High School Longitudinal Study of 2009 (HSLS:09) 2013 Update and High School Transcript

Data File Documentation

JUNE 2015

Steven J. Ingels
Daniel J. Pratt
Deborah R. Herget
Michael Bryan
Laura Burns Fritch
Randolph Ottem
James E. Rogers
David Wilson
RTI International

Elise M. Christopher
Project Officer
National Center for Education Statistics

NCES 2015-036
U.S. DEPARTMENT OF EDUCATION

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1990 K Street NW
Washington, DC 20006-5651 June 2015.

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This report was prepared for NCES under Contract No. ED-IES-10-C-0033 with RTI International. Mention of trade names, commercial products, or organizations does not imply endorsement by the U.S. Government.

Suggested Citation
Ingels, S.J., Pratt, D.J., Herget, D., Bryan, M., Fritch, L.B., Ottem, R., Rogers, J.E., and Wilson, D. (2015). *High School Longitudinal Study of 2009 (HSLS:09) 2013 Update and High School Transcript Data File Documentation* (NCES 2015-036). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC. Retrieved [date] from http://nces.ed.gov/pubsearch.

Content Contact
Elise M. Christopher
(202) 502-7899
elise.christopher@ed.gov

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Contents

PAGE

PAGE

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List of Tables

PAGE

PAGE

PAGE

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List of Figures

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Chapter 1. Introduction

1.1 Overview of the Data File Documentation (DFD) Report

This data file documentation provides guidance and information for users of data from the base year through first follow-up and, in particular, the 2013 Update and High School Transcript data collections of the High School Longitudinal Study of 2009 (HSLS:09). HSLS:09 is sponsored by the National Center for Education Statistics (NCES) of the Institute of Education Sciences, U.S. Department of Education, with additional support from the National Science Foundation.

This documentation is divided into seven chapters: Chapter 1 is an introduction. It presents the organization of the documentation, describes the historical background of HSLS:09 as part of the NCES secondary longitudinal studies program, and supplies a study overview including levels of analysis and research questions. Chapters 2 and 3 describe features of the 2013 Update survey. The second chapter provides information on instruments, sample design, and data collection for the 2013 Update, while the third chapter treats 2013 Update data processing and delivery. Chapters 4 and 5 address features of the high school transcript component of HSLS:09 design and data collection as well as catalog data keying, coding, and delivery. Chapter 6 addresses the combined Update-Transcript weighting and other statistical procedures and documentation, while chapter 7 describes the combined data delivery for the two elements of the study.

This documentation also contains 13 appendixes:

A. High School Longitudinal Study of 2009 (HSLS:09) Update and High School Transcript Field Test Report
B. 2013 Update Facsimile Instrument and Flow Charts
C. Glossary of Terms
D. Poststratification Detailed Tables
E. Standard Errors and Design Effects
F. 2013 Update Unit and Item Nonresponse Bias Analysis
G. Imputation Details
H. Weighting Equations
I. Transcript Data Collection Materials
J. Transcript Letter Grade Conversion Scale
K. ECB Variable Listing
L. Combined 2013 Update and Transcript Composite Variables with Code
M. Selection of Cases for Responsive Design Intervention

1.2 Historical Background: NCES Secondary Longitudinal Studies Program

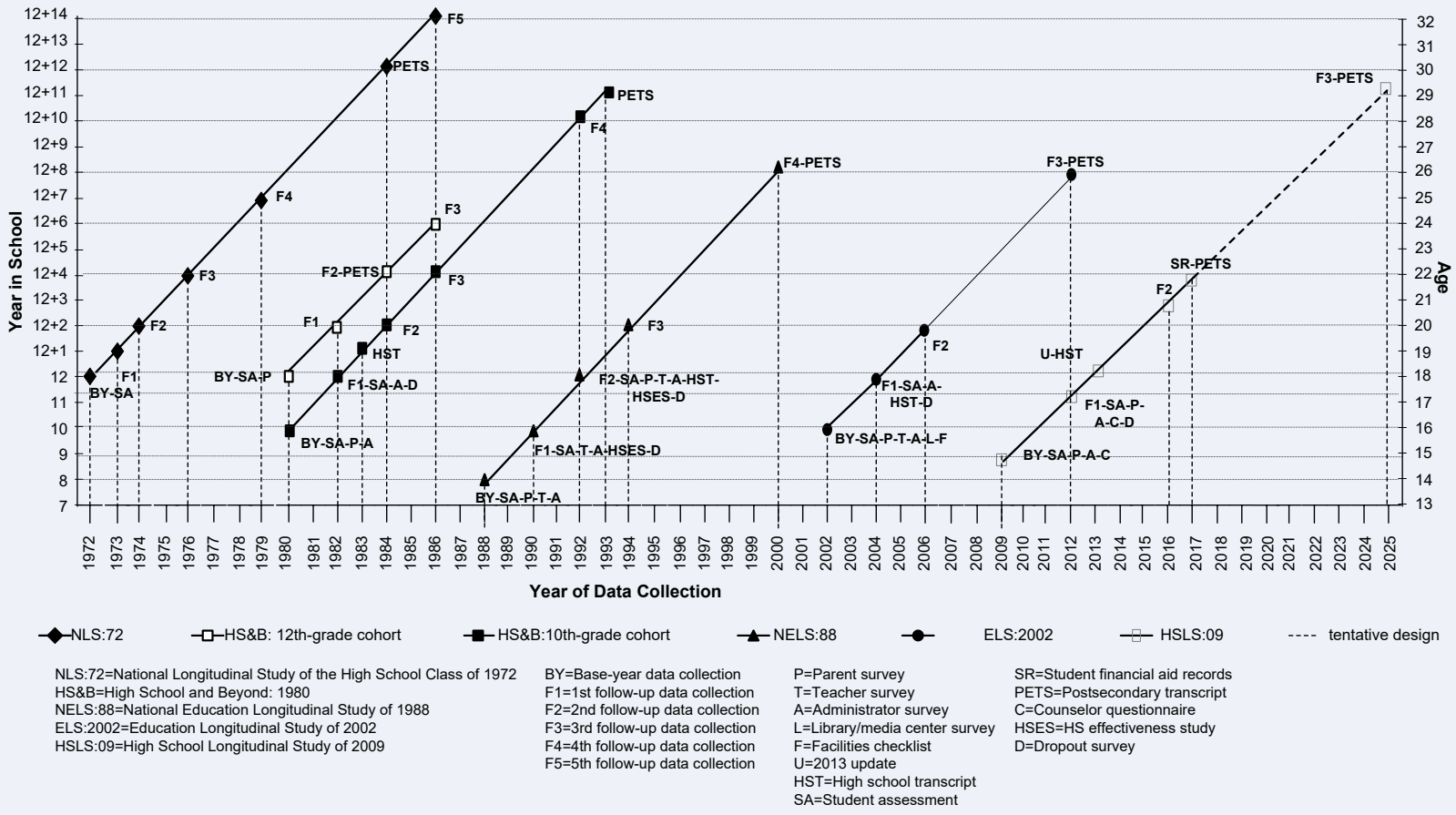
In response to its mandate to "collect and disseminate statistics and other data related to education in the United States" and the need for policy-relevant, nationally representative longitudinal samples of high school students, NCES instituted the Secondary Longitudinal Studies Program. The aim of this continuing program is to study the educational, vocational, and personal development of students at various stages in their educational careers and to examine the personal, familial, social, institutional, and cultural factors that may affect that development.

The Secondary Longitudinal Studies program consists of four completed studies as well as the ongoing HSLS:09. The completed studies are the National Longitudinal Study of the High School Class of 1972 (NLS:72), the High School and Beyond (HS&B) Longitudinal Study of 1980, the National Education Longitudinal Study of 1988 (NELS:88), and the Education Longitudinal Study of 2002 (ELS:2002). This document addresses the HSLS:09 2013 Update and the HSLS:09 High School Transcript component.

Taken together, these five studies describe (or will describe) the secondary and postsecondary experiences of students from five decades—the 1970s, 1980s, 1990s, 2000s, and 2010s—and also provide bases for further understanding the correlates of educational success in the United States. Information on both the concurrent and completed studies in the series is available on the NCES website.

Figure 1 presents a temporal representation of these five longitudinal education studies and highlights their component and comparison points for the time frame 1972–2025.

Figure 1. Longitudinal design for the NCES high school cohorts: 1972–2025



NLS:72=National Longitudinal Study of the High School Class of 1972
HS&B=High School and Beyond: 1980
NELS:88=National Education Longitudinal Study of 1988
ELS:2002=Education Longitudinal Study of 2002
HSLS:09=High School Longitudinal Study of 2009

BY=Base-year data collection
F1=1st follow-up data collection
F2=2nd follow-up data collection
F3=3rd follow-up data collection
F4=4th follow-up data collection
F5=5th follow-up data collection

P=Parent survey
T=Teacher survey
A=Administrator survey
L=Library/media center survey
F=Facilities checklist
U=2013 update
HST=High school transcript
SA=Student assessment

SR=Student financial aid records
PETS=Postsecondary transcript
C=Counselor questionnaire
HSES=HS effectiveness study
D=Dropout survey

SOURCE: U.S. Department of Education, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09).

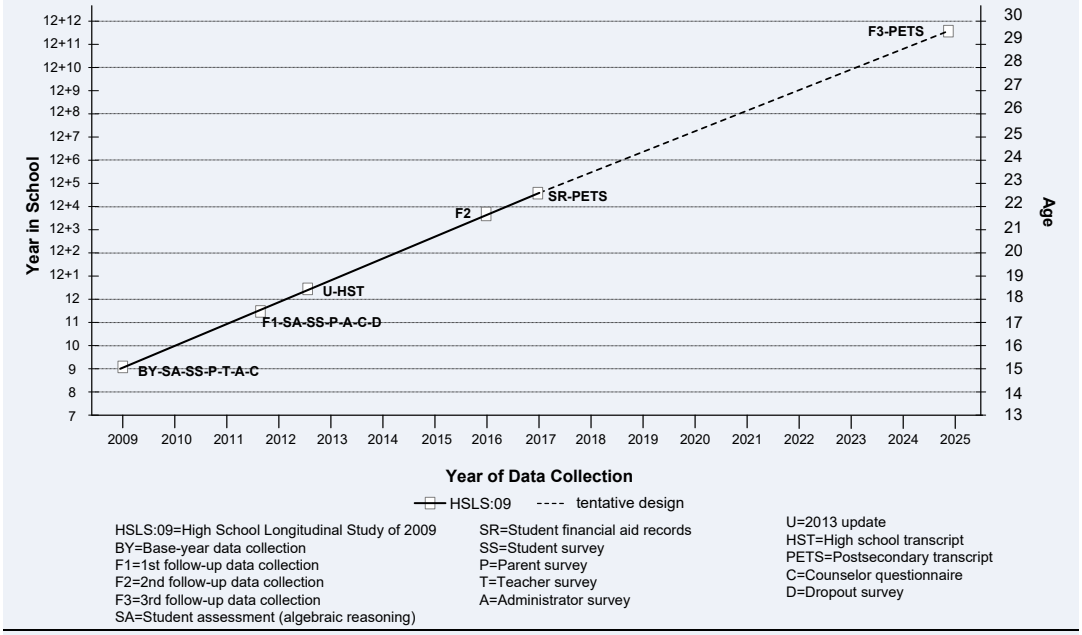
1.3 High School Longitudinal Study of 2009

1.3.1 Overview of HSLS:09

The longitudinal design of HSLS:09 is illustrated in Figure 2.

The HSLS:09 base-year data collection took place in the 2009–10 school year, with a randomly selected sample of fall-term 9th-graders in more than 900 public and private high schools with both 9th and 11th grades.[1] Students completed a mathematics assessment (in algebraic reasoning) and a survey online (the survey consisted of items on educational experiences, sociodemographic background, expectancies, and values for science and mathematics as a subject area or as a vocation, among other topics). Students' parents, principals, and mathematics and science teachers, as well as the school's lead counselor, completed surveys on the phone or on the Web.

Figure 2. Longitudinal design for the HSLS:09 9th-grade cohort: 2009–2025



SOURCE: U.S. Department of Education, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09).

[1] Types of schools that were excluded from the sample based on the HSLS:09 eligibility definitions are described in the discussion of the target population in the *HSLS:09 Base-Year Data File Documentation* (see chapter 3, section 3.2.1), Ingels et al. (2011).

The first follow-up of HSLS:09 took place in 2012, when most sample members were in 11th grade. The cohort was again assessed in mathematics, and they again completed a questionnaire. The first follow-up questionnaire explored topics such as high school attended, grade progression, school experiences, plans and preparations for the future transition out of high school, math and science identity and utility, and extracurricular participation. Contextual data were again collected from a subsample of parents and from school administrators and counselors. While re-administration of the counselor questionnaire occurred only in the base-year schools, administrator questionnaires were administered at those schools as well as the schools to which transfer students had dispersed.

The 2013 Update was field-tested in 2012; the field test report is appended (appendix A). The main study 2013 Update occurred in the last half of 2013 (summer/fall of 2013) (data collection methods, timing, and results are reported in chapter 2). The 2013 Update was designed to collect information on the cohort's postsecondary plans and choices, gathered at, for most of the cohort, completion of high school. More specifically, information was elicited concerning high school completion status; applications (and acceptances) to postsecondary institutions; education and work plans for the fall; financial aid applications and offers; choice of institution; and employment experiences.

High school transcripts were collected in the 2013–14 academic year; methodology was tested in the transcript field test (see the appended field test report, appendix A). Records matching (for example, ACT and SAT scores, Free Application for Federal Student Aid [FAFSA] data, General Educational Development [GED] data) also contributed to the dataset.

A second follow-up, featuring a student questionnaire (augmented by some administrative records sources), is scheduled for 2016, when most sample members will be 3 years beyond high school graduation. Not listed in Figure 2 above are two options that may be implemented in the second follow-up: a student financial aid records collection and a postsecondary transcript collection. The number and timing of future follow-ups beyond 2016 is yet to be determined, although the expectation is that the cohort will be followed at least to age 30, with a questionnaire administration and, it is hoped, a postsecondary education transcript collection in 2025–26.

1.3.2 HSLS:09 Analytic Levels and Research and Policy Issues

HSLS:09 is a general-purpose dataset; that is, it is designed to serve multiple policy objectives, rather than to test a specific hypothesis. The goal of HSLS:09 is to better

understand the impact of earlier educational experiences (starting at 9th grade) on high school performance and the impact of these experiences on the transitions that students make from high school to adult roles. HSLS:09 will help researchers and policy analysts investigate the features of effective high schools, growth in academic achievement (especially in mathematics),[2] the process of dropping out of school and possible return to school or pursuit of alternative credentials, the school experience and academic performance of English language learners, the nature of the paths into and out of STEM (science, technology, engineering, and mathematics) curricula and occupations, and the educational and social experiences that affect these outcomes.

The research agenda was guided by a theoretical framework or conceptual model developed in the base year and that served to shape questionnaire content in both in-school rounds (i.e., fall 2009 base year and spring 2012 first follow-up). (The conceptual model appears as figure 1 in the *HSLS:09 Base-Year Data File Documentation* [Ingels et al. 2011].) This model uses the student as the fundamental unit of analysis and attempts to identify factors that lead to academic goalsetting and decisionmaking. It traces the many influences (including motivation, interests, perceived opportunities, barriers, and costs) on students' values and expectations that factor into their most basic education-related choices. The mathematics assessment registers a critical outcome—mathematics achievement gain in the first 2-and-a-half years of high school; mathematics results can also be used as a predictor of readiness to proceed into STEM courses and careers and to persist in them. The study design also reflects the interaction between students and their families in the base year and first follow-up. It taps, too, the perspective of school administrators and counselors on the learning environment of the school. For the base year only, data are also available from 9th-graders' mathematics and science teachers.[3]

The addition of high school academic transcripts provides a continuous longitudinal record of courses taken, credit accrual, and grades in the high school years (though

[2] HSLS:09 includes an assessment in algebraic reasoning that measures achievement growth in the span between high school entry in the fall of 9th grade and the spring term of the junior year of high school for most cohort members (i.e., those in modal grade progression). The dataset provides both a longitudinal number-correct scale score and probabilities of proficiency based on seven discrete levels of algebraic content (e.g., algebraic expressions, systems of equations, quadratic functions, and so on). The number-correct scores provide aggregated gain, while the proficiency probabilities present disaggregated gain, in which the disaggregation is based on where on the vertical scale (e.g., at which proficiency level) the gains take place. Standardized and raw theta (ability) scores are also available.
[3] The purpose of the HSLS:09 teacher surveys is to capture teachers' backgrounds, attitudes, and perceptions of the school climate. Information of this kind may contribute to the understanding of how teachers may encourage or discourage students in following the path to STEM and college. Teacher data were collected in fall 2009 and did not include ratings of the individual students the teacher taught, given the brevity of teacher-student exposure so early in the academic year.

for a subset of cohort members, this record is less than a 4-year 9th-grade through 12th-grade span for dropouts, early high school graduates, and those held back).

Analysis levels and design considerations. The base-year HSLS:09 data can be analyzed cross-sectionally at both the student and the school level—i.e., fall 2009 entering freshmen can be descriptively profiled using the HSLS:09 nationally representative student sample. Analysis at the school level is also possible, supported by the HSLS:09 nationally representative sample of high schools with 9th and 11th grades; however, comparatively few school-level analyses can be done with the public-use files because, for most purposes, the restricted-use files are required. HSLS:09 obtained information about the base-year schools from several sources: a school administrator questionnaire; school characteristics' variables taken from the sampling frame (the NCES Common Core of Data [CCD] and Private School Universe Survey [PSS]); and the school's course offerings, as provided by school catalogues employed in the high school transcript study.

In addition to the national samples of high schools and fall 2009 9th-graders, the data support analysis of a number of state representative samples (California, Florida, Georgia, Michigan, North Carolina, Ohio, Pennsylvania, Tennessee, Texas, and Washington); the state samples pertain to the public sector only, while the national sample includes Catholic and other private schools.

The representativeness of the school sample is lost after the base year as students disperse and some schools close or merge and new schools open. While school administrator and counselor data were collected in the first follow-up (indeed, administrator data were collected even from schools that were not part of the base-year sample but rather schools transferred to after the base year), its sole use is as contextual data for the student.

HSLS:09 attempts to preserve the best design features of the predecessor high school longitudinal studies, while updating and improving upon those prior studies and maintaining, wherever possible, past strengths. The data collection points for HSLS:09 were chosen for their research value, considered independently of the data collection points employed in earlier secondary longitudinal studies.

The base-year 9th-grade starting point was designed to capture, like NELS:88 (which started in 8th grade), the transition into high school. It does so without the financial costs of following a sample in which 95 percent of the cohort had changed schools by the time of the first follow-up 2 years later, as experienced in NELS:88. It also does so without the statistical problem faced by NELS:88 of not having both a

nationally representative high school sample and large within-high school cluster sizes for change measurement.

The HSLS:09 first follow-up took place when most students were in the spring term of 11th grade. It has often been observed that students in the spring of their senior year are disengaging from high school and not highly motivated to complete low-stakes assessments and questionnaires. Much thought has been given—e.g., in the National Assessment of Educational Progress (NAEP), which traditionally conducted 12th-grade as well as 4th- and 8th-grade assessments (see StandardsWork 2006)—to improving students' participation and effort. One possible approach to addressing this problem is moving the testing point to spring of 11th grade, and that strategy was embraced by HSLS:09.

The timing of the 2013 Update—the last half of 2013 after (modal) graduation—also reflects a conscious choice. Earlier studies took place in the spring term (as early as January and February) of senior year, a time point at which many sample members had yet to make final decisions about postsecondary schooling (or work). Much of the information about the decision process and its outcomes had to be collected, if at all, at the time of a follow-up 2 years after the senior year, when recollection of process details (including acceptances, rejections, and financial aid offers) had decayed. The Update's timing strengthens the HSLS:09 longitudinal design.

The timing of the upcoming second follow-up (with student questionnaire administration in 2016) likewise is based on specific research considerations. In the past studies, the interval between high school graduation and the follow-up questionnaire was 2 years. For HSLS:09, the interval will be 3 years. One benefit of this longer interval is having the opportunity to obtain, in addition to information on college access and choice, better information on subbaccalaureate attainment and persistence.

Finally, the expectation that students will be followed to at least age 30 seems to be an improvement on the NELS:88 and ELS:2002 choice of a terminus at age 26. An extra 4 years would not only be invaluable in learning about career choice and attainment and wider labor market issues, but also be beneficial because many of the measures in the secondary longitudinal studies, HSLS:09 included, have asked students about educational and career plans, anchored by age 30.

While HSLS:09 offers the design benefit of important new measurement points as well as a refreshing and updating of the questionnaire construct and item pool, there is a tradeoff that should be noted. A limitation of the new design is that specific cross-cohort comparisons cannot be made with the earlier secondary longitudinal

studies. Nor can comparison be made with the High School Transcript studies of the National Assessment of Educational Progress (NAEP). HSLS:09 is based solely on a fall 9th-grade cohort, while the prior longitudinal studies were based on spring-term 8th-, 10th-, or 12th-grade cohorts (see figure 1). NAEP transcripts are collected only for graduating seniors and are nationally representative for that population. Similarly, the links between the NAEP, NELS:88, and ELS:2002 mathematics assessments cannot be replicated within the HSLS:09 design.

A final point about the comparative structures of HSLS:09 and the two most recent of its predecessor studies pertains to sample "freshening," a device for cost-efficiently generating multiple grade-representative cohorts during a longitudinal study. There is but a single cohort in HSLS:09, not two (grades 10 and 12 as in ELS:2002) or three (grades 8, 10, and 12 as in NELS:88). The 9th-grade student sample is the sole cohort across all rounds. The earlier studies freshened the sample to represent later grades. This was done for a compelling reason: to facilitate cross-cohort comparisons (e.g., trends among high school seniors in 1972, 1980, and 1992). Because HSLS:09 has no specific cross-cohort comparison points within the family of NCES secondary longitudinal studies, the traditional rationale for freshening does not apply. Freshening also was made problematic by the fact that the 9th-grade sample does not represent all (or nearly all) 9th-graders (schools were eligible if and only if they had both a 9th grade and an 11th grade at the time of sampling).

Despite its cross-sectional utility for the sample in 2009, the primary use of the HSLS:09 base-year data will be in longitudinal analysis. This analysis will focus either on the high school years (e.g., the factors, including coursework as captured in transcripts, associated with gains in algebraic reasoning between fall 2009 and spring 2012) or on the period from the high school years to the post-high school rounds (e.g., analyses of subbaccalaureate attainment that can be related to student background characteristics or high school processes and curriculum).

Research and policy uses: base year and first follow-up. There are many topic areas that can be investigated within the high school context. These areas include the process of dropping out of high school; the resilience of students who persist despite multiple risk factors; the educational and occupational trajectories of students who remain in school but take extra time to graduate; achievement gains in mathematics and the correlates of academic growth; the role of family background (including social capital) and the home education support system in fostering students' educational success; the features of effective schools; and the equitable distribution of educational opportunities, as observed in gaps (or parity) in performance based on sex, race/ethnicity, disability, risk factors, or language minority status.

Research and policy uses: 2013 update. Following the two in-school rounds (fall 2009 base year and spring 2012 first follow-up), the 2013 Update was administered immediately after completion of secondary school (for those who graduated "on time"). The 2013 Update questionnaire consisted of objective questions that could validly be completed either by parent or student; there was no preference for which respondent should complete the comparatively brief interview. Although the 2013 Update questionnaire was brief (average completion time was approximately 17 minutes, about half the length of the base-year and first follow-up instruments), it was designed to elicit critical time-sensitive data about how students and their parents construct a postsecondary choice set. The 2013 Update provides information about status in summer-fall after the normative high school graduation, including educational status (high school completion, continued high school enrollment, high school dropout, and postsecondary attendance); work status; postsecondary education applications and financial aid; and work experiences. Detailed information about questionnaire content can be found in chapter 2 of this document. Chapter 2 also describes the questionnaire development process. A facsimile of the questionnaire is provided in appendix B.

The data collected in 2013 can be used as outcome variables predicted by earlier (base-year or first follow-up) data or as predictor or control variables for the postsecondary outcomes to be captured later, that is, in the second and third follow-ups.

Research and policy uses: high school transcripts. The HSLS:09 High School Transcript component data encompass coursetaking (including course sequence, grades,[4] and credits earned) for grades 9–12, although some transcripts are incomplete (e.g., those of dropouts, repeaters, or students whose records could not be obtained from schools for part or all of the high school years). While transcript data normally cover the period starting in the fall term of 2009 (9th grade) through the summer term of 2013, sometimes transcripts received also include pre-9th-grade information (or for 9th-grade repeaters, 2008–09 9th-grade data). Such pre-9th-grade courses—typically 8th-grade algebra or 8th-grade foreign language courses—are

[4] The fact of having two measures of mathematics performance—from transcripts, coursetaking, course sequence, and grades, as well as mathematics assessment scores—is of special interest. Research based on past NCES Secondary Longitudinal Studies (both NELS:88 and ELS:2002 assessments and high school transcripts) has investigated the relationship between these two data sources. Willingham, Pollack, and Lewis (2002) suggest that though grades and test performance are in part mutually validating, they nevertheless tend to differ to a degree. Some of this disagreement can be corrected using ancillary data. Other differences between grades and test scores give these measures valuably complementary strengths. Bowers (2011) finds that teacher-assigned grades supply an assessment of student ability in noncognitive aspects of school as well as academic knowledge.

included in the transcript file with associated attributes such as grade and credit when the student received high school credit for the courses.

