

NAEP 2016 NONRESPONSE BIAS ANALYSIS REPORT

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1. NONRESPONSE BIAS ANALYSIS IN THE 2016 NAEP

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 2016 NAEP indicate a need for school nonresponse bias analyses for private school samples for grade 8. This report provides nonresponse bias analysis results for private schools for the Arts session for grade 8. Response rates for schools and students are shown in tables 1 and 2, with the groups of interest shaded in gray.

Table 1. Weighted school response rates by session, before substitution

Grade	Session	Subjects in Session	Public	Private
8	Arts	Music	94.53	75.67
	Arts	Visual Arts	94.53	75.67

Table 2. Weighted student response rates by subject

Grade	Session	Subject	Public	Private
8	Arts	Music	93.26	91.44
	Arts	Visual Arts	94.01	92.69

Note that the schools selected for the Arts assessment for 2016 were assessed in both Music and Visual Arts, and thus we do not consider them separately in this analysis.

The analyses discussed in this report consider only certain characteristics of schools. 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 (see Peytcheva and Groves, 2009).

2. SCHOOL NONRESPONSE BIAS ANALYSIS

The school analysis, required for private school samples in grade 8, was conducted in three parts.

1. The distribution of the responding original school sample was compared with that of the entire eligible original school sample. Schools were weighted by their school base weights and their enrollment, referred to as size-adjusted weights. The original sample is the sample before substitution.
2. The distribution of the responding sample, including participating substitutes, was compared to the full sample. In this case, substitutes were included in the responding sample in place of those nonresponding schools that they replaced. Again, the size-adjusted school base weights were used for both the full sample and the respondents.
3. The same sets of schools were compared as in the second analysis, but this time when analyzing the responding schools alone, school nonresponse adjustments were applied to the size-adjusted weights.

The first part of the analysis indicates the potential for nonresponse bias that was introduced through school nonresponse. The second part of the analysis suggests the remaining potential for nonresponse bias after the mitigating effects of substitution have been taken into account. The third part indicates the potential for bias after accounting for the mitigating effects of both substitution and nonresponse weight adjustments. Both the second and third parts, however, may provide an overly optimistic scenario, since even though substitution and nonresponse adjustments may correct somewhat for deficiencies in the few characteristics examined here, there is no guarantee that they are equally as effective for other characteristics, and in particular for student achievement.

In each analysis Chi-squared tests of association were applied to school response status at each of the three stages of analysis for each of the following four categorical variables:

- Census region;
- School affiliation for private schools (Catholic/ Non-Catholic);
- Urban-centric locale (collapsed into four mutually exclusive categories); and
- Estimated grade enrollment, divided into three similarly sized categories.

These variables were among the few available for both responding and nonresponding schools, since they came from the sampling frame.

The Chi-squared tests were carried out using procedures that appropriately account for the complex sample design used in NAEP, and the weighting procedures. The Rao-Scott Chi-squared test (Rao and Scott, 1984) was computed using the SAS/STAT® 12.1 survey procedures software (SAS Institute Inc., 2012).

In addition, mean values of race/ethnicity percentages and enrollment for responding and nonresponding schools were compared. These variables were also available from the frame. Two measures of the mean size of enrollment in 8th grade were considered, one using the size-adjusted school weight (mean size of school attended by an average student), and the other using the school weight without the size adjustment (mean estimated grade enrollment). Differences between the means for the respondents and full sample were tested using T-tests. These tests also took account of both the complex sample design and the fact that the respondents are a subset of the full sample. Thus, the first two sets of comparisons, using only school base weights, are equivalent to testing whether the mean for respondents is significantly different from the mean for nonrespondents.

Detailed analysis results for grade 8 private schools are presented in the tables in appendix A, and summarized in table 3.

Table 3. Characteristics with p-values less than 0.05, Arts session, grade 8 private schools

Analysis	Characteristics with p-values less than 0.05
Original sample	School Affiliation, Percentage American Indian/Alaska Native
Sample with substitutes	School Affiliation
Nonresponse adjusted	None

The results for private schools from these nonresponse bias analyses were consistent with meaningful reduction in the absolute and relative biases for the Arts sessions.

