample schools only and do not reflect any effect of substitution. The rates weighted by the base weight and enrollment show the approximate proportion of the student population in the jurisdiction that is represented by the responding schools in the sample. The rates weighted by just the base weight show the proportion of the school population that is represented by the responding schools in the sample. These rates differ because schools differ in size.

Participation, exclusion, and accommodation rates, grade 8 mathematics assessment, by school type and jurisdiction: 2013

School type and jurisdiction	Number of schools in original sample, rounded	School participation rates (percent) before substitution (weighted by base weight and enrollment)	School participation rates (percent) before substitution (weighted by base weight only)	Number of students sampled, rounded	Weighted percent of students excluded	Weighted student participation rates (percent) after makeups	Weighted percent of students accommodated
All	7,370	96.97	84.74	201,500	1.47	93.14	11.88
National all <sup>1</sup>	7,240	96.94	84.59	195,600	1.48	93.15	11.79
Northeast all	1,160	93.53	75.06	32,700	1.60	92.00	15.85
Midwest all	1,920	97.62	85.21	44,100	1.42	93.69	11.78
South all	2,380	97.75	86.70	68,800	1.51	93.24	11.59
West all	1,720	97.42	89.08	48,000	1.41	93.28	9.25
National public	6,760	99.48	99.61	189,400	1.59	93.02	12.25
Alabama	110	100.00	100.00	3,000	1.04	94.23	5.14
Alaska	150	99.91	98.79	3,000	1.08	91.72	18.75
Arizona	120	99.03	99.16	3,200	1.30	93.42	10.71
Arkansas	110	100.00	100.00	3,200	1.93	95.00	13.92
California	260	100.00	100.00	8,400	1.49	93.59	7.91
Colorado	120	100.00	100.00	3,100	1.12	93.47	11.50
Connecticut	110	98.00	97.87	3,100	2.05	92.44	13.92
Delaware	70	100.00	100.00	3,200	1.31	90.65	14.90
District of Columbia	90	100.00	100.00	2,100	0.96	91.26	20.71
Florida	230	100.00	100.00	6,400	1.70	91.06	15.32
Georgia	130	100.00	100.00	4,800	1.55	93.38	9.82
Hawaii	60	100.00	100.00	3,200	1.67	90.26	12.28
Idaho	100	100.00	100.00	3,100	1.06	94.15	8.42
Illinois	190	100.00	100.00	4,800	1.01	94.48	13.83
Indiana	110	97.06	96.65	3,000	1.64	92.49	13.95
Iowa	120	100.00	100.00	3,100	0.77	93.74	13.28
Kansas	130	100.00	100.00	3,300	1.67	93.94	11.23
Kentucky	140	99.04	99.21	4,300	2.08	94.54	10.09
Louisiana	150	100.00	100.00	3,200	1.06	94.14	14.26
Maine	120	100.00	100.00	2,900	1.33	92.79	15.99
Maryland	160	100.00	100.00	4,400	1.74	92.08	13.33
Massachusetts	140	100.00	100.00	4,800	2.01	91.98	16.11
Michigan	170	100.00	100.00	4,200	2.46	92.93	10.55

School type and jurisdiction	Number of schools in original sample, rounded	School participation rates (percent) before substitution (weighted by base weight and enrollment)	School participation rates (percent) before substitution (weighted by base weight only)	Number of students sampled, rounded	Weighted percent of students excluded	Weighted student participation rates (percent) after makeups	Weighted percent of students accommodated
Minnesota	130	98.99	99.67	2,900	1.70	91.58	9.16
Mississippi	110	100.00	100.00	3,200	0.80	93.80	6.51
Missouri	130	100.00	100.00	3,100	1.28	94.25	10.57
Montana	150	99.80	98.82	3,200	1.44	92.28	9.20
Nebraska	130	100.00	100.00	3,100	1.85	93.41	12.02
Nevada	90	100.00	100.00	3,300	1.04	92.80	11.91
New Hampshire	90	100.00	100.00	3,200	1.06	91.60	15.99
New Jersey	110	100.00	100.00	3,100	1.64	92.26	16.38
New Mexico	120	99.68	99.02	4,000	1.57	93.07	12.00
New York	160	93.08	95.81	4,300	1.90	91.15	19.38
North Carolina	140	100.00	100.00	4,500	1.29	92.95	13.74
North Dakota	190	99.92	99.44	3,700	2.93	94.98	11.44
Ohio	200	100.00	100.00	4,500	1.51	93.07	13.54
Oklahoma	130	100.00	100.00	3,100	1.63	92.97	14.09
Oregon	130	100.00	100.00	3,100	1.47	92.91	10.88
Pennsylvania	160	100.00	100.00	4,300	1.70	92.17	14.66
Rhode Island	60	100.00	100.00	3,200	1.11	93.93	15.92
South Carolina	110	100.00	100.00	3,200	1.33	94.19	9.86
South Dakota	150	100.00	100.00	3,200	1.30	94.44	8.66
Tennessee	110	100.00	100.00	3,200	1.77	92.81	9.81
Texas	230	100.00	100.00	8,800	1.92	93.82	12.13
Utah	120	100.00	100.00	3,300	1.53	92.07	10.15
Vermont	120	100.00	100.00	3,000	0.83	93.91	15.36
Virginia	110	100.00	100.00	3,200	1.05	93.39	12.18
Washington	120	100.00	100.00	3,100	2.03	90.87	11.47
West Virginia	110	100.00	100.00	3,200	1.69	92.62	9.02
Wisconsin	170	100.00	100.00	4,300	1.51	94.25	14.73
Wyoming	100	100.00	100.00	3,300	1.50	93.66	12.51
DoDEA <sup>2</sup>	70	99.40	96.83	2,600	1.15	94.47	9.23
Trial Urban (TUDA) Districts and Other Jurisdictions							
Albuquerque	30	100.00	100.00	1,400	1.53	90.76	14.44
Atlanta	30	100.00	100.00	1,600	0.72	91.57	11.10
Austin	30	100.00	100.00	1,600	1.88	90.97	20.60
Baltimore City	60	100.00	100.00	1,300	1.70	89.54	19.73
Boston	40	100.00	100.00	1,800	2.55	91.61	20.88
Charlotte	40	100.00	100.00	1,500	1.29	90.94	10.11
Chicago	100	100.00	100.00	2,300	1.28	94.80	17.19
Cleveland	90	100.00	100.00	1,500	2.62	91.57	28.48
Dallas	40	100.00	100.00	1,600	2.44	93.81	18.35
Detroit	50	100.00	100.00	1,100	4.29	91.58	15.07
Fresno	20	100.00	100.00	1,400	1.74	92.52	7.06
Hillsborough	50	100.00	100.00	1,600	1.35	93.78	20.46
Houston	50	100.00	100.00	2,400	2.21	92.37	14.67
Jefferson County, KY	40	100.00	100.00	1,600	1.65	93.37	12.72
Los Angeles	70	100.00	100.00	2,200	1.54	94.39	10.83
Miami	80	100.00	100.00	2,300	2.25	92.63	18.78
Milwaukee	60	100.00	100.00	1,500	4.10	91.60	25.55

School type and jurisdiction	Number of schools in original sample, rounded	School participation rates (percent) before substitution (weighted by base weight and enrollment)	School participation rates (percent) before substitution (weighted by base weight only)	Number of students sampled, rounded	Weighted percent of students excluded	Weighted student participation rates (percent) after makeups	Weighted percent of students accommodated
New York City	90	99.00	97.58	2,400	1.72	91.78	26.10
Philadelphia	50	100.00	100.00	1,400	3.74	92.67	20.69
San Diego	30	100.00	100.00	1,300	2.32	92.60	11.81
District of Columbia (TUDA)	40	100.00	100.00	1,100	1.69	90.15	22.20

National Catholic private	490	69.68	64.76	3,800	0.26	94.74	6.56
Non-Catholic private	270	53.51	48.11	1,600	0.26	93.50	7.51
Puerto Rico	130	100.00	100.00	5,900	0.03	92.75	23.05

1 Includes national public, national private, and Bureau of Indian Education schools located in the United States and all Department of Defense Education Activity schools, but not schools in Puerto Rico.

2 Department of Defense Education Activity schools.

NOTE: Numbers of schools are rounded to nearest ten, and numbers of students are rounded to nearest hundred. Detail may not sum to totals because of rounding.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2013 Mathematics Assessment.