Transcript data files can be analyzed on their own (as stand-alone restricted-use files) in conjunction with the study's standard classification variables (sex, race/ethnicity, school region, school locale, and so on). However, transcript information (e.g., grade point average overall or by a specific subject, highest mathematics course completed, and so on) can also be combined with the questionnaire and assessment data for analysis. A number of composite variables have been generated that summarize (and where there are multiple sources—e.g., academic transcript and questionnaire reports) and render consistent reports from academic records and questionnaire responses. Although the transcript dataset resides in a restricted-use file, many key transcript-based composites appear on the public-use files. (For details, see chapter 7 and appendix L.)

The secondary longitudinal studies high school transcripts may also be linked to postsecondary transcripts for high school cohort members who went on to postsecondary education, thus providing a strong basis for relating academic preparation in high school to coursetaking and attainment in higher education (Adelman 2006). At the high school level, evidence from HS&B (Cool and Keith 1991; Meyer 1998), NELS:88 (Rock and Pollack 1995), ELS:2002 (Bozick and Ingels 2008), and NAEP (Chaney, Burgdorf, and Atash 1997) suggests strong relationships between mathematics achievement and higher level coursetaking. The HSLS:09 mathematics assessments provide further scope for the use of the transcript data in exploring coursetaking and achievement and in ascertaining the role and impact of the various psychological variables in the base year and first follow-up, especially those that relate to mathematics identity, self-efficacy, and instructional experience.

Nevertheless, academic transcripts are not wholly without limitations. Though the transcript will usually be the best information source, there is always some level of possible error in administrative data. Additionally, highly similar or even identical course titles across schools do not always guarantee a high degree of similarity of course content (Cogan, Schmidt, and Wiley 2001). Nor does the HSLS:09 design provide for classroom observational studies that would describe the enacted curriculum and make what happens at a level below course titles more transparent. However, HSLS:09 includes a mathematics assessment, indeed an assessment that provides proficiency scores based on specific aspects of algebraic content domains and skills or processes, hence, the possibility in this critical subject area of, to a degree, inferring the rigor and topical coverage of courses.

Research and policy uses: second follow-up. Data pertaining to outcomes typically realized 3 years after high school completion will be collected in the spring 2016 second follow-up. In addition to the information obtained through interviews of participating sample members, data also will be obtained from file matching to external sources (e.g., federal student loan records) and, if the contract options are exercised, from postsecondary transcripts and institutionally provided financial aid data. Second follow-up data collection will include web and telephone interviews.

Because, in the 2016 second follow-up, most sample members will be 3 years beyond high school graduation, the chief foci will be access to postsecondary education, choice of postsecondary institution, and attainment of subbaccalaureate credentials. It will also be possible to study early persistence and transfer. The issue of choice spans postsecondary institutional type and sector (e.g., public and private 2-year and 4-year institutions) attended; intensity of attendance (e.g., full-time versus part-time); whether enrollment is at the "first-choice" institution; and the institution's location (e.g., urban, suburban, or rural; near home or distant). Choice also reflects institutional characteristics such as the appeal of the social and athletic environment, academic prestige or ethos, and availability of financial aid, all of which will be captured in the 2013 Update and the second follow-up.

The timing of the second follow-up also offers a window into attainment of 2-year degrees, postsecondary certificates, and certifications, whether granted by public institutions such as community colleges or by proprietary schools. The timing also provides an opportunity to view the transition from community college settings to 4-year programs for those sample members whose pathway treats 2-year institutions as a stepping-stone to 4-year institutions. Other topics that can be explored include family formation and early occupational choice (with an emphasis on STEM fields) and labor market experiences. Finally, the second follow-up (spring 2016), with its collection of data 3 years after the modal set of sample members has graduated, will also capture the educational, family formation, and labor market pathways of high school dropouts as well as those high school graduates who are unable to or decide not to participate in postsecondary education.

The second follow-up data on subbaccalaureate attainment specifically, and data on access and choice more generally, will be enriched in a timely fashion by information on 9th-grade cohort members' educational finance, enrollment patterns across institutions, coursetaking, and course performance as measured by grades.

Research and policy uses: 2025 round. A tentatively scheduled third follow-up in 2025 will address baccalaureate attainment and postbaccalaureate education, postsecondary educational persistence and rate of progress through the

postsecondary curriculum, and the influence of school transfer. The possible 2025 round also will provide a view of labor market outcomes from a perspective—age 30—that offers greater occupational stability and career growth than did the final rounds of the more recent predecessor secondary longitudinal studies (HS&B, NELS:88, and ELS:2002; see figure 1 for study terminus relative to respondent age). The HSLS:09 third follow-up in 2025 will capture baccalaureate and professional attainment, educational persistence, and economic rate of return for investments in education (including rate of return on STEM investments, contrasted to non-STEM domains) and provide further data about family formation, among other markers of young adulthood. Collection of postsecondary educational transcripts in 2025–26 will address information needs on educational persistence as well as baccalaureate and postbaccalaureate attainment, curriculum, and performance. Again, it should be remembered that all plans past the second follow-up are tentative. Additional follow-ups, either before or after age 30, may possibly be implemented.

In sum, HSLS:09 will help researchers, educators, and policymakers understand outcomes associated with the 9th-grade cohort's continued academic, social, and interpersonal growth in high school and thereafter. It will illuminate the transitions from postsecondary education to the workforce. It will also capture students' choices about, access to, and persistence in STEM courses and majors or alternative (non-STEM) educational and career pathways. Finally, it will help identify and understand the characteristics of educational institutions and curricula on student outcomes reflective of attainment of adult status, such as family formation (how prior experiences in and out of school relate to marital or parental status and how marital or parental status affects educational choice, persistence, and attainment); and the contexts of education, including how language-minority, low-SES, disability, racial/ethnic minority, and at-risk status are associated with young adult education and labor market outcomes.

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Chapter 2. 2013 Update Instrumentation, Sample Design, and Data Collection

2.1 Instrumentation

2.1.1 Goals and Constraints

The 2013 Update instrument was administered from June through December 2013, shortly after most sample members had graduated from high school and when many were transitioning to postsecondary education or entering the workforce. A survey at this time point is a new feature for the National Center for Education Statistics (NCES) high school longitudinal surveys. The goal of the 2013 Update was to efficiently collect information on sample members' status with respect to high school completion, postsecondary applications and enrollment, financial aid applications and offers, and employment. Two instrument design strategies were used to maximize the response rate. First, the instrument's response time was designed to average about 15 minutes, approximately half the length of the previous High School Longitudinal Study of 2009 (HSLS:09) instruments. Second, either the sample member or a parent could respond to the interview. Given this design, an effort was made to select factual questions that sample members and parents would respond to consistently. The data file includes a variable indicating whether the sample member or the parent was the respondent.

2.1.2 Development Process

NCES worked closely with RTI International to develop a draft questionnaire that was presented at a Technical Review Panel (TRP) meeting prior to the field test. Sources of items for the draft questionnaire included the HSLS:09 first follow-up instrument, the Education Longitudinal Study of 2002 (ELS:2002) second follow-up instrument, the 2012 National Postsecondary Student Aid Study (NPSAS:12), and the Virginia College Application Study. The panel was made up of researchers with expertise in high school and postsecondary education. The draft instrument was discussed at the same TRP meeting at which the first follow-up main study instrument was discussed so that each could inform the other. Reviewing the instruments together facilitated discussion of the optimal time point to ask each item under consideration as well as whether any items should be asked on both

questionnaires. NCES and RTI worked together to revise the draft questionnaire using input from the panelists as well as subsequent review from Office of Management and Budget (OMB).

The instrument was then programmed for web and computer-assisted telephone (CATI) administration in the field test. For approximately 100 sample member-parent pairs, the interview was administered to both individuals to evaluate the consistency of responses. After the field test, the TRP convened again to provide input on the instrument informed by field test analyses of item frequencies, response rates, and consistency of sample member and parent responses (see appendix A for the field test report). NCES worked closely with RTI to revise the instrument for the main study, taking the field test analyses and the TRP's input into account.

The instrument was designed for self-administration via the Web or CATI. In addition to the full-length version of the instrument, a 5-minute abbreviated version was developed for CATI, web, and paper-and-pencil self-administration.

2.1.3 Questionnaire Content

A facsimile of the survey instrument is presented in appendix B. The questionnaire flowchart is also shown in appendix B. A brief overview of the instrument content is provided below.

The questionnaire consisted of five sections. Section A focused on high school completion, enrollment in courses for college credit, and meetings with high school counselors and people who influenced the sample member's thinking about postsecondary education, financial aid, and careers.

Section B showed whether the sample member's activities as of November 1, 2013 included postsecondary enrollment, employment (including apprenticeships), serving in the military, and starting a family or taking care of children. Data collected from interviews before November 1 are predictive, whereas data collected on or after this date are based on actual experience. The data file includes a variable indicating whether the interview was completed before November 1, 2003 or on or after that date.

Detailed information on postsecondary enrollment and employment were collected in sections C, D, and E. Those who had not completed high school at the time of the interview were also asked about their high school enrollment and General Educational Development (GED) test preparation. Those who were working on a

high school diploma or GED as of November 1, 2013 (and not taking postsecondary classes) were routed around (i.e., did not answer questions in) sections C and D.

Section C collected detailed information about postsecondary enrollment and applications. Those who were attending a postsecondary institution as of November 1, 2013 reported the institution, the type of program in which they were enrolled, the field of study they were considering, and where they were living while attending. All sample members who had a high school credential were asked about postsecondary applications and registrations regardless of whether they were attending as of November 1, 2013. Questions pertained to the number of applications (including registrations at noncompetitive institutions), the two institutions that the sample member most seriously considered, the first choice among applications, the application status of the two most seriously considered applications, and their first choice among those institutions where they were accepted. Sample members who were attending a postsecondary institution were asked about the relative importance of various institution characteristics on their decision of where to enroll.

Section D focused on financial aid applications and offers. All sample members who had a high school credential were asked whether they had applied for financial aid, and, if not, why they had not. Sample members who were attending a postsecondary institution were asked to provide the total cost of their first year of enrollment before financial aid, how much they were borrowing, how much they received in scholarships and grants, and the types of financial aid they were offered by their institution. Sample members who were not attending their first-choice institution (among those where they were accepted) were asked about the total cost of enrollment and the types of financial aid they were offered at their first-choice institution. Sample members who had completed a high school credential but were not attending a postsecondary institution were asked to provide their reasons.

Section E collected information about employment. All sample members were asked about their employment as of the date of the interview. Questions included the job description, earnings, hours worked, how closely the job was related to their career goals, whether the job was an apprenticeship, when the job started, and whether the high school assisted the sample member in acquiring the position. Sample members also reported their earnings and their work hours for a second job if applicable. Finally, sample members were asked if their primary job as of the interview date was the same as the job held on November 1, 2013. If not, the job title and description for their job as of November 1, 2013 were also collected.

2.2 Sample Design

This section provides details of the sample design employed for the HSLS:09 2013 Update and High School Transcript study. The 2013 Update and High School Transcript sample consists of those study-eligible students selected for the base year in 2009–10 who are not deceased as of the 2013 Update. Therefore, succinct summaries of the school and student sampling used for the base year and first follow-up are provided in sections 2.2.1 and 2.2.2, respectively. The student sample for the 2013 Update and High School Transcript study is described in section 2.2.3.

2.2.1 Base-Year Sample Design

A summary of the base-year school and student samples and the corresponding target school and student populations for HSLS:09 are described in this section. The base-year school sample and population and the base-year student sample and population are described in section 2.2.1. The base-year samples form the basis for the first follow-up samples discussed in section 2.2.2, and the base-year student sample forms the basis for the 2013 Update and High School Transcript study sample discussed in section 2.2.3.

Selection of the school sample. HSLS:09 employed a stratified, two-stage random sample design with primary sampling units defined as schools selected in the first stage and students randomly selected from the sampled schools in the second stage. The HSLS:09 target population of schools was defined in the base year as regular public schools, including public charter schools and private schools in the 50 states and the District of Columbia providing instruction to students in both the 9th and 11th grades as of fall 2009. (For details of the rules for school inclusion or exclusion, see the *HSLS:09 Base-Year Data File Documentation* [Ingels et al. 2011].) A total of 944 of 1,889 eligible schools participated in the base year resulting in a 55.5 percent weighted school response rate (50.0 percent unweighted).

While HSLS:09 was designed to be representative of 9th-grade students in the 2009–10 school year in study-eligible schools across the United States (i.e., a national design), it also supports construction of select state-level estimates for students enrolled in 9th-grade public education in the fall of 2009. In particular, after receiving a request from the National Science Foundation for representative estimates within certain states, the design was augmented with additional sample schools to support the revised study objectives within 10 states (California, Florida, Georgia, Michigan, North Carolina, Ohio, Pennsylvania, Tennessee, Texas, and Washington). Additional information on construction of the HSLS:09 base-year

school sample may be found in the *HSLS:09 Base-Year Data File Documentation* (Ingels et al. 2011).

Selection of the student and contextual samples. The student target population contains all 9th-grade students as of fall 2009 who attended either regular public or private schools[5] in the 50 states and the District of Columbia that provide instruction in both 9th and 11th grades. This population is referred to as the "9th-grade cohort" in the subsequent discussions, where appropriate.

A sample of 26,305 students was randomly selected from the 944 participating schools in the base year. During base-year recruitment, 1,099 students (4.2 percent unweighted) were classified as study ineligible and excluded from the data collection rosters, yielding 25,206 study-eligible students. Student participants completed an in-school survey and mathematics assessment.

Contextual information was collected on the student sample to describe the home and school environments. Home life and background information was obtained through students' parent questionnaires. School information was obtained through the students' administrator and counselor questionnaires. Students' teacher questionnaires (completed by science and mathematics teachers linked to the sampled student) captured information on teacher background and preparation, school climate, and subject-specific and classroom practices.

Additional information on selection of the HSLS:09 base-year student and contextual samples may be found in the *HSLS:09 Base-Year Data File Documentation* (Ingels et al. 2011).

2.2.2 First Follow-Up Sample Design

The first follow-up school and student target populations are the same as defined for the base year.

First follow-up school sample. All of the 944 base-year participating schools were eligible for the HSLS:09 first follow-up. No new sample of schools was selected for the first follow-up. Therefore, the base-year school sample in the first follow-up is not representative of high schools with 9th and 11th grades in the 2011–12 school year but is intended as an extension of the base-year student record that may be used to analyze school-level effects on longitudinal student outcomes. Four of the 944 base-year sampled schools were no longer in operation as of the first follow-up, and

[5] Regular public schools also include public charter schools.

one school no longer had any base-year sampled students. Additional information on the HSLS:09 first follow-up school sample may be found in the *HSLS:09 Base-Year Data File Documentation* (Ingels et al. 2013).

First follow-up student and contextual samples. All 25,206 base-year study-eligible students, regardless of their response and enrollment status, were included in the first follow-up sample. Unlike prior NCES high school longitudinal studies (the National Education Longitudinal Study of 1988 [NELS:88] and the Education Longitudinal Study of 2002 [ELS:2002]), the HSLS:09 student sample was not freshened to include a representative later-grade cohort (such as 11th-graders in HSLS:09). Therefore, first follow-up estimates from the sample are associated only with the 9th-grade cohort 2.5 years later, and not the universe of students attending the 11th grade in the spring of 2012.

Some students were deceased as of the first follow-up, withdrew from HSLS:09 prior to the first follow-up, or were determined to be study ineligible for HSLS:09 as of the first follow-up. The number of students in each of these categories is not provided due to small sample sizes, though these students are included among the 248 sample members represented in the oval box labeled "Study withdrawal, deceased, or study ineligible" in figure 3 below. The 2013 Update is representative of the HSLS:09 target population of 9th-grade students who are currently alive.

The student questionnaire explored a variety of topics that include, but are not limited to, high school attendance, grade progression, school experiences, demographics and family background, completion of admission tests, college choice and characteristics, and high school coursetaking. Contextual information was collected for the student sample to describe their home and school environments. Home life and background information was obtained through students' parent questionnaires. The first follow-up parent questionnaires were administered to the parents of a random subsample of students, whereas parent questionnaires were sought for all students in the base year. School information was obtained through the students' administrator and counselor questionnaires; however, administrator data were collected at both the base-year schools and the schools to which sample members transferred. Counselor data were collected in the first follow-up only from base-year high schools. Additional information on selection of the HSLS:09 first follow-up student and contextual samples may be found in the *HSLS:09 Base-Year Data File Documentation* (Ingels et al. 2013).

2.2.3 2013 Update and High School Transcript Study Sample Design

The 2013 Update and High School Transcript student target population is the same as defined for the base year. The sample consists of those study-eligible students selected for the base year in 2009–10 who are not deceased as of the 2013 Update.

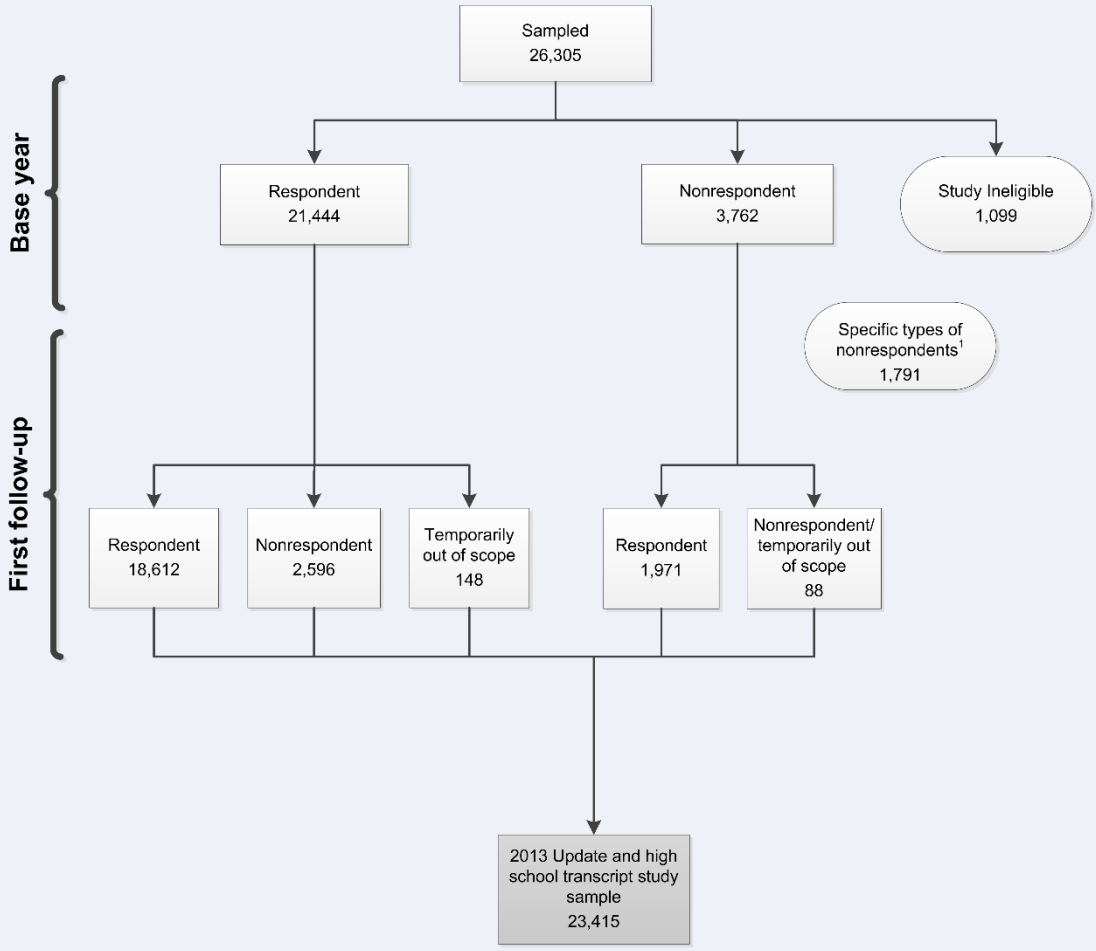
Prior to the start of the 2013 Update data collection and after the first follow-up, a small number of students were found to be deceased, and these students are included among the 248 sample members represented in the oval box labeled "Study withdrawal, deceased, or study ineligible" in figure 3 below. A total of 25,206 − 248 = 24,958 of the base-year sample members were study eligible, alive, and had not withdrawn from the HSLS:09 study as of the HSLS:09 2013 Update.

While all 24,958 sample members could have been fielded for the 2013 Update, 1,543 sample members were excluded because neither base-year nor first follow-up data were collected for them. There are three reasons why the 1,543 sample members have neither base-year nor first follow-up data. The majority of the 1,543 excluded students did not respond in either the base year or the first follow-up, while some did not respond in the base year and were unavailable for data collection in the first follow-up because they were out of the country, institutionalized, or incarcerated. A small number of the 1,543 excluded students were incapable of completing the first follow-up questionnaire due to language, intellectual, or physical barriers. The distribution of the 1,543 excluded sample members across the three reasons for lack of data is not provided out of confidentiality concerns.

In the base year and the first follow-up, a small percentage of cases were determined to be questionnaire incapable. Questionnaire incapable cases are those who, owing to severe disability or language barrier, could not validly complete the study instruments, in particular, the questionnaire. The study design was to continue to follow these cases, whose status might change over time. Therefore, there are 88 sample members who are included in the 2013 Update even though they did not respond in the base year or in the first follow-up.

The questionnaire capability status of these 88 sample members is not provided by study round in order to reduce potential disclosure concern. A total of 24,958 − 1,543 = 23,415 students were fielded for the HSLS:09 2013 Update. A flowchart of student response categories and counts from the base year up to the start of the 2013 Update is provided in figure 3.

Figure 3. Flowchart of student response categories and counts from base year up to the start of the 2013 Update: 2013



[1] Includes students incapable of completing the first follow-up questionnaire due to language, physical, or intellectual barriers; questionnaire-capable students who responded in neither the base year nor the first follow-up; as well as deceased and study withdrawal sample members.
SOURCE: U.S. Department of Education, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09).

2.3 Data Collection Methodology and Results

This section describes the data collection procedures employed during the 2013 Update of the HSLS:09. Section 2.3.1 provides a brief overview of the results for each of the first three rounds of the HSLS:09 data collection. Section 2.3.2 describes the pre-data collection activities, such as batch tracing, the panel maintenance mailing, and telephone interviewer (TI) trainings. Data collection procedures employed over the seven distinct data collection phases are described in section 2.3.3. Quality control strategies including help desk operations, TI monitoring

sessions, and regular meetings between project supervisors and TIs are discussed in section 2.3.4. The seven phases were implemented to minimize nonresponse bias, as described in section 2.3.5. Section 2.3.6 provides a report of the data collection results. Included in this section are discussions about both the average time to complete a questionnaire and response rates, the latter of which are presented for the entire data collection and by selected student characteristics.

2.3.1 Data Collection Results Summary

The Data File Documentation reports for the base year and first follow-up describe the procedures and results for the base-year and first follow-up data collections conducted in 2009 and 2012, respectively (see Ingels et al. 2011; 2013). Table 1 presents student-level results for each of the three rounds of HSLS:09 data collection.

Table 1. Student questionnaire participation rates by round of data collection: 2009–13

Data collection[1]	Fielded[2]	Participated	Unweighted participation rate
Base-year	25,206	21,444	85.1
First follow-up	25,184	20,594	81.8
2013 Update	23,401	18,558	79.3

[1] Response rates are provided for the student questionnaire. Base-year and first follow-up data collections included separate questionnaires for student and parent sample members. The 2013 Update, however, only included one student instrument that could be completed by either the student or a parent/guardian.
[2] 25,206 cases were eligible for the base-year collection; 25,184 cases were eligible for fielding in the first follow-up collection (22 students were identified as ineligible/deceased). The 2013 Update sample included 23,327 cases who completed a base-year or first follow-up student questionnaire. The 2013 Update sample also included 88 cases who had been identified, but not confirmed, as questionnaire incapable. Thus, the 2013 Update fielded sample was 23,415 students. During the 2013 Update data collection, 14 students were found to be deceased and removed from the questionnaire sample (but not the transcript sample), for a total of 23,401 eligible sample members. Calculating the response rate based on the full (unconditional) sample and the base weight, the 2013 Update data collection would result in a response rate of 73.1 percent. Eighty-eight cases, not among those identified as questionnaire incapable, who participated in either the base year or first follow-up study were excluded from the 2013 Update sample because they had been found to be deceased or a study withdrawal. However, these 88 cases are included on all data files because prior-round response data exist for these cases.
SOURCE: U.S. Department of Education, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09) Base Year, First Follow-Up, and 2013 Update.

