

## CHAPTER 2

### THE SCHOOL SURVEY

#### 2.1 Introduction

The School Survey is the starting point for all five of the SASS surveys. The initial operation in each round of SASS is the selection of samples of public and private schools. Samples of teachers for the Teacher Survey and the Teacher Follow-up Survey are selected from these schools, and data are collected from their principals in the School Administrator Survey. The sample for the public school sector in the Teacher Demand and Shortage Survey consists of the LEAs associated with the sample of public schools.

As background for our discussion of the quality of SASS data, we will describe the design and procedures for the Round 2 School Survey, which was conducted in school year 1990-91. Major changes between Rounds 1 and 2 are also identified. Available information about the quality of School Survey data is presented for both Rounds 1 and 2.

This chapter consists of four sections covering the main phases of the survey operations: frame development and sampling (2.2); data collection procedures and associated errors (2.3); data processing and estimation (2.4); and evaluation of estimates (2.5). For some phases, especially the frame development and sampling, there are substantial differences between the public and private sectors, so the design and procedures for the two sectors are described separately.

Separate questionnaires, Forms SASS-3A and 3B, were used in Round 1 for public and private schools. Most items were the same on both versions, but there were some additional questions for private schools. Each of the questionnaires had three main sections, covering school characteristics, staffing patterns and respondent characteristics (primarily the titles and identification of person(s) completing the questionnaire). In Round 2 there were three separate questionnaires, Forms SASS-3A, 3B and 3C, for public, private and Indian schools, respectively. Their contents were similar, but the private and Indian school questionnaires for Round 2 accommodated the requirements of the Teacher Demand and Shortage Survey by the inclusion of additional items in the section on staffing patterns and a separate section on school personnel policies.

The initial samples of schools for Round 2 were 9,806 public schools, 3,280 private schools and 101 Indian schools. Some of these proved to be out of scope and completed questionnaires were not obtained for all of those that were in scope. Further details on sample sizes and response rates are provided in Tables 2.1 to 2.8.

#### 2.2 Frame development and sampling

The target population The target population for the Round 2 School Survey consisted of elementary and secondary schools in the United States that were in operation during school

year 1990-91. Schools with no students in any of grades 1-12 were excluded, as were schools operating only postsecondary education programs. A public school was defined as:

... an institution that provides educational services for at least one of grades 1 through 12 (or comparable ungraded levels), has one or more teachers to give instruction, is located in one or more buildings, receives public funds as primary support, has an assigned administrator, and is operated by an education agency. (Gruber, Rohr and Fondelier, 1993)

Schools in juvenile detention centers, schools associated with publicly operated hospitals and schools located on military bases and operated by the Department of Defense were included with public schools.

A private school was defined as "... a school not in the public system that provides instruction for any of grades 1-12 where the instruction was not given in a private home" (Gruber, Rohr and Fondelier, 1993). In practice, if the question on place of operation (private home versus other) was not answered, the responding unit was excluded if it had fewer than 10 students or only 1 teacher.

Schools operated outside the local public school system by Indian tribes, the Bureau of Indian Affairs (BIA), or by Indian tribes under contract with the BIA were defined as Indian schools and were treated as a separate category for both sample selection and analysis.

Sample design objectives and considerations Four basic goals guided the sample design of the School Survey:

(1) *Provide estimates of acceptable precision for specified domains of analysis.* These domains included: public schools by state and by level (elementary, secondary and combined) within state; total U.S. private schools by association group (see box below); total U.S. private schools by level (elementary, secondary and combined); total U.S. public schools with more than 25 percent Indian enrollment; and total U.S. Indian schools. The general approach to achieving this goal was to select a specified minimum number of schools in each of these domains and to allocate the remaining sample schools in a way that would optimize the precision of estimates aggregated over domains, such as national estimates for public and private schools.

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ASSOCIATION GROUPS. Most private schools are affiliated with a religious body (Catholic, Evangelical Lutheran Church in America, Seventh Day Adventist, etc.) or belong to an association of schools, such as the National Association of Independent Schools. Some schools with religious affiliations are also members of associations. The allocation of the private school sample is designed to provide estimates of acceptable precision for each of these groups. The number of separately identified groups was increased from 13 in Round 1 to 18 in Round 2. Listings of the groups used in Rounds 1 and 2 are shown in Tables 2.7a and b.

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(2) *Balance the requirements of the school sample against the requirements of the samples of LEAs and teachers.* An important feature of SASS is the ability of users to link data for sample LEAs, schools and teachers for analytical purposes. To make this possible, some tradeoffs were required in the sample design. For example, for the public school sector, one possibility would have been to start with the selection of a sample of LEAs and then to select a sample of schools in those LEAs. However, a simulation study prior to Round 1 (Wright, n.d.) showed that using this design, in a configuration that would have provided the target sample sizes for both LEAs and schools, would have led to substantial reductions in the precision of school estimates as compared with those based on the design actually used, which starts with the selection of a sample of schools. Thus, a moderate loss in precision of estimates for LEAs has been accepted in order to preserve the precision of estimates for schools.

A similar issue arose in evaluating the relationships of the school and teacher samples. For the school sample, the greatest precision for count data would have been achieved by selecting schools with equal probability within each stratum or domain. For the sample of teachers, on the other hand, an optimum design would probably have been one that selected schools with probability proportionate to size (expected number of teachers, based on frame data) and then selected teachers within schools at a rate that would make the overall selection probability for teachers constant within strata. A compromise solution was adopted, namely, selection of schools with probability proportionate to the square root of their (teacher) size and, within each stratum, selection of a fixed number of teachers, subject to constraints on the total number of teachers selected in a school.

(3) *Minimize overlap between SASS and other NCES surveys of schools (Round 1 only).* During the data collection period for Round 1, the NCES was also collecting data for two other sample surveys of elementary and secondary schools: the National Assessment of Educational Progress (NAEP) and the National Educational Longitudinal Study of 1988 (NELS). To minimize the response burden on individual schools, the sample selection procedure used for SASS minimized the overlap among the SASS, NAEP and NELS school samples while maintaining the initial probability of selection for each school in SASS averaged over all possible school samples for the three surveys. A comparable procedure was not used in selecting the sample of schools for Round 2 because the other two surveys were not scheduled to be in the field at the same time.

(4) *Control the overlap between the Round 1 and Round 2 samples of schools.* Deciding how much the Round 1 and 2 school samples should overlap involved a tradeoff between anticipated favorable and unfavorable effects of overlap. To provide estimates of change over time with maximum precision, the overlap should be as great as possible. However, it was thought that response rates for schools being asked to participate a second time might be lower than for those that were selected for the first time. The analysis of these tradeoffs is complicated by the fact that overlap in schools guarantees overlap in the sample of LEAs associated with those schools.

A Round 2 pretest conducted early in 1990 provided some data on response rates for samples of overlap and non-overlap schools. It was estimated that overlap would reduce response rates by 5 percent for schools and 11 percent for LEAs. To avoid an undue effect on LEA response rates, the decision taken was to control the overlap for the public school sample at 30 percent, which would lead to an expected LEA overlap of 58 percent. For private schools, which had a lower overall response rate in Round 1, the decision was to control overlap at 30 percent for association groups with high response rates (generally 80 percent or more) in Round 1 and to minimize it for the remaining groups (Kaufman and Huang, 1993, part 4). This procedure was used only for the list sample of private schools. For those parts of the Round 2 area sample which had not been included in the Round 1 area sample, there was no overlap. For the areas included in both rounds, the samples for the two rounds were selected independently, with no attempt to control overlap.

The public school sample for Round 2 The primary frame for the Round 2 public school sample was the 1988-89 school year Common Core of Data (CCD) file. The CCD Public Elementary/Secondary School Universe Survey is an annual census of public schools in which NCES obtains a listing of schools, with basic information on characteristics and size, from states. A small supplemental frame, not part of the CCD, consisted of a list, obtained from the Bureau of Indian Affairs, of tribal schools and schools operated by that agency.

The Round 2 frame differed from the frame for Round 1, which was a listing of schools obtained from Quality Education Data (QED), a private organization. Schools on the QED list were defined as physical locations, whereas those on the CCD list were defined as administrative units. For example, an elementary school and high school at the same physical location but with different principals would have been counted as one school on the QED list but were counted as two schools on the CCD list.

To make it easier to produce estimated school counts under both the QED and CCD definitions, the QED school definitions were retained for sampling purposes in Round 2. Thus for sample selection purposes the school units in the Round 2 frame were either CCD schools or groups of CCD schools corresponding to a single QED school. However, whenever one of these groups of CCD schools was included in the sample, each CCD school was considered a separate unit of analysis and data were collected separately for each one. Each school in such a group of schools would receive the same sampling weight for estimation purposes. The effects of the change in school definitions have been analyzed by Kasprzyk, Salvucci, Saba and Zhang (1994).

The Round 2 public school sample was a stratified sample. The allocation of sample schools among the strata was designed to provide estimates of acceptable precision for each of several analytical domains. Within each stratum, the schools in the frame were further sorted on several geographic and other characteristics. Following the sorting operation, the specified number of schools was selected from each stratum systematically with probability proportionate to the square root of number of teachers as reported on the CCD file. All schools whose measures of size exceeded the sampling interval for the stratum were selected.

For the remaining schools, the controls on overlap with the Round 1 sample were built into this part of the selection process.

The private school sample for Round 2 Because of the difficulties of obtaining a complete list of private schools, a dual frame approach has been used to select the samples of private schools. The list frame for Round 2 was the one that was developed for the 1989-90 Private School Survey. It was based on the 1988-89 QED private school list, supplemented by schools not included in that source but found on lists supplied by 20 private school associations in the spring of 1989. The list frame consisted of 22,600 schools from the QED list and 1,586 schools added from association lists.