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/participation\\_exclusion\\_and\\_accommodation\\_rates\\_for\\_grade\\_8\\_mathematics\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/participation_exclusion_and_accommodation_rates_for_grade_8_mathematics_for_the_2013_assessment.aspx)

## NAEP Technical Documentation Participation, Exclusion, and Accommodation Rates for Grade 8 Reading for the 2013 Assessment

The following table displays the school- and student-level response, exclusion, and accommodation rates for the grade 8 reading assessment by school type and jurisdiction. Various weights were used in the calculation of the rates, as indicated in the column headings of the table.

The participation rates reflect the participation of the original sample schools only and do not reflect any effect of substitution. The rates weighted by the base weight and enrollment show the approximate proportion of the student population in the jurisdiction that is represented by the responding schools in the sample. The rates weighted by just the base weight show the proportion of the school population that is represented by the responding schools in the sample. These rates differ because schools differ in size.

Participation, exclusion, and accommodation rates, grade 8 reading assessment, by school type and jurisdiction: 2013

School type and jurisdiction	Number of schools in original sample, rounded	School participation rates (percent) before substitution (weighted by base weight and enrollment)	School participation rates (percent) before substitution (weighted by base weight only)	Number of students sampled, rounded	Weighted percent of students excluded	Weighted student participation rates (percent) after makeups	Weighted percent of students accommodated
All	7,240	96.94	84.59	199,100	2.15	93.11	10.76
National all <sup>1</sup>	7,240	96.94	84.59	199,100	2.15	93.11	10.76
Northeast all	1,160	93.53	75.06	33,300	1.55	91.80	15.53
Midwest all	1,920	97.62	85.21	45,100	1.93	93.48	11.08
South all	2,380	97.75	86.70	69,900	2.60	93.39	9.99
West all	1,720	97.42	89.08	48,900	2.08	93.21	8.32
National public	6,760	99.48	99.61	192,900	2.32	92.93	11.16
Alabama	110	100.00	100.00	3,100	1.14	94.26	4.83
Alaska	150	99.91	98.79	3,100	1.40	91.91	18.39
Arizona	120	99.03	99.16	3,300	1.47	93.67	9.67
Arkansas	110	100.00	100.00	3,200	1.96	93.21	13.36
California	260	100.00	100.00	8,500	2.52	93.42	6.74
Colorado	120	100.00	100.00	3,200	1.15	93.46	10.89
Connecticut	110	98.00	97.87	3,100	2.13	91.38	13.88
Delaware	70	100.00	100.00	3,200	3.49	91.59	12.23
District of Columbia	90	100.00	100.00	2,100	1.82	91.33	19.57
Florida	230	100.00	100.00	6,500	1.86	91.72	15.15
Georgia	130	100.00	100.00	4,900	3.80	93.67	8.18
Hawaii	60	100.00	100.00	3,300	1.93	90.58	12.33
Idaho	100	100.00	100.00	3,200	1.61	93.64	7.76
Illinois	190	100.00	100.00	4,900	1.44	93.76	12.94
Indiana	110	97.06	96.65	3,100	1.90	93.12	13.75
Iowa	120	100.00	100.00	3,100	1.27	93.44	12.16
Kansas	130	100.00	100.00	3,300	1.72	93.42	11.72
Kentucky	140	99.04	99.21	4,300	3.28	93.93	8.47
Louisiana	150	100.00	100.00	3,300	1.24	93.78	14.15
Maine	120	100.00	100.00	3,000	1.55	92.34	15.16
Maryland	160	100.00	100.00	4,400	9.41	93.77	5.45
Massachusetts	140	100.00	100.00	4,900	2.15	91.82	15.04
Michigan	170	100.00	100.00	4,300	3.53	93.66	9.68
Minnesota	130	98.99	99.67	3,000	2.33	91.30	8.43

School type and jurisdiction	Number of schools in original sample, rounded	School participation rates (percent) before substitution (weighted by base weight and enrollment)	School participation rates (percent) before substitution (weighted by base weight only)	Number of students sampled, rounded	Weighted percent of students excluded	Weighted student participation rates (percent) after makeups	Weighted percent of students accommodated
Mississippi	110	100.00	100.00	3,200	0.70	93.72	6.55
Missouri	130	100.00	100.00	3,100	1.02	92.55	10.62
Montana	150	99.80	98.82	3,200	2.29	91.61	7.51
Nebraska	130	100.00	100.00	3,200	2.99	92.32	10.14
Nevada	90	100.00	100.00	3,400	1.00	92.19	10.91
New Hampshire	90	100.00	100.00	3,200	2.93	91.46	14.28
New Jersey	110	100.00	100.00	3,200	2.64	92.01	14.78
New Mexico	120	99.68	99.02	4,000	1.70	93.39	10.00
New York	160	93.08	95.81	4,400	0.96	90.46	20.03
North Carolina	140	100.00	100.00	4,600	1.72	92.51	12.29
North Dakota	190	99.92	99.44	3,800	4.30	94.07	9.52
Ohio	200	100.00	100.00	4,600	2.22	93.08	13.08
Oklahoma	130	100.00	100.00	3,200	1.39	93.43	12.42
Oregon	130	100.00	100.00	3,200	1.45	92.62	11.30
Pennsylvania	160	100.00	100.00	4,300	1.78	91.94	14.51
Rhode Island	60	100.00	100.00	3,300	1.37	92.96	15.18
South Carolina	110	100.00	100.00	3,200	1.88	94.03	7.48
South Dakota	150	100.00	100.00	3,300	2.95	95.01	6.02
Tennessee	110	100.00	100.00	3,200	3.13	93.54	7.75
Texas	230	100.00	100.00	8,900	3.51	93.78	10.05
Utah	120	100.00	100.00	3,400	3.05	93.00	8.36
Vermont	120	100.00	100.00	3,100	0.92	92.93	15.08
Virginia	110	100.00	100.00	3,300	1.40	92.97	10.56
Washington	120	100.00	100.00	3,200	2.46	91.22	9.78
West Virginia	110	100.00	100.00	3,200	1.82	93.10	7.60
Wisconsin	170	100.00	100.00	4,400	1.61	94.11	14.45
Wyoming	100	100.00	100.00	3,400	1.14	93.15	12.27
DoDEA <sup>2</sup>	70	99.40	96.83	2,600	3.84	94.13	7.11
Trial Urban (TUDA) Districts and Other Jurisdictions							
Albuquerque	30	100.00	100.00	1,400	2.04	93.46	11.79
Atlanta	30	100.00	100.00	1,700	1.02	92.20	10.98
Austin	30	100.00	100.00	1,600	3.35	88.54	18.36
Baltimore City	60	100.00	100.00	1,300	16.39	89.73	5.14
Boston	40	100.00	100.00	1,800	3.41	93.05	18.94
Charlotte	40	100.00	100.00	1,500	1.68	92.20	9.90
Chicago	100	100.00	100.00	2,300	1.60	94.72	16.76
Cleveland	90	100.00	100.00	1,500	3.52	91.90	27.75
Dallas	40	100.00	100.00	1,600	3.51	93.98	15.20
Detroit	50	100.00	100.00	1,100	5.74	91.37	12.53
Fresno	20	100.00	100.00	1,500	3.10	93.27	5.86
Hillsborough	50	100.00	100.00	1,600	1.94	91.85	19.74
Houston	50	100.00	100.00	2,400	3.80	93.58	12.29
Jefferson County, KY	40	100.00	100.00	1,600	4.30	94.71	9.49
Los Angeles	70	100.00	100.00	2,300	2.70	94.30	9.97
Miami	80	100.00	100.00	2,400	2.88	94.21	18.45
Milwaukee	60	100.00	100.00	1,500	4.06	93.15	25.08
New York City	90	99.00	97.58	2,400	1.46	91.17	26.00

School type and jurisdiction	Number of schools in original sample, rounded	School participation rates (percent) before substitution (weighted by base weight and enrollment)	School participation rates (percent) before substitution (weighted by base weight only)	Number of students sampled, rounded	Weighted percent of students excluded	Weighted student participation rates (percent) after makeups	Weighted percent of students accommodated
------------------------------	---	---	---	-------------------------------------	---------------------------------------	--	---

School type and jurisdiction	Number of schools in original sample, rounded	School participation rates (percent) before substitution (weighted by base weight and enrollment)	School participation rates (percent) before substitution (weighted by base weight only)	Number of students sampled, rounded	Weighted percent of students excluded	Weighted student participation rates (percent) after makeups	Weighted percent of students accommodated
Philadelphia	50	100.00	100.00	1,400	3.79	91.35	20.91
San Diego	30	100.00	100.00	1,300	2.58	93.78	10.58
District of Columbia (TUDA)	40	100.00	100.00	1,100	2.53	90.18	22.13
National private	400	69.63	60.45	3,500	0.30	95.45	6.32
Catholic	130	87.18	84.76	1,900	0.21	96.07	4.96
Non-Catholic private	270	53.51	48.11	1,600	0.39	94.67	7.56

<sup>1</sup> Includes national public, national private, and Bureau of Indian Education schools located in the United States and all Department of Defense Education Activity schools, but not schools in Puerto Rico.