In this chapter, data collection outcomes are expressed in a *participation rate*, the denominator of which represents the cases that were actually fielded. The participation rate quantifies the degree of success in data collection. The fielded sample supports a methodological product: it shows how well the data collectors did with the cases they were given. Because the point of the participation rate is to make a statement about the fielded *sample* (a subset of the cases), not the *population*, the participation rates are calculated using unweighted data. On the other hand, in the statistical documentation in chapter 6, *response rates*—using the base weight—are

reported that use a larger denominator (for questionnaire completion, the deceased are excluded).[6]

2.3.2 Pre-Data Collection Activities

This section describes the activities used to prepare for the 2013 Update data collection, including batch tracing and panel maintenance activities and call center trainings. Table 2 shows the common abbreviations used in section 2.3.2, and table 3 lists the major dates and milestones during data collection.

Table 2. Data collection abbreviations: 2013

Abbreviation	Name
QCS	Quality Control Specialist
QE	Quality Expert
TI	Telephone Interviewer
CATI	Computer-assisted telephone interview
CMS	Case Management System
PAPI	Paper and pencil interview
QC meeting	Quality circle meeting

SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update.

[6] In follow-up rounds to a longitudinal study, typically not all eligible baseline cases will be released for data collection. There are out-of-scope sample members (e.g., a sample member is abroad or incarcerated or is hospitalized and incapacitated), who are not fielded in a given round but remain eligible in future rounds, when their status may change. Likewise, there are sample members who have withdrawn from the study and have requested that they not be re-contacted; these cases too will not be fielded, nor (for the 2013 Update) will be sample members who were nonrespondents both in the base year and first follow-up. Although such cases will not be fielded, they remain central to population estimation as part of the full sample; an adjustment must be made in the weights to reflect their nonresponse. For purposes of comparing and evaluating response rates across different NCES studies, the full sample in weighted form should be used (NCES Standard 1-3, Seastrom 2014).

Table 3. Major dates and milestones for 2013 Update activities: 2013

Date	Activity
May 31	Data collection letters mailed
June 1	Phase 1 (Web-only data collection)[1]
June 24	Phase 2 (CATI data collection)
July 29	Phase 3 ($5 prepaid incentives)
Aug. 23	Phase 4 ($15 promised incentives)
Sep. 24	Phase 5 ($25 promised incentives)
Nov. 4	Phase 6 (Additional $5 prepaid and $25 incentives)
Dec. 10	Phase 7 (Abbreviated and PAPI questionnaires)
Dec. 31	End of data collection

[1] Cases with students identified as ever having dropped out of high school were offered a $40 incentive to complete a questionnaire throughout data collection. Nonresponding dropout cases were also offered the $5 prepaid incentive in phase 3.
NOTE: CATI = Computer-assisted telephone interview. PAPI = Pencil and paper interview.
SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update.

Pre-data collection batch-tracing and panel maintenance activities. Data collection for the 2013 Update occurred during a period of increased sample mobility as many students were transitioning out of high school. It was therefore important to ensure that the contact information (e.g., addresses and telephone numbers) for each sample member was up to date. Thus, HSLS:09 utilized third-party batch tracing services and sent a panel maintenance mailing to sample members before the start of data collection.

In April 2013, RTI sent a data file to batch-tracing vendors that included contact information for each case. The data file included the best-known address and telephone number for one or both parents and for all students who were at least 18 years old. The vendors verified that the information was correct or provided new information for each case in the data file. RTI then updated the HSLS:09 locator database with any new contact information.

In May 2013, students and parents received e-mails asking them to update their contact information on the study website. The e-mails informed the students and parents that they would receive a reminder in the mail after a few days. The mailing included information for the student or parent to log in to the study website and update contact information. The mailing also included a hardcopy form and business reply envelope to provide students and parents with the option of providing updated contact information in hardcopy form. The panel maintenance mailing was sent directly to students aged 18 or older or to the parents of students under age 18.

Interviewer training. The first Telephone Interviewer (TI) training was conducted during the final week of May 2013, before the start of data collection on June 1, 2013. During the first 3 weeks of data collection, students and parents could

complete a questionnaire on the Web or by telephone (see section 2.3.3 below). The first TI training included approximately a dozen Quality Control Supervisors (QCSs), Quality Experts (QEs), and TIs who were trained to answer questions, provide technical assistance, and conduct telephone interviews as requested. Additional TIs were trained 3 weeks later before the start of outbound CATI data collection, which began on June 24, 2013. Additional TI trainings were conducted in September and November 2013.

Trainers certified each TI before the TI began production activities. The certification areas included working with the CATI-Case Management System (CATI-CMS), administering the questionnaire, and answering student and parent questions. Table 4 presents the TI training agenda.

Table 4. Interviewer training agenda: 2013

Day 1	Day 2	Day 3	Day 4
Overview of Study	Coders Overview	Help desk	Coders Practice
Confidentiality	Front End Overview Cont.	Mock interviews	Front End Practice
Your Role as an HDA/TI	QxQ Overview	Front End Overview Cont.	Wrap Up/Questions
Frequently Asked Questions	Round Robin	FAQ Review	Certification
Front End Overview	Wrap-Up/Questions	Monitoring/Supervision	
Wrap-Up/Questions		Wrap-Up/Questions	

SOURCE: U.S. Department of Education, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09) 2013 Update.

QCSs and QEs supervised and assisted telephone interviewers. QEs also monitored telephone interviews and contact attempts for quality control. TIs were trained to locate, contact, and conduct interviews with student and parent sample members. Tracers used proprietary databases to locate sample members after TIs exhausted existing contact information. Select TIs were identified and trained to work as refusal conversion specialists.

2.3.3 Data Collection Methods

The 2013 Update data collection was conducted between June 1 and December 31, 2013. This section describes the data collection procedures implemented for the 2013 Update data collection.

Contacting procedures. An initial mailing was sent to all sample members to announce the commencement of data collection and provide information on how to participate. Nonrespondents received regular data collection reminders via mail and e-mail. The primary purpose of these reminders was to prompt students and parents to participate in the study.

For cases with a student who was under the age of 18, parent letters also included a sealed envelope with a letter addressed to the student. These letters requested that the sealed envelope be given to the student that would indicate the parent's implied consent for the student to take part in the study. Parents could also provide their explicit permission via the study website. If parents did not provide permission in either of these two ways, TIs prompted parents to provide permission over the telephone. After parents provided permission, students received letters, e-mails, and telephone contacts directly.

Responsive design-based approach to target nonrespondents. Responsive design approaches divide the data collection period into multiple phases to reduce different sources of survey error within cost constraints (Groves and Heeringa 2006). In this study, these phases included various protocols for handling different sample members to reduce the potential for biased survey estimates or reduce data collection costs (Peytchev 2013). The remainder of this section details the responsive design approach used in the 2013 Update data collection.

The responsive design approach developed for the 2013 Update was based on approaches used in previous NCES studies. It aims to reduce nonresponse bias in survey estimates by directing effort and resources during data collection to sample members who are most unlike the current responding cases. To successfully target nonrespondent cases, two related conditions have to be met: the targeted cases have to be underrepresented among survey respondents, and the change in data collection procedures has to be effective at increasing participation among this group.

To identify target cases, a response indicator (R) identifies nonresponding cases that are underrepresented for covariates (Z). When values of Z are strongly related to survey estimates of interest (Y), then Z can be used to identify cases that can reduce nonresponse bias. That is, nonresponse bias arises when there is a significant relationship between R and Y, and Z can act as either proxies for Y or at least correlates of Y. The goal for this responsive design approach was to identify cases with the values of Y associated with lower response rates. Those cases are then targeted with an intervention, directly addressing nonresponse bias in key survey estimates.

The key criterion for selecting covariates Z is a strong association with Y, including those that measured Y in a prior wave, and any that indicate change over time for the estimates of interest. A second set of criteria for selecting covariates Z are those used in weighting, as well as those used to define subdomains for analysis, such as demographic variables. Selecting covariates based on these criteria should reduce the

variance inflation resulting from weighting and nonresponse bias in comparisons across groups within the sample.

However, it is key to exclude covariates *Z* that are highly predictive of *R* while at the same time are unrelated to *Y*. These types of covariates, such as the number of prior contact attempts and refusals, can mask the relationship between *Z* and *Y* in models predicting the likelihood of participation. The approach implemented for the 2013 Update incorporates response propensities and survey estimates into a single model. Section 2.3.6 includes a discussion of the results of the responsive design-based approach.

Data collection phases. The 2013 Update data collection utilized a responsive design approach with seven distinct phases (see table 3 in section 2.3.2). The phases targeted nonrespondents to address potential nonresponse bias (see section 2.3.5 for a discussion of the responsive design approach).

- *Phases 1 and 2*. The first phase of data collection began on June 1, 2013. During the first phase, students and parents were asked to complete the questionnaire over the Web. During the second phase, which began on June 24, 2013, and continued for 5 weeks, TIs began calling students and parents to complete the questionnaire over the telephone as an alternative to the self-administered Web questionnaire, which was available throughout data collection. During phases 1 and 2, no monetary incentives were employed for nondropout cases.
  A total of 1,974 cases with a student identified as having ever dropped out of school received an offer of $40 to participate in the study.[7] Except as noted, all ever-dropout cases received an offer of $40 through the end of data collection.
- *Phase 3*. After the first two phases, response propensities were calculated, and more than 6,500 cases received a $5 prepaid incentive in phase 3. Nonresponding cases with a student identified as ever having dropped out of school also received the $5 prepaid incentive in addition to the offer of $40 to complete the questionnaire.
- *Phase 4*. Four weeks after the start of phase 3, response propensities were recalculated for all nonresponding cases. Approximately 4,700 cases received letters offering $15 to complete an HSLS:09 questionnaire. About 70 of the cases targeted in phase 4 had received the $5 prepaid incentive in phase 3. Nonresponding cases with a student identified as ever having

[7] Dropout students included students who stopped attending school for a period of 4 weeks or longer, not including early graduates or homeschooled students.

dropped out of school continued to receive an offer of $40 to complete the questionnaire.

Phase 5. Four weeks after the start of phase 4, response propensities were recalculated a final time for remaining nonresponding cases. A total of 3,600 targeted cases received letters offering $25 to complete an HSLS:09 questionnaire. The 3,600 targeted cases included approximately 3,400 who received the $5 prepaid incentive in phase 3, were offered the $15 incentive in phase 4, or both. Nonresponding cases with a student identified as ever having dropped out of school continued to receive an offer of $40 to complete the questionnaire. A partial shutdown of the federal government began on October 1, 2013, approximately 2 weeks after the start of phase 5. As a result, the project was required to suspend all contact with students and parents and the study servers were shut down. HSLS:09 data collection resumed after the partial shutdown was lifted on October 17, 2013. The following day, letters and e-mails were sent to sample members announcing the reopening of data collection, and TIs resumed outbound CATI calls. After the end of the shutdown, project supervisors conducted an attrition training to account for the TIs who had resigned from the project to find other employment.

- *Phase 6*. The sixth phase began on November 4, 2013. During phase 6, additional cases were incentivized to bolster response rates after the partial government shutdown. To identify cases who had not been incentivized in a previous phase, response propensities calculated before phase 5 were used to determine which cases to incentivize. The cases selected to receive a phase 6 incentive were those cases with the lowest response propensities who had not been previously incentivized.

  Approximately 2,700 new cases received a $5 prepaid incentive, an offer of a $25 incentive, or both. Of the 2,700 cases, approximately 600 cases received the $5 prepaid incentive in phase 3 and were therefore only offered the $25 incentive in phase 6. All of the remaining 2,100 cases received a $5 prepaid incentive. Of these cases, more than 900 cases also received an offer of $25 to complete a questionnaire. Nonresponding cases with a student identified as ever having dropped out of school continued to receive an offer of $40 to complete the questionnaire.
- *Phase 7*. The seventh and final phase began on December 10, 2013. Web and CATI questionnaires were shortened in phase 7, so most sample members could participate in approximately 5 minutes. Phase 7 also included a paper and pencil interview (PAPI) form, which nonresponding sample members received at the start of the phase. No changes to the incentive dollar amounts occurred in phase 7, and nonresponding cases with a student

identified as ever having dropped out of school continued to receive an offer of $40 to complete the questionnaire.

Telephone interviewer production. In addition to mail and e-mail contacts, students and parents were also contacted via telephone. The telephone calls served two purposes. First, TIs could locate students and parents to conduct the interview over the telephone. Second, TIs prompted students and parents to complete a Web questionnaire if they were unable or unwilling to complete the questionnaire in CATI.

The 2013 Update collected data about the student from either the student or the student's parent or guardian. Once the TIs reached either the student or a parent, the TIs attempted to complete the questionnaire with the person on the phone. If the person on the phone was a parent, the TIs also asked for updated student contact information when parents were unavailable or unwilling to take part in the 2013 Update.

Approximately 20 percent of the students in the sample were minors (i.e., under the age of 18) when data collection began in June 2013. As discussed in section 2.3.3, parents received requests to provide their permission for their minor students to participate in the 2013 Update study. TIs asked for permission to contact students when parents were unavailable or unwilling to participate in the study. Over the course of data collection, as students turned 18, the parental consent requirement was removed.

The TIs logged about 25,000 CATI hours, which was an average of 3.2 hours per call. TIs made approximately 400,000 call attempts to students and parents during data collection. About 30 percent of these calls were associated with a completed student questionnaire, and about 26 percent were associated with a completed parent questionnaire. The remaining 44 percent—roughly 175,000 call attempts—went to nonresponding cases. Respondents and nonrespondents averaged 16.6 and 37.4 call attempts, respectively.

The average number of call attempts varied by mode. Completed Web and CATI questionnaires required about 15.7 and 16.3 call attempts, respectively. As detailed above in the description of phase 7, nonresponding students and parents received PAPI forms during the final 3 weeks of data collection. Cases who completed a PAPI form required an average of 51.7 call attempts over the course of data collection.

2.3.4 CATI Quality Control Procedures

The following sections describe the quality control processes during data collection, including a help desk, TI monitoring sessions, and regular meetings with TIs.

Help desk. The 2013 Update study staffed a help desk to assist sample members in completing the Web questionnaire. Letters and e-mails provided a telephone number and e-mail address for sample members to reach the help desk. Sample members could also reach the help desk using a contact form on the study website. Sample members called the help desk most often to ask questions about the study or to request their log-in information. Less often, sample members called the help desk to ask about missing incentive payments or to refuse to participate in the study.

Interviewer monitoring. Project supervisors monitored interviewer productivity on a regular basis. The monitoring system allowed supervisory staff to listen to (1) live interviews and contact attempts in real time or (2) previously recorded interviews. Live monitoring sessions allowed supervisors to provide immediate feedback to TIs. Monitoring previously recorded interviews allowed supervisors to select specific interviews or to review cases from a specific TI for monitoring.

Quality circle meetings. Quality Circle (QC) meetings allowed project supervisors to maintain a direct line of communication with the TIs. Besides providing TIs with updates about data collection progress, other meeting topics included locating and gaining cooperation from students and parents, dealing with reluctant respondents and converting refusals, coding responses, and communicating case-specific issues as they arose. Project supervisors conducted weekly QC meetings during the first 2 months of data collection. After the first 2 months, QC meetings were held every other week. At the end of data collection, project supervisors conducted a debriefing meeting with the call center staff to get their input about working on the project.

2.3.5 Responsive Design Methodology

The following section describes the responsive design methodology that provided a plan for maintaining bias-minimizing response rates.

Implementation and evaluation of the responsive design plan for targeting nonrespondents: selection methodology. The 2013 Update responsive design methodology consisted of seven phases (see section 2.3.2 above) that provided a plan to (1) target sample members identified as ever having dropped out of school, (2) calculate response propensities to select cases for incentives at several points during collection, and (3) offer abbreviated and PAPI questionnaires to all

nonrespondents. Targeted cases included underrepresented, nonresponding cases whose survey estimates after completing a questionnaire would likely be different from those who responded.

The propensity model developed for the 2013 Update data collection incorporated both survey variables and demographic variables from prior rounds. The dependent variable for all propensity models was survey outcome (i.e., response or nonresponse) at the time that the model was run. The goal of the model was not to *maximize* the ability to predict the survey outcome. Rather, the goal was to use a prediction of the likelihood to participate in order to identify nonresponding cases who may reduce nonresponse bias if interviewed.

The models excluded paradata (e.g., such as the number of call attempts or the number of refusals during the 2013 Update data collection) and other variables that were highly predictive of response but unrelated to the survey estimates of interest. Using survey estimates in the models required using single imputations to provide missing values for model variables. After imputing missing values, the distributions of the model estimates were examined and categories collapsed when cell sizes were less than 4 percent. Table 5 shows the estimates used in the final model.

Table 5. Estimates used in final propensity model: 2013

Variable	Label
X2ENROLSTAT	First follow-up enrollment status
X2RACE	Student race
S2ALG1WHEN	Grade when student took Algebra I
S2ALG1GRADE	Student's final grade in Algebra I
X1STUEDEXPCT	How far student expected to go in school as of base-year data collection
X1PAREDEXPCT	How far parent expected student to go in school as of base-year data collection
X2STUEDEXPCT	How far student expected to go in school as of first follow-up data collection
X2PAREDEXPCT	How far parent expected student to go in school as of first follow-up data collection
X2FREELUNCH	National School Lunch Program status

SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update.

The same logistic regression was performed before the start of phases 3, 4, and 5. Because the study targeted those cases that were found to be the least likely to participate in the 2013 Update, many of the same cases were targeted in each phase.

Evaluation of targeting methods and intervention effectiveness. This section reviews the effectiveness of the responsive design model used to target cases for incentives during data collection. The results of the responsive design approach on survey estimates and nonresponse bias can be found in chapter 6. That chapter presents weighted and unweighted key survey estimates and estimates of nonresponse bias for each variable used in the model:

$$\left|\frac{\overline{y}_r - \overline{y}_s}{\overline{y}_s}\right|$$

where $\overline{y}_r$ is the respondent mean and $\overline{y}_s$ is the sample mean.

Model effectiveness. The responsive design approach requires that nonresponding cases be identified with survey responses that are underrepresented among the respondents. The tables in appendix M show each model variable and the proportion of cases within four groups, by phase: (1) the entire sample, (2) the set of respondents by phase, (3) the nonresponding cases selected for intervention, and (4) the nonresponding cases not selected for intervention.

The general pattern across all model variables indicates that the model effectively selected cases who were underrepresented among the respondents. For example, table 1 in appendix M shows the phase 3 breakdown across the model variables. The timing of the Algebra 1 variable is illustrative of the general trend. In the entire sample:

- 30.7 percent took Algebra 1 in 8th grade;
- 56.8 percent took Algebra 1 in 9th grade;
- 8.4 percent took Algebra 1 in 10th grade; and
- 4.2 percent took Algebra 1 in 11th or 12th grades or did not take Algebra 1.

Among respondents at the start of phase 3:

- 39.2 percent took Algebra 1 in 8th grade;
- 49.8 percent took Algebra 1 in 9th grade;
- 7.4 percent took Algebra 1 in 10th grade; and
- 3.6 took Algebra 1 in 11th or 12th grades or did not take Algebra 1.

If the model effectively targeted cases, we should see these differences among the targeted set of cases.

Among the respondents at the start of phase 5:

- 35.1 percent took Algebra 1 in 8th grade;
- 53.1 percent took Algebra 1 in 9th grade;
- 8.0 percent took Algebra 1 in 10th grade; and
- 3.8 took Algebra 1 in 11th or 12th grades or did not take Algebra 1.

Changes in this survey estimate between the start of phase 3 and the start of phase 5 appear to move in the direction of the estimates for the entire sample. These results suggest that targeted cases did account for discrepancies between the entire sample and the set of respondents.

Intervention effectiveness. The responsive design plan specified an intervention for each phase to increase participation. The intervention in each phase included a different combination of treatments, which included (1) prepaid incentives, (2) promised incentives, and (3) an increased dollar amount of promised incentives. Because a control group was not included in the research design, it is not possible to conduct an experimental analysis of the responsive design plan. However, cases not targeted with incentives can serve as a baseline for the pattern of response over the course of the data collection. During data collection, disproportionate increases in the response rates of targeted cases would help to identify effective intervention strategies. While smaller increases in response rates were expected in later phases, overall participation among targeted cases was expected to increase with each phase relative to nontargeted cases, which only received outbound telephone calls.

Table 6 displays participation rates during each phase by ever-dropout, nontargeted, targeted, and previously targeted cases. The highest participation rates for both ever-dropout cases (34 percent) and nontargeted cases (31 percent) occurred during phase 2. As seen in table 6, the lowest participation rate for three of the four categories occurred during phase 5. This may be an unintended consequence of the partial government shutdown, which began less than 2 weeks after the start of phase 5.

Excluding cases identified as ever having dropped out of school, targeted cases became incentivized during phases 3, 4, 5, and 6. Table 6 demonstrates that targeted cases had higher participation rates than nontargeted cases in each phase besides phase 3. The highest participation rate occurred during phase 6 (26 percent), and the lowest rate occurred during phase 3 (16 percent).

Table 6. Participation rates for all cases, ever-dropout cases, nontargeted cases, targeted cases, and previously targeted cases by phase of data collection: 2013

	All cases					Ever-dropout			Nontargeted			Targeted			Previously targeted		
		Responses															
	Number of	By phase		Cumulative		Number	Responses		Number	Responses		Number	Responses		Number	Responses	
Phase	cases[1, 2]	N	%	N	%	of cases	N	%	of cases	N	%	of cases	N	%	of cases	N	%
1	23,415	3,700	15.8	3,700	15.8	1,974	490	24.8	21,441	1,210	15.0	†	†	†	†	†	†
2	19,715	6,207	31.5	9,907	42.3	1,484	497	33.5	18,231	5,710	31.3	†	†	†	†	†	†
3	13,508	2,585	19.1	12,492	53.4	987	280	28.4	6,183	1,267	20.5	6,338	1,038	16.4	†	†	†
4	10,923	2,213	20.3	14,705	62.8	707	120	17.0	4,845	1,000	20.6	4,731	991	21.0	640	102	15.9
5	8,710	1,181	13.6	15,886	67.8	587	82	14.0	3,777	412	10.9	3,627	603	16.6	719	84	11.7
6	7,529	1,547	20.6	17,433	74.5	505	87	17.2	1,357	257	18.9	2,706	710	26.2	2,961	493	16.6
7	5,982	1,125	18.8	18,558	79.3	418	65	15.6	1,100	227	20.6	†	†	†	4,464	833	18.7

† Not applicable.
[1] The 2013 Update began data collection with a sample of 23,415 students. During data collection, 14 of these students were found to be deceased, so the total number of sample members fielded during the 2013 Update was 23,401.
[2] In addition to the 23,415 cases, 88 cases who participated in either the base year or first follow-up study were excluded from the 2013 Update sample because their status was deceased, ineligible, or a study withdrawal. However, these 88 cases are included on 2013 Update data files because prior-round response data exist for these cases.
SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update.

Table 7 shows response outcomes for standard (full-length) and abbreviated questionnaires by student and parent respondents and data collection mode. Overall, about 62 percent of standard questionnaires were completed by student sample members for ever-dropout cases and targeted incentive cases. However, the proportion of parent and student respondents completing a questionnaire was about the same when no incentive was offered.

Table 7. Percentage of completed standard questionnaires, abbreviated questionnaires, by respondent type, questionnaire type, and data collection mode: 2013

	Respondent type		Interview type		Data collection mode		
Incentive	Student	Parent	Standard	Abbrevi-ated	Web	CATI	PAPI
Both questionnaire types							
No incentive	49.2	50.8	98.3	1.7	58.7	41.0	0.3
Ever dropout	60.9	39.1	95.9	4.1	60.1	38.5	1.3
Targeted	61.0	39.0	84.1	15.9	45.9	51.1	3.0
Standard questionnaire							
No incentive	49.2	50.8	†	†	59.3	40.7	†
Ever dropout	61.6	38.4	†	†	61.5	38.5	†
Targeted	61.5	38.5	†	†	48.4	51.6	†
Abbreviated questionnaire							
No incentive	46.5	53.5	†	†	28.7	55.4	16.0
Ever dropout	46.5	53.5	†	†	27.9	39.4	32.8
Targeted	58.0	42.0	†	†	32.3	48.8	18.9

† Not applicable.
NOTE: CATI = Computer-assisted telephone interview. PAPI = Pencil and paper interview.
SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update.

As noted in section 2.3.3, cases with a student who had ever dropped out of high school were offered an incentive of $40 to complete a questionnaire for the 2013 Update. Table 8 presents unweighted participation rates for cases who had ever dropped out of high school, were offered no incentive, and were targeted for an incentive during one of the seven data collection phases (see section 2.3.3). At the end of data collection, cases who had ever dropped out of school had an 82 percent unweighted participation rate. The unweighted participation rate for all other completed cases besides the ever-dropout cases was 78 percent.