To supplement the list frame, an area sample consisting of 123 primary sampling units (PSUs, usually counties or groups of contiguous counties) was selected and special efforts were made, using classified telephone directories, government offices and other local sources, to locate eligible private schools not included in the list frame. At the U.S. level, it is estimated that schools identified by these procedures would account for 21 percent of all private schools on the list and area frames combined (Kaufman and Huang, 1993, part 3.3). The samples from the list and area frames were selected independently. The overall target sample size for private schools was 3,270, with 2,670 of these allocated to the list sample and the remaining 600 to the area sample.

The list sample was allocated to 216 strata defined by association group, level (elementary, secondary, combined) and census region. An initial allocation was made, proportional to the estimated number of teachers in each stratum. This allocation was then modified to ensure a minimum of 100 sample schools for each association group, except for groups having fewer than 100 schools. Within each stratum, schools in the list frame were sorted by state and several other variables within state. Following the sorting operation, the specified number of schools was selected from each stratum systematically with probability proportionate to the square root of number of teachers as reported in the 1989-90 Private School Survey. All schools whose measures of size exceeded the sampling interval for the stratum were selected. For the remaining schools, the controls on overlap with the Round 1 sample were built into this part of the selection process.

A similar procedure was used to select schools from the area frame for the sample PSUs. Within each PSU, schools were stratified by level and then sorted by association group, enrollment and alphabetical order of school name. Most of the schools in the sample PSUs were selected with certainty. When sampling did occur, the selection probabilities were based on the square root of the reported number of teachers. There were no controls on overlap with Round 1.

Changes between Rounds 1 and 2 Most features of the school samples, including overall sample sizes, were similar in Rounds 1 and 2. The principal changes in frame development and sampling procedures for Round 2 were:

- For public schools, the shift from the use of the QED list to the CCD as the primary frame.
- Reallocation of the public school sample to improve the reliability of estimates of elementary and secondary schools for small states and for public schools with high Indian enrollment.
- Inclusion of a sample of Indian schools.
- Introduction of procedures for controlling the overlap between Round 1 and 2 samples, except for the private school area sample. Procedures for minimizing overlap with other current NCES surveys of schools were not needed in Round 2.
- Increase in the number of PSUs for the private school area sample from 75 to 123.
- Additional efforts, including the 1989-90 Private School Survey, to improve the coverage and quality of the private school list frame.

Evaluation of the sampling frames Two quality-related features of sampling frames are their coverage of the target populations for the survey and the accuracy of information which they provide for individual units.

For public schools, it was discovered after the data collection for Round 1 that for the state of Nebraska 275 school districts, each with a single elementary school (Class 1 districts) had not been included in the school frame developed from the QED list. As a consequence, approximately 275 schools, with an average of about 10.2 students per school, were not covered by the Round 1 School Survey (Hammer and Gerald, 1991, p.22).

For private schools, the estimated proportions of schools from the list and area frames provide an indicator of the completeness of coverage of the list frames. As noted earlier, in Round 2 about 21 percent of the estimated total number of private schools in the combined frames was accounted for by the area sample frame. The corresponding figure for Round 1 was 22 percent (NCES, 1991a, p.9). Data for Round 2 show that the estimated proportions of schools coming from the area frame varied substantially by association group. The area frame contribution was especially large for schools that were members of the National Association of Private Schools for Exceptional Children (35.4 percent) and the American Montessori Schools Society (31.6 percent). At the other end of the spectrum, the area frame accounted for fewer than 5 percent of schools associated with the Friends Council on Education, the Association of Military Colleges and Schools and Christian Schools International (Kaufman and Huang, 1993, Appendix 4, Table 18).

Another factor that might affect coverage is the lag between the period for which the sampling frame was constructed and the reference period for the survey. The public school sample for Round 2 of SASS was based on the CCD for school year 1988-89, but the

reference period for the School Survey was school year 1990-91. Schools beginning operation after school year 1988-89 were not covered unless they resulted from a split of an existing school or a merger involving one or more existing schools. Now that data from the 1990-91 CCD are available, it would be possible to identify schools that were in operation in school year 1990-91 but were not included in the sampling frames for Round 2 of SASS.

Similarly, the private school list sample frame was the one that was developed for the 1989-90 Private School Survey, so that schools starting operation after the spring of 1989 would normally not be included in the sampling frame. An evaluation of efforts to improve the private school sampling frame for Round 2 is given by Jackson and Frazier (1994).

Some problems occurred in both rounds when the CCD, QED and PSS definitions of schools did not correspond precisely with those used in SASS. In some states, administrative groupings of schools within local education agencies were listed on the CCD as single schools, whereas SASS treats each location within such a grouping as a separate school. In California, it was determined in Round 2 that special education *programs* had been listed on the CCD as *schools*. For example, the Los Angeles special education program had been listed as one school, but was found to have a total of 115 separate locations, 74 of which were at regular schools already included in the CCD. It was necessary, therefore, to obtain lists of sites for these multi-site programs, match them against the CCD file, and select samples of those that were not in schools already included in the CCD (Kaufman and Huang, 1993, Chapter 10). Similar problems were discovered in Illinois and Pennsylvania.

The private school list frame contained duplicate listings for some schools, usually with slight differences in the name or address of the school. Those discovered prior to sample selection were removed. Some were discovered after sample selection; these schools received a weighting adjustment to account for their increased probability of selection (NCES, 1991a, p.8). Occasionally, public schools were found to have been included mistakenly on private school lists received from some states.

In some instances, frames contained incorrect information or lacked information on school characteristics that were used in the sample selection process. In Round 1, for example, some private schools were reported in the School Survey as being in the Friends, military or Christian international association groups, although they had been classified, in the frame, in other groups that had been sampled at a much lower rate (all Friends and military schools in the list frame had been selected with certainty). No bias was introduced into the estimates for the affected association groups, but their sampling errors were substantially increased (Kaufman and Huang, 1993, Appendix 4).

Current information on number of teachers and enrollment was sometimes lacking for schools on both the public and private list frames for Round 2. Because teacher counts were needed to determine selection probabilities, they were imputed for these schools. Values were imputed from Round 1 of SASS, when available, from the application of assumed student-teacher ratios to enrollment figures, or by using the median value for other schools in the

same stratum. One would normally expect a small increase in sampling errors to result from the use of such imputed values in place of reported values.

### **2.3 Data collection procedures and associated errors**

In this section we first describe the data collection procedures in Round 2 and the associated supervision and quality assurance procedures. We then provide detailed information on nonresponse rates, followed by a discussion of measurement errors, based on reinterviews, cognitive interviews and other sources.

Data collection procedures for Round 2 For public schools, the initial mailing of questionnaires was preceded by an advance mailing to all LEAs with one or more sample schools, providing general information about SASS and asking for their cooperation. There was also an advance mailing to schools, public and private, containing similar information about SASS and asking them to submit lists of teachers for use in sample selection.

Initial mailing of the public and private School Survey questionnaires for Round 2 of SASS took place in December 1990 and January 1991, somewhat earlier in the school year than in Round 1. The questionnaires were addressed to school principals, who were asked to complete and return them to the Census Bureau's Jeffersonville processing office within 3 weeks. Response to the survey was voluntary. There were no restrictions on who should complete the questionnaire; principals who wished to do so could assign someone on their staff to complete the questionnaire.

After 4 to 5 weeks, a second questionnaire was mailed to schools that had not responded. For schools that did not respond to the second mailing after about 3 weeks, Census Bureau field representatives, working from the Census regional offices in 2 regions and from their homes in the other regions, attempted to complete the questionnaires by telephone. They were instructed to try to reach school principals during normal working hours, 8:00 a.m. to 5:00 p.m. Because some of the questionnaire items might require respondents to check school records, Census field representatives were expected to offer to hold the line a few minutes, call back or accept collect calls from respondents (Bureau of the Census, 1991b).

Time required for completion of questionnaire The Round 2 questionnaires for private schools included a final question "Not counting interruptions, how long did it take to complete this survey?" For questionnaires completed and returned by mail, this item was answered by the school employee who completed the questionnaire; for questionnaires completed in followup telephone interviews, the item was answered by the interviewer. The median time for completion was 60 minutes, with an interquartile range of 50 minutes. For about 90 percent of all schools, the questionnaire was completed in less than 2 hours and 10 minutes and for 1 percent it took more than 5 hours.

Supervision and quality assurance Field representatives who conducted telephone interviews with mail nonrespondents mailed their completed questionnaires to their regional offices on a



flow basis. For each field representative, the first 2 questionnaires received were reviewed for errors by regional office staff. If a total of 10 or more errors was found in the 2 questionnaires, the field representative was to be notified of the errors and given suggestions for improvement. This process was repeated for successive sets of 2 questionnaires until the field representative succeeded in completing a set with fewer than 10 errors (Gruber, Rohr and Fondelier, 1993). Some findings from these reviews are reported below under "Measurement error, findings from other sources".

In both Rounds 1 and 2 of SASS, reinterviews were undertaken for samples of completed questionnaires for all surveys except the Survey of Teacher Demand and Shortage for LEAs. The purpose of the reinterview program in the first 2 rounds was to estimate components of error, such as the simple response variance, a measure of the inconsistency of responses over repeated applications of a question. In the reinterviews, respondents are asked to answer a subset of the questions to which they responded initially.