<sup>2</sup> Department of Defense Education Activity schools.

NOTE: Numbers of schools are rounded to nearest ten, and numbers of students are rounded to nearest hundred. Detail may not sum to totals because of rounding.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2013 Reading Assessment.

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/participation\\_exclusion\\_and\\_accommodation\\_rates\\_for\\_grade\\_8\\_reading\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/participation_exclusion_and_accommodation_rates_for_grade_8_reading_for_the_2013_assessment.aspx)

# NAEP Technical Documentation Participation, Exclusion, and Accommodation Rates for Grade 12 Mathematics for the 2013 Assessment

The following table displays the school- and student-level response, exclusion, and accommodation rates for the grade 12 mathematics assessment. Various weights were used in the calculation of the rates, as indicated in the column headings of the table.

The participation rates reflect the participation of the original sample schools only and do not reflect any effect of substitution. The rates weighted by the base weight and enrollment show the approximate proportion of the student population in the jurisdiction that is represented by the responding schools in the sample. The rates weighted by just the base weight show the proportion of the school population that is represented by the responding schools in the sample. These rates differ because schools differ in size.

Participation, exclusion, and accommodation rates, grade 12 mathematics assessment, by school type and geographic region: 2013

School type and geographic region	Number of schools in original sample	School participation rates (percent) before substitution (weighted by base weight and enrollment)	School participation rates (percent) before substitution (weighted by base weight only)	Number of students sampled	Weighted percentage of students excluded	Weighted student participation rates (percent) after makeups	Weighted percentage of students accommodated
All	2,200	89.51	82.66	62,200	2.16	84.33	8.65
National all <sup>1</sup>	2,200	89.51	82.66	62,200	2.16	84.33	8.65
Northeast all	510	89.05	81.63	16,200	2.29	81.79	11.95
Midwest all	650	87.14	83.20	16,600	1.65	83.87	8.61
South all	710	89.42	85.99	20,300	2.31	86.52	7.98
West all	330	92.21	77.24	9,100	2.32	83.37	7.15
National public	2,030	92.95	93.31	60,400	2.31	84.17	8.77
Arkansas	100	100.00	100.00	2,900	2.78	92.09	8.61
Connecticut	110	98.93	99.45	3,200	1.76	81.22	8.71
Florida	120	99.05	99.30	3,300	3.21	77.25	12.67
Idaho	100	100.00	100.00	3,000	1.65	89.17	6.72
Illinois	130	90.38	93.98	3,300	1.85	85.16	9.79
Iowa	120	100.00	100.00	3,300	1.13	83.05	10.78
Massachusetts	110	99.04	99.45	3,200	2.21	81.71	11.13
Michigan	140	100.00	100.00	4,000	1.90	86.94	8.78
New Hampshire	80	100.00	100.00	4,100	1.61	76.64	11.22
New Jersey	110	98.14	98.57	3,300	1.89	84.10	14.28
South Dakota	140	99.74	99.07	3,100	1.51	87.48	5.78
Tennessee	130	100.00	100.00	4,100	2.51	88.15	7.84
West Virginia	90	100.00	100.00	3,300	2.00	83.68	7.01
Remaining jurisdictions <sup>2</sup>	570	91.16	90.91	16,200	2.26	84.41	10.55
National private	160	53.34	55.43	1,800	0.63	86.51	7.32
Catholic	40	68.06	79.95	1,000	0.83	85.53	5.46
Non-Catholic private	120	38.52	50.25	800	0.42	87.96	9.28

<sup>1</sup> Includes national public, national private, Bureau of Indian Education, and Department of Defense Education Activity schools located in the United States.

<sup>2</sup> Includes national public schools not part of the state assessment.

NOTE: Numbers of schools are rounded to nearest ten, and numbers of students are rounded to nearest hundred. Detail may not sum to totals because of rounding.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2013 Mathematics Assessment.



## NAEP Technical Documentation Participation, Exclusion, and Accommodation Rates for Grade 12 Reading for the 2013 Assessment

The following table displays the school- and student-level response, exclusion, and accommodation rates for the grade 12 reading assessment. Various weights were used in the calculation of the rates, as indicated in the column headings of the table.

The participation rates reflect the participation of the original sample schools only and do not reflect any effect of substitution. The rates weighted by the base weight and enrollment show the approximate proportion of the student population in the jurisdiction that is represented by the responding schools in the sample. The rates weighted by just the base weight show the proportion of the school population that is represented by the responding schools in the sample. These rates differ because schools differ in size.

Participation, exclusion, and accommodation rates, grade 12 reading assessment, by school type and geographic region: 2013

School type and geographic region	Number of schools in original sample	School participation rates (percent) before substitution (weighted by base weight and enrollment)	School participation rates (percent) before substitution (weighted by base weight only)	Number of students sampled	Weighted percentage of students excluded	Weighted student participation rates (percent) after makeups	Weighted percentage of students accommodated
All	2,200	89.51	82.66	62,300	2.41	83.89	8.55
National all <sup>1</sup>	2,200	89.51	82.66	62,300	2.41	83.89	8.55
Northeast all	510	89.05	81.63	16,500	2.16	80.91	12.89
Midwest all	650	87.14	83.20	16,700	2.05	84.05	8.75
South all	710	89.42	85.99	20,000	2.87	85.51	7.18
West all	330	92.21	77.24	9,000	2.24	83.58	7.14
National public	2,030	92.95	93.31	60,400	2.56	83.77	8.73
Arkansas	100	100.00	100.00	3,000	2.56	90.21	8.24
Connecticut	110	98.93	99.45	3,400	2.34	79.77	8.70
Florida	120	99.05	99.30	3,300	3.55	77.34	12.14
Idaho	100	100.00	100.00	3,200	1.66	88.68	6.42
Illinois	130	90.38	93.98	3,400	2.29	83.72	9.92
Iowa	120	100.00	100.00	3,500	1.51	84.26	10.62
Massachusetts	110	99.04	99.45	3,200	1.87	79.84	11.31
Michigan	140	100.00	100.00	3,900	4.01	87.21	6.17
New Hampshire	80	100.00	100.00	4,300	2.55	76.91	10.25
New Jersey	110	98.14	98.57	3,300	1.80	84.67	14.78
South Dakota	140	99.74	99.07	3,300	1.60	86.17	5.16
Tennessee	130	100.00	100.00	3,900	2.88	88.82	7.13
West Virginia	90	100.00	100.00	3,400	2.37	84.28	6.89
Remaining jurisdictions <sup>2</sup>	570	91.16	90.91	15,200	2.77	83.98	10.05
National private	160	53.34	55.43	1,900	0.84	85.52	6.67
Catholic	40	68.06	79.95	1,100	0.92	84.67	4.01
Non-Catholic	120	38.52	50.25	800	0.75	86.75	9.41

<sup>1</sup> Includes national public, national private, Bureau of Indian Education, and Department of Defense Education Activity schools located in the United States.


<sup>2</sup> Includes national public schools not part of the state assessment.

NOTE: Numbers of schools are rounded to nearest ten, and numbers of students are rounded to nearest hundred. Detail may not sum to totals because of rounding.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2013 Reading Assessment.

## NAEP Technical Documentation Nonresponse Bias Analyses for the 2013 Assessment

NCES statistical standards call for a nonresponse bias analysis to be conducted for a sample with a response rate below 85 percent at any stage of sampling. Weighted school response rates for the 2013 assessment indicated a need for school nonresponse bias analyses for private school samples in grades 4, 8, and 12 (operational subjects). Student nonresponse bias analyses were necessary for the grade 12 public school student sample overall and in specific states, for both reading and mathematics: Connecticut, Florida, Iowa, Massachusetts, New Hampshire, and West Virginia. Additionally, a student nonresponse bias analysis was required for the grade 12 public school student sample in Illinois based on the weighted response rate for reading, while such an analysis was required for grade 12 public school student sample in New Jersey based on the weighted response rate for mathematics. Thus, three separate school-level analyses and nine separate student-level analyses were conducted.