Table 8. Summary of 2013 Update participation rates for dropout cases, cases who were not offered an incentive, and targeted cases: 2013

	All cases[1]	Completed	Unweighted participation rates
Total	23,401	18,558	79.3
Dropout	1,973	1,621	82.2
No incentive[2]	12,951	12,083	93.3
Targeted	8,477	4,854	57.3

[1] An additional 88 cases who participated in either the base year or first follow-up study were excluded from the 2013 Update sample because their status was deceased, ineligible, or a study withdrawal. However, these 88 cases are included on 2013 Update data files because prior-round response data exist for these cases.
[2] New cases received an incentive offer at the start of phase 1, 3, 4, 5, or 6 (see section 2.3.3). A total of 1,100 nonresponding cases were never offered an incentive during data collection.
SOURCE: U.S. Department of Education, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09) 2013 Update.

2.3.6 Data Collection Results

Time to complete standard and abbreviated interviews. The average time required to complete a standard, full-length 2013 Update questionnaire was approximately 17 minutes overall and for student and parent respondents (see table 9). The standard questionnaire took longer to complete via CATI than it did for self-administration on the Web.

On December 10, 2013, all nonresponding students and parents were offered an abbreviated questionnaire, which averaged 8 minutes to complete, with the student average time shorter than that for parents. Web and CATI questionnaire completion times each averaged 8 minutes.

Table 9. Average time to complete 2013 Update questionnaire by respondent type and mode of data collection: 2013

Respondent type and mode of data collection	Time to complete (in minutes)	
	Standard questionnaire	Abbreviated questionnaire
All completed questionnaires	16.8	8.0
Respondent type		
Student	16.5	7.4
Parent	17.0	8.6
Response mode		
Web	16.2	7.9
CATI	17.6	8.1

NOTE: CATI = Computer-assisted telephone interview.
SOURCE: U.S. Department of Education, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09) 2013 Update.

Results of tracing activities. The 2013 Update data collection was designed to allow either the student sample member or his or her parent to participate in the study. The study traced sample members after all telephone numbers for a case that failed to result in contact with the student or a parent. In addition to the batch-tracing and panel maintenance activities, both TIs and tracing specialists conducted tracing activities during data collection. Batch-tracing and panel maintenance activities and CATI and intensive tracing activities resulted in a locate rate of approximately 97.5 percent by the end of data collection.

TIs used CATI tracing to locate sample members during data collection. CATI tracing occurs as TIs dial several numbers for a case. If a TI determined that a sample member was no longer located at a telephone number, the TI either attempted to get a new telephone number from the person on the telephone or called that case's next available telephone number. If the TIs attempted all telephone numbers associated with a case without reaching the sample member, the case then went to the call center's tracing specialists for intensive tracing.

The intensive tracing process uses known identifying information (e.g., date of birth, Social Security number, and previous address information) to search for a sample member through credit reports and other private-use databases. The 2013 Update budgeted 60 minutes per case for intensive tracing. Intensive tracing ended if a sample member was not located after 60 minutes. Cases that used the entire 60 minutes of tracing without locating a sample member received an additional 30 minutes of intensive tracing during the final 3 weeks of data collection.

Survey results by prior-round response status and respondent type. Table 10 displays 2013 Update data collection outcomes for students and parents combined by prior-round student response status. Most of the 2013 Update sample (99.6 percent) completed a student questionnaire during one or both of the previous studies. Among the 2013 Update sample, more than 21,000 sample members, or 91 percent, completed a base-year student questionnaire. Approximately 80 percent of the sample members who completed a base-year questionnaire also completed a 2013 Update questionnaire. Approximately 88 percent of the 2013 Update sample included a completed first follow-up student questionnaire. Among these cases, 84 percent completed a 2013 Update questionnaire. About 85 percent of the cases who completed student interviews in both of the prior rounds also completed a 2013 Update questionnaire.

Table 10. Participation outcomes by prior-round student response status: 2013

Prior round response status	Outcome in 2013 Update data collection[1]			
	Overall		Students and parents	
	Eligible sample[2]	Percent of total eligible	Number interviewed	Percent interviewed
Total sample	23,401	100.0	18,558	79.3
Base-year				
Respondents	21,348	91.2	17,117	80.2
Nonrespondents	2,053	8.8	1,441	70.2
First follow-up				
Respondents	20,573	87.9	17,282	84.0
Nonrespondent	2,828	12.1	1,276	45.1
Double respondents	18,608	79.5	15,857	85.2
Nonrespondents to one or both prior rounds	4,793	20.5	2,701	56.4

[1] All percentages are unweighted.
[2] Eighty-eight cases who participated in either the base year or first follow-up study were excluded from the 2013 Update sample because they had been found to be deceased, ineligible, or a study withdrawal. However, these 88 cases are included on 2013 Update data files because prior-round response data exist for these cases.
SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update.

Table 11 presents the percentage of responses for all respondents; student and parent respondents; and Web, CATI, and PAPI responses by selected base-year student characteristics. The 2013 Update data collection ended on December 31, 2013, with a total of 18,558 completed questionnaires. Among these, students completed 54 percent of the total questionnaires. Among the study respondents, 55 percent completed a web questionnaire, almost 44 percent completed a CATI questionnaire, and about 1 percent completed a PAPI questionnaire.

Table 11. All respondents, student and parent respondents, and Web, CATI, and PAPI responses, by selected student characteristics: 2013

			Respondent type				Data collection mode					
	All respondents		Students		Parents		Web		CATI		PAPI	
Characteristic	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	18,558	79.3	9,693	53.9	8,865	46.1	10,613	57.2	7,723	41.6	222	1.2
Base-year school type												
Public	15,039	78.3	8,172	54.3	6,867	45.7	8,344	55.5	6,496	43.2	199	1.3
Total private	3,519	83.7	1,521	43.2	1,998	56.8	2,269	64.5	1,227	34.9	23	0.7
Catholic	2,209	84.7	956	43.3	1,253	56.7	1,414	64.0	781	35.4	14	0.6
Other private	1,310	82.0	565	43.1	745	56.9	855	65.3	446	34.0	9	0.7!
Locale												
City	5,401	81.1	2,817	52.2	2,584	47.8	3,246	60.1	2,100	38.9	55	1.0
Suburban	6,672	79.2	3,445	51.6	3,227	48.4	3,919	58.7	2,673	40.1	80	1.2
Town	2,140	77.0	1,110	51.9	1,030	48.1	1,155	54.0	953	44.5	32	1.5
Rural	4,345	78.4	2,321	53.4	2,024	46.6	2,293	52.8	1,997	46.0	55	1.3
Region												
Northeast	2,872	78.8	1,421	49.5	1,451	50.5	1,728	60.2	1,114	38.8	30	1.0
Midwest	5,019	81.0	2,588	51.6	2,431	48.4	2,971	59.2	1,993	39.7	55	1.1
South	7,464	78.1	3,895	52.2	3,569	47.8	4,144	55.5	3,219	43.1	101	1.4
West	3,203	79.9	1,789	55.9	1,414	44.1	1,770	55.3	1,397	43.6	36	1.1
Sex												
Male	9,298	78.1	4,596	49.4	4,702	50.6	5,036	54.2	4,134	44.5	128	1.4
Female	9,260	80.6	5,097	55.0	4,163	45.0	5,577	60.2	3,589	38.8	94	1.0
Race/ethnicity												
American Indian or Alaska Native	181	77.0	95	52.5	86	47.5	92	50.8	83	45.9	6	3.3!
Asian	1,933	79.8	1,219	63.1	714	36.9	1,200	62.1	713	36.9	20	1.0
Black, non-Hispanic	2,269	77.9	1,233	54.3	1,036	45.7	1,047	46.1	1,185	52.2	37	1.6
Hispanic or Latino	2,847	75.6	1,828	64.2	1,019	35.8	1,391	48.9	1,415	49.7	41	1.4
White, non-Hispanic	11,031	80.7	5,156	46.7	5,875	53.3	6,716	60.9	4,200	38.1	115	1.0
More than one race	297	76.0	162	54.5	135	45.5	167	56.2	127	42.8	3	1.0!

See notes at end of table.

Table 11. All respondents, student and parent respondents, and Web, CATI, and PAPI responses, by selected student characteristics: 2013—Continued

			Respondent type				Data collection mode					
	All respondents		Students		Parents		Web		CATI		PAPI	
Student characteristics	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Highest parent education level												
Less than HS diploma	862	78.9	666	77.3	196	22.7	384	44.5	461	53.5	17	2.0
HS diploma or GED	5,123	80.1	2,958	57.7	2,165	42.3	2,696	52.6	2,365	46.2	62	1.2
Occupational certificate/ diploma	787	77.9	442	56.2	345	43.8	400	50.8	375	47.6	12	1.5
Associate's degree	2,767	82.9	1,456	52.6	1,311	47.4	1,523	55.0	1,210	43.7	34	1.2
Bachelor's degree	4,452	86.5	2,087	46.9	2,365	53.1	2,783	62.5	1,628	36.6	41	0.9
Master's degree	2,327	89.1	1,035	44.5	1,292	55.5	1,577	67.8	741	31.8	#	#
PhD, MD, law degree	1,174	90.1	498	42.4	676	57.6	827	70.4	345	29.4	‡	‡

Rounds to zero.
! Interpret with caution. Estimate is unstable because the standard error is more than 30 percent of the estimate.
‡ Reporting standards not met.
NOTE: CATI = Computer-assisted telephone interview. PAPI = Pencil and paper interview. HS = high school.
SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update.

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Chapter 3. Data Processing and File Preparation for 2013 Update

Item documentation procedures were developed to capture variable and value labels for each item. Item wording for each question was pulled from electronic facsimiles and provided as part of the item documentation. This information was loaded into an item documentation database that could export final data file layouts and format statements used to produce formatted frequencies for review. The documentation database also had tools to produce final Electronic Codebook (ECB) input files.

3.1 Data Cleaning and Editing

Questionnaire data were stored in an SQL database that was consistent across data collection modes for a particular questionnaire. The instrument used to administer the web survey was the same instrument as that used for the computer-assisted telephone (CATI) survey, and the questionnaire data were stored in the same SQL database. Paper and pencil interview (PAPI) questionnaires were also administered to sample members. The instrument used for the web and CATI survey was modified to facilitate the entry of data from the PAPI form into the same database as the web and CATI surveys. Having the same instrument database across all modes of data collection ensured that skip patterns were consistent across applications.

Editing programs were developed to identify inconsistent items across logical patterns within the questionnaire. These items were reviewed, and rules were written to either correct previously answered (or unanswered) questions to match the dependent items or blank out subsequent items to stay consistent with previously answered items. For abbreviated interviews, items not administered were set to a −4 reserve code to indicate missing due to abbreviated interview, except when logical edits determined the item did not apply, in which case the item was set to a −7 reserve code to indicate legitimate skip.

For the 2013 Update, either the parent or the student could respond to the survey. In some cases, both responded and it was determined which survey to include. Procedures did not blend data from both interviews but instead decided which interview to include. The rules favored the student report over the parent report,

except when the student completed fewer than 75 percent of the items responded to by the parent.

Programs were also developed to review consistencies across multiple sources of data and identify discrepancies that required further review and resolution. Consistency checks included unlikely patterns across rounds (i.e., between the first follow-up and the 2013 Update).

3.2 Coding

The survey instruments collected data on high schools attended, postsecondary institutions applied to and attended, reasons for not attending a postsecondary institution if applicable, expected major field of study, and jobs held, all of which required coding. The survey instrument included applications that allowed respondents or interviewers to code text strings to widely used taxonomies. All text strings that were not coded during the interview were coded as part of data processing. This section describes the types of data requiring coding, the coding applications, the coding process, quality control procedures, and measures of coding quality.

3.2.1 High School Coding

Respondents were asked to provide the name, city, and state of all high schools that the sample member had attended since she or he was last interviewed. These included the school that the sample member had last attended before leaving or completing high school (S3LASTHSID) and any other schools that the sample member had attended since the last interview (S3OTHHSID1-2).

High school coding methods. The survey contractor matched the text strings to two NCES databases: (1) the Common Core of Data (CCD), a comprehensive and annually updated database on public elementary and secondary schools and school districts in the United States and (2) the Private School Universe Survey (PSS), a similar database of private schools in the United States. Multiple years of each database were searched to account for schools that had closed and opened over the time span of the HSLS:09 base year and 2013 Update.

High school coding results. The results of coding by variable are presented in table 12. The majority of schools named by respondents were located in the United States and matched to a CCD or PSS code. Note that for tables derived from the restricted file, counts have been rounded as a confidentiality protection.

Table 12. Final disposition of high school coding for Update Survey : 2013

High school coding	Number	Percent
Last school attended (S3LASTHSID)		
Located in United States	18,000	97.7
Unlocated or foreign	430	2.3
First other high school (S3OTHHSID1)		
Located in United States	490	81.7
Unlocated or foreign	110	18.3
Second other high school (S3OTHHSID2)		
Located in United States	50	81.8
Unlocated or foreign	10	18.2

NOTE: Detail may not sum to totals because of rounding.
SOURCE: U.S. Department of Education, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09) 2013 Update, Restricted-use Data File.

3.2.2 Postsecondary Institution (Integrated Postsecondary Education Data System [IPEDS]) Coding

Respondents were asked to name the postsecondary institution that the student sample member was attending as of November 1 if applicable (S3CLGID) and up to two other institutions to which the sample member had applied or registered at (S3CLGAPPID1 and S3CLGAPPID2). If the sample member had applied to more than two other institutions, the respondent was instructed to select the two that the sample member most seriously considered. The postsecondary institution IDs are available only on the restricted-use data file.

Postsecondary institution coding methods and results. Respondents were asked to indicate the postsecondary institutions using an interactive look-up tool. After respondents (or the interviewer) entered the institution's name, city, and state into the web survey, they could search a look-up tool containing institutions from the 2010–11 IPEDS for the appropriate match. When a match was not found, the respondent was asked to provide the institution's level (i.e., 4-year, 2-year, less-than-2-year) and control (i.e., public, private nonprofit, private for-profit). This information was later used to assist RTI staff in finding a match in IPEDS as part of data processing.

Text strings not coded by respondents (or interviewer) through the interactive look-up tool were provided to coding experts to be upcoded during data processing in the following manner. First, cases were again compared against the 2010–11 IPEDS database for matching. Any case with school name, city, and state that exactly matched an IPEDS record was assigned the corresponding IPEDS ID. Then, any

text strings that remained uncoded were loaded into the coding application for an RTI coding expert to assign IDs.

The final results of postsecondary institution coding are presented in table 13. Nearly all of the postsecondary institutions were assigned an IPEDS ID.

Table 13. Final disposition of postsecondary institution coding: 2013

Postsecondary institution coding	Number	Percent
November 1 institution (S3CLGID)		
Located in United States	12,900	97.9
Unlocated or foreign	270	2.1
First other institution applied to/registered at (S3CLGAPPID1)		
Located in United States	9,200	98.7
Unlocated or foreign	120	1.3
Second other institution applied to/registered at (S3CLGAPPID2)		
Located in United States	6,000	98.3
Unlocated or foreign	100	1.7

NOTE: Detail may not sum to totals because of rounding.
SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update, Restricted-use Data File.

3.2.3 Major Field of Study Coding

Respondents were asked to identify the major field of study being considered. The instruments included an interactive application that allowed coding using the NCES 2010 Classification of Instructional Programs (CIP) taxonomy.[8] On the restricted-use data file, researchers will find both 2-digit and 6-digit versions of the CIP code (S3FIELD2 and S3FIELD6). Only the 2-digit versions of these variables appear on the public-use data file.

Major field of study coding methods. To use the coding application, respondents or interviewers first entered text to describe the field of study. A list of majors, customized based on the text string, was presented. The respondent or interviewer could choose one of the options listed or choose "none of the above." If "none of the above" was selected, a two-tiered dropdown menu appeared. The first dropdown menu contained a general list of majors; the second was more specific and was dependent on the first. Interviewers were trained to use probing techniques to assist in the online coding process. Self-administered web respondents were provided supporting text on-screen. If the respondent or interviewer was unable to find a

[8] For more information on this taxonomy, see http://nces.ed.gov/ipeds/cipcode/.

good match, he or she could proceed with the interview without selecting a code. In this case, the text string and any selections from the dropdown menus were retained.

All major text strings that were not coded to the detailed 6-digit level during the interview were processed by RTI. First, the most commonly reported major text strings were assigned a code by an expert coder. These codes were then applied to all other exact matching text strings to ensure consistency of codes for duplicate text strings. The remaining text strings were "upcoded" to the CIP taxonomy by coding experts using an application that used the same search function as the application in the instruments. The coding expert could assign a CIP field of study code or assign a value of 999999 to indicate that the text string was too vague to code.

Major field of study coding quality control procedures and results. To evaluate the quality of the coding completed during the interview, a random sample of 10 percent of the pairs of verbatim strings and codes was selected for recoding and analysis. RTI coding personnel evaluated text strings and assigned codes without knowledge of the codes that were selected during the interview. If the code selected differed from the code assigned during the interview, the coding expert was then shown both codes. The coding expert was instructed to only override the code selected during the interview if it was clearly incorrect. Text strings were designated "too vague to code" when they lacked sufficient clarity or specificity.

Results of recoding of strings coded during the interview are shown in the top portion of table 14. Nearly all of the codes selected during the interview were deemed to be accurate to the most detailed 6-digit level (93 percent). The coding expert disagreed with the CIP code selected during the interview for 4 percent of the strings. The expert coder's selection replaced the code selected during the interview.

Table 14. Results of quality control recoding and upcoding of major: 2013

Sample of strings coded	Percent
During interview	
Match at 6-digit and 2-digit	93.0
Match at 2-digit but not 6-digit	2.5
Disagree	4.4
During data processing	
Match at 6-digit and 2-digit	43.5
Match at 2-digit but not 6-digit	34.8
Match too vague to code	17.4
Disagree	4.3[1]

[1] All of the majors that were not coded during the interview were coded independently by two coding experts and compared. This includes instances where one coding expert thought the string was too vague to code and the other did not. A third coding expert adjudicated all of the instances of disagreement.
SOURCE: U.S. Department of Education, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09) 2013 Update.

Strings that were not coded during the interview and not batch coded were upcoded to the CIP taxonomy by an RTI coding expert. This coding was also subject to a quality control review. Ten percent of these upcodes were selected for independent coding by a second coding expert. When this process was complete, the results of the two coding experts were compared. The results are shown in the lower portion of table 14.

The two expert coders selected the same detailed 6-digit code for 44 percent of the text strings. The expert coders disagreed at the 6-digit level, but they agreed at the 2-digit level for 35 percent of the text strings. Combining these strings with the strings where agreement was reached at both levels yields 78 percent agreement at the 2-digit level overall. Both of the expert coders determined that the text was too vague to code for 17 percent of the strings. The relatively high rate of vague text strings reflects first-time beginning postsecondary students' uncertainty about what field they will pursue. RTI's expert coders disagreed on the appropriate code for 4 percent of the strings. All instances where there was disagreement at either the 6-digit or 2-digit level or where one expert coder thought the string was too vague to code were adjudicated by a third expert coder.

It is notable that the rates of agreement for major fields of study coded during the interview are higher than the rates of agreement for those that were not. This result is not surprising given that the text strings for which an appropriate code is hard to find are more likely to be left uncoded by respondents or interviewers.

3.2.4 Occupation Coding

Respondents were asked to provide job titles and duties for up to two positions: the position the sample member held at the time of the interview and the position held as of November 1 if it was different. The instrument included tools that allowed coding of these text strings to the 2010 Standard Occupational Classification (SOC) taxonomy.[9] The 2000 SOC taxonomy was used for consistency with the base-year data. Occupation job title and duties were matched to occupation descriptions from the Occupational Information Network (O*NET).[10] On the restricted-use data file, researchers will find both 2-digit and 6-digit versions of the SOC/O*NET code for the current job as of the interview date (S3CURJOB2 and S3CURJOB6) and the November 1 job (S3NOV1JOB2 and S3NOV1JOB6). Only the 2-digit versions of these variables appear on the public-use data file.

[9] See http://www.bls.gov/soc/major_groups.htm.
[10] See http://www.onetcenter.org/overview.html.

Occupation coding methods. To code the occupation, interviewers or respondents who were self-administering the web questionnaire first entered the job title and duties. These strings were automatically matched to the occupation descriptions from O*NET and a customized list of occupations was presented. Interviewers and respondents could choose one of the options listed or choose "none of the above." In the occupation coding application, selecting "none of the above" presented the user with a set of three sequential dropdown menus, each with choices increasing in their level of specificity. The first dropdown menu contained a general list of occupations. The options presented in the second dropdown menu were dependent on the code selected in the first. Some selections from the second dropdown menu required users to make a selection from a third even more detailed dropdown menu. Interviewers were trained to use probing techniques to assist in the coding process. Self-administered web respondents were provided supporting text on screen. If the respondent or interviewer was unable to find an appropriate SOC/O*NET code for the occupation, he or she could proceed with the interview without selecting a code. In this case, the text string and any selections from the dropdown menus were retained to assist with coding during data processing.

RTI's coding experts attempted to code all occupations that were not coded in the web interview. This "upcoding" was completed using an application that used the same search function as the application in the 2013 Update instrument. The coding expert could assign a SOC/O*NET code or assign a value of 999999 to indicate that the text string was too vague to code.

Occupation coding quality control procedures and results. Coding experts evaluated the quality of coding that was completed during the interview by recoding a random sample of approximately 10 percent of the occupation text strings. The same methods used for quality control described in section 3.2.3 were followed here. The top portion of table 15 displays the results of the quality control review of strings for the current job title and duties coded during the interview.

Table 15. Results of quality control recoding and upcoding of current occupation coding: 2013

Sample of strings coded	Percent
During interview	
Match at 6-digit and 2-digit	88.2
Match at 2-digit but not 6-digit	9.5
Disagree	2.3
During data processing	
Match at 6-digit and 2-digit	60.3
Match at 2-digit but not 6-digit	25.0
Match at too vague to code	1.5
Disagree	13.2[1]

[1] This includes instances where one coding expert thought the occupation was too vague to code and the other did not.
SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update.

RTI's expert coders agreed with the 6-digit code selected during the interview for 88 percent of the text strings reviewed and agreed with the 2-digit code (but not the 6-digit code) for an additional 10 percent of the text strings reviewed, for a total of 98 percent agreement at the 2-digit level. The expert coder disagreed with the code selected during the interview for just 2 percent of the occupations.

The coding of occupation text strings by RTI's expert coders was also subject to a quality control review. All of the text strings that were not coded during the interview were upcoded to the SOC/O*NET taxonomy by a coding expert. Ten percent of these upcodes were randomly selected for independent coding by a second coding expert. When this process was complete, the results of the two coding experts were compared. The results are shown in the bottom portion of table 15.

The two expert coders selected the same detailed 6-digit code for 60 percent of the text strings. The coders agreed at the 2-digit level but not at the 6-digit level for 25 percent of the strings. Summing these two categories yields 85 percent in agreement at the 2-digit level. A very small percentage of strings were deemed too vague to code by both expert coders (2 percent). The coders disagreed for 13 percent of the strings. If the two coders disagreed, the strings were adjudicated by a third expert coder.

As was also the case for the quality control review of major field of study coding (see section 3.2.3), the rate of agreement for the text strings coded during the interview is higher than the rate of agreement for those that were not. The occupations that are hardest to classify are more likely to be left uncoded during the interview and require upcoding.

The same quality control process was used for the coding of jobs held as of November 1, 2013. The results for recoding strings that were coded during the interview are presented in the top portion of table 16. The RTI expert chose a 6-digit code that matched the 6-digit code selected during the interview for about three-quarters of the November 1 occupations. This is lower than the 88 percent agreement at the 6-digit level for the current occupations. The November 1 occupation also had a higher rate of disagreement than did the current occupation (18 percent versus 2 percent). The majority of the respondents answered the survey before the November 1, 2013 reference date. Therefore, the text strings for the job title and duties reflect the uncertainty that many had about what job they would hold at that time.

The challenge of accurately coding many of the November 1 jobs is even more evident when examining the results of upcoding. Ten percent of the strings that were not coded during the interview were independently coded by two RTI expert coders. Nearly two-thirds (64 percent) of the November 1 job strings were found to be too vague to code by both expert coders. Most of these strings were "don't know," "any job," or a variant. Agreement at the 6-digit level occurred for 18 percent of the strings and agreement at the 2-digit level for an additional 11 percent.

Table 16. Results of quality control recoding and upcoding of November 1 occupation coding: 2013

Sample of strings coded	Percent
During interview	
Match at 6-digit and 2-digit	73.5
Match at 2-digit but not 6-digit	9.0
Disagree	17.5
During data processing	
Match at 6-digit and 2-digit	18.2
Match at 2-digit but not 6-digit	10.9
Match at too vague to code	63.6
Disagree	7.3[1]

[1] This includes instances where one coding expert thought the occupation was too vague to code and the other did not.
SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update.

Reasons for not attending coding. When the sample member was not attending a postsecondary institution as of November 1, 2013, the respondent was asked for the reasons for this. Respondents could indicate that a reason other than the three options provided (S3DONOTWANT, S3NOTADMITTED, S3CANTAFFORD) was a contributing factor and enter a textual response. These textual responses were categorized and represented in S3NOCLGOTHRSN.