Reinterviews for Round 1 were conducted by telephone for all surveys. The Round 1 reinterviews covered selected questions from both the School Survey and the School Administrator Survey on a single questionnaire. For the Round 2 School Survey, matched mode reinterviews were undertaken, that is, schools returning their questionnaires by mail were reinterviewed by mail (with telephone followups as necessary) and those responding by telephone were reinterviewed by telephone. A sample of 1123 schools was selected for reinterview, nearly 10 percent of the initial sample. Overall, reinterviews were completed for 91 percent of the schools in the reinterview sample that had responded to the initial questionnaire. A few of the reinterviews for schools that initially responded by mail had to be completed by telephone, but the great majority of reinterviews used the same mode as the initial response. Results from the School Survey reinterviews are presented below, under the heading "Measurement error, findings from reinterviews".

Mode effects There have been no controlled experiments to compare the quality of mail and telephone response in SASS. Parmer, Shen and Tan (1992) reviewed information relevant to mode effects in the Round 2 School Survey. As shown in Tables 2.1 to 2.4, mail response rates (mail responses as a percent of mail plus telephone) varied substantially among different subgroups of the school universe. Table 2.1 shows that about two-thirds of the public schools responded by mail, but only 56 percent of the private schools (the data for private schools were based only on the list frame sample schools). Public school mail response rates (Table 2.3) varied widely by state, from 47.9 percent for the District of Columbia to 81.1 percent for Delaware. For the private schools, mail response rates varied widely by association group (Table 2.4), from 30.7 percent for the American Association of Christian Schools to 73.6 percent for the Lutheran, Missouri Synod schools (based on the private school list sample only).

Because it was not a controlled experiment, the study did not provide any conclusive evidence about mode effects. There was some evidence of differences for private schools, but the

analysis procedure used did not provide any indication of which mode produced more accurate information. Item nonresponse rates were found to be higher for the mail responses.

Reinterviews, the results of which are discussed in detail below under "Measurement error: findings from reinterviews," provide some evidence on mode effects. In the Round 1 reinterviews, all of which were conducted by telephone, counts of students served by special programs, such as bilingual education, showed more evidence of "heaping" in multiples of 100 than was found for the initial interviews. This finding suggests a hypothesis that telephone respondents are less likely to refer to records or to arrive at a carefully considered estimate than those who respond by mail (Bushery, Royce and Kasprzyk, 1992).

Changes in Round 3 and beyond A pretest for Round 3 was undertaken during the 1991-92 school year. One new feature was the mailing of a reminder postcard to *all* schools two weeks after the initial mailing to let them know that another form would be mailed if they did not mail the first one back. The primary goal of this procedure was to increase the proportion of questionnaires returned by mail and reduce the number of more costly telephone follow ups.

In 1992, Census Bureau subject matter and programming staff started work on the development of a prototype automated data collection instrument for use in one or more of the SASS surveys. Schools or other units willing to use this mode would receive a diskette containing the survey questionnaire and instructions for completing it. Using their own microcomputers, they would enter their responses on the diskette and return it to the Census Bureau. There will be some small-scale testing of the prototype in Round 3. If the test results are encouraging, this mode of data collection may be made available to respondents for some surveys in subsequent rounds.

Nonresponse error The two types of nonresponse in the School Survey are *unit nonresponse*, in which no questionnaire of acceptable quality is obtained from an eligible school and *item nonresponse* in which entries are missing for one or more items on a questionnaire. At this time, there is no direct evidence on the magnitude of biases caused by these two kinds of nonresponse. However, information about the levels of unit nonresponse for different subgroups of the survey population and the levels of item nonresponse for different questionnaire items provides some indication of the *potential* effects of nonresponse bias (Moonesinghe, Smith and Gruber, 1993; Scheuren, Parke and Bureika, 1994).

Unit nonresponse may occur at various points in the data collection process. For public schools, a few LEAs in both rounds of SASS have refused participation completely, that is, they declined to complete the LEA questionnaire for the Teacher Demand and Shortage Survey and they specifically requested NCES not to ask schools in their district to participate. In Round 1, 35 school districts with 63 sample schools initially refused to have their schools participate in SASS. After contacts by Census Bureau representatives, 17 of these districts with 24 sample schools reconsidered their positions and agreed to allow the Census Bureau to mail questionnaires to individual schools in their districts (Nash, 1988). Thus, the ultimate

loss of schools at this stage was less than 0.5 percent of the public school sample. Although only a few schools and school districts were lost to the Round 1 and 2 surveys at this stage of data collection, a few large districts were lost in each round, with adverse consequences for the quality of data for the states in which those districts were located.

Most of the unit nonresponse was associated with individual schools. Table 2.5 shows unweighted and weighted response rates for Rounds 1 and 2, for public and private schools. Tables 2.6 and 2.7 show weighted response rates for public schools by state and private schools by association group. Weighted response rates take into account the probabilities with which schools in various strata were selected and are therefore a better indicator of the effects of nonresponse on survey estimates. The base for each of the response rates shown is the number of sample schools that were found to be eligible for the survey. Schools that were not operating in the school year of reference for the survey or that failed to meet the definition for other reasons were excluded. Table 2.8 shows that 4.0 percent of public schools, 5.6 percent of private schools and 1.0 percent of Indian schools were excluded for such reasons in Round 2.

As shown in Table 2.5, response rates for public schools were substantially higher than those for private schools in both rounds. Response rates for both sectors were higher in Round 2, with an increase over Round 1 of 3 percentage points for public schools and 5 percentage points for private schools (based on weighted rates). This result was encouraging in the light of Round 2 pretest results which had suggested that response rates might be lower for schools that had been in the sample in Round 1. However, it may have been due in part to more lenient criteria used in Round 2 for the amount of item nonresponse that could be present in a questionnaire before classifying it as not acceptable.

Within each sector there was substantial variation. In Round 1, in the public sector, 24 states had weighted response rates of 95 percent or better and 3 states were below 80 percent (Table 2.6). In Round 2, there were 34 states with rates of 95 percent or better and none below 80 percent, the lowest rate being 81.0 percent for Maryland. There was wider variation among association groups in the private sector, with a spread of nearly 40 percentage points in the weighted response rates between the highest and lowest group in both rounds (Tables 2.7a and b).

Although, as mentioned in Section 2.2, it had been felt that schools included in the sample for a second round might have lower response rates, this did not happen. Response rates in Round 2 for overlap and non overlap schools were as follows: for public schools, 95.0 percent for overlap schools (those in the sample for both rounds) and 95.1 percent for nonoverlap schools, and for private schools, 87.1 percent for overlap schools and 84.5 percent for nonoverlap schools (Kaufman and Huang, 1993, Table 2).

Additional analyses of school response rates for Round 2 by Moonesinghe, Smith and Gruber (1993) showed that smaller public schools (in terms of enrollment) tended to have higher response rates than larger schools and that those with low proportions of minority students

enrolled had higher response rates than those with higher proportions of minority students. For private schools, the response rate for schools on the list frame (86.6 percent) was substantially greater than the rate for schools from the area frame (74.0 percent).

The available data on item nonresponse are somewhat more difficult to interpret and summarize. In general, the rates refer to the status of each item after edits but prior to imputation, and the base for the each rate is the number of questionnaires for which the item should have been answered. Data from published summaries of unweighted item response rates for the School Survey in Rounds 1 and 2 (NCES, 1991a; Gruber, Rohr and Fondelier, 1993) are shown in Table 2.9. The rates are based on completed questionnaires; they do not include questionnaires that were classified as nonresponse cases because of an unacceptably high number of unanswered items.

Item nonresponse rates tended to be higher for items requiring respondents to report numerical amounts than for those requiring a choice among two or more categories. A common problem in both Rounds 1 and 2 was failure to check boxes for "none" when that was called for. Item nonresponse problems in Round 1 led to several changes in the content and format of the questionnaires. Because of these and other changes, the results for the two rounds shown in Table 2.9 are not directly comparable. Subject to this caveat, they suggest that item nonresponse was somewhat less of a problem in Round 2.

One item that caused particular problems in Round 1, for both public and private schools, was an item on staffing patterns that appeared in the form of a 3 x 28 grid (Item 32 on the questionnaire for public schools and 35 on the questionnaire for private schools). The 3 columns asked for: number of teachers as on October 1, 1986; number of those no longer teaching on October 1, 1987; and number of teachers in the category on October 1, 1987. In the 28 rows, teachers were to be classified by 27 different primary fields of assignment, with a total in the final row. This item appeared to be difficult for respondents to complete, as indicated by a combination of missing and inconsistent entries. NCES decided that the quality of data from this item was unacceptable and did not include the data in either its public or restricted use microdata files for the School Survey. In the Round 2 School Survey, some parts of this item were dropped; other parts were retained but were asked in a different format.

Other items with high item nonresponse rates in Round 1 for both sectors included an item on availability of instruction and size of enrollment in "grades 13 and 14" (covering vocational and other "post-graduate" secondary education) and an item asking for a breakdown of prior year staff roles of teachers who were no longer in the profession in the current year. In Round 2, the grades 13 and 14 categories for enrollment were replaced by a single "postsecondary" category. The other item was retained but the number of separate response categories was substantially reduced.

In Round 2, items with response rates below 75 percent included those relating to counts of part-time staff and to degree of difficulty in filling vacancies in selected categories. Problems

with the items on part-time staff are attributed partly to the format of the item covering full and part-time staff and partly to respondents' uncertainty about the definition of "part-time", especially in the smaller schools.

Measurement error: introduction Information about measurement errors in the School Survey comes from several sources, including reinterviews, in-depth interviews using cognitive research techniques, reviews of completed questionnaires and analyses of errors and inconsistencies detected during data processing. Findings from these sources are presented in the next 3 subsections.