The procedures and results from these analyses are summarized briefly below. The analyses conducted consider only certain characteristics of schools and students. They do not directly consider the effects of the nonresponse on student achievement, the primary focus of NAEP. Thus, these analyses cannot be conclusive of either the existence or absence of nonresponse bias for student achievement. For more details, please see the NAEP 2013 NRBA report  (657.56 KB).

Each school-level analysis was conducted in three parts. The first part of the analysis looked for potential nonresponse bias that was introduced through school nonresponse. The second part of the analysis examined the remaining potential for nonresponse bias after accounting for the mitigating effects of substitution. The third part of the analysis examined the remaining potential for nonresponse bias after accounting for the mitigating effects of both school substitution and school-level nonresponse weight adjustments. The characteristics examined were Census region, reporting subgroup (private school type), urban-centric locale, size of school (categorical), and race/ethnicity percentages (mean).

Based on the school characteristics available, for the private school samples at grade 4, there does not appear to be evidence of substantial potential bias resulting from school substitution or school nonresponse. However, the analyses suggest that a potential for nonresponse bias remains for the grade 8 and 12 private school samples. For grade 8, this result is evidently related to the fact that, among non-Catholic schools, larger schools were less likely to respond. Thus, when making adjustments to address the underrepresentation of non-Catholic schools among the respondents, the result is to over represent smaller schools at the expense of larger ones. The limited school sample sizes involved means that it is not possible to make adjustments that account fully for all school characteristics. For grade 12, the analyses suggested potential bias for percentage Asian and percentage Two or more races. Please see the full report for more details.

Each student-level analysis was conducted in two parts. The first part of the analysis examined the potential for nonresponse bias that was introduced through student nonresponse. The second part of the analysis examined the potential for bias after accounting for the effects of nonresponse weight adjustments. The characteristics examined were gender, race/ethnicity, relative age, National School Lunch Program eligibility, student disability (SD) status, and English language learner (ELL) status.

Based on the student characteristics available, there does not appear to be evidence of substantial potential bias resulting from student nonresponse. Please see the full report for more details.

---

[http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/nonresponse\\_bias\\_analyses\\_for\\_the\\_2013\\_assessment.aspx](http://nces.ed.gov/nationsreportcard/tdw/weighting/2013/nonresponse_bias_analyses_for_the_2013_assessment.aspx)

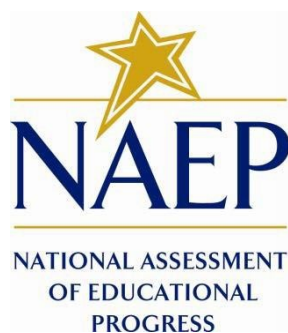
# Appendix C

*NATIONAL CENTER FOR EDUCATION STATISTICS NATIONAL  
ASSESSMENT OF EDUCATIONAL PROGRESS*

*National Assessment of Educational Progress (NAEP)  
2022*

*Appendix C  
2022 Sampling Memo (New)*

*OMB# 1850-0928 v.25*



August 2021



Date: July 23, 2021                      Memo: 2022-  
1.2A/1.2B/1.2D/1.2E/1.2L

To:	William Ward, NCES	Chris Averett
	Ed Kulick, ETS	Kavemuii Murangi
	David Freund, ETS	Dwight Brock
	Amy Drescher, ETS	Yiting Long
	Cathy White, Pearson	Jing Kang
	Lauren Byrne	Sabrina Zhang
	Lisa Rodriguez	Amy Lin
	Rick Rogers	Natalia Weil
	Rob Dymowski	Véronique Lieber
	William Wall	Sipeng Wang
	Greg Binzer	Sarah Shore

From: Leslie Wallace, John Burke, and Lloyd Hicks  
Reviewer: Keith Rust

Subject: Sample Design for 2022 NAEP - FINAL

Changes This version drops the LTT age 17 samples and adds LTT age 9  
from April overlap control plans for private schools have changed. Finally,  
2021 Tables 3 and 4  
DRAFT: are revised to reflect the actual sample results.

## I. Introduction

For 2022, the NAEP assessment involves the following components:

- A. National assessments in reading and mathematics at grades 4 and 8;
- B. State-by-state and Trial Urban District Assessment (TUDA) assessments in reading and mathematics for public schools at

grades 4 and 8;

\\westat.com\dfs\NAEPLIB\2022\Memos\School Sampling\Alpha - Public, Grades 4 & 8\2022-m01v02a.docx

- C. An assessment of mathematics in Puerto Rico for public schools at grades 4 and 8;
- D. National assessments in US history and civics at grade 8;
- E. National Long-Term Trend (LTT) assessments in reading and mathematics at age 9.

Below is a summary list of the features of the 2022 sample design.

1. The alpha<sup>1</sup> samples for grades 4 and 8 public, and the delta samples for private schools at grades 4 and 8, will be used for the operational assessments in reading and mathematics.
2. The alpha samples will be selected to have maximum overlap with the NAEP 2021 sigma samples because the sigma samples were the basis for the 2021 School and Teacher Questionnaire Study and the 2021 Monthly School Survey. The plan is retain the schools surveyed in 2021 for the 2022 assessment, to the extent possible while ensuring an efficient representative sample for 2022.
3. The beta public school sample and the epsilon private school sample at grade 8 will be used for the national US history and civics assessments.
4. As in past NAEP studies, each Trial Urban District Assessment (TUDA) sample will form part of the corresponding state sample, and each state sample will form part of the national sample. There are twenty-seven Trial Urban District Assessment (TUDA) participants. These are the same districts that participated in 2019. The population of schools for a TUDA district consists of those public schools, charter and non-charter, for which the district is responsible for academic accountability.
5. Reading, mathematics, history, and civics in the alpha, delta, beta, and epsilon samples will be digitally-based assessments (DBA) and administered using tablets. Reading and mathematics in the LTT samples will be paper-based assessments (PBA).
6. The school and student sample sizes for the alpha samples in each state will be considerably smaller than in 2019 and past assessments involving state-level reporting. This can be seen by comparing the figures in Tables 1, 3, and 4, with comparable tables from previous assessments. This also means that there will be fewer schools with multiple assessment sessions assigned. In the alpha sample at grade 4, we anticipate approximately 94 schools with a double-size student sample, and 17 schools with a sample

more than double the usual student sample size. This compares with comparable counts of 234 and 38 schools in 2019. At grade 8, we anticipate approximately 346 schools with a double-size student sample, and 143 schools with a sample more than double the usual student sample size. This compares with comparable counts of 588 and 336 schools in 2019.

7. There will be no samples in U.S. territories other than for Puerto Rico at grades 4 and 8.

---

<sup>1</sup>The terminology of alpha, beta, delta, epsilon, sigma, etc. is defined in Section III.



8. As in 2019, the Department of Defense Schools (DoDEA) are expected to be reported as a single jurisdiction.
9. There is no National Indian Education Study. This means that less extensive sampling of Bureau of Indian Education (BIE) schools in the alpha samples is required than in 2019 and other years when NIES has been conducted. To ensure sound results for American Indian and Alaska Native (AIAN) students in reading and mathematics at the national level, at grades 4 and 8 BIE students will be sampled at the same rate as students in Oklahoma, the state with the highest proportion AIAN population.
10. The LTT age 9 samples will be selected to ensure the inclusion of the 2020 LTT age 9 sample schools (that are still on the 2022 frame).
11. The sampling rates of private schools at grades 4 and 8 will be similar to those of 2019. Response rates permitting, this will allow separate reporting for reading and mathematics for Catholic and non-Catholic schools at grades 4 and 8, but no further breakdowns by private school type. The sampling rates of LTT private schools at age 9 will be similar to those that were planned for 2020. Because private schools are not oversampled and the sample sizes are small, the LTT design does not support separate reporting for Catholic and non-Catholic private schools. Ten percent of the LTT sampled students are associated with private schools. This roughly represents a proportional sample, as about 10% of the population attends private schools.
12. The sample sizes of assessed students for these various components are shown in Table 1 (which also shows the approximate numbers of participating schools).
13. In the beta and public LTT samples, there will be moderate oversampling of schools with moderate to high proportions of Black, Hispanic, and AIAN students.
14. In the public LTT sample only, there will be moderate oversampling of Black, Hispanic, and AIAN students in schools that were not oversampled at the school level.