Reasons for not attending coding methods and results. The text strings were output to a Microsoft Excel spreadsheet that allowed for sorting to ensure that all similar responses would be coded consistently. A coding expert reviewed the strings and developed a coding frame that included 17 categories. The coding expert first upcoded the text strings to one of the three existing options if possible. The remaining text strings were then coded to one of the 17 new categories. If a text string fit into more than one of the 17 categories, the reason listed first was used for coding purposes.

Chapter 4. High School Transcript Sample Design and Data Collection

The data collection process for the High School Longitudinal Study of 2009 (HSLS:09) transcript collection included identifying the school sample and gaining cooperation from schools to submit student transcripts, course catalogs, and other school information. Procedures associated with these activities are described in this chapter.

4.1 HSLS:09 Transcript Sample

Transcripts were collected for all student sample members who participated in either the base-year data collection, first follow-up data collection, or both. In addition, transcripts were collected for a subset of students who were incapable of participating in prior rounds due to physical or cognitive disabilities. In all, 23,415[11] student sample members were included in the HSLS:09 high school transcript sample. An attempt was made to collect student transcripts from each of the 944 schools that participated in the base year, though six of those schools had closed by the time of the transcript collection. Thus, 938 base-year schools were contacted to provide transcripts for the 23,415 students sampled in the fall 2009.

4.2 Transcript Data Collection Systems and Materials

The design and development of transcript data collection materials and procedures was informed by prior NCES high school transcript studies and, in particular, the transcript components of prior secondary longitudinal studies (Bozick et al. 2006; Ingels et al. 1995) and the National Assessment of Education Progress 2009 high school transcript study (Nord et al. 2011). Control systems were designed to manage the transcript and other data requested from schools. Institution contactors (ICs) served as liaisons to schools that provided the requested materials through a variety

[11] The same 23,415 cases eligible for the 2013 Update were also eligible for the transcript collection. This includes the 14 students who were found to be deceased after the start of the transcript collection; however, transcripts were not pursued for deceased students.

of possible submission methods, including a study website. The details of transcript data collection systems and materials are included in this section.

A web-based control system supported each step of the transcript collection, including project management, communications, and tracking. The School Contacting System (SCS) was used to store and access data on students and to track communication with the schools that were contacted regarding the transcript collection; the Data Receipt System was used to manage data received on sample members, including transcripts and catalogs.

Institution contacting staff consisted of eight ICs, one project supervisor, and two quality experts (QEs) who were responsible for staff supervision. Prior to the start of transcript data collection, the ICs were trained over a 2-day period on transcript and catalog collection, gaining cooperation, problem resolution, and collection and receipt systems. Training included information on HSLS: 09 and a review of confidentiality regulations.

The transcript data collection commenced in September 2013 with the mailing of materials to all base-year schools. Transfer schools (e.g., a school attended by a sample member who transferred out of their base-year school) identified during the HSLS:09 first follow-up and the 2013 Update received the initial request for transcripts in October 2013. As new transfer schools were identified during the transcript data collections, transcript request materials were sent to these schools if a complete transcript record had not already been obtained from another school. The materials were designed to request transcript data and guide school personnel in the preparation of transcripts and related documents. The materials also directed school staff to the study website where additional information about the transcript collection could be obtained. Each school was asked to provide basic enrollment, testing, and coursetaking information for each student, as well as information about the school's grading and graduation policies/requirements. The information requested included the following:

- Student-level information:
  - Student address
  - Participation in specialized programs
  - Date student left school (graduation date or final withdrawal date)
  - Reason student left school (graduated, transferred, etc.)
  - Type of diploma awarded (standard diploma, General Educational Development (GED) certificate, certificate of attendance, etc.)
  - Cumulative grade point average (GPA)

  - Standardized test scores (composites variables constructed from transcript and external data sources) for the PSAT, SAT/ACT, AP, and/or SAT subject tests (see Appendix L for composite variable documentation)
  - Standardized test scores (composite variables constructed from transcript and external data sources) for the International Baccalaureate (IB) (See Appendix L for composite variable documentation)

- Coursetaking histories for grades 9 through 12 (plus some high school-level courses such as algebra, geometry, or foreign language, taken before 9th grade):
  - Course title
  - Course number
  - School name where course was taken
  - School year course was taken
  - Grade level that course was taken
  - Term course was taken
  - Number of credits earned for each course taken
  - Raw course grade/Standardized letter grade received
  - Classification of Secondary School Courses (CSSC) code
  - School Codes for the Exchange of Data (SCED)

- School-level information:
  - Grade scale
  - Course grade-weighting system used, if any
  - Availability of student-level information
  - GPA formula
  - Term system used
  - Course catalogs (if not collected previously[12])
  - Types of diplomas granted
  - Credits required for different types of diplomas

Student-level information was provided on the transcripts, while school-level information was collected separately on the School Information Page (SIP). The instructions for preparing student transcripts and SIP data requested that transcripts be prepared for the students listed on the secure study website. The transcripts could be uploaded via the secure study website, faxed to a secure fax number, sent as an

[12] When possible, course catalogs were collected from schools during the first follow-up data collection in 2012, as described in section 4.3.4.

encrypted attachment by e-mail, or sent by FedEx (redacted transcripts). The information about the school's grading and graduation policies/requirements collected on the SIP could be completed online or by hardcopy. If the SIP was missing any key information such as the grading scale or term system, ICs followed up with schools to obtain this information or searched for it online. SIP information was used to provide context for transcript data collected from each school.

4.3 Transcript Data Collection Methodology

Transcript data for 23,415 sample members were requested from 4,249 schools. Transcripts were collected through June 2014. Research applications, extensions of existing research approvals, or data-sharing agreements were completed for 38 districts. Once research approval was granted from these districts, transcripts were collected from either the districts or schools.

Approximately 1 week after the initial transcript request materials were sent to the school principal, ICs began making telephone contacts to follow up on the materials sent to the school and offer technical assistance with the transcript collection process at the school. Follow-up e-mails were also sent by the IC asking the schools to send the requested materials as soon as possible. Periodic mailings and e-mails were sent to nonrespondents throughout the transcript collection period. Nonresponding schools contacted during the telephone prompting frequently requested that the materials be e-mailed or faxed to the school. During the telephone contacts, the ICs also identified any additional requirements the school had for releasing transcripts, such as the need to obtain student or parent consent. The principal often delegated the request for transcripts to a registrar or guidance counselor who then served as the HSLS:09 transcript coordinator for the school.

4.3.1 Transcripts of Transfer Students

In addition to collecting data from base-year schools, transcript data were collected from the transfer schools of students who left their base-year high school. Transfer students, and the schools to which they transferred, were identified at several points in the HSLS:09 data collection process. These time periods included the enrollment status update completed by the schools in the fall of 2011, questionnaire data provided by students and parents in the spring of 2012, and other contact updates with students and parents, most recently being the spring 2013 update. Schools were also identified through the analysis of transcripts that were submitted.

Once the schools were identified, processing transfer schools involved obtaining information about each school, assigning a school ID, and loading it into the HSLS:09 School Contacting System (SCS). To obtain school contact information for the transfer schools, databases such as the most recent Common Core of Data (CCD) and Private School Universe Survey (PSS) were searched. District and school websites were also used to obtain school contact information. Transcripts were requested from each base-year school. The original plan was to request transcript data from each school attended. However, when the project team learned of additional schools attended from transcripts received, these transcripts were checked for completeness to determine whether it was necessary to contact the additional school for transcript data. A complete transcript was defined as having at least five courses in each of the four grades plus a graduation date. Users need to be cautious when including those sample members with incomplete high school transcript information. This situation occurs when the data are either missing or censored. Missing transcript information may result from unit nonresponse from the school, inability to obtain multiple transcripts for certain students who have transferred, or school recordkeeping errors or inconsistencies. School staff frequently reported that records had been archived or forwarded to another school and were not retrievable. Because dropouts occasionally were enrolled in a school for too brief a period to accumulate a coursetaking record, there is often little or no record of their origin or destination. In this case, the student should have 4 years of data, but the data were not reported. Having censored data leads to less than 4 years of data because the student dropped out, graduated early, or withdrew from the base-year school to be homeschooled. In this case, the student should not have 4 years of data: the information captures the student's entire high school experience but is censored by the student's pathway and status.

4.3.2 Obtaining Consent for Collecting High School Transcripts

Because the U.S. Department of Education, under the Family Educational Rights and Privacy Act (FERPA), has the right to obtain transcripts without prior consent for evaluation purposes, and because RTI informed parents, students, and school personnel about the transcript data collection as part of the base-year and first follow-up data collection/consent activities, the first approach to collecting transcripts was a direct mail request to each school. When ICs contacted schools to prompt for the submission of the transcripts and answer any questions, they also recorded whether the school had additional consent requirements before the school would release student transcripts. Despite assurances that federal regulations permitted the release of transcripts without student or parent consent, 270 schools or the school's associated district required explicit consent from sample members,

their parents/guardians, or both, and 26 schools or the school's associated district required implicit consent from sample members. (See table 17 for a breakdown of numbers by school type, and table 18 for the number and percentage of students who granted permission.) For sample members who attended these schools, RTI prepared and mailed consent forms to the students (or parents if the student was known to be under age 18 or if the school required parental consent). Consent forms were to be returned directly to RTI, where they would be uploaded to the school's secure study website for viewing by the school. Students (or parents if the student is known to be under age 18) were also given the option of providing consent via a secure website. A unique study ID and password were included in the materials mailed to the students (or parents if the student is known to be under age 18). The student could then login to the secure website and grant/deny consent for the release of his or her transcript. If permissible by the school or school district, students were also able to provide consent over the phone.

Table 17. Schools requiring additional consent: 2013

School type	Number of schools	
	Requiring explicit consent	Requiring implied consent
Total	270	26
Base-year	45	6
Transfer	225	20

SOURCE: U.S. Department of Education, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09) High School Transcript Study.

Table 18. Student explicit consent: 2013

	Number of students associated with schools requiring explicit consent	Students granting permission	
		Number	Percent
Student	989	460	47

SOURCE: U.S. Department of Education, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09) High School Transcript Study.

4.3.3 Consent Receipt and Prompting

Consent forms returned from sample members or parents were receipted via the Data Receipt System (DRS). The consent forms were then reviewed by data receipt staff to ensure they contained a valid signature, date, and an indication of whether consent was granted or refused. Most consent forms were returned via hardcopy, but some were returned by e-mail. All hardcopy consent forms were scanned into PDFs and saved so that all consent forms were available for review in the DRS. Sample members or parents (if the sample member was under age 18) were also given the

option to provide their consent via a secure website where they could log in using the study ID and password provided in the materials mailed to the household.

After the initial letter was sent to sample members and parents, periodic reminder letters and e-mails were sent prompting them to return the explicit consent forms. Telephone interviewers (TIs) also prompted all sample members and parents by phone to either return the explicit consent form if the school required written consent, or if the school allowed verbal consent, to give their permission over the phone. If permission or denial to release the transcript was given over the phone, TIs recorded this information in the School Contacting System (SCS). Consent prompting was conducted from November 2013 through May 2014.

After consent to release the transcript was received, the electronic consent forms were loaded onto the secure study website and made available to schools for viewing. Schools were then notified via e-mail or phone that the signed consent form or electronic (time/date stamped) consent was available to view on the study website and that they could proceed to send the student(s) transcripts.

4.3.4 Course Catalog Data Collection

Course catalogs were collected to build a high school course offerings file and to facilitate the process of keying and coding transcript data, as described in chapter 5. RTI began the collection of course catalogs in the 2011–12 school year as part of the HSLS:09 first follow-up data collection activities. During the transcript collection, course catalogs were requested for 2 school years covering 2012–13 or 2013–14 and could be submitted either electronically or in hardcopy. Course catalogs were requested from base-year schools that had not provided them in the first follow-up and from all transfer schools.

ICs combined prompts for catalogs with transcript-related school contacts when possible. If a school did not have a conventional catalog, then a course list, master teaching schedule, or any other information from which course offerings could be extracted was accepted. ICs followed up with schools to clarify information as needed. ICs also searched the Internet to locate course catalogs or course descriptions when this information was not provided by the school.

4.3.5 Receipt Control

The Data Receipt System (DRS) was used to log the receipt of any file from the schools. If a school selected to fax the School Information Pages (SIPs), these data were keyed into the DRS by data clerks. Transcripts that were uploaded via the study

website, faxed, e-mailed, or received by hardcopy were imported into the DRS for review. Each transcript file was associated with a school, and individual transcripts were parsed from the complete transcript file to allow them to be reviewed and processed individually. Data receipt clerks reviewed the transcripts for legibility and completeness using a quality control checklist in the DRS. If the transcripts did not pass the quality control check, they were routed to a supervisor for further review. Supervisors monitored electronic reports that identified missing or unclear information at the transcript level. If supervisors were unable to resolve transcript-level issues, ICs were then asked to follow up with schools to either ask schools to resend transcripts with missing or illegible information or to send any outstanding transcripts for students. Transcripts that passed quality control were routed to keying and coding.

4.4 Data Collection Results

4.4.1 Participation Rates, Overall and by Select Case Characteristics

This section presents information on the unweighted participation rates of schools that provided student transcripts (table 19); completed the school information page (table 21); provided course catalogs (table 22); and students with a complete or partial transcript (table 23).

Base-year schools are sampled to represent the population of schools that contained 9th grade in fall 2009. Transcripts were requested from any transfer school a sampled student attended. By design, these transfer schools are not representative of the nation as a whole and therefore did not receive a weight for analysis purposes. As a result, all participation and coverage rates presented in this chapter are unweighted.

A total of 3,028 out of 4,249 schools (base-year and transfer) submitted transcripts, resulting in an unweighted school participation rate of 71 percent (table 19). A total of 910 out of 944 base-year schools submitted transcripts, resulting in a 96 percent participation rate. Among the transfer schools, 2,118 of 3,305 schools submitted transcripts, representing an unweighted transfer school participation rate of 64 percent.

Table 19. Participation rates of base-year and transfer schools that provided student transcripts, by school control, location, and region: 2013–14

	Base-year		Transfer		All	
	Number	Percent	Number	Percent	Number	Percent
Total	910	96.4	2,118	64.1	3,028	71.3
Control						
Public	752	98.0	1,868	68.5	2,620	75.0
Catholic	94	92.2	59	68.6	153	81.4
Private Other	64	85.3	133	69.3	197	73.8
Unknown	†	†	58	19.4	58	19.4
Location						
City	255	94.1	655	67.1	910	73.0
Suburb	273	96.8	614	67.0	887	74.0
Town	123	96.1	209	67.4	332	75.8
Rural	259	98.5	582	72.8	841	79.1
Unknown	†	†	58	19.1	58	19.1
Region[1]						
Northeast	143	96.0	268	72.0	411	78.9
Midwest	240	95.6	483	65.8	723	73.4
South	373	98.2	818	69.0	1,191	76.1
West	154	93.9	488	69.7	642	74.3
Unknown	†	†	61	19.4	61	19.4

† Not applicable.
[1] Region is defined by the U.S. Census Bureau based on the state in which the school is located.
SOURCE: U.S. Department of Education, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09) High School Transcript Study.

Table 20 shows the transmission mode used by schools to provide transcript data. The number of schools that uploaded transcripts to the secure website may be somewhat lower than expected, and the number faxing transcripts may be somewhat higher than expected. The website was unavailable for a period of 17 days during the partial government shutdown from October 1–17, 2013. During this time, base-year schools were unable to access the website, and all transcript data had to be sent to RTI via other transmission modes.

Table 20. School transmission mode for transcript data: 2013

Transmission mode	Number	Percent
Total	2,981	
Upload via study website	1,620	54
Fax	1,211	41
E-mail (encrypted file)	110	4
FedEx	40	1

SOURCE: U.S. Department of Education, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09) High School Transcript Study.

SIP information and course catalogs were collected from both base-year and transfer schools. As previously stated, the SIP asked for information about the school's grading and graduation policies/requirements. Seventy-six percent or 3,248 schools provided SIP information. Course catalogs were requested from base-year schools that had not provided them in the first follow-up and from all transfer schools. At least one course catalog was received or was able to be retrieved from school/district websites for 3,154 schools (74 percent). See tables 22and 23 for additional detail.

Table 21. Unweighted participation rates of base-year and transfer schools that completed the school information page, by school control, location, and region: 2013–14

	Base-year		Transfer		All	
	Number	Percent	Number	Percent	Number	Percent
Total	912	96.6	2,336	70.7	3,248	76.4
Control						
Public	750	97.8	2,049	75.1	2,799	80.1
Catholic	94	94.9	66	80.5	160	88.4
Private other	68	87.2	151	77.0	219	79.9
Unknown	†	†	70	23.4	70	23.4
Location						
City	261	96.3	723	74.1	984	78.9
Suburb	271	96.1	667	72.8	938	78.3
Town	124	96.9	232	74.8	356	81.3
Rural	256	97.3	642	80.4	898	84.5
Unknown	†	†	72	23.8	72	23.8
Region[1]						
Northeast	145	97.3	281	75.5	426	81.8
Midwest	242	96.4	547	74.5	789	80.1
South	373	98.2	911	76.9	1,289	82.0
West	152	92.7	520	74.3	672	77.8
Unknown	†	†	77	24.5	77	24.5

[1] Region is defined by the U.S. Census Bureau based on the state in which the school is located.
SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) High School Transcript Study.

Table 22. Participation rates of base-year and transfer schools that provided course catalogs, by school control, location, and region: 2013–14

	Base-year		Transfer		All	
	Number	Percent	Number	Percent	Number	Percent
Total	918	97.2	2,236	67.7	3,154	74.2
Control						
Public	754	98.3	1,982	72.7	2,736	78.3
Catholic	96	97.0	64	78.0	160	88.4
Private Other	68	87.2	128	65.3	196	71.5
Unknown	†	†	62	20.7	62	20.7
Location						
City	262	96.7	690	70.7	952	76.3
Suburb	278	98.6	653	71.3	931	77.7
Town	123	96.1	223	71.9	346	79.0
Rural	255	97.0	606	75.8	861	81.0
Unknown	†	†	64	21.1	64	21.1
Region[1]						
Northeast	147	98.7	262	70.4	409	78.5
Midwest	243	96.8	535	72.9	778	79.0
South	371	97.6	881	74.3	1,252	80.0
West	157	95.7	491	70.1	648	75.0
Unknown	†	†	67	21.3	67	21.3

[1] Region is defined by the U.S. Census Bureau based on the state in which the school is located.
SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) High School Transcript Study.

Of the 25,167 transcripts requested, 21,928 were received (88 percent). The student coverage rate was 94 percent, where 21,928 of the 23,415[13] students have complete or partial transcript data, as shown in table 23. Student coverage is defined as having any transcript data provided by a school. Characteristics of student coverage are based on the base-year school because students may have attended schools with varying demographics throughout their high school career.

[13] Eighty-eight cases were excluded from the transcript sample because their status was determined to be deceased, ineligible, or study withdrawal. Prior-round response data are associated with these cases; therefore, they are available on the public-use file for analyses.

Table 23. Coverage rates of students with a complete or partial transcript, by selected base-year characteristics: 2013–14

Base-year characteristic	Number	Percent
Total	21,928	93.6
Sex		
Male	11,146	93.5
Female	10,782	93.8
Race/ethnicity		
American Indian or Alaska Native	219	93.2
Asian	2,270	93.7
Black, non-Hispanic	2,685	92.2
Hispanic or Latino	3,488	92.5
White, non-Hispanic	12,897	94.3
More than one race	369	94.4
School control		
Public	18,123	94.3
Catholic	2,368	90.8
Private other	1,437	90.0
School location		
City	6,218	93.3
Suburb	7,792	92.5
Town	2,630	94.6
Rural	5,288	95.3
School region[1]		
Northeast	3,425	93.9
Midwest	5,835	94.1
South	8,932	93.5
West	3,736	93.1

[1] Region is defined by the U.S. Census Bureau based on the state in which the school is located.
SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) High School Transcript Study.

Chapter 5. Transcript Keying and Coding Systems and Staff

High school transcript and catalog keying and coding was completed using a keying and coding system for data entry. Course catalogs for base-year schools were keyed and coded to collect data for a course offerings data file. Sample member transcripts, from base-year schools and additional non-base-year schools attended by sample members, were keyed and coded to collect student data. The keying and coding process included several quality-control activities intended to provide feedback to keyer/coder staff and to produce measures of the reliability of the keyed and coded data.

5.1 Transcript Keying and Coding System

The High School Longitudinal Study of 2009 (HSLS:09) keying and coding system was the web-based data entry application used by the keyer/coders. This system was used for both course catalog and transcript keying and coding. Course catalogs for base-year schools were keyed and coded first, followed by the keying of transcripts for each of those schools. Transcripts from non-base-year schools attended by sample members were coded individually. The School Codes for the Exchange of Data (SCED) was used as the basic classification system; the SCED provides a comprehensive framework for capturing secondary school courses.

The use of the SCED was a departure from previous high school transcript studies, which had used the Classification of Secondary School Courses (CSSC) for course coding. The decision to switch to the SCED was based on several factors, including the additional detail captured with the SCED, the up-to-date nature of the SCED, the widespread adoption of the SCED within the K12 education data community, and advantageous characteristics of the SCED codes for course coding.

More specifically, the SCED provides a five digit course code that categorizes the subject of the course. While this is reminiscent of the CSSC, the SCED also has attributes to capture the sequence of a course (e.g., course one of two), the level (e.g., honors), and the number of Carnegie units available for the course. This more robust coding scheme has been refined through regular meetings of a working group of experts including representatives of state and local education agencies (SEAs and

LEAs) who use the SCED. This working group continues to refine the SCED, resulting in a coding scheme that is in line with contemporary course offerings and the needs of data users. The SCED is actively promoted for use by SEAs and LEAs with their own data, and as it is more broadly adopted, the growing familiarity with the SCED can facilitate the use of HSLS:09 data by researchers familiar with the taxonomy.

Finally, the five-digit course code taxonomy of the SCED offered advantages to course coding. The detailed SCED course code descriptions aid in distinguishing between codes and reliably selecting valid codes for courses. The SCED includes 500 fewer total codes than the CSSC , which further aids course coding, as does the detailed best practices documentation provided by the SCED working group, which is available publicly at http://nces.ed.gov/forum/SCED.asp.

A crosswalk from the CSSC to the SCED was developed by the working group. This crosswalk was used to recode past high school transcript studies to the SCED to enable analysis across studies. The previous study data that were recoded using this crosswalk include High School and Beyond, the National Education Longitudinal Study of 1988, and the Education Longitudinal Study of 2002. The recoded data are available for users with restricted use data licenses. For more information, visit http://nces.ed.gov/pubsearch/licenses.asp. Table 24 provides examples of differences between CSSC and SCED codes for equivalent course topics. These examples highlight how SCED course level and sequence attributes allow use of a single course code for courses with comparable topics but with different instructional levels or separated across terms. They also illustrate the more robust descriptions often found in the SCED, which aids in selecting course codes.

Table 24. Selected examples of CSSC/SCED course categorization differences

CSSC Examples			Equivalent SCED Examples				
Code	Title	Description	Title	Code	Level	Sequence	Description
23.0112	English 3, Below Grade Level; English 11, Basic	High interest reading; reading, writing, listening, speaking skills; writing through literature.	English/Language Arts III (11th grade)	01003	B	1	English/Language Arts III (11th grade) courses continue to develop students' writing skills, emphasizing clear, logical writing patterns, word choice, and usage, as students write essays and begin to learn the techniques of writing research papers. Students continue to read works of literature, which often form the backbone of the writing assignments. Literary conventions and stylistic devices may receive greater emphasis than in previous courses.
23.0113	English 3; English 11, Average	On grade level English; genres; reading; writing; writing through literature; listening, speaking skills; techniques of writing research papers.	English/Language Arts III (11th grade)	01003	G	1	
45.0707	Physical Geography	Physical elements and effect on human living.	Physical Geography	03007	G	1	Physical Geography courses equip students with an understanding of the constraints and possibilities that the physical environment places on human development. These courses include discussion of the physical landscape through geomorphology and topography, the patterns and processes of climate and weather, and natural resources.
45.0852	Modern Europe	History and culture; Industrial Revolution; Renaissance; the age of exploration and nationalism; European nations development; World Wars.	Modern European History	04055	G	1	Modern European History courses examine the development of political, social, and economic movements in Europe over the past few centuries (from the Renaissance period, or later, to the contemporary period) and usually include such topics as the rise of the modern nation state, scientific and industrial revolutions, the age of exploration and nationalism, imperialism, and world war.
45.0855	European History, Advanced Readings	Modern European history; political and diplomatic; intellectual and cultural; social and economic.	Modern European History	04055	H	1	

Continued.