REFERENCES

- Peytcheva, E., and Groves, R.M. (2009). Using Variation in Response Rates of Demographic Subgroups as Evidence of Nonresponse Bias in Survey Estimates. *Journal of Official Statistics*, **25**, 193-201.
- Rao, J.N.K., and Scott, A.J. (1984). On Chi-Squared Tests for Multiway Contingency Tables with Cell Proportions Estimated from Survey Data. *Annals of Statistics*, **12**, 46-60.
- SAS Institute Inc. (2012). *SAS/STAT® 12.1 User's Guide*. Cary, NC: SAS Institute, Inc. <http://support.sas.com/documentation/cdl/en/statug/65328/HTML/default/viewer.htm#titlepage.htm>

Appendix A

Table A-1. 2016 NAEP Arts Grade 8 original sample - Weighted percentages of full sample and responding schools by various subgroups - All Private Schools (sample size = 48)

	Full sample weighted percentage	Respondent weighted percentage	Bias	Relative bias	Chi-square p-value
Census Region					0.9237
Northeast	21.60	21.62	0.0*	0.001	
Midwest	20.14	19.03	-1.1	-0.055	
South	42.73	42.36	-0.4	-0.009	
West	15.53	16.99	1.5	0.094	
Private School Affiliation					0.0008
Roman Catholic	45.62	60.29	14.7	0.322	
Non-Catholic Private	54.38	39.71	-14.7	-0.270	
Urban-Centric Locale					0.5162
City	42.11	44.66	2.6	0.061	
Suburban	47.07	47.42	0.4	0.008	
Town	5.43	5.41	0.0*	-0.005	
Rural	5.39	2.51	-2.9	-0.535	
Size					0.8272
Large (≥ 48)	43.10	41.58	-1.5	-0.035	
Medium (19-47)	36.77	36.62	-0.2	-0.004	
Small (≤ 18)	20.13	21.81	1.7	0.083	

*Estimate rounds to zero.

NOTE: Size-adjusted school weights were used.

Table A-2. 2016 NAEP Arts Grade 8 original sample - Weighted mean values of various characteristics for full sample and responding schools - All Private Schools

	Full sample mean	Respondent mean	Bias	Relative bias	T-test p-value
Size of School Attended by Average Student	56.44	60.88	4.4	0.079	0.352
Estimated Grade Enrollment	26.08	27.57	1.5	0.057	0.568
Race/Ethnicity					
Percentage White, not Hispanic	69.40	65.58	-3.8	-0.055	0.073
Percentage Black, not Hispanic	5.69	6.28	0.6	0.103	0.270
Percentage Hispanic Heritage	15.54	18.28	2.7	0.176	0.096
Percentage Asian	4.84	5.00	0.2	0.035	0.633
Percentage American Indian/Alaskan Native	0.63	0.78	0.1	0.238	0.048
Percentage Native Hawaiian/Pacific Islander	0.42	0.39	0.0*	-0.050	0.811
Percentage Two or More Races	3.48	3.69	0.2	0.059	0.624

*Estimate rounds to zero.

NOTE: For the mean of school size attended by average student and the race/ethnicity percents, size-adjusted school base weights were used. For the mean of enrollment, school weights were used.

Table A-3. 2016 NAEP Arts Grade 8 sample with substitutes - Weighted percentages of full sample and responding schools by various subgroups - All Private Schools (sample size = 48)

	Full sample weighted percentage	Respondent weighted percentage	Bias	Relative bias	Chi-square p-value
Census Region					0.9144
Northeast	21.60	21.10	-0.5	-0.023	
Midwest	20.14	20.48	0.3	0.017	
South	42.73	41.34	-1.4	-0.033	
West	15.53	17.09	1.6	0.100	
Private School Affiliation					0.0026
Roman Catholic	45.62	58.84	13.2	0.290	
Non-Catholic Private	54.38	41.16	-13.2	-0.243	
Urban-Centric Locale					0.4821
City	42.11	44.09	2.0	0.047	
Suburban	47.07	48.19	1.1	0.024	
Town	5.43	5.28	-0.2	-0.029	
Rural	5.39	2.45	-2.9	-0.546	
Size					0.8329
Large (≥ 31)	43.10	41.08	-2.0	-0.047	
Medium (14-30)	36.77	37.64	0.9	0.024	
Small (≤ 13)	20.13	21.28	1.2	0.057	

NOTE: Size-adjusted school weights were used.