Table 1. Target sample sizes of assessed students, and expected number of participating schools, for 2022 NAEP

Spiral <sup>1</sup>					Jurisdictions		Students		Total
					Urban districts	Public school students	Private school students		
				Spiral Indic.					
Grade 4				States <sup>2</sup>					
Nat'l/state reading				DS	52	27	114,500	2,350	116,850
Nat'l/state math				DS	52	27	114,500	2,350	116,850
Puerto Rico				DP	1		3,000		3,000
Total - alpha							232,000		232,000
Total - delta								4,700	4,700
Typical max. no. students/school							50	50	
Average assessed students/school							39	20	
Total schools - alpha, delta							6,022	235	6,257
Total number of students grade 4							232,000	4,700	236,700
Total number of schools grade 4							6,022	235	6,257
Grade 8									
Nat'l/state reading				DS	52	27	114,500	2,350	116,850
Nat'l/state math				DS	52	27	114,500	2,350	116,850
Puerto Rico				DP	1		3,000		3,000
Total - alpha							232,000		232,000
Total - delta								4,700	4,700
Typical max. no. students/school							50	50	
Average assessed students/school							39	22	
Total schools - alpha, delta							5,875	214	6,089
US history				HC			7,200	800	8,000
Civics				HC			7,200	800	8,000
Total - beta							14,400		14,400
Total - epsilon								1,600	1,600
Typical max. no. students/school							50	50	
Average assessed students/school							40	22	
Total schools - beta, epsilon							360	73	433
Total number of students grade 8							246,400	6,300	252,700
Total number of schools grade 8							6,235	287	6,522

Table 1. Target sample sizes of assessed students, and expected number of participating schools, for 2022 NAEP (Continued)

	Spiral <sup>1</sup> Jurisdictions			Students		Total
	Spiral Indic.	States <sup>2</sup>	Urban districts	Public school students	Private school students	
Age 9						
LTT reading	LT			7,200	800	8,000
LTT math	LT			7,200	800	8,000
Total - LTT public				14,400		14,400
Total - LTT private					1,600	1,600
Typical max. no. students/school				50	50	
Average assessed students/school				42	15	
Total schools - LTT				343	107	450
Total number of students age 9				14,400	1,600	16,000
Total number of schools age 9				343	107	450
GRAND TOTAL STUDENTS				492,800	12,600	505,400
GRAND TOTAL SCHOOLS				12,600	629	13,229

<sup>1</sup> See Table 2 for definitions of DS, HC, DP and LT.

<sup>2</sup> Includes BIE, District of Columbia (DC), DoDEA, and Puerto Rico schools.

## II. Assessment Types

The assessment spiral types are shown in Table 2. Two different spirals will be used at grade 4, three different spirals will be used at grade 8, and one spiral will be used at age 9. Session IDs contain six characters, traditionally. The first two characters identify the assessment “type” (subjects and type of spiral in a general way). Grade or age is contained in the second pair of characters, and the session sequential number (within schools) in the last two characters. For example, session DS0401 denotes the first grade 4 reading and mathematics operational DBA assessment in a given school.

Table 2. NAEP 2022 assessment types and IDs

ID	Type	Subjects	Grades (or age)	Schools	Comments
DS	Operational	Reading, math	4, 8	Public, Private	All schools in the alpha (except Puerto Rico) and delta samples.
HC	Operational	US history, civics	8	Public, Private	All schools in the beta and epsilon samples.
DP	Operational	Mathematics	4, 8	Public	Puerto Rico alpha samples.
LT	Operational	Reading, math	(9)	Public, Private	LTT samples.

### III. Sample Types and Sizes

In similar fashion to past years, we have identified five different types of school samples: alpha, beta, delta, epsilon, and LTT. These distinguish sets of schools that will be conducting distinct portions of the assessment.

#### 1. Alpha Samples at Grades 4 and 8

These are public school samples for grades 4 and 8. They will be used for the operational state-by-state assessments in reading and mathematics, and contribute to the national samples for these subjects as well. There will be alpha samples for each state, DC, DoDEA, BIE, and Puerto Rico. These samples will be selected to have maximum overlap with the NAEP 2021 sigma samples, which were the basis of the school and teacher questionnaire (STQ) study and the monthly school survey (MSS) samples carried out in 2021.

The details of the target student sample sizes for the alpha samples are as follows:

- A. At each grade, the assessed student target sample size is 3,500 per state. The goal in each state (before considering the contribution of TUDA districts) is to roughly assess 1,750 students for math and 1,750 students for reading. The initial target sample size of students after

considering attrition is 4,100 for grade 4 and 4,200 for grade 8.

- B. There will be samples for twenty-seven TUDA districts. For the six large TUDA districts (New York, Los Angeles, Chicago, Miami-Dade, Clark County, and Houston) the assessed student target sample sizes are three-quarters the size of a state sample (2,625). The target student sample size after considering attrition is 3,075 for grade 4 and 3,150 for grade 8.

- C. For the remaining 21 TUDA districts, the assessed student target sample sizes are half the size of a state sample (1,750). The target student sample size after inflation to account for attrition is 2,050 for grade 4 and 2,100 for grade 8.
- D. Note that, above, there is a conflict between sample size requirements at the state level, and the TUDA district level. This will be resolved as in previous years: the districts will have the target samples indicated in B and C, and reflected in Table 3. For the states that contain one or more of these districts, the target sample size indicated in A (and shown in Table 3) will be used to determine a school sampling rate for the state, which will be applied to the balance of the state outside the TUDA district(s). Thus the target student sample sizes, shown in Table 3, for states that contain a TUDA district, are only 'design targets', and are smaller than the final total sample size for the state, but larger than the sample for the balance of the state, exclusive of its TUDA districts.
- E. In Puerto Rico, the target sample size is 3,600 per grade (grades 4 and 8), with the goal of assessing 3,000 students.

As in past state-by-state assessments, schools with fewer than 20 students in the grade in question will be sampled at a moderately lower rate than other schools (at least half, and often higher, depending upon the size of the school). This is in implicit recognition of the greater cost and burden associated with surveying these schools.

Table 3 shows the target student sample sizes, and the approximate counts of schools to be selected in the alpha samples, along with the school and student frame counts, by state and TUDA districts for grades 4 and 8. The table also identifies the jurisdictions where we take all schools and where we take all students.

Table 4 consolidates the target student (and resulting school) sample size numbers, to show the total target sample sizes in each state, combining the TUDA targets with those for the balance of the state.

Table 3. Grade 4 and 8 school and student frame counts, expected school sample sizes, and initial target student sample sizes for the 2022 state-by-state and TUDA district assessments (Alpha samples)

Jurisdiction	Grade 4				Grade 8					
	Schools in frame	Schools in sample	Students in frame	Overall target student sample size	Schools in frame	Schools in sample	Students in frame	Overall target student sample size		
Alabama	689	86	56,232	4,100	436	86	56,217	4,200		
Alaska	346	132	9,155	4,100	266	105	9,202	4,200		
Arizona	1,230	91	86,152	4,194	†	830	92	88,080	4,308	†
Arkansas	474	86	37,099	4,100	304	86	37,124	4,200		
Bureau Of Indian Education	136	9	3,066	225	110	6	2,742	225		
California	6,135	225	454,342	4,100	3,096	87	466,048	4,200		
Colorado	1,099	123	66,131	4,100	614	88	68,739	4,200		
Connecticut	559	85	37,280	4,100	289	85	39,376	4,200		
Delaware	117	78	10,511	4,100	68	49	11,041	4,200		
District Of Columbia	129	90	6,607	4,100	76	76	5,637	4,200	*	
DoDEA Schools	89	89	5,708	5,708	**	60	60	4,671	4,671	**
Florida	2,290	211	215,654	4,100	1,302	88	219,984	4,200		
Georgia	1,252	119	130,599	4,100	583	85	138,315	4,200		
Hawaii	208	87	14,325	4,100	84	53	13,911	4,200		
Idaho	393	94	23,634	4,100	219	86	24,793	4,200		
Illinois	2,221	145	139,349	4,100	1,598	91	148,461	4,200		
Indiana	1,033	88	77,755	4,100	490	85	80,844	4,200		
Iowa	614	91	36,402	4,100	357	88	38,428	4,200		
Kansas	695	96	35,714	4,100	392	93	37,025	4,200		
Kentucky	724	115	50,397	4,100	431	90	52,426	4,200		
Louisiana	739	87	53,725	4,100	499	89	53,361	4,200		
Maine	309	107	13,041	4,100	198	91	13,472	4,200		
Maryland	892	121	68,713	4,100	371	86	67,807	4,200		
Massachusetts	951	128	68,723	4,100	492	85	72,234	4,200		
Michigan	1,677	132	104,633	4,100	1,102	90	110,949	4,200		
Minnesota	990	89	65,135	4,100	730	95	67,317	4,200		
Mississippi	407	86	35,543	4,100	278	85	36,803	4,200		
Missouri	1,163	97	67,268	4,100	712	95	70,194	4,200		