Measurement error: findings from reinterviews The first reinterviewing for the School Survey occurred in connection with a large-scale pretest for Round 1 of SASS in the early part of 1987. The pretest, which was carried out in 10 states, included 220 schools. Of these, 98 were reinterviewed, by telephone, by Census Bureau interviewers. Unlike the subsequent reinterviews following Rounds 1 and 2, which merely asked for second responses to the selected questions without any attempt to reconcile differences, the pretest reinterviews called for in-depth discussions with respondents about how they had arrived at their initial answers, what they had included in their counts and what was excluded. Respondents were also asked for their recommendations for improving any of the questionnaire items.

The report of the reinterviews (Nash, n.d.) included several recommendations for improvements in specific questionnaire items, for example:

- For an item on special programs, clarify the definition of bilingual education.
- For an item on student enrollment by grade, clarify the treatment of students enrolled under Head Start and Chapter 1 programs.
- For an item asking about present activities of teachers who had left the school after the preceding school year, 38 percent of the schools did not have records available. The report recommended further review of nonresponse rates for this item to determine how useful the results would be.

Certain other items that were found to be difficult for some schools to report were subsequently dropped from the questionnaire.

As part of the regular data collection cycle, reinterviews have been conducted by Census Bureau field representatives for about 10 percent of all School Survey interviews in Rounds 1 and 2. The Round 1 reinterviews were all conducted by telephone; in Round 2 they were completed, insofar as possible, by the same means as the initial interview.

Bushery, Royce and Kasprzyk (1992) provide a detailed analysis of reinterview results for Rounds 1 and 2. Table 2.10 presents response variance measures for 4 School Survey items

that were included in the reinterviews in both rounds. There were moderate statistically significant reductions between Rounds 1 and 2 in the gross difference rates for 3 of the 4

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The *gross difference rate* is the percent of respondents whose responses in the original interview and the reinterview were different. The *index of inconsistency* measures the percent of total variance for an item that is accounted for by response variance. The *L-fold index of inconsistency* is used for closed response items with more than two response categories: it is a weighted average of the simple index over all categories. As a rough rule of thumb, response variance is considered to be low when the simple or L-fold index of inconsistency is less than 20, moderate when it is between 20 and 50, and high when it is greater than 50. For further discussion of these measures of response error, see Groves (1989) and Forsman and Schreiner (1991).

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items and in the index of inconsistency for two of them. Changes in reinterview methodology may have contributed to some of the reduced response variance. All four had indexes of inconsistency in the moderate range in Round 2.

Looking at *all* of the factual reinterview items (most of them not the same in both rounds) from the School Survey shows the following distribution by level of response variance, as measured by the index of inconsistency (Newbrough, 1989; Royce, 1992):

Round	Index of inconsistency		
	Low	Medium	High
1	0	6	8
2	17	12	7

Although not definitive, because the items and reinterview procedures for the two rounds were different, these findings suggest that efforts by NCES and the Census Bureau to improve the questions and instructions for Round 2 may have had some success.

For Round 2, Bushery *et al* compared the results for schools in which mail was used for both the original interview and the reinterview with results for schools in which the telephone was used for both. Table 2.11 shows the results of this comparison for 4 School Survey items. For each item, both measures of response variance were significantly lower for the mail/mail group. It occurred to the investigators that one possible reason for this might have been that some mail respondents had saved copies of their questionnaires and had used the copies to prepare their mail reinterview questionnaires. However, a school-by-school comparison of individual responses showed that no more than 6 percent were likely to have done this. They hypothesized that the lower response variance for the mail interviews may have resulted primarily from two factors:

- Only respondents who answered the original survey by mail were eligible for the mail reinterview. These respondents were likely to be more cooperative and answer the questions more carefully in both interviews.
- Respondents interviewed by mail may take time to look up the answers to questions from records or they may go through a more careful, but more lengthy, thought process to provide the needed facts. (Bushery, Royce and Kasprzyk, 1992)

Measurement errors: findings from in-depth interviews We now turn to a review of findings from in-depth *initial* interviews (sometimes called cognitive or think-aloud interviews) that have been conducted with school principals to explore their understanding of and ability to answer the questions used in the School Survey. Since the questionnaires are designed to be self-administered by most respondents, the technique used in these interviews is to ask the principals to complete the questionnaire themselves with an observer/interviewer present and to describe their reactions and thought processes while proceeding through the questionnaire. The observer/interviewer may ask probing questions where necessary to clarify the respondents' remarks or behavior. Interviews are tape recorded for use in subsequent analysis.

In the spring of 1990, members of the Census Bureau's Center for Survey Methods Research conducted in-depth interviews with 9 public and 6 private school administrators, using the School Survey questionnaires from the pretest for Round 2 (Jenkins and DeMaio, 1990). These interviews identified several items asking for counts or percentages that were difficult for respondents to answer. An item asking for the percent of students enrolled at the start of the previous school year who were still enrolled at the end of that year was subsequently eliminated from the final version of the public school questionnaire. Two matrix style items on the private school questionnaire that asked for information about full-time equivalent teaching staff by grade level and subject or specialty proved to be extremely difficult for respondents and were eliminated from the final version of that questionnaire. Other findings from the in-depth interviews led to changes in format and wording for some items.

A second set of in-depth interviews was carried out in the winter of 1991-92 with 20 public school principals in 5 mid-western states - Oklahoma, North Dakota, South Dakota, Nebraska and Iowa - using a condensed version of the questionnaire that had been used in the pretest for Round 3. One objective of the interviews was to learn more about questions that had high edit failure rates in Round 2; another was to test new questions that had been developed for possible inclusion in Round 3. The particular states were chosen because they had had high pre-edit failure rates for student and teacher counts in Round 2. Three of the four schools in each state had not been in the SASS school sample previously; the fourth was chosen because its School Survey questionnaire had been rejected at the pre-edit stage in Round 2 due to discrepancies between the teacher and student counts and comparable data from the Common Core of Data.

A detailed account of each interview is available, as well as a paper (Jenkins, 1992b) and a memorandum (Jenkins, Ciochetto and Davis, 1992) that summarize the main findings and provide an item-by-item description of the problems that respondents had in answering the questions. The paper identifies three types of respondent problems and gives two examples of each:

(A) Misunderstanding of concepts

*Example 1 - Definition of the unit (school) to be covered by the questionnaire.* As described in Sections 2.4 and 2.5 of this chapter, edits during and after the main processing operations in both Rounds 1 and 2 of SASS identified several instances in which school questionnaires had been completed for a unit other than the one intended. Such errors were frequently associated with schools in very small districts and distinct school units located in a single building or in nearby buildings with common grounds. In the cognitive interviews, several of the principals interviewed had difficulty deciding what units to cover in completing the questionnaire. Three of the 20 principals actually reported for a unit other than the one intended. Some of the errors and uncertainties were associated with respondents' failure to give close attention to the label and instructions on the cover page of the questionnaire, failure to display the name of the school prominently on the cover page and misleading cues in some of the initial questions. The investigators believed that most problems of this kind could be eliminated by redesign of the questionnaire, especially the cover page and label.

*Example 2 - Full-time versus part-time status.* When respondents were asked to give the numbers of full and part-time employees in each of several instructional and support services categories, they had difficulty in correctly classifying employees who: had jobs which by their nature could not be full-time, for example, bus drivers; worked part-time in more than one category, but full-time at the school; or worked part-time at the sample school, but full-time for the school district.

(B) Format considerations

*Example 1 - "None" boxes and skip instructions.* A series of items about limited-English proficient (LEP) students was introduced with a blank space in which to record the total number of LEP students and a "none" box underneath it with an instruction to skip the remaining items on LEP students if there were none. Several respondents entered "0" in the answer space, did not notice the none box and were thus led to a frustrating attempt to answer several questions that did not apply to them. Failure to use none boxes and follow skip instructions correctly is a fairly common problem, especially with self-administered questionnaires.

*Example 2 - Item layout.* One item asked respondents, for each of several fields of instruction, either to check a box to indicate that they had no vacancies in that field or to check one of four boxes indicating the level of difficulty they experienced in filling vacancies in that field. Some of the respondents were uncertain how to respond for fields that were not relevant in their schools. The intent of a sub-item at the end of this item, asking for



specification of subfields in the vocational-technical education category, was especially unclear to respondents.

(C) Use of records

*Example 1 - Use of inappropriate records.* One item asked for enrollment by grade on October 1 of the current school year. Public schools are required by law to submit such information annually to their school district or to their state. It was the intention of the questionnaire developers that respondents use the same information to complete this item. However some respondents did not rely on their official fall reports, with the result that they went through unnecessary work to complete the item and sometimes provided numbers for a different date.

*Example 2 - Converting information in records to the desired format.* For an item asking for a breakdown of enrollment by standard race/ethnic categories, many respondents recorded the numbers for the 4 categories other than white, non-Hispanic, using available records. They then derived the number for white, non-Hispanic by subtraction from the total enrollment on October 1 that had been reported in the preceding item. However, in some instances, the records used to obtain the data for the first 4 categories referred to a date other than October 1, leading to a number for white, non-Hispanic enrollment that was not correct for either date.

The above and other findings from the in-depth interviews were given serious consideration in the design of the Round 3 questionnaire for public schools.