Table 24. Selected examples of CSSC/SCED course categorization differences—Continued

CSSC Examples			Equivalent SCED Examples				
Code	Title	Description	Title	Code	Level	Sequence	Description
11.0604	Network Administration/ Management 1	Courses leading toward certification in network management by Microsoft, Novell, etc.	Networking Systems	10102	G	1	Networking Systems courses are designed to provide students with the opportunity to understand and work with hubs, switches, and routers. Students develop an understanding of LAN (local area network), WAN (wide area network), wireless connectivity, and Internet-based communications (including cloud-based computing), with a strong emphasis on network function, design, and installation practices. Students acquire skills in the design, installation, maintenance, and management of network systems that may help them obtain network certification.
11.0605	Network Administration/ Management 2	Courses leading toward certification in network management by Microsoft, Novell, etc.	Networking Systems	10102	G	2	
11.0606	Network Administration/ Management 3	Courses leading toward certification in network management by Microsoft, Novell, etc.	Networking Systems	10102	G	3	
11.0607	Network Administration/ Management 4	Courses leading toward certification in network management by Microsoft, Novell, etc.	Networking Systems	10102	G	4	

CSSC codes for 23.0112 and 23.0113 illustrate how the SCED simplifies coding by using the same code and course description for courses of comparable topical content, using the course level attribute to indicate when the instructional level of one course is basic/remedial and another is general. SCED code 01003 describes the content equivalent to either CSSC code, but the difference in rigor can still be identified by analysts by using the level attribute.

Physical Geography, CSSC code 45.0707 illustrates the more robust course descriptions of the SCED, which improves both the search functions for codes in electronic coding applications and the decision-making processes of staff selecting the best-fitting codes for high school courses. Modern Europe (CSSC 45.0852) and European History, Advanced Readings (CSSC 45.0855) show CSSC descriptions that are difficult to distinguish between, with only the titles providing clues for discrimination ("Advanced Readings"). The SCED uses a single code and more articulate description for courses on the topic of modern European history, with the course level attribute used to distinguish between a general and advanced course.

CSSC codes for Network Administration/Management provide examples of subjects where the CSSC used multiple codes with descriptions that provide little to distinguish between them beyond numbers one through four in the titles, which may not correspond to the titles or descriptions for actual high school courses. The SCED uses a single code for Networking Systems and uses the course sequence element to distinguish between sequential iterations of the course.

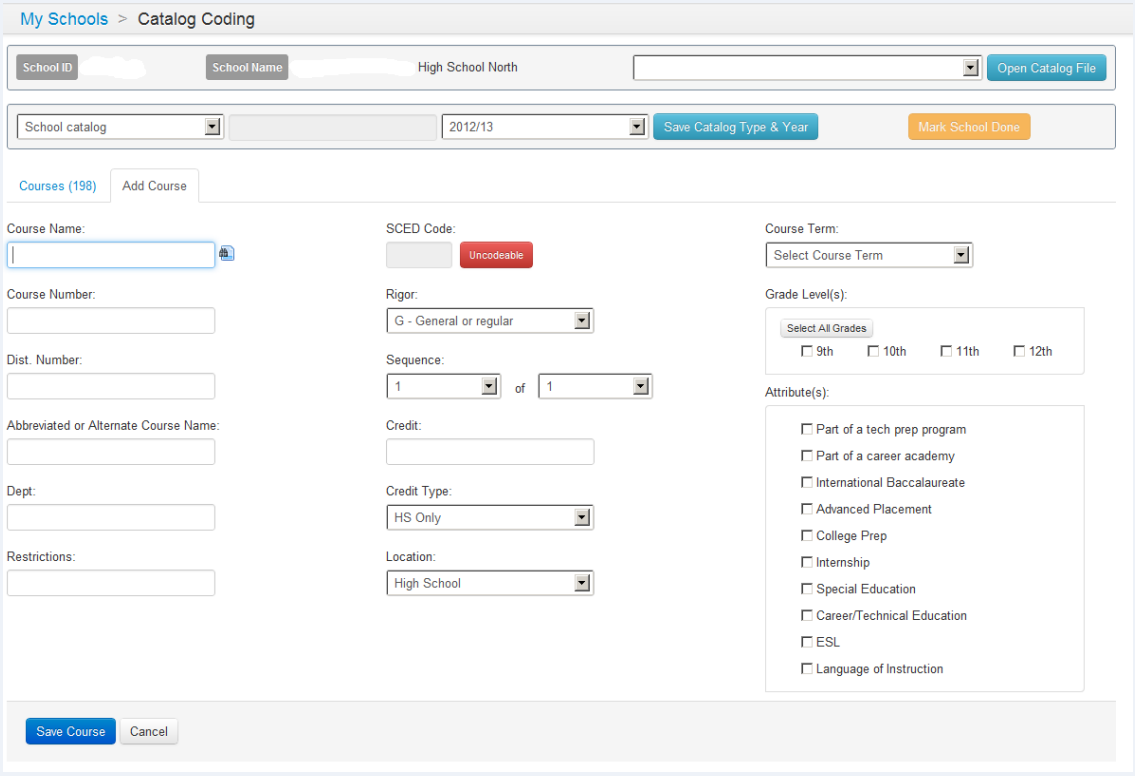
5.1.1 Course Catalog Keying and Coding System

All courses listed in base-year school course catalogs were keyed and coded using the HSLS:09 keying and coding system. Figure 4 shows a sample course data entry screen in the catalog keying/coding system, illustrating how course information was organized and collected. The course catalog section of the keying/coding system collected the following coursetaking information:

- Course Name and Number, including any alternate or abbreviated course name.
- District Number, when different from a course number.
- Department offering the course, for example, English or History.
- Course Restrictions, for example, student must be 16 years old in order to take a driver's education course.

- Course Subject, coded using a School Codes for the Exchange of Data (SCED) subject code, as detailed in section 5.3.
- Sequence and Rigor, components of the SCED code.
- Number of Credits awarded for course.
- Credit Type, awarded for the course, including High School, College, or both High School and College credit.
- Location where the course was taken—at High School, Career/Vocational Center, College/University, or Online.
- Term Course was offered, such as for a full year or only part of the year, in the fall or spring.
- Grade Levels to which the course was offered.
- Course Attributes. These included if the course was part of a tech prep program, part of a career academy, Advanced Placement or International Baccalaureate, College Prep, Internship, Special Education, Career/Technical Education, ESL, or if the course was taught in a language other than English.

Figure 4. Catalog course entry page in keying and coding system: 2014



SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) High School Transcript Study.

5.1.2 Course Catalog Entry Process

Each course catalog was assigned to a single keyer/coder. This allowed staff to become familiar with the layout and appearance of the course catalog. Only base-year school course catalogs were entered into the keying/coding system. Catalogs for non-base-year schools identified as attended by sample members were used as resources for transcript course coding, but the catalog courses were not keyed and coded.

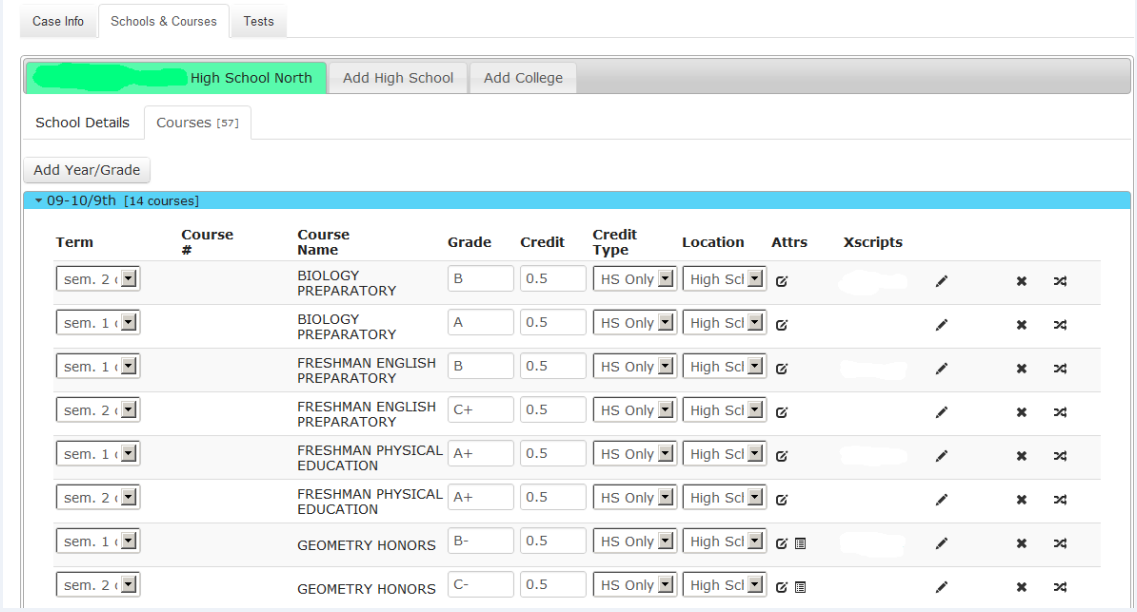
Keyer/coder staff entered every course listed in a school's course catalog into the catalog entry screen. In addition to keying the course information outlined in section 5.1.1, each course subject was coded using the SCED taxonomy. Upon completion of a course catalog, keyer/coder staff were assigned the transcripts of sample members who attended the same school. Continuity of staff keying and coding catalogs and transcripts from the same schools added familiarity with the school's courses, credit and grading systems, and methods of presenting information.

5.1.3 Transcript Keying and Coding System

Sample member transcript data were also collected using the keying and coding system. Figure 5 shows a sample screen from the transcript courses data entry page in the keying/coding system, illustrating how transcript data are organized by common data elements to facilitate data entry. The keying and coding sections collected the following transcript information:

- Case Information, including student name, address, date of birth, and social security number.
- School Details, including completion or departure dates, current enrollment, completion type (type of diploma, if applicable), special programs (e.g., Special Education, Gifted, Bilingual), and grade point average.
- Additional Schools Attended—when additional schools attended by a sample member were shown on transcripts, these schools were recorded in the keying and coding system, along with dates of attendance, when available.
- Course Data, including the terms in which the courses were taken, course numbers and names, and grades and credit earned, type of credit awarded, and location. Any course attributes associated with course were also captured here.
- Tests and test scores listed on transcripts, such as competency and placement exams or externally administered exams (e.g., SAT and ACT).

Figure 5. Courses page in transcript keying and coding system: 2014



SOURCE: U.S. Department of Education, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09) High School Transcript Study.

To help to ensure the quality of data that were keyed and coded, specific features were incorporated into the design of the keying and coding system. For example, the keying and coding system provided links to school course catalogs for easy reference; limited ranges and the types of characters input for fields such as dates and exam scores; and included code search features for secondary school and postsecondary institution codes.

5.1.4 Transcript Entry Process

Transcripts, like catalogs, were assigned to keyer/coders by school, so that a single keyer/coder was responsible for all transcripts received from a particular school. Furthermore, transcripts were assigned to the keyer/coder who completed the catalog for the same school. Data entry fields were organized similarly to how student data are typically arranged on transcripts. For example, term names and dates were entered, and courses were entered within the terms during which they were taken. A sample member's record within the keying and coding system included sections for each school that he or she attended, with associated data entered accordingly. Courses that were transferred between schools were noted in the keying and coding system, so that courses could be identified by the school where the credits originated and by the school(s) that later included these courses on transcripts.

As transcript courses were entered into the keying and coding system, they were linked to courses from the course offerings files, which was created from the process of course catalog keying and coding. The links were made using course numbers and names. These linkages enable association of the course offerings file to the courses found on transcripts, including the course subject code.

When a transcript course did not link to a catalog course, the course was coded using a course coding and linking application. This application was used for unlinked courses from base-year school transcripts as well as courses from transfer schools that did not have course offerings files to match to. The coding and linking application allowed keyer/coders to review course offerings data to determine if a link could be found or to search the course subject codes to select the most appropriate code. This application included links to course catalogs for both base-year and transfer schools to facilitate selection of the best fitting course code. For schools that did not provide catalogs, courses were coded based on course title.

Keyer/coders also reviewed the school information entered by school contacts, as described in section 5.2. Where data were missing, keyer/coders reviewed school catalogs to look for the information, and when available, such information was entered into the keying and coding system.

5.2 Keyer/Coder Staff Training

Keying and coding training took place in December 2013 with an additional training held in March 2014. Training participants included keyer/coders, quality experts, and quality control supervisors. Quality experts were responsible for assisting with quality control during data collection and answering keyer/coder questions or relaying more difficult questions to project staff as needed. The quality control supervisor was responsible for administrative management of the keyer/coders. Keyer/coders reviewed confidentiality regulations, underwent fingerprinting, and signed notarized affidavits prior to the start of training.

Training began with an overview of HSLS:09 and a discussion of different types of course catalog and transcript formats, data elements, and data entry using the keying and coding system. Presentations on keying and coding fundamentals were followed by problem-solving exercises and practice sessions. The fourth day of training consisted primarily of supervised keying and coding practice using actual course catalogs and transcripts, followed by a practicum exam.

Additional training was performed as needed during Quality Circle meetings, which were held weekly to discuss important aspects of the keying/coding operation, such as handling the wide variation in course catalog and transcript layouts and information provided by the institutions. During the meetings, quality experts and the keyer/coders were encouraged to ask questions regarding course catalogs, transcripts, data elements, and other aspects of their responsibilities. Using information from these meetings, keying and coding guidance documents were updated to reflect new guidelines or updates to existing procedures; the documents were available to all keyer/coder staff throughout the duration of the project.

5.3 Transcript Coding Taxonomies

Coding taxonomies were incorporated into the KCS for the coding of secondary schools, postsecondary institutions, and course subjects. Public and private secondary schools were coded using the set of schools contained in the Common Core of Data (CCD) (http://nces.ed.gov/ccd/) and the Private School Universe Survey (PSS) (http://nces.ed.gov/surveys/pss/), respectively. For students with coursework at postsecondary institutions listed on their high school transcripts, these postsecondary institutions were coded using the Integrated Postsecondary Education Data System (IPEDS) (http://nces.ed.gov/IPEDS/), developed by the National Center for Education Statistics (NCES).

High school course subjects were coded using version 2.0 of the School Codes for the Exchange of Data (SCED), a secondary school course classification system (http://nces.ed.gov/forum/SCED.asp). The SCED is a 12-digit code consisting of four elements: course subject, level of rigor, available credit, and sequence.

The subject code accounts for the first 5 digits of the full SCED code. The first 2 digits indicate the subject area, and the complete 5-digit code provides the specific definition of the course subject. There are 23 subject codes, and 1,672 total 5-digit codes. Over 140 courses are considered presecondary because the subject focuses on courses for pre-kindergarten through 8th grade. These codes were not used to code courses taken by HSLS:09 transcript sample members.

Rigor identifies the level of difficulty, which is captured using one of the following five options:

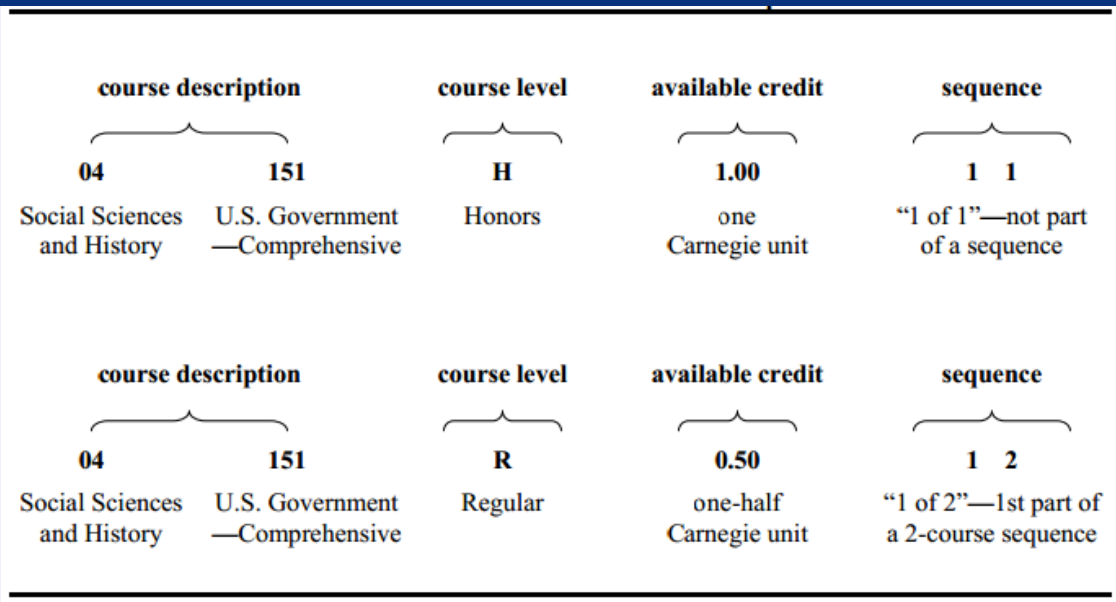
- B – basic or remedial,
- G – general or regular,
- E – enriched or advanced,
- H – honors, and
- X – no level of rigor.

Available credit captures the number of Carnegie units earned for completing the course. A course that meets daily for a year is coded as one Carnegie unit. Other courses, such as physical education, may only meet for half a year or every other day and would be coded as 0.5 Carnegie units.

Sequence refers to the order in which related courses are taken. In the SCED, courses can only be in sequence if the same 5-digit subject code is used for the related courses. For example, Accounting I and II are consecutive courses taken in the accounting department and are in a sequence because both courses are coded using the same subject code (12104 – Accounting). Spanish I and II would not be in sequence, although they are related, because there are different subject codes for these courses (06101 – Spanish I and 06102 – Spanish II). Sequence is reported as two characters to capture the placement of the course in the sequence and the total number of courses in the set (e.g., part 'n' of 'm' parts). In the accounting example above, the sequence would be 1 of 2 for the Accounting I course to indicate it is the first of two courses in a series.

Figure 6 shows a visual representation of the structure of the 12-digit SCED code.

Figure 6. SCED code diagram: 2007



SOURCE: Bradby, D., Pedroso, R., and Rogers, A. (2007). *Secondary School Course Classification System: School Codes for the Exchange of Data (SCED)* (NCES 2007-341). Washington, DC: National Center for Education Statistics, U.S. Department of Education. http://nces.ed.gov/pubs2007/2007341.pdf

Certain characteristics are common across the 22 categories of related subject codes. The SCED contains 5-digit subject codes related to the method of learning. For example, codes ending in 45 or 95 are aide codes, which represent courses where

students assist the teacher with preparing or delivering course content. Independent study codes, ending in 47 or 97, are used for courses in which students are allowed to explore a particular topic in more detail or at an advanced level. Codes ending in 48 or 98 are workplace codes, which are used for courses that provide students with work experience outside of the classroom.

The 5-digit structure also includes codes that are described as "others." Codes ending in 49 or 99 are "other" codes, used for subjects that are not covered in a specific code. "Other" codes may be used for more specialized courses or those with emerging topics not currently covered in the SCED.

5.4 Catalog and Transcript Keying and Coding Results

5.4.1 Catalog Keying and Coding Results

Of the 911 participating sampled schools, complete catalogs were keyed and coded for 889 schools. Nineteen schools either did not have a catalog available or did not provide a catalog, and three schools sent partial catalogs. Forty-nine participating schools were in common local or state education systems that shared a common course catalog across schools. For these schools, the catalogs were not keyed and coded individually; the catalog records were keyed and coded once and replicated for the other schools.

A total of 185,389 courses were keyed and coded from the collected catalogs. Fewer than 300 courses were deemed uncodeable, often due to unclear course titles or inadequate information on course content.

5.4.2 Transcript Keying and Coding Results

At least one transcript was received from each of 21,928 students. As students can have more than one transcript, a total of 24,397 transcripts were receipted and keyed and coded. These transcripts included a total of 1,013,425 courses taken at 3,071 schools. Of the courses coded, 0.05 percent were coded with an "other" code. Courses deemed uncodeable accounted for 0.02 percent of courses coded, often due to unclear course titles or inadequate information on course content.

5.5 Quality Control

Evaluations of the data were undertaken to ensure the quality of catalog and transcript data entered into the KCS. These activities included double-coding with

arbitration for catalog course coding, double-keying for transcript data, and reviewing "other, specify," and uncodeable school data.

5.5.1 Double-Coding with Arbitration

Double-coding was performed on a sample of approximately 10 percent of the courses from each school's catalog, for a total of 17,827 courses, both to evaluate the reliability of coded data and to create feedback opportunities to improve course coding. After the catalog was keyed and coded, a second keyer/coder reviewed course data and selected the four components of the SCED code for the course. The second keyer/coder did not have access to the initial coder's selections. The rate of agreement between the two keyer/coders provided a measure of inter-rater reliability for course code data.

Cohen's Kappa statistic was used to assess inter-rater reliability between the first coder and the double-coder at two levels of SCED subject code specificity: the 2-digit general category and the specific 5-digit course code. Measuring the proportion of agreement between raters, above what would be expected by chance, a kappa score of 0.81-1.00 is considered "almost perfect agreement," 0.61-0.80 is "substantial agreement," and 0.41-0.60 is "moderate agreement." The kappa statistic at the 2-digit level was 0.95, and at the 5-digit level, it was 0.70.

Inter-rater reliability was also assessed for the other components of the SCED code: rigor, sequence, and credit. The kappa statistic for rigor was 0.78; for sequence, it was 0.64; and for credit, it was 0.90.

When codes chosen by the first and second coders did not match, the difference was arbitrated in a second step. The arbiter, a member of project staff with extensive knowledge of the taxonomy and coding guidance, reviewed the course information and selected a subject code, rigor, credit, and sequence, thus agreeing with either the first or second coder or selecting a third code, rigor, credit, and/or sequence. Project staff used arbitration results to provide direct feedback to keyer/coders on coding choices and to develop additional guidance on selecting the best-fitting codes.

5.5.2 Rekeying

To evaluate the reliability of transcript data keyed into the KCS, approximately 10 percent of each keyer/coder's transcripts were randomly selected to be rekeyed by a different keyer/coder. As with double-coding, the Cohen's Kappa statistic was used to assess inter-rater reliability between the original keyer/coder and the rekeyer. The results show that rekeyed items had a kappa value of 0.80.

5.5.3 Review and Upcoding of Uncodeable Schools

When courses from another school were listed on a transcript, these courses were associated with the school where they were originally taken. In some cases, the transcripts did not provide adequate or clear data on the previously attended school for them to be coded with a CCD, PSS, or IPEDS code. Project staff reviewed data for schools that keyer/coders had noted as unknown (typically unnamed schools) or uncodeable (named schools that could not be matched to a CCD, PSS, or IPEDS code). Because transcript collection pursued transcripts from all known schools attended, often a school that was unclearly listed on a transcript was later clarified when additional transcripts were received for the student. In total, 1,243 schools reported on transcripts could not be coded. Note that the count of uncodeable schedules likely contains duplicates—multiple students may have attended the same uncodeable school. Uncodeable schools also included learning centers, such as career and technical education centers that were not included in CCD or PSS databases.

5.5.4 Review of Variables with "Other, specify" Options

An "other, specify" upcoding process was performed to review text strings captured in "other, specify" response options in the KCS. Transcript data elements with "other, specify" options included the following:

- completion type (e.g., standard diploma),
- reason for leaving (e.g., transferred),
- program (e.g., bilingual),
- tests (e.g., SAT), and
- catalog type.

All items coded as "other, specify" were reviewed by analysts to determine if the text strings could fit into existing choices or if there were common strings that merited addition of a new choice. If a value appeared repeatedly as a text string, it was assigned as a category and upcoded accordingly. Table 25 shows the results of "other, specify" upcoding. The total number of cases is shown for each data element along with the number and percent that were upcoded.

Table 25. Upcoding of "other, specify" data

Data elements with "other, specify" option	Number of "other, specify" cases	Number upcoded	Percent upcoded
Completion type	1,230	906	73.3
Reason for leaving	689	456	66.2
Program	684	56	8.2

NOTE: Detail may not sum to totals because of rounding.
SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) High School Transcript Study.

Chapter 6. 2013 Update and Transcript Weighting, Nonresponse Bias, Imputation, and Estimation and Design Effects

6.1 2013 Update and High School Transcript Weights

Estimates are generated for the High School Longitudinal Study of 2009 (HSLS:09) target populations with a set of analytic weights and software that accounts for the complex, two-stage sample design. A series of weights have been computed for HSLS:09 to accommodate analyses specific to each round of the study (base year, first follow-up, or 2013 Update and high school transcript collection) plus analyses to evaluate change over time.

A brief overview of base-year and first follow-up weights is presented in section 6.1.1, while the 2013 Update weights are discussed in detail in sections 6.1.2 and 6.1.3. Quality control procedures employed in the development of the 2013 Update weights are described in section 6.1.4, and guidance on the process of selecting weights for particular analyses is provided in section 6.1.5.

6.1.1 Overview of Weighting in Base Year and First Follow-up

Five sets of weights were constructed for the HSLS:09 base year: a school-level weight used to analyze information collected in the administrator and counselor questionnaires; a student weight for analyzing student survey responses and mathematics ability; and three contextual weights to incorporate responses obtained from the science teacher questionnaire, the mathematics teacher questionnaire, and the home-life (parent) questionnaires. The steps implemented to create these weights are detailed in the *HSLS:09 Base-Year Data File Documentation* (Ingels et al. 2011). Relevant information from the base year as it pertains to the 2013 Update is provided below to strengthen the discussion.