Table 3. Grade 4 and 8 school and student frame counts, expected school sample sizes, and initial target student sample sizes for the 2022 state-by-state and TUDA district assessments (Alpha samples) (Continued)

Jurisdiction	Grade 4				Grade 8				
	Schools in frame	Schools in sample	Students in frame	Overall target student sample size	Schools in frame	Schools in sample	Students in frame	Overall target student sample size	
Montana	394	127	11,721	4,100	277	103	11,939	4,200	
Nebraska	511	103	23,867	4,100	290	95	23,444	4,200	
Nevada	434	94	37,167	4,100	194	82	38,808	4,200	
New Hampshire	269	100	12,854	4,100	151	79	13,626	4,200	
New Jersey	1,362	88	96,698	4,100	789	87	100,973	4,200	
New Mexico	438	113	24,591	4,100	236	89	25,397	4,200	
New York	2,520	120	194,631	4,100	1,547	87	197,329	4,200	
North Carolina	1,506	158	118,068	4,100	784	87	122,342	4,200	
North Dakota	264	118	9,116	4,100	180	88	8,823	4,200	
Ohio	1,667	139	125,413	4,100	1,061	88	130,259	4,200	
Oklahoma	840	96	51,807	4,100	588	91	52,202	4,200	
Oregon	754	89	43,807	4,100	419	92	45,433	4,200	
Pennsylvania	1,543	121	127,950	4,100	889	85	133,614	4,200	
Puerto Rico	531	149	20,203	3,600	345	145	22,853	3,600	
Rhode Island	166	86	10,460	4,100	63	63	10,922	4,200	*
South Carolina	656	85	58,707	4,100	318	85	59,887	4,200	
South Dakota	314	120	10,725	4,100	252	98	11,013	4,200	
Tennessee	1,025	120	76,174	4,100	613	88	76,937	4,200	
Texas	4,614	264	399,382	4,100	2,359	86	415,166	4,200	
Utah	650	86	51,190	4,100	275	87	53,345	4,200	
Vermont	208	132	5,916	4,100	116	87	5,867	4,200	
Virginia	1,110	84	96,163	4,100	383	84	99,765	4,200	
Washington	1,256	89	84,888	4,100	631	89	86,202	4,200	
West Virginia	387	99	19,055	4,100	180	86	19,653	4,200	
Wisconsin	1,081	133	59,391	4,100	647	90	61,906	4,200	
Wyoming	187	102	7,286	4,100	91	62	7,664	4,200	



Table 3. Grade 4 and 8 school and student frame counts, expected school sample sizes, and initial target student sample sizes for the 2022 state-by-state and TUDA district assessments (Alpha samples) (Continued)

Jurisdiction	Grade 4				Grade 8				
	Schools in frame	Schools in sample	Students in frame	Overall target student sample size	Schools in frame	Schools in sample	Students in frame	Overall target student sample size	
Albuquerque	102	43	6,704	2,050	46	33	6,493	2,100	
Atlanta	56	39	4,443	2,050	26	26	3,914	2,100	*
Austin	81	42	6,112	2,050	21	21	5,558	2,100	*
Baltimore City	116	45	6,420	2,050	88	46	5,373	2,100	
Boston	70	47	3,621	2,050	46	46	3,676	2,200	*
Charlotte	111	41	11,430	2,050	45	33	11,436	2,100	
Chicago	459	70	26,029	3,075	454	70	26,680	3,150	
Clark County, NV	237	62	23,890	3,075	76	54	25,352	3,150	
Cleveland	80	53	3,265	2,050	78	54	3,179	2,100	
Dallas	148	41	11,497	2,050	41	41	10,336	2,100	*
Denver	110	44	6,823	2,050	62	40	6,571	2,100	
Detroit	72	44	4,164	2,050	59	44	3,362	2,100	
Duval County, FL	124	42	10,577	2,050	60	35	9,784	2,100	
Fresno	69	41	5,869	2,050	19	19	5,195	2,100	*
Fort Worth	85	42	6,196	2,050	33	33	6,049	2,100	*
Guilford County, NC	73	43	5,440	2,050	29	29	5,497	2,100	*
Hillsborough County, FL	189	42	17,620	2,050	100	41	16,814	2,100	
Houston	176	62	16,509	3,075	60	44	13,143	3,150	
Jefferson County, KY	99	42	7,443	2,050	41	25	7,425	2,100	
Los Angeles	497	64	38,919	3,075	126	62	33,124	3,150	
Miami	287	63	25,525	3,075	190	66	26,991	3,150	
Milwaukee	112	47	5,563	2,050	79	44	4,964	2,100	
New York City	820	64	67,351	3,075	512	64	66,309	3,150	
Philadelphia	147	43	10,490	2,050	120	41	9,339	2,100	
San Diego	121	44	8,247	2,050	38	38	7,036	2,100	*
Shelby County, TN	119	44	8,885	2,050	62	36	7,965	2,100	
District of Columbia PS	79	45	4,034	2,050	32	32	3,013	2,100	*

Counts for states *do not* reflect the oversampling for their constituent TUDA districts.

Target student sample sizes reflect sample sizes prior to attrition due to exclusion, ineligibility, and nonresponse.

† The Arizona targets reflect the oversampling of high American Indian/Alaska Native schools (so that we get exactly 4 of these schools in sample).

\* identifies jurisdictions where all schools (but not all students) for the given grade are included in the NAEP sample. The decision to include all schools in Boston at grade 8 results in a slightly larger overall target student sample size there (2,200 instead of 2,100).

\*\* identifies jurisdictions where all students for the given grade are included in the NAEP sample.

Table 4. Total sample sizes, combining state and TUDA samples

Jurisdiction	Grade 4				Grade 8				
	Schools in frame	Schools in sample	Students in frame	Overall target student sample size	Schools in frame	Schools in sample	Students in frame	Overall target student sample size	
Alabama	689	86	56,232	4,100	436	86	56,217	4,200	
Alaska	346	132	9,155	4,100	266	105	9,202	4,200	
Arizona	1,230	91	86,152	4,194 †	830	92	88,080	4,308	†
Arkansas	474	86	37,099	4,100	304	86	37,124	4,200	
Bureau Of Indian Education	136	9	3,066	225	110	6	2,742	225	
California	6,135	225	454,342	10,769	3,096	197	466,048	11,108	
Colorado	1,099	123	66,131	5,739	614	120	68,739	5,904	
Connecticut	559	85	37,280	4,100	289	85	39,376	4,200	
Delaware	117	78	10,511	4,100	68	49	11,041	4,200	
District Of Columbia	129	90	6,607	4,100	76	76	5,637	4,200	*
DoDEA Schools	89	89	5,708	5,708 **	60	60	4,671	4,671	**
Florida	2,290	211	215,654	10,253	1,302	209	219,984	10,554	
Georgia	1,252	119	130,599	6,010	583	108	138,315	6,182	
Hawaii	208	87	14,325	4,100	84	53	13,911	4,200	
Idaho	393	94	23,634	4,100	219	86	24,793	4,200	
Illinois	2,221	145	139,349	6,410	1,598	144	148,461	6,546	
Indiana	1,033	88	77,755	4,100	490	85	80,844	4,200	
Iowa	614	91	36,402	4,100	357	88	38,428	4,200	
Kansas	695	96	35,714	4,100	392	93	37,025	4,200	
Kentucky	724	115	50,397	5,549	431	103	52,426	5,693	
Louisiana	739	87	53,725	4,100	499	89	53,361	4,200	
Maine	309	107	13,041	4,100	198	91	13,472	4,200	
Maryland	892	121	68,713	5,749	371	125	67,807	5,984	
Massachusetts	951	128	68,723	5,935	492	126	72,234	6,190	
Michigan	1,677	132	104,633	5,981	1,102	131	110,949	6,173	
Minnesota	990	89	65,135	4,100	730	95	67,317	4,200	
Mississippi	407	86	35,543	4,100	278	85	36,803	4,200	
Missouri	1,163	97	67,268	4,100	712	95	70,194	4,200	
Montana	394	127	11,721	4,100	277	103	11,939	4,200	