Measurement error: findings from other sources Information on both measurement and item nonresponse error is available from a 1992 review of post-edit item response rates, pre-edit reject rates and edit change tallies from Round 2 of SASS (Jenkins, 1992a). (The nature of the pre-edit and edit operations is described in Section 2.4 below.) School and LEA questionnaires had been rejected (for inconsistencies, invalid entries and critical missing data) much more often at the pre-edit stage than the questionnaires for individuals - school administrators and teachers. The rejection rates were 59.4 percent for public schools and 72.4 percent for private schools. The private school questionnaire also had a relatively high proportion of items with post-edit response rates less than 75 percent, and the reviewer concluded that, of all the SASS questionnaires, it was the one most in need of improvement, although many of the problems observed were similar for public and private schools.

Specific problems observed for both public and private schools in this review were similar to those identified in in-depth interviews. These included:

- Frequent inconsistencies between a total reported in one item and breakdowns of that total reported in subsequent items. This problem was observed for breakdowns of total enrollment, enrollment in grades 10 to 12 and total number of teachers.
- Failure to complete the minutes part of the entries for the item on length of school day.

- Failure to report numbers of students in selected programs or receiving selected services.
- (For public schools only) Enrollment and teacher counts that were substantially higher than those reported for the same schools in the CCD file. The School Survey counts for enrollment were at least 35 percent higher for about 8 percent of the schools and the teacher counts were higher for about 20 percent. (These differences are discussed further in Section 2.5 below.)

We have referred earlier to the regional office reviews of questionnaires completed by the Census Bureau field representatives in telephone followups of mail nonrespondents. In Round 2, the regional offices were asked to send the Forms SASS-23, on which the review findings for their field representatives had been recorded, to the Census Bureau office in Suitland, Maryland. A review of these forms led to the following conclusions (Pasqualucci, 1991):

- Most of the regional offices did not complete the review forms correctly and one office apparently had not used them.
- Many of the field representatives had accumulated more than 10 errors on their first 4 questionnaires. Common errors were disregard of skip patterns and failure to check "None" boxes, entering "0" instead.
- In the item on the public school questionnaire asking for a breakdown of enrollment by race/ethnic category, the total for all categories frequently was not equal to the total enrollment reported in a prior question. Some field representatives had entered a percentage instead of a whole number for each category.
- On private school questionnaire items requiring decimal entries, e.g., years of instruction required for graduation by subject and items relating to full-time equivalent staff, some field representatives failed to record any digits to the right of the preprinted decimal points.

## **2.4 Data processing and estimation**

Data processing procedures for Round 2 Exhibit 2.1 shows, for the Round 2 School Survey, the sequence of basic processing operations that occurred between the receipt of questionnaires in the Census Bureau's processing facility in Jeffersonville, Indiana and the production of a clean data file. As the exhibit shows, activities with large clerical elements were carried out in Jeffersonville, whereas the purely computerized operations were done at the Census Bureau's headquarters in Suitland, Maryland. As needed, data files were transmitted electronically between the two locations.

For two of the operations, clerical review of questionnaires and resolution of rejects from the computer pre-edit, Jeffersonville personnel sometimes made callbacks to respondents to try to resolve data problems. In particular, for the School Survey this was often done to try to

reconcile large differences between reported enrollments and teacher counts and expected values of these items based on the CCD for the 1989-90 school year. In Round 1, many discrepancies of this kind were detected only after these items were compared at the aggregate level (see Section 2.5), and their resolution at that stage caused significant delays in the production of clean data files. In Round 2, the CCD values for these items were included on the mailing labels for the school questionnaires, so that large discrepancies could be detected and resolved by the clerical reviews in Jeffersonville. Any discrepancies not resolved at that stage were flagged for resolution by the computer pre-edit.

The specifications for data entry called for 100 percent verification of all data keyed from the questionnaires.

Checks for invalid entries for specific items, inconsistencies between items and other problems were included in both the pre-edit and edit operations. The difference lies in how these problems were resolved. In the pre-edit, a listing of rejected schools and items was produced and sent to Jeffersonville, where the clerical staff reviewed the listings in conjunction with the questionnaires and, as needed, recontacted respondents. In the edit, problems detected in the corrected data files were resolved through programmed instructions to blank or impute problem items; there were no attempts to contact respondents at this stage. Some questionnaires were rejected in the edit and the schools were treated as nonrespondents if values were still missing or out of range for selected key items.

Imputation At several stages during data processing, respondents' or interviewers' initial entries on the questionnaire are changed or deleted, or values (including 0) are supplied for items initially left blank on the questionnaire. Except when these changes are the result of followup contacts with respondents, the process of changing or deleting entries is called imputation. Some data items are changed at more than one stage; for example, an item failing a consistency check in the computer edit might be blanked at that point and a new value supplied in the subsequent computer imputation operation.

Most of the imputation for both Rounds 1 and 2 of the School Survey was done in a computerized imputation operation following the computer edit. Some imputation was done during the computer edit and a very limited amount in earlier stages of processing, including the initial clerical edit and the clerical resolution of pre-edit rejects (see Exhibit 2.1). Most changes during the clerical operations resulted from followup contacts with respondents; clerical imputation was permitted only in a few situations where the correct entry was obvious from other information on the questionnaire. In Round 2, all School Survey items that were missing or failed consistency checks were imputed; in Round 1 there were two items on the private school questionnaire that were not imputed: an item on place of operation and one concerning staffing patterns (items 7 and 35 on Form SASS-3B).

Information used for imputation in Round 2 came from several sources: other items on the same questionnaire; information from the questionnaire for the LEA in which the school was located (public schools only); information for the same school from the sample control file, which included expected enrollment and teacher counts from the CCD; and information for

other sample schools with similar characteristics. The last of these sources was used in a sequential hot deck (donor-based) procedure that matched the school with the missing item to the most similar responding school in the same stratum. Similarity was determined on the basis of variables such as metropolitan status, percent minority enrollment and size of enrollment (NCES, 1992).

The hot deck method can be illustrated by an example. If a school reported that it had a remedial reading program but did not report the number of students served by the program, the school's total enrollment would be multiplied by the proportion of enrollment served in remedial reading programs at another school with similar characteristics (Kaufman and Huang, 1993, section 8.2).

Computer imputation was done in two stages. The first stage consisted of imputations for which the missing or inconsistent values could be derived with a reasonable degree of assurance from other available data for the same school or school district. The remaining items, for which this was not possible, were imputed in the second stage, using the hot-deck method.

All items imputed in either stage of the computer imputation operation were flagged as imputed on the final data tapes, including the files that are made available for public or restricted use by outside researchers. In Round 2, items imputed in the first stage were flagged with code 1, indicating "internal imputation"; those imputed in stage 2 were flagged with code 2, indicating "donor-based" imputation. In Round 1, only a single code was used to distinguish imputed values from those based directly on reported data. The imputation flags in both rounds reflect only those imputations made during the computer imputation operation. Additional information about the imputation procedures for Round 2 is given in Chapter VIII of the Data File User's Manual (Gruber, Rohr and Fondelier, 1993), and detailed item-by-item specifications for imputation are available in SASS Specifications Memoranda covering each survey and each questionnaire.

Assignment of locale codes Round 1 reinterviews and cognitive interviews using Round 2 pretest questionnaires showed that responses to the question, "Which best describes the community in which the school is located?" had moderate response variance. The same question was used in Round 2, but a separate locale or "urbanicity" code was also developed by matching each school's mailing address to Census Bureau geographic files containing population density data, Standard Metropolitan Statistical Area codes and urban/rural codes. The same locale codes were used for the school and school administrator data files. These more rigorously defined locale codes will sometimes differ from the codes based on self-reports of community type (Kaufman and Huang, 1993, section 1.4.4; Johnson, 1993).

Weighting Sample weighting procedures used for the School Survey have three purposes: to take account of the selection probabilities at every stage of selection; to minimize biases that may result from unit nonresponse; and to make use of available information from external sources to improve the precision of sample estimates.

The weighting procedures for public, private and Indian schools were quite similar, with minor variations at some stages. For each sector, the overall weights were the product of four factors: a basic weight; a sampling adjustment factor; a school nonresponse adjustment factor; and a frame ratio adjustment factor.

- The *basic weight* is the inverse of the probability of selection of the school. For schools selected with certainty it has a value of 1.00.
- The *sampling adjustment factor* is used to take account of special circumstances that affected a school's probability of selection. Such circumstances included frame duplications not discovered prior to sample selection, including the special case where a sample school was discovered to have merged with another one also included in the frame. Another instance is the one described earlier, in which some special education programs, with operations at several locations, were identified in the frame as single schools. In this situation, locations not already included in the frame as regular schools were subsampled.
- The *school nonresponse adjustment factor* is applied to the schools for which acceptable questionnaires were obtained to compensate for unit nonresponse. The factors, which are calculated separately for specified adjustment cells, are the ratios of the summed sampling weights (product of the first two factors above) for all eligible sample schools in the cell to the summed weights for those that responded. For public schools the cells are defined by state, school grade level, enrollment size and urbanicity. Cells with small samples and those with high factor values are combined, following designated rules. A similar procedure was followed for Indian schools, using somewhat different cell definitions and rules for collapsing cells.

A similar procedure is also used for the private school list and area frames. For the list frame, the nonresponse adjustment cells are defined by association group, grade level and, for Catholic and "all other" category schools only, by urbanicity. For the area frame, they are defined by broad types (Catholic, other religious, nonsectarian and unknown), grade level and enrollment size class. Similar rules are used to collapse small cells and those with high factor values.

- The *frame ratio adjustment factor* is used to adjust for differences between expected and actual sample sizes. Like the nonresponse adjustment factors, these ratio adjustment factors are calculated separately for specified adjustment cells. The factor for each cell is the ratio of the total number of schools in the frame in that cell to the sample estimate of that number, based on all schools selected, without regard to their final response status. Schools that turned out to be ineligible or did not respond had to be included in the denominator because no corresponding information was available for schools not in the sample.