Four analytic weights were computed for the HSLS:09 first follow-up using a similar methodology as implemented in the base year. They include two student weights;

one weight for analyses specific to the first follow-up and one for longitudinal analyses associated with change between the base year and first follow-up and two home-life contextual weights; one weight for first follow-up analyses; and one weight for longitudinal analyses connected to responses obtained from the parent questionnaire. The steps utilized to create these weights are discussed in detail in the *HSLS:09 Base Year to First Follow-Up Data File Documentation* (Ingels et al. 2013). Information from the first follow-up relevant to the 2013 Update is provided below to enhance the documentation.

6.1.2 Overview of 2013 Update and High School Transcript Survey Weights

Nine analytic weights were computed for the HSLS:09 2013 Update using a similar methodology as implemented in the base year and first follow-up. Four of the weights were constructed for respondents to the 2013 Update student survey, not adjusting for high school transcript response (non-transcript weights). Five weights were constructed for high school transcript respondents. The construction processes for the four non-transcript weights are described in this section.

The four non-transcript weights include one for analyses specific to the 2013 Update (W3STUDENT); one for analyses associated with the change between the base year and the 2013 Update (W3W1STU); one for analyses associated with change between the first follow-up and the 2013 Update (W3W2STU); and one for analyses associated with change across the base year, first follow-up, and the 2013 Update (W3W1W2STU).

The five transcript weights include one for analyses specific to high school transcript response only (W3HSTRANS); one for analyses that utilize 2013 Update data combined with high school transcript data (W3STUDENTTR); one for analyses associated with change between the base year and the 2013 Update that also incorporate high school transcript data (W3W1STUTR); one for analyses associated with change between the first follow-up and 2013 update that also incorporate high school transcript data (W3W2STUTR); and one for analyses associated with change across the base year, first follow-up, and the 2013 Update and incorporate high school transcript data (W3W1W2STUTR).

Precision (standard errors) and bias are important attributes to evaluate when assessing the quality of the survey estimates. Results from a series of nonresponse bias analyses are summarized in section 6.2 to highlight the effectiveness of the weight adjustments in improving data quality (details are provided in appendix F). Precision for a set of important characteristics is summarized in sections 6.6 and 6.7,

following specifications for correctly calculating HSLS:09 standard errors (details are provided in appendix E).

6.1.3 Computation of 2013 Update and High School Transcript Survey Weights

This section discusses the two types of weight adjustments used to produce the nine Taylor series and associated balanced repeated replication (BRR) weights for the 2013 Update and high school transcript survey. The base weight used to construct each weight is described in section 6.1.3.1; the nonresponse adjustments are described in section 6.1.3.2; and the calibration adjustments are described in section 6.1.3.3. The sets of BRR weights constructed for each of the Taylor series weights are listed in section 6.1.3.4.

6.1.3.1 Base Weight

The student base weight developed for the HSLS:09 base year also served as the first follow-up base weight. Specifically, the HSLS:09 base student weight was calculated as

$$w_{1hij} = w_{3hi}\, d_{j|hi} \tag{6.1}$$

where w_{3hi} is the base-year school analytic weight and $d_{j|hi}$ is the conditional student-level base weight (inverse probability of selection in stratum *j* within sample school *hi*). Please see the *HSLS:09 Base-Year Data File Documentation* (Ingels et al. 2011) for more information on the construction of the HSLS:09 base student weight.

6.1.3.2 Adjustments for Nonresponse

A variety of nonresponse adjustments were applied to the student base weight, as described in section 6.1.3.1, in order to produce the nine Taylor series weights and their associated BRR weights. The nonresponse adjustments were designed to adjust the student base weights for respondents so that nonresponse-adjusted weighted distributions of a variety of respondent characteristics matched the base-weighted distributions of the same characteristics across all eligible sample members. These nonresponse adjustments reduce bias in survey estimates to the degree that the characteristics used in the nonresponse adjustments correlate with survey variables.

The first nonresponse adjustment for each weight was designed to account for sample members who had not responded in any prior round where prior rounds include the base year and first follow-up for the four Update weights

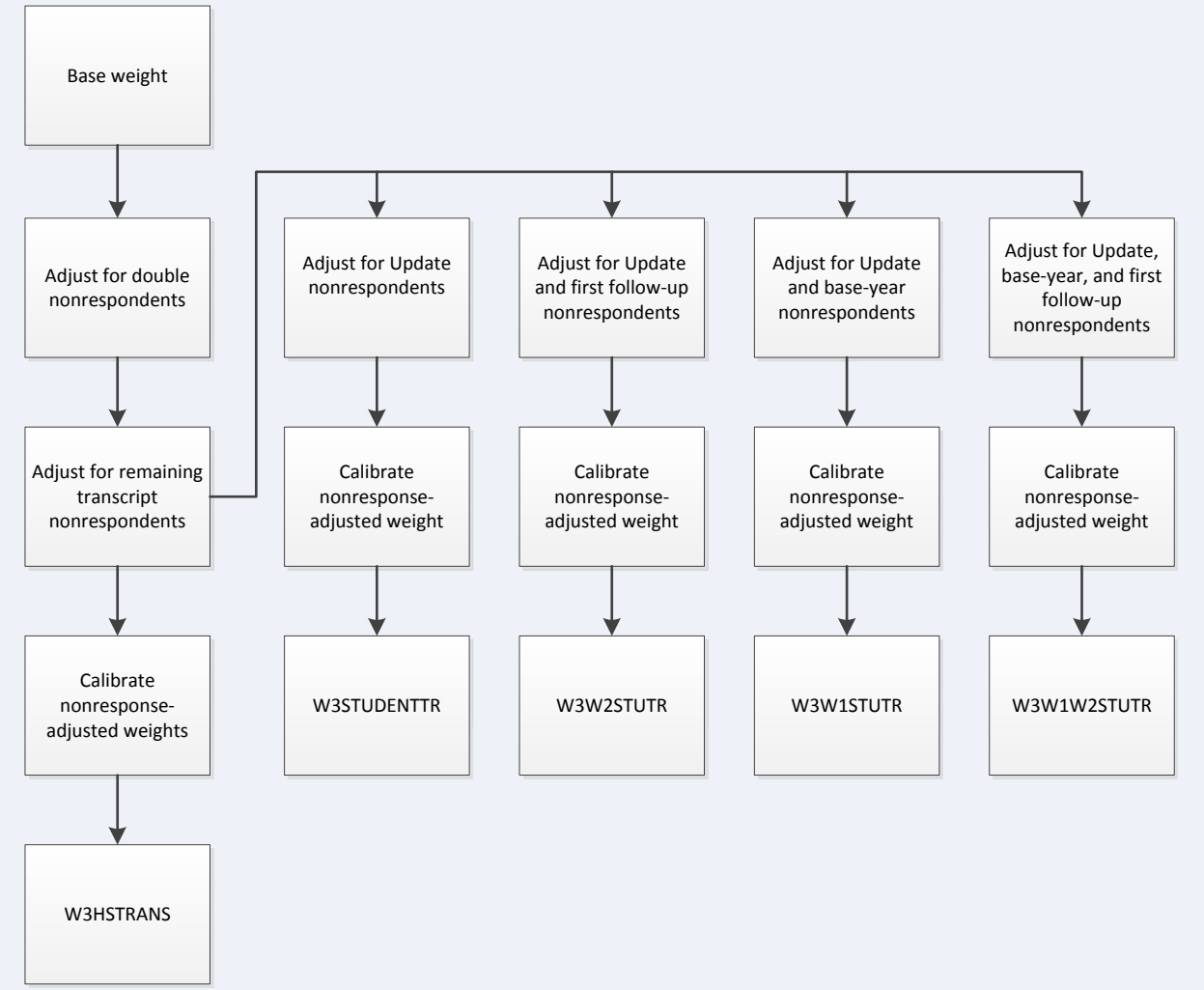
(W3STUDENT, W3W2STU, W3W1STU, and W3W1W2STU) and include the base year, first follow-up, and 2013 Update for the five high school transcript weights (W3HSTRANS, W3STUDENTTR, W3W2STUTR, W3W1STUTR, and W3W1W2STUTR).

The second nonresponse adjustment for each weight was designed to account for additional nonrespondents associated with the weight, and for the four Update weights and high school transcript weight W3HSTRANS, this second adjustment accounted for all remaining nonrespondents.

A third nonresponse adjustment was applied in the construction of the four high school transcript weights W3STUDENTTR, W3W2STUTR, W3W1STUTR, and W3W1W2STUTR due to the fact that nonresponse occurs in two manners: missing transcript data and sample member nonparticipation in the base year, first follow-up, or 2013 Update. For these four weights, the second nonresponse adjustment accounts for nonresponse arising from missing transcript data, while the third nonresponse adjustment accounts for nonresponse arising from nonparticipation in prior HSLS:09 rounds. The weight construction process for the five high school transcript weights is illustrated in figure 7.

Nonresponse models incorporated student-level and school-level characteristics where possible and were implemented using the WTADJUST procedure in SUDAAN®.

Figure 7. High school transcript weight construction process



SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) High School Transcript Study.

6.1.3.3 Weight Calibration

While the nonresponse adjustments described in section 6.1.3.2 were designed to account for differences in the characteristics of respondents and nonrespondents, the resulting nonresponse-adjusted weights had different weight sums, across various high school and sample member characteristics that differed from population totals defined in the base year. In order to ensure that the 2013 Update and high school transcript weights are representative of the population defined in the base year, the nonresponse-adjusted weights were poststratified to control totals defined in the base year.

For example, for the computation of W3STUDENT, to maintain consistency with the student population first defined in the HSLS:09 base year, a weight adjustment was applied to the nonresponse-adjusted weight. A calibration model was developed that included both school-level and student-level characteristics. As with the nonresponse adjustments, the calibration adjustment was constructed and applied through the WTADJUST procedure in SUDAAN®.

For more information on the weight calibration adjustment procedure employed for each specific weight, please see appendix H, Weighting Equations.

6.1.3.4 Balanced Repeated Replication (BRR) Weights

A set of 200 BRR weights was created for each of the nine analytic weights. These sets of BRR weights include (1) 2013 Update student weights (W3STUDENT001–200); (2) base year to 2013 Update student weights (W3W1STU001–200); (3) first follow-up to 2013 Update student weights (W3W2STU001–200); (4) base year to first follow-up to 2013 Update student weights (W3W1W2STU001–200); (5) high school transcript weights (W3HSTRANS001–200); (6) 2013 Update and high school transcript weights (W3STUDENTTR001–200); (7) first follow-up, 2013 Update, and high school transcript weights (W3W2STUTR001–200); (8) base year, 2013 Update, and high school transcript weights (W3W1STUTR001–200); (9) base year to first follow-up to 2013 Update and high school transcript weights (W3W1W2STUTR001–200). Procedures for constructing the weights mirrored those used to construct the corresponding analytic weight. Namely, BRR base weights were constructed and subjected to nonresponse and calibration adjustments developed for each replicate. Additional information about BRR weights may be found in section 6.6.

6.1.4 Characteristics of Analytic Weights

The characteristics of the nine analytic weights are presented in table 26. For each weight, the number of respondents, the average weight, the standard deviation, the minimum and maximum, weight sums, and associated weighted response rates are provided.

Table 26. Descriptive characteristics of survey weights

Weight	Number of Respondents	Mean	Standard deviation	Minimum	Maximum	Sum[1]
W3STUDENT	18,558	225.9	289.5	2	7,657.8	4,191,356
W3W1STU	17,117	242.5	312.1	1.9	7,670.1	4,151,658
W3W2STU	17,282	242.3	318.2	2	7,848.4	4,186,572
W3W1S2STU	15,857	261.3	335.2	2.4	7,955.0	4,143,944
W3HSTRANS	21,928	191.2	236.1	1.8	6,162.2	4,191,832
W3STUDENTTR	17,656	237.4	305.8	2.1	7,639.2	4,191,305
W3W1STUTR	16,303	254.6	325.5	2.2	7,615.3	4,150,651
W3W2STUTR	16,525	253.4	326.9	2.2	7,702.4	4,187,366
W3W1W2STUTR	15,188	272.8	348.6	2.6	7,871.5	4,143,492

[1] The student counts in table 10 of chapter 3 in the *HSLS:09 Base-Year Data File Documentation* (Ingels et al. 2011) were used as the control totals. Weight sums differ from the population counts because of the suppression of the questionnaire-incapable students from the public-use file and deceased students being included in the calibration and subsequently having their weights set to zero. Values may not sum to overall totals because of rounding.
SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update and High School Transcript Study, Public-use Data File.

6.1.5 Choosing an Analytic Weight

The choice and number of HSLS:09 weights were driven by the need to maximize the analytic utility for the research community. Such analyses may include responses obtained from a particular instrument within a round of the study (e.g., student questionnaire responses in the first follow-up) along with combinations of data from multiple instruments (e.g., student and parent questionnaire responses, changes in student responses from the base year to the 2013 Update). As discussed in the *HSLS:09 Base Year to First Follow-Up Data File Documentation* (Ingels et al. 2013) and repeated here, weights were derived to facilitate many, but not all, possible scenarios.[14] Some important scenarios are described below.

The 2013 Update data file contains a total of 18 analytic weights (see table 27): five weights for analysis of the base-year data, four weights to be used in conjunction with the first follow-up data, and nine weights to be used for analysis involving the 2013 Update and high school transcripts. Researchers analyzing *any* data from the 2013 Update (alone or in conjunction with base-year, first follow-up data, or both) should use one of the four 2013 Update weights, and *any* analyses using high school transcript data (alone or in conjunction with base-year, first follow-up, and/or 2013

[14] The creation of additional HSLS:09 weights was considered to address other analytic scenarios. However, to limit the size of the analytic files and to limit potential confusion in the choice of analytic weight if a large number of weights were produced, decisions were made to focus only on the most likely types of analyses given the HSLS:09 first follow-up data sources.

Update data) should utilize one of the five high school transcript weights. Analyses involving *only* the base-year data, with no first follow-up, 2013 Update, or high school transcript data, should include one of the five weights for analysis of base-year data. Similarly, analyses involving *only* the first follow-up data, with no base-year, 2013 Update, or high school transcript data, should include one of the two first follow-up weights for first follow-up responses.

Response patterns for the HSLS:09 base-year, first follow-up, and 2013 Update and high school transcript studies addressed by the weights are summarized in table 28. Only use the student weight on the restricted use file to analyze data pertaining to sample members classified as questionnaire incapable in the base year or first follow-up. To produce general population estimates that align with public-use estimates, for all other analyses set the restricted-use analysis weights to zero for any sample member classified as questionnaire incapable in the relevant base year or first follow-up study. Two restricted-use variables, X1SQSTAT and X2SQSTAT, can be used to identify sample members classified as questionnaire incapable in the base year or first follow-up. If X1SQSTAT=7 then a sample member was classified as questionnaire incapable in the base year and if X2SQSTAT=7 then a sample member was classified as questionnaire incapable in the first follow-up.

The following guidelines are provided to assist researchers in identifying the appropriate weight for analyses that include a particular combination of components. The best approach to choosing a sample weight for a given analysis is to select one that maximizes the number of sources of data included in the analyses for which nonresponse adjustments are made. This in turn minimizes bias in estimates, while maintaining as large an unweighted sample size as possible.

Table 27. HSLS:09 analytic weights

HSLS:09 study	Universe[1]	Estimation	Variable name	Nonresponse-adjusted component(s) in each weight[2]
Base year	All study-eligible schools	Base year only	W1SCHOOL	School
Base year	All study-eligible students in base year[3]	Base year only	W1STUDENT W1PARENT W1SCITCH W1MATHTCH	Student Student*Parent Student*Science teacher Student*Math teacher
First follow-up	9th-grade cohort	First follow-up only	W2STUDENT W2PARENT	Student Parent

See notes at end of table.

Table 27. HSLS:09 analytic weights—Continued

HSLS:09 study	Universe[1]	Estimation	Variable name	Nonresponse-adjusted component(s) in each weight[2]
Base year and first follow-up	9th-grade cohort	Change from base year to first follow-up	W2W1STU W2W1PAR	Student[4] Student*Parent[4]
2013 Update	9th-grade cohort[5]	2013 Update only	W3STUDENT	Student
Base year and 2013 Update	9th-grade cohort[5]	Change from base year to 2013 Update	W3W1STU	Student[4]
First follow-up and 2013 Update	9th-grade cohort[5]	Change from first follow-up to 2013 Update	W3W2STU	Student[4]
Base year, first follow-up, and 2013 Update	9th-grade cohort[5]	Change from base year to first follow-up to 2013 Update	W3W1W2STU	Student[4]
High school transcript	9th-grade cohort[5,6]	High school transcript only	W3HSTRANS	High school transcript
High school transcript and 2013 Update	9th-grade cohort[5,6]	High school transcript and 2013 Update	W3STUDENTTR	High school transcript*Student
High school transcript, base year, and 2013 Update	9th-grade cohort[5,6]	High school transcript, base year, and 2013 Update	W3W1STUTR	High school transcript*Student
High school transcript, base year, first follow-up, and 2013 Update	9th-grade cohort[5,6]	High school transcript, base year, first follow-up, and 2013 Update	W3W1W2STUTR	High school transcript*Student
High school transcript, first follow-up, and 2013 Update	9th-grade cohort[5,6]	High school transcript, first follow-up, and 2013 Update	W3W2STUTR	High school transcript*Student

[1] The sum of the associated analytic weights estimates the total for the universe.
[2] Student-level weights are a function of the school analytic weights and therefore are also adjusted for school nonresponse. Unless otherwise specified, the weights were additionally adjusted for nonresponse within the listed HSLS:09 study.
[3] The subpopulation associated with the public-use file is restricted to 9th-grade students who were capable of participating in the student questionnaire and math assessment.
[4] The longitudinal student weights account for nonresponse in the base year, the first follow-up, the 2013 Update, and all possible response patterns across the three surveys.
[5] Excludes those from the cohort who are deceased.
[6] Excludes those who were determined to be deceased, between the conducting of the 2013 Update and high school transcript collection.
NOTE: The symbol "*" should be interpreted as "and." For example, the W1PARENT weight was developed using adjustments for student and parent nonresponse.
SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update and High School Transcript Study.

Table 28. Number and percentage of completed surveys, complete high school transcripts, or their combinations for the student sample: 2013

Study round and high school transcript combinations	Data source	Eligible	Participated	Weighted percent[1]	Unweighted percent
Base year	Student questionnaire	25,206	21,444	85.7	85.1
	Student assessment	25,206	20,781	83.0	82.4
	Parent questionnaire	21,444	16,429	76.1	76.6
	School administrator	21,444	20,301	94.2	94.7
	School counselor	21,444	19,505	90.2	91.0
	Teacher questionnaire				
	Math teacher	20,970	16,035	72.3	76.5
	Science teacher	20,101	14,629	70.0	72.8
First follow-up	Student questionnaire	25,184	20,594	82.0	81.8
	Student assessment	25,184	18,507	73.0	73.5
	Parent questionnaire[2]	11,952	8,651	72.5	72.4
Base year and first follow-up[3]	Student questionnaire	25,184	18,623	74.3	74.0
	Student assessment	25,184	16,356	64.7	65.0
	Parent questionnaire[4]	10,210	6,611	64.2	64.8
2013 Update	Student questionnaire	25,168	18,558	73.1	73.7
Base year and 2013 Update[5]	Student questionnaire	25,168	17,117	67.6	68.0
First follow-up and 2013 Update[7]	Student questionnaire	25,168	17,282	68.0	68.7
Base year, first follow-up, and 2013 Update[6]	Student questionnaire	25,168	15,857	62.5	63.0
High school transcript	High school transcript[8]	25,167	21,928	87.7	87.1
High school transcript and 2013 Update	High school transcript	25,167	17,656	70.2	69.63
High school transcript, base year, and 2013 Update	High school transcript	25,167	16,303	64.7	64.4

See notes at end of table.

Table 28. Number and percentage of completed surveys, complete high school transcripts, or their combinations for the student sample: 2013—Continued

Study round and high school transcript combinations	Data source	Eligible	Participated	Weighted percent[1]	Unweighted percent
High school transcript, first follow-up, and 2013 Update	High school transcript	25,167	16,525	65.6	64.9
High school transcript, base year, first follow-up, and 2013 Update	High school transcript	25,167	15,188	60.4	59.8

[1] All weighted percentages are based on the row under consideration and are calculated with the student base weight.
[2] Details of the parent subsample design are provided in section 3.3.4 of the *HSLS:09 Base Year to First Follow-up Data File Documentation* (Ingels et al. 2013).
[3] Only sampled students who participated in both the base year and first follow-up are considered as participants.
[4] Participants are identified as sampled students who participated in both the base year and first follow-up and who have parent responses in both the base year and first follow-up.
[5] Only sampled students who participated in both the base year and 2013 Update are considered as participants.
[6] Only sampled students who participated in the base year, first follow-up, and 2013 Update are considered as participants.
[7] Only sampled students who participated in both the first follow-up and 2013 Update are considered as participants.
[8] The number of participants associated with high school transcript data sources corresponds to the number of sample members with high school transcript data and who also responded in the study rounds indicated in the first column.
SOURCE: U.S. Department of Education, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09) 2013 Update and High School Transcript Study, Restricted-use Data File and Control System Data.

Two sources of contextual information for analysis of the student data were obtained in the HSLS:09 base year but not in the first follow-up or 2013 Update. They include interviews with the science teacher and mathematics teacher for students taking the associated course in the 9th grade. Researchers may choose to condition the analyses of first follow-up, 2013 Update student data on teacher responses from the base year, or both. Unlike the base-year data file, the 2013 Update and high school transcript data file do not contain contextual analytic weights to account for nonresponse among students with base-year teacher information. Instead, for first follow-up data, either W2STUDENT or W2PARENT should be used depending on the inclusion of parent responses; for 2013 Update student data, W3STUDENT should be used; and for high school transcript data, W3HSTRANS should be used. Note that estimates generated with first follow-up student data and either W2STUDENT or W2PARENT, 2013 Update student data and W3STUDENT, or high school transcript data and W3HSTRANS, in conjunction with the base-year teacher responses, are no longer associated with the HSLS:09 target population of 9th-grade students and should be used with caution.

Four of the five high school transcript weights incorporate student response status in prior rounds, while remaining weight is constructed regardless of prior-round

response status. Each of the four weights whose construction incorporates student response in prior rounds necessarily requires student response in the 2013 Update. That is, all of these four high school transcript weights created in conjunction with student data involve the 2013 Update, and there are no transcript weights created in conjunction with base-year data, first follow-up student data, or both that do not involve the 2013 Update. Thus, researchers who are interested in analyzing base-year data, first follow-up data, or both alongside high school transcript data, irrespective of the 2013 Update, must utilize one of the high school transcript longitudinal weights created that encompasses the 2013 Update. For those interested in analyzing base-year student data with high school transcript data, and no first follow-up data, it is recommended that the high school transcript and base-year to 2013 Update longitudinal weight (W3W1STUTR) be used. For researchers interested in analyzing first follow-up student data with high school transcript data, and no base-year data, it is recommended that the high school transcript and first follow-up to 2013 Update longitudinal weight (W3W2STUTR) be used. Finally, for those interested in analyzing base-year and first follow-up student data with high school transcript data, it is recommended that the high school transcript and base-year to first follow-up to 2013 Update longitudinal weight (W3W1W2STUTR) be used. In all three of the scenarios described, estimates are representative of the HSLS:09 target population of 9th-grade students.

6.1.5.1 Base-Year School-Level Analysis

School-level analysis is only appropriate with the base-year school-level data. At the base year, the HSLS:09 study design supports national estimates of schools with 9th-graders in the 2009–10 school year.[15]

- W1SCHOOL. This weight accounts for base-year school nonresponse. Estimates generated with this base-year school weight are associated with the HSLS:09 target population of schools. This weight can be used for the analysis of school characteristics, school administrator survey data, and counselor survey data, individually or in combination. Note that weighted values generated from the school administrator and counselor response

[15] Base-year school-level estimates pertain to all regular public schools, including public charter schools, and all private schools in the 50 United States and the District of Columbia providing instruction to students in both the 9th and 11th grades. Additional details are found in section 3.2.1 of the *HSLS:09 Base-Year Data File Documentation* (Ingels et al. 2011).

provide information for the HSLS:09 target population of schools.[16] Additional information on construction of the school weight is provided in the *HSLS:09 Base-Year Data File Documentation* (Ingels et al. 2011).

6.1.5.2 Base-Year Student-Level Analysis

If a researcher is *only* using base-year student-level data, with no 2013 Update or high school transcript data, then one of the four weights discussed in this section should be used. If a researcher is analyzing any data from the 2013 Update or high school transcript (alone or in conjunction with base-year data), then one of the weights for first follow-up data (either W2STUDENT or W2Parent) should be used, as will be discussed in section 6.1.5.3.