Table 4. Total sample sizes, combining state and TUDA samples (Continued)

Jurisdiction	Grade 4				Grade 8				
	Schools in frame	Schools in sample	Students in frame	Overall target student sample size	Schools in frame	Schools in sample	Students in frame	Overall target student sample size	
Nebraska	511	103	23,867	4,100	290	95	23,444	4,200	
Nevada	434	94	37,167	4,556	194	86	38,808	4,662	
New Hampshire	269	100	12,854	4,100	151	79	13,626	4,200	
New Jersey	1,362	88	96,698	4,100	789	87	100,973	4,200	
New Mexico	438	113	24,591	5,000	236	100	25,397	5,171	
New York	2,520	120	194,631	5,762	1,547	123	197,329	5,938	
North Carolina	1,506	158	118,068	7,606	784	137	122,342	7,802	
North Dakota	264	118	9,116	4,100	180	88	8,823	4,200	
Ohio	1,667	139	125,413	6,039	1,061	139	130,259	6,194	
Oklahoma	840	96	51,807	4,100	588	91	52,202	4,200	
Oregon	754	89	43,807	4,100	419	92	45,433	4,200	
Pennsylvania	1,543	121	127,950	5,807	889	120	133,614	6,019	
Puerto Rico	531	149	20,203	3,600	345	145	22,853	3,600	
Rhode Island	166	86	10,460	4,100	63	63	10,922	4,200	*
South Carolina	656	85	58,707	4,100	318	85	59,887	4,200	
South Dakota	314	120	10,725	4,100	252	98	11,013	4,200	
Tennessee	1,025	120	76,174	5,693	613	115	76,937	5,834	
Texas	4,614	264	399,382	12,909	2,359	218	415,166	13,302	
Utah	650	86	51,190	4,100	275	87	53,345	4,200	
Vermont	208	132	5,916	4,100	116	87	5,867	4,200	
Virginia	1,110	84	96,163	4,100	383	84	99,765	4,200	
Washington	1,256	89	84,888	4,100	631	89	86,202	4,200	
West Virginia	387	99	19,055	4,100	180	86	19,653	4,200	
Wisconsin	1,081	133	59,391	5,744	647	127	61,906	5,970	
Wyoming	187	102	7,286	4,100	91	62	7,664	4,200	
Total	52,248	6,005	3,750,123	266,436	29,665	5,453	3,870,570	272,431	

Sample sizes for each state reflect the samples in the TUDA districts within the state.

† The Arizona target student sample sizes reflect the oversampling of high American Indian/Alaska Native schools (so that we get exactly 4 of these schools in sample).

\* identifies jurisdictions where all schools (but not all students) for the given grade are included in the NAEP sample.

\*\* identifies jurisdictions where all students for the given grade are included in the NAEP sample.

## Stratification

Each state and grade will be stratified separately, but using a common approach in all cases. TUDA districts will be separated from the balance of their state, and each part stratified separately. The first level of stratification will be based on urban-centric type of location. This variable has 12 levels (some of which may not be present in a given state or TUDA district), and these will be collapsed so that each of the resulting location categories contains at least 10 percent of the student population (13 percent for large TUDA districts and 20 percent for small TUDA districts).

Within each of the resulting location categories, schools will be assigned a minority enrollment status. This is based on the two race/ethnic groups that are the second and third most prevalent within the location category. If these groups are both low in percentage terms, no minority classification will be used. Otherwise three (or occasionally four) equal-sized groups (generally high, medium, and low minority) will be formed based on the distribution across schools of the two minority groups.

Within the resulting location and minority group classes (of which there are likely to be from two to twenty-three, depending upon the jurisdiction), schools will be sorted by a measure derived from school level results from the most recent available state achievement tests at the relevant grade. In general, mathematics test results will be used, but where these are not available, reading results will be used. In the few states that do not have math or reading tests at grades 4 and 8 (or where we are unable to match the results to the NAEP school frame), instead of achievement data, schools will be sorted using a measure of socio-economic status. This is the median household income of the 5-digit ZIP Code area where the school is located, based on the 2019 ACS (5-year) data. For BIE and DoDEA schools neither achievement data nor income data are available, and so grade enrollment is used in these cases.

Once the schools are sorted in a serpentine fashion by location class, minority enrollment class, and achievement data (or household income/grade enrollment), a systematic sample of schools will be selected

using a random start. Schools will be sampled with probability proportional to size and sampling will employ a controlled selection method that maximizes overlap with the NAEP 2021 sigma samples. The exact details of this process are described in the individual sampling specification memos.

## 2. Beta Sample

The beta sample comprises the national public school sample at grade 8 that will be used for the national US history and civics assessments. The sample will be nationally representative, selected to have minimal overlap with the alpha sample schools at the same grade. The number of students targeted for selection per school will be 50.

In order to increase the likelihood that the results for AIAN students can be reported for these samples, we will oversample high-AIAN public schools. That is, a public school with more than 5 AIAN students and greater than 5 percent AIAN enrollment will be given four times the chance of selection of a public school of the same size with a lower AIAN percentage. For all other schools, whenever there are more than 10 Black or Hispanic students enrolled and the combined Black and Hispanic enrollment exceeds 15 percent, the school will be given twice the chance of selection of a public school of the same size with a lower percentage of these two groups. This approach is effective in increasing the sample sizes of AIAN, Black, and Hispanic students without inducing undesirably large design effects on the sample, either overall, or for particular subgroups.

### Stratification

The beta samples will have an implicit stratification, using a hierarchy of stratifiers and a serpentine sort. The highest level of the hierarchy is high/low AIAN status. The second stratifier is Census division (10 categories: the usual 9 plus California as a separate category). Some of the Census divisions within the high AIAN stratum will be collapsed with neighboring Census divisions (this will occur if the expected school sample size within the cell is less than 4.0). The next stratifier in the hierarchy is type of location, which has twelve categories. Within the high AIAN stratum, the cells will likely be too small to further stratify by type of location. Within the low AIAN stratum, many of the type of location strata nested within Census divisions will be collapsed with neighboring type of location cells (this will occur if the expected school sample size within the cell is less than 4.0). These geographic strata will be



subdivided into high/low Black and Hispanic substrata. If the expected initial sample size in a Black/Hispanic substratum is less than 8.0, it will be left as is. If the expected sample size is greater than or equal to 8.0, then it will be subdivided into up to four substrata (two for expected sample size up to but less than 12.0, three for expected sample size up to but less than 16.0, and four for expected sample size greater than or equal to 16.0). For the high Black/Hispanic substrata, the subdivision will be by percentage Black and Hispanic. For the low Black/Hispanic substrata, the subdivision will be by state or groups of contiguous states. Within these substrata, the

schools are to be sorted by school type (public, BIE, DoDEA) and median household income from the 2019 5-year ACS (using a serpentine sort within the school type substrata).

### 3. Delta Samples

These are the private school samples at grades 4 and 8 for conducting the operational assessments in reading and mathematics. The sample sizes are large enough to report results by Catholic and non-Catholic at grades 4 and 8 (of course participation rate standards must be met). Approximately half the sample at each grade will be from Catholic schools. The grade 8 delta samples will be selected to have minimum overlap with the grade 4 delta sample. The number of students targeted per school will be 50 at each grade.

#### Stratification

The private schools are to be explicitly stratified by private school type (Catholic/Other). Within each private school type, implicit stratification will be by Census region (4 categories), type of location (12 categories), race/ethnicity composition, and enrollment size. In general, where there are few or no schools in a given stratum, categories will be collapsed together, always preserving the private school type.

### 4. Epsilon Sample

With regard to subjects and grades assessed, this sample is analogous to the beta sample, but for private schools. However, in contrast to the beta sample, there will be no oversampling of high AIAN or high Black and Hispanic schools. The same stratification variables will be used as for the delta samples. The epsilon sample schools will have minimum overlap with the delta grade 4 and delta grade 8 sample schools which, given the respective sample sizes, means that no schools will be selected for both the

delta and epsilon samples. The number of students targeted per school will be 50.

## 5. LTT Samples

These are the public and private school samples at age 9 for conducting the LTT operational assessments in reading and mathematics. The sample sizes are not large enough for separate reporting by Catholic and non-Catholic. Approximately half the private school student sample will be from Catholic schools. The public LTT schools will be selected so as to ensure the inclusion of all eligible schools that were sampled for 2020. The number of students targeted per school will be 50.