Table A-4. 2016 NAEP Arts Grade 8 sample with substitutes - Weighted mean values of various characteristics for full sample and responding schools - All Private Schools

	Full sample mean	Respondent mean	Bias	Relative bias	T-test p-value
Size of School Attended by Average Student	56.44	60.07	3.6	0.064	0.415
Estimated Grade Enrollment	26.08	27.75	1.7	0.064	0.503
Race/Ethnicity					
Percentage White, not Hispanic	69.40	66.21	-3.2	-0.046	0.136
Percentage Black, not Hispanic	5.69	6.14	0.4	0.079	0.377
Percentage Hispanic Heritage	15.54	17.86	2.3	0.149	0.145
Percentage Asian	4.84	4.98	0.1	0.030	0.661
Percentage American Indian/Alaskan Native	0.63	0.76	0.1	0.215	0.061
Percentage Native Hawaiian/Pacific Islander	0.42	0.39	0.0*	-0.073	0.719
Percentage Two or More Races	3.48	3.67	0.2	0.052	0.679

*Estimate rounds to zero.

NOTE: For the mean of school size attended by average student and the race/ethnicity percents, size-adjusted school weights were used. For the mean of enrollment, school weights were used.

Table A-5. 2016 NAEP Arts Grade 8 nonresponse-adjusted sample - Weighted percentages of full sample and responding schools by various subgroups - All Private Schools (sample size = 48)

	Full sample weighted percentage	Respondent weighted percentage	Bias	Relative bias	Chi-square p-value
Census Region					0.8318
Northeast	21.60	22.71	1.1	0.051	
Midwest	20.14	19.03	-1.1	-0.055	
South	42.73	41.39	-1.3	-0.031	
West	15.53	16.87	1.3	0.086	
Private School Affiliation					1.0000
Roman Catholic	45.62	45.62	0.0	0.000	
Non-Catholic Private	54.38	54.38	0.0	0.000	
Urban-Centric Locale					0.7363
City	42.11	39.34	-2.8	-0.066	
Suburban	47.07	51.41	4.3	0.092	
Town	5.43	5.34	-0.1	-0.018	
Rural	5.39	3.92	-1.5	-0.273	
Size					0.5093
Large (≥ 31)	43.10	40.35	-2.7	-0.064	
Medium (14-30)	36.77	35.25	-1.5	-0.042	
Small (≤ 13)	20.13	24.40	4.3	0.212	

NOTE: Size-adjusted school weights were used.

Table A-6. 2016 NAEP Arts Grade 8 nonresponse-adjusted sample - Weighted mean values of various characteristics for full sample and responding schools - All Private Schools

	Full sample mean	Respondent mean	Bias	Relative bias	T-test p-value
Size of School Attended by Average Student	56.44	57.75	1.3	0.023	0.742
Estimated Grade Enrollment	26.08	25.37	-0.7	-0.027	0.807
Race/Ethnicity					
Percentage White, not Hispanic	69.40	67.94	-1.5	-0.021	0.380
Percentage Black, not Hispanic	5.69	7.02	1.3	0.233	0.165
Percentage Hispanic Heritage	15.54	15.08	-0.5	-0.030	0.645
Percentage Asian	4.84	5.61	0.8	0.159	0.211
Percentage American Indian/Alaskan Native	0.63	0.70	0.1	0.116	0.222
Percentage Native Hawaiian/Pacific Islander	0.42	0.36	-0.1	-0.142	0.461
Percentage Two or More Races	3.48	3.30	-0.2	-0.054	0.674

NOTE: For the mean of school size attended by average student and the race/ethnicity percents, size-adjusted school weights were used. For the mean of enrollment, school weights were used.