For public schools and private schools in the list sample, the cell definitions and collapsing rules are similar, although not always identical, to those used for the

nonresponse adjustments. For the private school area sample, the frame ratio adjustment factors are used only for the PSUs selected with certainty, because there is no universe frame for the non-certainty PSUs. For the certainty PSUs, the cells used are defined by grade level and PSU.

Further details on weighting are provided in the Data File User's Manuals and the reports on Sample Design and Estimation for each round.

The nonresponse adjustment procedure is based on the assumption that the probability of nonresponse may vary between cells, but does not vary among individual schools within cells. Therefore, it is important to define the cells in a way that makes nonresponse probabilities as homogeneous as possible within cells. Shen, Parmer and Tan (1992) explored the correlates of nonresponse, based on the Round 2 School Survey samples of public and private list sample schools, using a variety of analytical procedures. Their analyses confirmed the appropriateness of the adjustment cells currently in use for public schools. They suggested a change in the order of variables used in collapsing cells when collapsing is necessary. For the private school list frame, they suggested the use of enrollment size in creating adjustment cells, in addition to the variables currently used, as well as a change in the order of variables used in collapsing cells. Their suggestions have been adopted in part for the Round 3 School Survey.

Variance estimation The balanced half-sample replication method has been used to estimate the sampling errors associated with estimates for all of the SASS surveys. Replicates are subsamples of the full sample. The statistic of interest, such as number of students at a specified grade level, is estimated from each replicate. (In Round 1, the same overall nonresponse and frame ratio adjustment factors were used for each replicate. In Round 2 these factors were calculated separately for each replicate.) The mean square error of the replicate estimates around the full sample estimate provides an estimate of the variance of the statistic. For the balanced half-sample procedure, each replicate or subsample consists of approximately one-half of the full sample of schools. Each sample school is included in one-half of the replicates, except for schools selected with certainty, which are included in all replicates.

A total of 48 replicates were designated for each of the SASS surveys. For the School Survey, special procedures were used to ensure that the effect of controlling overlap of the Round 1 and Round 2 samples would be properly reflected in estimates of variance for changes occurring between the two rounds. Details on the procedures for designating the replicates are provided in the Data File User's Manuals and the Sample Design and Estimation Report for each round. Each SASS public-use data file contains the 48 sets of weights needed to produce balanced half-sample replicated variance estimates, so that file users can estimate the sampling errors for statistics that are of interest to them. The same procedures are used to estimate the sampling errors that are presented in all SASS publications.

A recent study has confirmed the feasibility of including generalized variance functions in SASS publications (Salvucci and Holt, 1992). These functions, which relate the sampling error of an estimate to its size, can be used by those who do not work with microdata files, or lack the software for the replication method, to produce approximations to the sampling errors associated with their estimates of interest. Specific parameter values for the four basic surveys in Round 1 have been computed (Salvucci, Holt and Moonesinghe, 1994) and will be used for internal analyses. Parameter values for Round 2 are being developed and will be made available to data users.

## **2.5 Evaluation of estimates**

This section describes comparisons of weighted School Survey estimates with data from other sources, including other SASS surveys, the CCD and, to a limited extent, data from other agencies and organizations. Comparisons of survey estimates with other data can be made both prior to and following publication. In Round 1, as soon as weighted data files were available, state-level estimates of numbers of schools, total enrollment and teacher counts were compared with CCD and QED data. The large differences that were found for public schools in some states led to a substantial amount of review of individual school records and questionnaires and, in some instances, recontacts with schools in order to correct erroneous data. A similar set of operations was undertaken in Round 2, except that QED data were not used in the comparisons. This sequence of pre-publication review and correction operations is referred to as the "post-processing edit".

Round 1: Post-processing edit An initial comparison of survey estimates and CCD counts of total enrollment by state identified several states, predominantly in the Midwest, for which public school enrollment estimated from the School Survey was much higher than expected. To identify the individual schools that might account for the differences, a list was prepared of 972 public schools whose reported enrollment exceeded the expected value, based on the QED frame, by 35 percent or more. Questionnaires for 687 of these schools (excluding those in the states with the lowest ratios of reported to expected enrollment) were subjected to detailed reviews. About one-fourth of the 687 questionnaires were accepted as correct. About one-half of them had been partially filled for the school district or for more than one school and there was enough information on the questionnaire to make corrections. For the remaining one-fourth, it appeared that all questionnaire items had been completed for a school district, two schools, or the wrong school. These cases were assigned to NCES and Census Bureau staff for telephone reinterviews, which were successfully completed for about four-fifths of them.

This experience led to the following conclusion:

Our review of the questionnaires and phone conversations with school secretaries and principals lead us to believe that these errors were made because the respondents misread the first question on the school questionnaire, or because of their employment positions (district superintendent, assistant superintendent, principal for two schools,

etc.), they assumed we wanted information for all schools under their jurisdiction rather than the school named on the questionnaire label. (Fondelier, 1989a)

After the corrections based on this review had been incorporated in the School Survey data file, further comparisons with CCD data showed that estimates of the number of public school teachers for some states were still much higher than expected, based on the CCD. As in the previous case, a list of suspect schools was compiled, based on several criteria, such as student/teacher ratios, comparison of head counts and full-time equivalent (FTE) counts of teachers, and comparison of FTE counts for the school and for the district in which it was located. Two of the criteria used for flagging schools were met by more than one-eighth of all sample schools.

In this instance, the review was based primarily on examination of computer listings and a review of programming specifications for prior operations. There were no recontacts with schools and only a few of the original questionnaires were examined. The review led to corrections for 281 school records. The conclusion concerning sources of the problem was:

The problem of FTE teacher overestimates was caused chiefly by the respondents' reporting district enrollment for some schools - the inconsistency between the district enrollment and the school teacher count triggered the edit procedure which increased the teacher count [which had not been subsequently returned to its original value when the enrollment count was corrected]. Other causes were probably poorly recorded entries which were misread by the keyers and a lack of understanding by some respondents of "full-time equivalent." (Fondelier, 1989b)

The review found that 13.7 percent of the interviewed schools with one or more part-time teachers had identical entries for the head count and FTE number of teachers. However, no changes were made for these schools; it was believed that "... changing the FTE entries for these cases would not significantly alter the weighted teacher counts for the states in which they were located" (Fondelier, 1989b)

Round 1: Evaluation of published estimates Information obtained from pre-publication reviews, comparisons with CCD data, and other sources of information within NCES leads to the following conclusions about the quality of final estimates from the School Survey in Round 1:

- School counts estimated from SASS were lower than those obtained from NCES's Public Elementary/Secondary School Universe Survey, a part of the CCD program. At the national level, CCD counts exceeded SASS estimates by 6 percent, with the differences being greatest for Nebraska (44 percent), North Dakota (42 percent), South Dakota (38 percent) and Montana (15 percent). These differences were due in part to definitional differences between the QED (frame for the Round 1 School Survey), which defines schools in terms of physical locations, and the CCD, which defines them in terms of administrative units (NCES, 1991a).



- In Nebraska, the QED was found to have excluded some small (elementary grades only) LEAs with a total of about 275 schools and 2,800 students. The schools, students and teachers in these LEAs were not included in SASS (Hammer and Gerald, 1991, p.22).
- The FTE teacher counts from the School Survey are likely to be overestimates. In the average state, 19 percent of the schools having part-time teachers reported identical FTE and head counts for teachers (NCES, 1991a).
- FTE teacher counts for Hawaii from SASS were substantially higher than the CCD counts. For the latter, the state had reported in terms of "authorized" positions that were filled, whereas in SASS the schools correctly reported all teachers, regardless of whether their positions were officially authorized (Fondelier, 1989b).

A report by an NCES contractor (Smith and Salvucci, 1989) compared preliminary estimates of private school enrollment from the Round 1 School Survey with estimates from the October Education Supplement to the Census Bureau's Current Population Survey (CPS) and, for Catholic Schools, compared SASS estimates of school counts and enrollment with data available annually from the National Catholic Educational Association (NCEA).

The CPS estimate of enrollment in private elementary and secondary schools in October 1987 was 4,420,000. This estimate was 16.5 percent below the preliminary SASS estimate of 5,291,000 and 15.3 percent below the final SASS estimate of 5,218,000. CPS estimates of private school enrollment were also significantly below estimates from NCES sources other than SASS for 1983, 1985 and 1988. The report asserted that "... these differences cannot be fully explained without a major benchmarking study" and recommended that if such a study were undertaken it should be done when data from the 1990 Census of Population were available.

For Catholic private schools, the SASS estimates of number of schools and enrollment for the school year 1987-88 both exceeded the NCEA figures, which are based on an annual census covering all schools identifiable as Catholic, including those operated by private boards of control and not affiliated with a parish or diocese.

1987-88 estimate of:	NCEA	SASS	
		Preliminary	Final
Number of Catholic schools	8,992	9,540	9,527
Enrollment (thousands)	2,623	2,827	2,823

As shown, the SASS final school and enrollment estimates exceeded those of the NCEA by 5.9 and 7.6 percent, respectively. For the following school year, the estimate of Catholic school enrollment from NCES's Early Estimates Survey exceeded the NCEA's count by 9.2 percent. A subsequent review of school lists available annually from the Council for American Private Education (1992) suggested that the higher estimates from SASS may be accounted for in part by schools that are affiliated with the United States Catholic Conference, but were not included in the NCEA annual census.