In addition, we will implement oversampling of certain public schools based on their percentages of AIAN or Black and Hispanic enrollment. This school-level oversampling will be done in the same manner previously described for the beta samples. Beyond this, we will also implement the oversampling of AIAN, Black, and Hispanic students at the student level in schools not being oversampled at the school level.

### Primary Sampling Unit (PSU) Selection

As the LTT assessments are national, with a total sample size of assessed students of about 16,000, for reasons of operational efficiency the assessments will be conducted in a sample of PSUs. These PSUs are the same ones used for the LTT assessments conducted in 2020 at ages 9 and 13. All sampled schools for LTT age 9 will be drawn from within the sampled NAEP 2020 LTT PSUs.

The PSUs were created from aggregates of counties. Data on counties were obtained from the 2010 Census, and the definitions of Metropolitan Statistical Areas (MeSAs) used were the December 2009 Office of Management and Budget (OMB) definitions. Each Metropolitan Statistical Area (MeSA) constitutes a PSU, except that MeSAs that cross state boundaries were split into their individual regional components.

Non-metropolitan PSUs were formed by aggregating counties into geographic units of sufficient minimum size to provide enough schools to

constitute a workload of about 1% of the total sample. These PSUs were made of contiguous counties where possible, and almost contiguous counties (separated by MeSA counties) otherwise. Each PSU falls within a single state.

This process generated a frame of approximately 1,000 PSUs. The PSUs were stratified, using characteristics aggregated from county-level characteristics, found by analysis to be related to NAEP achievement in past assessments. A sample of 105 PSUs was selected. Twenty-nine large MeSAs

were selected with certainty, and the remaining sample was a stratified probability proportional to size (PPS) sample, where the size measure was a function of the number of children as given in the most recent population estimates prepared by the U.S. Census Bureau at the time of PSU selection.

## Stratification

As in the recent past, the plan is to draw separate public and private school samples. Explicit stratification of schools will take place at the PSU level. For schools within PSUs, stratification gains are achieved by sorting the school file prior to systematic selection. As in past national PSU-based samples, the expectation is that, within the set of certainty MeSA PSUs within a census region, PSU will not necessarily be the highest level sort variable. Thus, type of location will be used as the primary sort variable. Consider for example the large MeSAs in the Midwest region. The design is aimed primarily at getting the correct balance of city, suburban, town, and rural schools crossed by city size and distance from urbanized areas, as a priority over getting exactly a proportional representation from each MeSA (Chicago, Detroit, Minneapolis), although of course it should be possible to get a high degree of control over both of these characteristics.

The sort of the schools will use other variables beyond type of location, such as PSU (for schools in non-certainty PSUs), estimated age 9 enrollment, oversampling stratum based on percentage of AIAN or Black and Hispanic enrollment, and actual percentage of AIAN or Black and Hispanic enrollment. Several distinct serpentine sorts will result depending on school type, whether or not the school is in a certainty PSU, and whether or not the school is in an oversampling stratum.

## IV. New Schools

To compensate for the fact that files used to create the NAEP school sampling frames are at least two years out of date at the time of frame construction, we will supplement the alpha, beta, delta, epsilon, and LTT

samples with new school samples at each grade (or age in the case of LTT).

The new school samples will be drawn using a two-stage design. At the first stage, a minimum of ten school districts (in states with at least ten districts) will be selected from each state for public schools, and ten Catholic dioceses will be selected nationally for the private schools. The sampled districts and dioceses will be asked to review lists of their respective schools and identify new schools. Frames of new schools will be constructed from these updates, and new schools will be

drawn with probability proportional to size using the same sample rates as their corresponding original school samples. The new school frames for LTT will be restricted to new schools in the sampled PSUs.

The school sample sizes in the above tables do not reflect new school samples.

## V. Substitute Samples

Substitute samples will be selected for each of the beta, delta, epsilon, and LTT samples. The substitute school for each original will be the next “available” school on the sorted sampling frame, with the following exceptions:

- A. Schools selected for any NAEP samples will not be used as substitutes.
- B. Private schools whose school affiliation is unknown will not be used as substitutes. Also, unknown affiliated private schools in the original samples will not get substitutes.
- C. New schools will not get substitutes.
- D. A school can be a substitute for one and only one sample. (If a school is selected as a substitute school for grade 8, for example, it cannot be used as a substitute for grade 4.)
- E. A public school substitute will always be in the same state as its original school.
- F. A Catholic school substitute will always be a Catholic school, and the same for non-Catholic schools.

## VI. Contingency Samples

The districts that are taking part in the TUDA program are volunteers. Thus it is possible that at some point over the next few months, a given district



might choose to opt out of the TUDA program for 2022. However, it is not acceptable for all schools in such a district to decline NAEP, as then the state estimates will be adversely affected. Thus to deal with this possibility, in each TUDA district, subsamples of the alpha sample schools will be identified as contingency samples. In the event that the district withdraws from the TUDA program prior to the selection of the student sample, all alpha sampled schools from that district will be dropped from the sample, with the exception of those selected in the contingency sample. The contingency sample will provide a

proportional representation of the district, within the aggregate state sample. Student sampling in those schools will then proceed in the same way as for the other schools within the same state.

## VII. Student Sampling

Students within the sampled alpha, beta, delta, epsilon, and LTT private schools will be selected with equal probability. Students within the sampled LTT public schools will be selected with equal probability within race/ethnicity category. The student sampling parameters vary by sample type (alpha, beta, delta, epsilon, LTT) and grade (or age in the case of LTT) as described below.

### Alpha Sample, Grades 4 and 8 Schools (Except Puerto Rico)

- A. All students, up to 52, will be selected.
- B. If the school has more than 52 students, a systematic sample of 50 students will be selected. In some schools, the school may be assigned more than one 'hit' in sampling. In these schools we will select a sample of size 50 times the number of hits, taking all students if this target is greater than or equal to 50/52 of the total enrollment.

### Alpha Sample, Puerto Rico Grades 4 and 8

- A. All students, up to 26, will be selected.
- B. If the school has more than 26 students, a systematic sample of 25 students will be selected.

### Delta Samples, Grades 4 and 8

- A. All students, up to 52, will be selected.
- B. If the school has more than 52 students, a systematic sample of 50 students will be selected.

### Beta Sample, Grade 8

- A. All students, up to 52, will be selected.
- B. If the school has more than 52 students, a systematic sample of 50 students will be selected.

Epsilon Sample, Grade 8

- A. All students, up to 52, will be selected.
- B. If the school has more than 52 students, a systematic sample of 50 students will be selected.

#### LTT Samples, Age 9

- A. In all LTT public sample schools that are oversampled (as described in section III.5) and all LTT private sample schools, all students, up to 50, will be selected. If the school has more than 50 students, a systematic sample of 50 students will be selected.
- B. In all LTT public sample schools not oversampled at the school level, up to 50 students will be selected, plus an oversample of up to an additional 5 AIAN, Black, and Hispanic students. The maximum number of students selected in these schools will be 55.

## VIII. Weighting Requirements

### The Operational Reading and Mathematics Assessments, Grades 4 and 8

The exact weighting requirements for these samples have yet to be determined. One likely possibility is that two sets of student weights will be required - the usual weights plus an additional set for linking to the NAEP 2021 Monthly School Survey. The samples will have student weights for each subject (reading and math) applied to reflect probabilities of selection, school and student nonresponse, any trimming, and the random assignment to the particular subject. There will be separate replication schemes by grade and public/private. Weights will also be derived for the Puerto Rico assessment at grades 4 and 8.

### The Operational US History and Civics Assessments, Grade 8

The samples will have a single set of student weights for each subject (US history and civics) applied to reflect probabilities of selection, school and student nonresponse, any trimming, and the random assignment to the particular subject. There will be separate replication schemes by

public/private.

## The Operational LTT Reading and Mathematics Assessments, Age 9

The samples will have a single set of student weights for each subject (reading and math) applied to reflect probabilities of selection, school and student nonresponse, any trimming, and the random assignment to the particular subject. There will be separate replication schemes by public/private.

## School Weights

In addition to student weights, each sample described above will have a set of school weights to provide secondary users a means to analyze data at the school level. Each sample will have a single set of school weights for each subject (reading, math, US history, or civics) applied to reflect probabilities of selection, school nonresponse, any trimming, and a small-school adjustment to account for schools too small to do both subjects associated to their respective samples. There will be separate replication schemes by public/private.