Round 2: Post-processing edit (For additional details, see Chapter VII, Section F of the Data File User's Manual for Round 2.) In Round 1 the discovery, at the weighting stage, of discrepancies between SASS preliminary estimates and CCD counts of schools and teachers led to substantial unanticipated processing costs and significant delays in publication of the survey results. Changes were introduced in Round 2 in an attempt to eliminate or minimize the impact of such problems. The CCD replaced the QED list as the primary source of the frame for the public school sample. Instructions were added to the public school questionnaire to report data only for the school named on the label, and the expected number of teachers and students for each school was displayed on the label. Expected and reported school enrollment and teacher counts were compared in the field office edit operation, with followups for differences of 50 percent or more.

In spite of these changes, initial post-processing comparisons of weighted estimates by state showed that the SASS estimates of total teachers from the public school data file for 9 states were at least 15 percent greater than the state FTE teacher counts from the 1991 CCD, and staff reviews identified significant data problems in one additional state. For these 10 states, approximately 375 schools with large differences between the SASS and CCD records were identified. The individual records for these schools were compared and, when appropriate, the SASS records were changed to make them consistent with the CCD data for the schools. Changes were made to about 300 of the SASS records in this group. These comparisons of records for individual schools showed that there were two main causes of the SASS overestimates of teachers: schools that reported data for all of the schools in a school district and instances where there were 2 or more schools (as defined for CCD) at a single location and they had been reported as a single school.

After the changes were made, the school files for the 10 states were reprocessed to produce new estimates of students and teachers. Some residual problems were identified and a few additional changes were made. As will be noted in Chapter 5, for the schools for which changes had been made in the post processing edit, some of the teacher records also required changes.

Round 2: Evaluation of published estimates Final estimates of public schools by state were compared with school counts from the CCD. The SASS estimate for one state, Oklahoma, was about 15 percent higher than the CCD count. There were differences of 5 to 10 percent for 8 states and the District of Columbia. The SASS estimates were from 5 to 10 percent higher for Arizona and Nevada and 5 to 10 percent lower for Alaska, Louisiana, Minnesota,

South Dakota, Wisconsin, Wyoming and the District of Columbia. For the remaining 42 states, the SASS estimates were within 5 percent of the CCD counts. For the United States, the SASS estimate was 97.9 percent of the CCD count for the same school year (Gruber, Rohr and Fondelier, 1993, Table XII-4).

We would expect the CCD counts to be higher mainly for two reasons. With a few exceptions, the SASS sample did not cover schools that did not exist at the time of the 1989 CCD, but were reported in the 1991 CCD. Second, as Table 2.8 shows, 4.0 percent of the schools sampled from the 1989 CCD were found in SASS to be ineligible for the survey because they were no longer operating, had merged with another school or were not serving students in any of grades 1-12. A factor causing differences in the other direction was that some of the schools sampled from the 1989 CCD list were found in SASS to represent more than one school, for example, an elementary and secondary school operating at the same location but under separate administration. The elimination of schools that were ineligible during the reference school year and the inclusion in the sample of units with more than one school did not cause any bias in the survey estimates.

The SASS estimates of the number of private schools by school type (9 categories of schools with religious affiliations and non-sectarian schools) were compared with counts from the 1989-90 Private School Survey, which provided the sampling frame for the sample of private schools for the Round 2 School Survey (which covered the 1990-91 school year). The SASS estimates were smaller in all 9 categories: this was primarily the result of PSS schools that were found to be out of scope in SASS. As Table 2.8 shows, 5.6 percent of the sample of private schools were found to be ineligible, because they were no longer operating, had fewer than 10 students, or did not meet the SASS definition for other reasons. For the United States, the SASS estimate of the number of private schools came to 92.4 percent of the 1989-90 PSS count (Gruber, Rohr and Fondelier, 1993, Table XII-5).

For private schools, the Round 2 School Survey estimates of numbers of students and teachers were compared with counts from the 1989-90 PSS. The SASS student counts were 3.8 percent higher than the PSS counts and the SASS teacher counts were 1.7 percent lower. These differences may have been due in part to the sampling error associated with the SASS estimates.

The 1989-90 PSS enrollment counts for Catholic schools exceeded counts from the National Catholic Education Association (NCEA)'s census for the same year by 5.4 percent of the latter's figure (Gruber, 1992b). Differences by state showed large variations; however, some of these could be attributed to the inclusion by the NCEA in a single state of counts for archdioceses with schools in more than one state.

Data reported on the School Survey questionnaires were not always internally consistent. For example, the total of enrollment counts by grade frequently differed from the total of enrollment counts by race for the same school. The questionnaire item on enrollment by grade asked for counts as of October 1, whereas the item on enrollment by race did not

specify a reference date. For schools with large discrepancies, the data for the two items were edited to make them consistent, but there were some residual differences.

**Table 2.1 School Survey Mail Response as a Percent of Total Response (List Frame Only): Round 2**

Type of School by Grade Level	Percent Obtained by Mail* (Percent)	
	Public	Private
Elementary	67.5	60.3
Secondary	67.2	57.7
Combined (Elementary & Secondary)	66.8	47.7
<b>TOTAL</b>	<b>67.3</b>	<b>55.7</b>

\*Mail responses as a percent of mail plus telephone responses.

Source: Parmer, Shen, and Tan (1992).

**Table 2.2 School Survey Mail Response as a Percent of Total Response by Metropolitan Status (List Frame Only): Round 2**

Metropolitan Status	Percent Obtained by Mail* (Percent)	
	Public	Private
Large Central City	54.9	54.6
Mid-size Central City	66.4	
Urban Fringe of Large Central City	65.2	54.2
Urban Fringe of Mid-size Central City	69.5	
Large Town - Non MSA**	73.7	63.1
Small Town	71.4	
Rural	67.0	
<b>TOTAL</b>	<b>67.3</b>	<b>55.7</b>

\*Mail responses as a percent of mail plus telephone responses.

\*\*Metropolitan Statistical Area.

Source: Parmer, Shen, and Tan (1992).

**Table 2.3 School Survey Mail Response as a Percent of Total Response for Public Schools: Round 2 (Shown in Percent)**

State	Percent Obtained by Mail*	State	Percent Obtained by Mail*
Alabama	71.1	Montana	64.7
Alaska	60.0	Nebraska	69.5
Arizona	59.9	Nevada	71.6
Arkansas	68.7	New Hampshire	59.3
California	61.3	New Jersey	55.5
Colorado	57.9	New Mexico	60.1
Connecticut	69.2	New York	62.5
Delaware	81.1	North Carolina	69.8
District of Columbia	47.9	North Dakota	67.3
Florida	74.8	Ohio	64.8
Georgia	68.9	Oklahoma	59.2
Hawaii	70.7	Oregon	70.3
Idaho	75.2	Pennsylvania	68.8
Illinois	67.0	Rhode Island	60.7
Indiana	77.6	South Carolina	71.0
Iowa	65.8	South Dakota	63.6
Kansas	68.5	Tennessee	70.6
Kentucky	72.5	Texas	64.4
Louisiana	67.0	Utah	77.0
Maine	71.0	Vermont	75.2
Maryland	72.5	Virginia	79.3
Massachusetts	69.1	Washington	69.3
Michigan	59.2	West Virginia	77.9
Minnesota	61.2	Wisconsin	74.1
Mississippi	67.4	Wyoming	72.2
Missouri	67.8	TOTAL	67.3

\*Mail responses as a percent of mail plus telephone responses.

Source: Parmer, Shen, and Tan (1992).

**Table 2.4 School Survey Mail Response as a Percent of Total Response for Private Schools (List Frame Only): Round 2**

Association Group	Percent Obtained by Mail*
<b>Total</b>	<b>55.3</b>
<b>Association of Military Colleges and Schools - US</b>	<b>66.7</b>
<b>Catholic</b>	<b>63.0</b>
<b>Friends</b>	<b>42.3</b>
<b>Episcopal</b>	<b>50.5</b>
<b>National Society for Hebrew Day Schools</b>	<b>35.1</b>
<b>Solomon Schecter</b>	<b>42.5</b>
<b>Other Jewish</b>	<b>36.1</b>
<b>Lutheran - Missouri Synod</b>	<b>73.6</b>
<b>Evangelical Lutheran Church - Wisconsin Synod</b>	<b>66.0</b>
<b>Evangelical Lutheran Church in America</b>	<b>71.3</b>
<b>Other Lutheran</b>	<b>58.2</b>
<b>Seventh-day Adventists</b>	<b>57.0</b>
<b>Christian Schools International</b>	<b>64.0</b>
<b>American Association of Christian Schools</b>	<b>30.7</b>
<b>National Association of Private Schools for Exceptional Children</b>	<b>58.1</b>
<b>Montessori</b>	<b>48.5</b>
<b>National Association of Independent Schools</b>	<b>48.8</b>
<b>All Other</b>	<b>50.3</b>

\*Mail responses as a percent of mail plus telephone responses.

Source: Parmer, Shen and Tan (1992).

**Table 2.5 School Survey Response Rates**

	Round 1 (1988)		Round 2 (1991)	
	Unweighted	Weighted	Unweighted	Weighted
Public	91.9	91.9	95.0	95.3
Private	79.6	78.6	85.1	83.9

**Sources:**

**Round 1 Unweighted: Kindel (1989).**

**Round 1 Weighted: NCES (1991c).**

**Round 2: Gruber, Rohr and Fondelier (1993).**



**Table 2.6 School Survey Weighted Response Rates for Public Schools by State**

State	Response Rate		State	Response Rate	
	Round 1	Round 2		Round 1	Round 2
Alabama	96.6	95.9	Montana	94.8	97.8
Alaska	96.9	92.0	Nebraska	96.4	98.7
Arizona	97.0	94.8	Nevada	96.1	96.1
Arkansas	95.1	97.7	New Hampshire	97.0	96.3
California	88.0	94.6	New Jersey	91.5	88.3
Colorado	99.1	95.9	New Mexico	88.3	96.0
Connecticut	88.6	93.1	New York	84.9	87.6
Delaware	91.0	93.3	North Carolina	90.5	92.6
District of Columbia	68.0	86.3	North Dakota	100.0	98.4
Florida	97.5	93.9	Ohio	95.0	97.0
Georgia	95.0	96.6	Oklahoma	89.5	96.3
Hawaii	77.7	98.7	Oregon	96.6	95.3
Idaho	98.2	98.6	Pennsylvania	87.0	96.1
Illinois	95.4	98.7	Rhode Island	99.1	96.5
Indiana	97.2	99.6	South Carolina	88.3	96.6
Iowa	95.9	96.5	South Dakota	94.8	98.5
Kansas	93.1	98.0	Tennessee	91.9	98.1
Kentucky	90.0	98.1	Texas	87.1	97.4
Louisiana	88.8	93.9	Utah	100.0	98.4
Maine	97.1	94.7	Vermont	99.3	98.5
Maryland	74.5	81.0	Virginia	89.9	92.2
Massachusetts	94.6	91.1	Washington	99.5	92.6
Michigan	97.5	97.1	West Virginia	94.4	98.2
Minnesota	91.4	97.4	Wisconsin	93.5	94.6
Mississippi	96.7	97.2	Wyoming	93.5	97.7
Missouri	85.4	98.0	TOTAL	91.9	95.3

Sources: NCES (1991c) and Gruber, Rohr and Fondelier (1993).

**Table 2.7a School Survey Weighted Response Rates for Private Schools by Association Group: Round 1**

Association Group	Response Rate (Percent)
<b>Total</b>	<b>78.6</b>
<b>Area Sample</b>	<b>66.9</b>
<b>Association of Military Colleges and Schools - US</b>	<b>86.4</b>
<b>Catholic</b>	<b>89.8</b>
<b>Friends</b>	<b>83.0</b>
<b>Episcopal</b>	<b>82.0</b>
<b>Jewish</b>	<b>71.9</b>
<b>Lutheran</b>	<b>90.3</b>
<b>Seventh-day Adventists</b>	<b>88.7</b>
<b>Christian Schools International</b>	<b>95.3</b>
<b>American Association of Christian Schools</b>	<b>55.6</b>
<b>National Association of Private Schools for Exceptional Children</b>	<b>83.5</b>
<b>American Montessori Society</b>	<b>82.0</b>
<b>National Association of Independent Schools</b>	<b>73.6</b>
<b>Other</b>	<b>70.6</b>

Source: NCES (1991c).

**Table 2.7b School Survey Weighted Response Rates for Private Schools  
by Association Group: Round 2**

Association Group	Response Rate (Percent)
<b>Total, area frame and list frame</b>	<b>83.9</b>
<b>Area frame</b>	<b>74.0</b>
<b>Association list frame</b>	
<b>Association of Military Colleges and Schools</b>	<b>90.9</b>
<b>National Catholic Education Association, Jesuit Secondary Education Association</b>	<b>90.9</b>
<b>Friends Council on Education</b>	<b>90.6</b>
<b>National Association of Episcopal Schools</b>	<b>89.4</b>
<b>Hebrew Day Schools</b>	<b>70.8</b>
<b>Solomon Schechter Day Schools</b>	<b>85.1</b>
<b>Other Jewish</b>	<b>70.4</b>
<b>Lutheran Church--Missouri Synod</b>	<b>96.1</b>
<b>Evangelical Lutheran Church--Wisconsin Synod</b>	<b>97.9</b>
<b>Evangelical Lutheran Church in America</b>	<b>95.5</b>
<b>Other Lutheran</b>	<b>94.2</b>
<b>General Council of Seventh-day Adventists</b>	<b>93.9</b>
<b>Christian Schools International</b>	<b>93.7</b>
<b>American Association of Christian Schools International</b>	<b>59.0</b>
<b>National Association of Private Schools for Exceptional Children</b>	<b>86.5</b>
<b>American Montessori Society Schools</b>	<b>85.5</b>
<b>National Association of Independent Schools</b>	<b>84.6</b>
<b>All else</b>	<b>81.1</b>

Source: Gruber, Rohr and Fondelier (1993).

**Table 2.8 School Survey Losses from Initial Sample Selected: Round 2 (Unweighted)**

Type of School	Initial Sample	Percent Out of Scope	Percent In Scope	In Scope					
				Interview			Noninterview		
				Frequency	Percent of Sample	Percent of In Scope	Frequency	Percent of Sample	Percent of In Scope
Public	9,806	4.0	96.0	8,946	91.2	95.0	467	4.8	5.0
Private	3,280	5.6	94.4	2,625	80.0	84.8	472	14.4	15.2
Indian	101	1.0	99.0	97	96.0	98.0	2	2.0	2.0

Source: Gruber (1992).

**Table 2.9 School Survey Unweighted Item Response Rates**

Sector	Range of Item Response Rates (Percent)	Percent of Items with Response Rates:	
		≥ 90%	< 75%
<b>Round 1</b>			
Public	43 - 100	64	11
Private	11 - 100	56	8
<b>Round 2</b>			
Public	56 - 100	77	1
Private	67 - 100	77	5
Indian	60 - 100	87	4

Sources: NCES (1991c) and Gruber, Rohr and Fondelier (1993).

**Table 2.10 School Survey, Extent of Consistency Between Survey Interview and Reinterview**

Topic (Text of questions is presented below)	Percent Yes (Survey Interview)		Gross Difference Rate		Index of Inconsistency		L-fold Index of Inconsistency	
	Round 1 (1988)	Round 2 (1991)	Round 1 (1988)	Round 2 (1991)	Round 1 (1988)	Round 2 (1991)	Round 1 (1988)	Round 2 (1991)
Community Where School Is Located Point Estimate 90% Confidence Interval			34.7*	30.4*			42.4*	37.6*
			32.3-37.1	27.9-32.9			39.6-45.4	34.7-40.9
Bilingual Education Point Estimate 90% Confidence Interval	15.3	14.2	16.2*	12.1*	53.5	45.1		
			14.5-18.2	10.5-14.1	47.7-60.0	39.0-52.3		
English as a Second Language Point Estimate 90% Confidence Interval	31.6	28.3	16.1*	13.7*	37.1*	30.1*		
			14.4-18.1	12.0-15.8	33.1-41.7	26.3-34.6		
Extended Day Care Point Estimate 90% Confidence Interval	16.3	23.0	9.3	8.8	31.7	24.7		
			7.9-11.0	7.4-10.6	26.8-37.4	20.5-29.7		

\*Statistically significant difference between Round 1 and Round 2 (at 90% confidence).

Source: Bushery, Royce, and Kasprzyk (1992).

**Question for School Location:**

**"Which best describes the community in which this school is located?"**

- 1 rural or farming community [continued on next page]**
- 2 small city or town, not a suburb of a large city**
- 3 medium-sized city**
- 4 suburb of medium city**
- 5 large city**
- 6 suburb of large city**
- 7 very large city**
- 8 suburb of very large city**
- 9 military base or station**
- 10 Indian reservation**

**Question for School Programs and Services:**

**"Which of the following programs and services are available to students in this school, either during or outside of regular school hours, and regardless of funding source --**

- bilingual education**
- English as a second language**
- extended day or before-or-after-school day-care"**

**Table 2.11 School Survey, Extent of Consistency Between Survey Interview and Reinterview by Interview Methods: Round 2**

Topic (For text of questions, see Table 2.10)	Number of Cases Evaluated		Gross Difference Rate		Index of Inconsistency		L-fold Index of Inconsistency	
	Mail/ Mail	Phone/ Phone	Mail/ Mail	Phone/ Phone	Mail/ Mail	Phone/ Phone	Mail/ Mail	Phone/ Phone
Community Where School Is Located Point Estimate 90% Confidence Interval	469	276	19.0* 16.3-22.2	39.9* 35.5-45.2			24.0* 20.6-28.2	48.6* 43.2-55.1
Bilingual Education Point Estimate 90% Confidence Interval	466	274	6.9* 5.2-9.1	18.6* 15.2-23.0	31.5* 23.5-42.0	55.3* 45.3-68.2		
English as a Second Language Point Estimate 90% Confidence Interval	468	274	10.9* 8.8-13.6	15.7* 12.6-19.8	24.2* 19.6-30.1	33.5* 26.8-42.3		
Extended Day Care Point Estimate 90% Confidence Interval	464	269	6.7* 5.1-8.9	11.5* 8.8-15.2	19.7* 14.7-26.4	31.9* 24.5-42.2		

\*Statistically significant difference between mail/mail and telephone/telephone (at 90% confidence).

Source: Bushery, Royce, and Kasprzyk (1992).



Exhibit 2.1

**Major Processing Steps  
for SASS Surveys**

Activity	Location*	
	Jeffersonville	Suitland
Computer check-in of questionnaires	X	
Clerical review of questionnaires**	X	
Data entry	X	
Merge data and sample control files		X
Computer pre-edit		X
Resolution of pre-edit rejects**	X	
Input of corrections to data file		X
Computer edit		X
Imputation		X
Weighting		X
Post processing edit		X

\* Data files are transmitted electronically between the Census Bureau's processing facility in Jeffersonville, Indiana and headquarters in Suitland, Maryland.

\*\* Includes telephone follow-ups to respondents as needed.