- W1STUDENT. This weight accounts for (1) base-year school nonresponse and (2) student nonresponse in the base-year study. All records for sample students who participated in the base year will have a positive (nonzero) weight. Estimates generated with this base-year student weight are associated with the HSLS:09 target population of 9th-grade students.[17] This weight can be used for the analysis of base-year student assessment scores or survey data, alone or in combination with the school characteristics or administrator/counselor data.
- W1PARENT. This weight accounts for nonresponse in the base year associated with (1) schools, (2) students, and (3) parents.[18] All records for sample students who participated in the base year with a parent who also participated in the base year will have a positive (nonzero) weight. Estimates generated with this base-year student home-life weight are associated with the HSLS:09 target population of 9th-grade students. This weight can be used for the analysis of base-year parent responses, alone or in conjunction with student data, school characteristics, or administrator/counselor data.
- W1SCITCH. This weight includes adjustments for (1) school nonresponse, (2) student nonresponse, and (3) science-teacher nonresponse in the base

[16] Questionnaire responses were requested from the lead counselor or counselor most knowledgeable about 9th-grade counseling practices at each sampled school. Because the counselor was *not* randomly selected from the set of counselors, contextual estimates can only be generalized to the target population of schools and not to a population of school counselors.
[17] An analysis of the nonresponse patterns in the combined student and administrator or counselor data did not indicate the need for additional student-level weights.
[18] Parent information was available for neither *all* sampled 9th-grade students nor for the target population of parents. Therefore, the contextual weights were adjusted for the known characteristics of the participating students.

year.[19] All records for sample students who participated in the base year with a science teacher who also participated in the base year will have a positive (nonzero) weight. Estimates generated with this base-year science-course enrollee weight are associated with the subgroup of 9th-grade students in the HSLS:09 target population taking a science course in the 9th grade. These estimates ***do not*** reflect the population of all science teachers of 9th-grade students because science teachers themselves were not sampled directly (see sections 3.4 and 6.5 of the *HSLS:09 Base-Year Data File Documentation* [Ingels et al. 2011] for further information). This weight can be used for the analysis of science teacher data in conjunction with base-year student data, school characteristics, or administrator/counselor data.

- W1MATHTCH. This weight includes adjustments for (1) school nonresponse, (2) student nonresponse, and (3) mathematics-teacher nonresponse in the base year.[20] All records for sample students who participated in the base year with a mathematics teacher who also participated in the base year will have a positive (nonzero) weight. Estimates generated with this base-year mathematics-course enrollee weight are associated with the subgroup of 9th-grade students in the HSLS:09 target population taking a mathematics course in the 9th grade. These estimates do not reflect the population of all mathematics teachers of 9th-grade students because mathematics teachers themselves were not sampled directly (see sections 3.4 and 6.5 of the *HSLS:09 Base-Year Data File Documentation* [Ingels et al. 2011] for further information). This weight can be used for the analysis that draws on mathematics teacher data in conjunction with base-year student data, school characteristics, or administrator/counselor data.

6.1.5.3 First Follow-Up Student-Level Analysis

If a researcher is *only* analyzing data from the first follow-up, one of the two first follow-up weights discussed in this section should be used. If a researcher is analyzing any data from the 2013 Update or high school transcript (alone or in

[19] As with the home-life contextual weight (W1PARENT), the science teacher contextual weights were adjusted for the known characteristics of the participating students because information was not available for the associated target population of teachers. The sum of the weights estimates the total number of 9th-grade students in the HSLS:09 target population taking a science course and is less than the total number of 9th-grade students.

[20] The mathematics teacher contextual weights were adjusted for the known characteristics of the participating students because information was not available for the associated target population of teachers. The sum of the weights estimates the total number of 9th-grade students in the HSLS:09 target population taking a mathematics course and is less than the total number of 9th-grade students.

conjunction with base-year or first follow-up data), then one of the weights discussed in section 6.1.5.4 should be used.

- W2STUDENT. This weight accounts for (1) base-year school nonresponse and (2) student nonresponse in the first follow-up only (regardless of the student's base-year response status). All records for sample students who participated in the first follow-up will have a positive (nonzero) weight. The estimates generated with these weights are associated with the HSLS:09 target population of 9th-grade students.[21] This weight can be used for the analysis of first follow-up student assessment scores or survey data, alone or in combination with the school characteristics, administrator/counselor data from either round of HSLS:09, or teacher data from the base year.[22] If the analysis includes base-year student data, researchers are encouraged to consider W2W1STU (see below).
- W2PARENT. This weight accounts for (1) base-year school nonresponse, (2) subsampling of parents for the first follow-up, and (3) parent nonresponse in the first follow-up.[23,24] All records for sample students with a parent who participated in the first follow-up will have a positive (nonzero) weight. The estimates generated with these weights are associated with the HSLS:09 target population of 9th-grade students. This weight can be used for analysis of first follow-up parent responses alone or in combination with student survey data, assessment data, or both, administrator/counselor data from either round of HSLS:09, or teacher data from the base year. If the analysis includes base-year parent interview data, researchers are encouraged to consider W2W1PAR.

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[21] Responses in the first follow-up were obtained from the administrator and counselor of the base-year sample school for (1) students who were attending that school during the first follow-up and (2) dropouts and early graduates whose last known school was that base-year school. First follow-up administrator responses, but not counselor responses, were obtained from the transfer school for (1) students who were attending the transfer school during the first follow-up and (2) dropouts and early graduates who had last attended that school. Administrator and counselor responses were not obtained for homeschooled students and nonresponding transfer students.

[22] As discussed for the course enrollee weights, not all students were taking science or mathematics courses in the 9th grade. Therefore, analyses involving the base-year teacher responses will provide estimates for the subgroup of 9th-grade students in the HSLS:09 target population taking the associated course.

[23] Note that W2PARENT differs slightly from the base-year weight (W1PARENT). Unlike in the base year, a positive weight was calculated for student cases with a responding parent irrespective of the student's first follow-up response status. The base-year weight was calculated only for participating students with a responding parent.

[24] Parent information was available for neither *all* sampled 9th-grade students nor the target population of parents. Therefore, the contextual weights were adjusted for the known characteristics of the participating students. Note that student data are not available for 355 responding parent records because of student nonresponse in the first follow-up.

- W2W1STU. This weight accounts for (1) base-year school nonresponse and (2) student nonresponse in both the base year and the first follow-up. All records for sample students who participated in the base year *and* first follow-up will have a positive (nonzero) weight. The estimates generated with this weight are associated with the HSLS:09 target population of 9th-grade students. This weight can be used for analysis of population change that examines the student data from the base year to the first follow-up, alone or in combination with administrator/counselor data from the base year, the first follow-up of HSLS:09, or both or teacher data from the base year.[25]
- W2W1PAR. This weight accounts for (1) school nonresponse at the base year, (2) student nonresponse in the base year and the first follow-up, (3) subsampling of parents for the first follow-up, and (4) parent nonresponse at the base year and the first follow-up. All records for sample students who participated in the base year *and* first follow-up with parents who also responded in the base year *and* first follow-up will have a positive (nonzero) weight. The estimates generated with this weight are associated with the HSLS:09 target population of 9th-grade students. This weight can be used for analysis of population change from the base year to the first follow-up in the home-life (contextual) responses obtained from the parent questionnaires, alone or in combination with student survey data, assessment data, or both, administrator/counselor data from either round of HSLS:09, or teacher data from the base year.[26]

6.1.5.4 2013 Update and High School Transcript Student-Level Analysis

- W3STUDENT. This weight accounts for (1) base-year school nonresponse and (2) student nonresponse in the 2013 Update only (regardless of the student's base-year and first follow-up response status). All records for sample students who participated in the 2013 Update will have a positive (nonzero) weight. The estimates generated with these weights are associated with the HSLS:09 target population of 9th-grade students adjusted for the

[25] Note that estimates generated with first follow-up student data and W2W1STU in conjunction with the base-year teacher responses are no longer associated with the HSLS:09 target population of 9th-grade students and should be used with caution.
[26] Note that estimates generated with first follow-up student data and W2W1PAR in conjunction with the base-year teacher responses are no longer associated with the HSLS:09 target population of 9th-grade students and should be used with caution.

number of deceased students observed in the HSLS:09 sample.[27] This weight can be used for the analysis of 2013 Update survey data, alone or in combination with the school characteristics, administrator/counselor data from any round of HSLS:09, or teacher data from the base year. If the analysis includes base-year student data, researchers are encouraged to consider W3W1STU and W3W2STU if the analysis includes first follow-up data in conjunction with 2013 Update data, W3W1W2STU if the analysis includes both base-year and first follow-up data, and W3STUDENTTR if the analysis incorporates high school transcript data.

- W3W1STU. This weight accounts for (1) base-year school nonresponse and (2) student nonresponse in both the base year and the 2013 Update. All records for sample students who participated in the base year *and* 2013 Update will have a positive (nonzero) weight. The estimates generated with this weight are associated with the HSLS:09 target population of 9th-grade students adjusted for the number of deceased students observed in the HSLS:09 sample. This weight can be used for analysis of population change that examines the student data from the base year to the 2013 Update, alone or in combination with administrator/counselor data, teacher data from the base year, or both.[28]
- W3W2STU. This weight accounts for (1) base-year school nonresponse and (2) student nonresponse in the first follow-up and the 2013 Update. All records for sample students who participated in the first follow-up *and* 2013 Update will have a positive (nonzero) weight. The estimates generated with this weight are associated with the HSLS:09 target population of 9th-grade students adjusted for the number of deceased students observed in the HSLS:09 sample. This weight can be used for analysis of population change that examines the student data from the first follow-up to the 2013 Update, alone or in combination with administrator/counselor data from the first follow-up of HSLS:09.
- W3W1W2STU. This weight accounts for (1) base-year school nonresponse and (2) student nonresponse in the base year, first follow-up, and the 2013 Update. All records for sample students who participated in the base year, first follow-up, and 2013 Update will have a positive (nonzero) weight. The estimates generated with this weight are associated with the HSLS:09 target

[27] Weights were computed for deceased students and then subsequently removed such that the sum of the weights is representative of the HSLS:09 target population of 9th-grade students who are currently alive. This method was implemented for all four 2013 Update student weights.

[28] Note that estimates generated with 2013 Update student data and W3W1STU in conjunction with the base-year teacher responses are no longer associated with the HSLS:09 target population of 9th-grade students and should be used with caution.

population of 9th-grade students adjusted for the number of deceased students observed in the HSLS:09 sample. This weight can be used for analysis of population change that examines the student data from the base year to the first follow-up to the 2013 Update, alone or in combination with administrator/counselor data from the base year, the first follow-up of HSLS:09, or both or teacher data from the base year.[29]

- W3HSTRANS. This weight accounts for (1) base-year school nonresponse and (2) high school transcript nonresponse only (regardless of the student's base year, first follow-up, and 2013 Update response status). All records for sample students for whom a high school transcript was collected will have a positive (nonzero) weight. The estimates generated with these weights are associated with the HSLS:09 target population of 9th-grade students adjusted for the number of deceased students observed in the HSLS:09 sample.[30] This weight can be used for the analysis of high school transcript data, alone or in combination with the school characteristics, administrator/counselor data from any round of HSLS:09, or teacher data from the base year. If the high school transcript analysis includes 2013 Update student data, and no base-year or first follow-up data, then researchers are encouraged to consider W3STUDENTTR, consider W3W1STUTR if the transcript analysis includes base-year data or base-year and 2013 Update data, consider W3W2STUTR if the analysis includes first follow-up data or first follow-up and 2013 Update data, or consider W3W1W2STUTR if the transcript analysis includes both base-year and first follow-up data or base-year, first follow-up, and 2013 Update data.
- W3STUDENTTR. This weight accounts for (1) base-year school nonresponse, (2) high school transcript nonresponse, and (3) student nonresponse in the 2013 Update only (regardless of the student's base-year and first follow-up response status). All records for sample students for whom a high school transcript was collected *and* who participated in the 2013 Update will have a positive (nonzero) weight. The estimates generated with these weights are associated with the HSLS:09 target population of 9th-grade students adjusted for the number of deceased students observed in the HSLS:09 sample. This weight can be used for the analysis of high school transcript data in conjunction with 2013 Update student data, alone or in

[29] Note that estimates generated with 2013 Update student data and W3W1W2STU in conjunction with the base-year teacher responses are no longer associated with the HSLS:09 target population of 9th-grade students and should be used with caution.

[30] Weights were computed for deceased students and then subsequently removed such that the sum of the weights is representative of the HSLS:09 target population of 9th-grade students who are currently alive. This method was implemented for all five high school transcript weights.

combination with the school characteristics, administrator/counselor data from any round of HSLS:09, or teacher data from the base year. If the high school transcript analysis does not include 2013 Update student data, and does not include student data from the base year or first follow-up, then researchers are encouraged to consider W3HSTRANS.

- W3W1STUTR. This weight accounts for (1) base-year school nonresponse, (2) high school transcript nonresponse, and (3) student nonresponse in both the base year and the 2013 Update. All records for sample students for whom a high school transcript was collected *and* who participated in the base year *and* 2013 Update will have a positive (nonzero) weight. The estimates generated with this weight are associated with the HSLS:09 target population of 9th-grade students adjusted for the number of deceased students observed in the HSLS:09 sample. This weight can be used for analysis of population change that examines the student data from the base year to the 2013 Update and incorporates the high school transcript data, alone or in combination with administrator/counselor data, teacher data from the base year, or both.[31]
- W3W2STUTR. This weight accounts for (1) base-year school nonresponse, (2) high school transcript nonresponse, and (3) student nonresponse in both the first follow-up and the 2013 Update. All records for sample students for whom a high school transcript was collected *and* who participated in the first follow-up *and* 2013 Update will have a positive (nonzero) weight. The estimates generated with this weight are associated with the HSLS:09 target population of 9th-grade students adjusted for the number of deceased students observed in the HSLS:09 sample. This weight can be used for analysis of population change that examines the student data from the first follow-up to the 2013 Update and incorporates the high school transcript data, alone or in combination with administrator/counselor data from the first follow-up of HSLS:09.
- W3W1W2STUTR. This weight accounts for (1) base-year school nonresponse, (2) high school transcript nonresponse, and (3) student nonresponse in the base year, first follow-up, and the 2013 Update. All records for sample students for whom a high school transcript was collected *and* who participated in the base year, first follow-up, *and* 2013 Update will have a positive (nonzero) weight. The estimates generated with this weight are associated with the HSLS:09 target population of 9th-grade students

[31] Note that estimates generated with 2013 Update student data and W3W1STU in conjunction with the base-year teacher responses are no longer associated with the HSLS:09 target population of 9th-grade students and should be used with caution.

adjusted for the number of deceased students observed in the HSLS:09 sample. This weight can be used for analysis of population change that examines student data from the base year to the first follow-up to the 2013 Update and incorporates the high school transcript data, alone or in combination with administrator/counselor data from the base year, the first follow-up of HSLS:09, or both or teacher data from the base year.[32]

6.1.6 Weighting Quality Control

A quality control (QC) phase was implemented for all activities, including the construction of the 2013 Update and High School Transcript weights. Various analytic properties of the initial weights, the weight adjustment factors, and the resulting weights after applying the adjustments were examined both overall and within sampling strata, including the (1) distribution of the weights, (2) ratio of the maximum weight divided by the minimum weight, (3) unequal weighting effect, and (4) the minimum and maximum weight adjustments. Finally, the sum of the weights were verified against pre-adjusted weight sums (e.g., marginal totals of the student weights prior to nonresponse adjustment and of respondents after nonresponse adjustment) and against the counts used in the final calibration adjustment. Similar procedures were used for the QC of the 2013 Update and High School Transcript BRR weights. As with the base year and first follow-up, a senior statistician also thoroughly checked each set of weights, owing to the central importance of these values in the calculation of population estimates.

6.2 Unit and Item Nonresponse Bias Analysis

Unit and item nonresponse bias analyses are presented in this section, with unit nonresponse discussed in section 6.2.1 and item nonresponse discussed in section 6.2.2.

6.2.1 Unit Nonresponse Bias Analysis

NCES standards require unit nonresponse bias analyses when unit weighted response rates fall below 85 percent. These analyses identify any statistically detectable differences between estimates calculated for the study respondents and for the nonrespondents. Unit nonresponse bias analyses were conducted for all nine

[32] Note that estimates generated with 2013 Update student data and W3W1W2STU in conjunction with the base-year teacher responses are no longer associated with the HSLS:09 target population of 9th-grade students and should be used with caution.

analytic weights and 15 categorical items were used to assess unit nonresponse bias. Most of the 15 items are derived from sampling frame data and are not available in either restricted-use or public-use files. The 15 items and, where applicable, their corresponding variable names are listed below.

- School type (X1CONTROL)
- Charter school status (A1SCHTYPE)
- Ninth grade enrollment by race
- Total school enrollment
- Ninth grade enrollment
- Number of full-time teachers (A1FTTCHRS)
- Student to teacher ratio
- Census region (X1REGION)
- School urbanicity (X1LOCALE)
- School grade range (X1GRADESPAN)
- Religious affiliation of school
- Secondary status of school
- State of school (X1STATE)
- Gender (X2SEX)
- Race (X2RACE)

The 15 items consist of 67 different values and estimates of bias were calculated and tested for each of those 67 values for each of the nine analytic weights. The explicit categorization and category labels for each of the 15 items are provided in Appendix F.

Bias reduction attributable to base weight adjustments for nonresponse is described below, beginning with a description of the statistical test for unit nonresponse bias (section 6.2.1.1). The results of the unit nonresponse bias assessments are provided for the student 2013 Update weight W3STUDENT (section 6.2.1.2), student base-

year to 2013 Update weight W3W1STU (section 6.2.1.3), first follow-up to 2013 Update weight W3W2STU (section 6.2.1.4), student base-year to first follow-up to 2013 Update weight W3W1W2STU (section 6.2.1.5), high school transcript weight W3HSTRANS (section 6.2.1.6), high school transcript and 2013 Update weight W3STUDENTTR (section 6.2.1.7), high school transcript and base-year to 2013 Update weight W3W1STUTR (section 6.2.1.8), high school transcript and first follow-up to 2013 Update weight W3W2STUTR (section 6.2.1.9), and high school transcript and base-year and first follow-up and 2013 Update weight W3W2W1STUTR (section 6.2.1.10).

6.2.1.1 Test of Significant Nonresponse Bias

Nonresponse bias is the difference between the estimated parameter calculated from the respondent data and the true value. For a population mean, for example, the nonresponse bias is calculated as

$$Bias(\bar{y}_R) = \bar{y}_R - \mu \tag{6.2}$$

where $\bar{y}_R$ is the mean (or proportion) estimated from the survey responses and μ is the corresponding (true) population value. Because the truth is unknown, the population value and the bias must be estimated using data from respondents and nonrespondents:

$$\hat{\mu} = (1-\hat{\eta})\bar{y}_R + \hat{\eta}\bar{y}_{NR} \tag{6.3}$$

where $\hat{\eta}$ is the weighted unit nonresponse rate.[33] Substituting expression (6.3) into expression (6.2) provides the formula for the estimated bias:

$$\hat{Bias}(\bar{y}_R) = \hat{\eta}(\bar{y}_R - \bar{y}_{NR}) \tag{6.4}$$

Initial bias estimates were calculated with the DESCRIPT procedure in SUDAAN, and the (adjusted) base weights were used to generate the nonresponse rate. With the estimated standard error of the bias that accounted for the association between $\bar{y}_R$ and $\bar{y}_{NR}$, a t test was formed to determine whether the bias was significantly greater than zero at a 0.05 level of significance. The same test was recomputed using nonresponse-adjusted weights to determine whether the weight adjustment appropriately reduced the

[33] The weighted unit nonresponse rate was calculated using the design weights adjusted for school release and the student design weights for each type of nonresponse bias analysis.

bias to insignificant levels. Table 29 contains a summary of the analysis for the nine analytic weights; see appendix F for the detailed analysis tables.

Table 29. Summary statistics for unit nonresponse bias analyses before and after a weight adjustment for nonresponse, by HSLS:09 2013 Update analytic weights

Analytic weight	Significant bias tests at 0.05 level[1]		Median absolute relative bias[2]		
	Percent before weight adjustment	Percent after weight adjustment	Percent before weight adjustment	Percent after weight adjustment	Percent relative change[3]
[W3STUDENT] 2013 Update	32.8	0	1.9	0	-100.0
[W3W1STU] Base year to 2013 Update	38.8	0	2.8	0	-100.0
[W3W1W2STU] Base year to first follow-up to 2013 Update	41.8	0	3.2	0	-100.0
[W3W2STU] First follow-up to 2013 Update	38.8	0	2.3	0	-100.0
[W3HSTRANS] High school transcript	19.4	1.5	1.4	0	-100.0
[W3STUDENTTR] Transcript and 2013 Update	26.9	0	2.3	0	-100.0
[W3W1STUTR] Transcript and base year to 2013 Update	35.8	0	2.9	0	-100.0
[W3W2STUTR] Transcript and base year to first follow-up to 2013 Update	31.3	0	2.8	0	-100.0
[W3W1W2STUTR] Transcript and first follow-up to 2013 Update	43.3	0	3.5	0	-100.0

[1] "Before" and "after" are in reference to the nonresponse weight adjustment. A total of 67 statistical tests were performed; the number 67 was used as the basis for the reported percentages.
[2] The percent relative bias is calculated as 100 multiplied by the estimated bias divided by the estimated value. The absolute relative bias is the absolute value of the (percent) relative bias.
[3] The percent relative change is calculated as 100 multiplied by the median value after adjustment minus the median value before adjustment divided by the median value before adjustment.
NOTE: The percent relative change is the percentage decrease in median bias after weight adjustment. The formula for this was 100 * (median value after adjustment – median value before adjustment) / median value before adjustment.
SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update and High School Transcript Study, Restricted-use Data File and Control System Data.

6.2.1.2 2013 Update Student-Level (W3STUDENT) Unit Nonresponse Bias Analysis

In keeping with the NCES statistical standards, nonresponse bias analyses were performed for 2013 Update student responses using the student analytic weight W3STUDENT because, as shown in table 26, the unit weighted response rate for the 2013 Update was 73.1 percent. Students who completed a substantial portion of the questionnaire were classified as a respondent. (Note that participation rates in chapter 2 are based on unweighted cases fielded, while response rates in the current chapter are based on the full sample and weighted.)

As in the base year and first follow-up, some information (e.g., race/ethnicity, sex) was available for nonresponding students through the study enrollment lists. Base-year school characteristics were available for all sampled students. Note that 2013 Update school characteristics were not collected, and first follow-up school characteristics were either not available or not applicable for some first follow-up nonresponding students. In total, 18 variables were used for the 2013 Update student unit nonresponse bias analysis. Approximately 32.8 percent of the 67 statistical tests identified bias significantly greater than zero at the 0.05 significance level (see table 26) prior to adjusting the weights for nonresponse. After adjustment, no levels of bias were detectable at the 0.05 level of significance, and the median absolute relative bias was reduced by 100.0 percent. The results are presented in table F-1 in appendix F. Additional comparisons between estimates produced after nonresponse adjustment and estimates produced after poststratification are provided in table F-2 in appendix F.

6.2.1.3 Base-Year to 2013 Update Longitudinal Student-Level (W3W1STU) Nonresponse Bias Analysis

Nonresponse bias was also evaluated in student items available for longitudinal analyses in the base year to 2013 Update. As shown in table 26, the unit weighted response rate for the 2013 Update was 73.1 percent. However, the unit weighted response rate for students with responses in the 2013 Update *and* the base year was 67.6 percent. A total of 18 variables were used for the student base-year to 2013 Update longitudinal unit nonresponse bias analysis. These 18 variables resulted in 67 comparisons (tests). Bias was detected for 38.8 percent of the 67 tests (see table 29) implemented with the student base-year to 2013 Update longitudinal weight (W3W1STU). After applying the nonresponse adjustments, no bias was statistically significant in any of the 67 tests. A 100.0 percent reduction was also seen in the median absolute relative bias. The detailed analyses are shown in table F-3 in

appendix F. Additional comparisons between estimates produced after nonresponse adjustment and estimates produced after poststratification are provided in table F-4 in appendix F.

6.2.1.4 First Follow-Up to 2013 Update Longitudinal Student-Level (W3W2STU) Nonresponse Bias Analysis

The unit weighted response rate for students with responses in the 2013 Update and first follow-up was 68.0 percent. A total of 18 variables were used for the student first follow-up to 2013 Update longitudinal unit nonresponse bias analysis. These 18 variables resulted in 67 comparisons (tests). Bias was detected for 38.8 percent of the 67 tests (see table 29) implemented with the student first follow-up to 2013 Update longitudinal weight (W3W2STU). After applying the nonresponse adjustments, no bias was statistically significant in any of the 67 tests. A 100.0 percentage point reduction was also seen in the median absolute relative bias. The detailed analyses are shown in table F-5 in appendix F. Additional comparisons between estimates produced after nonresponse adjustment and estimates produced after poststratification are provided in table F-6 in appendix F.

6.2.1.5 Base-Year to First Follow-Up to 2013 Update Longitudinal Student-Level (W3W1W2STU) Nonresponse Bias Analysis

The unit weighted response rate for students with responses in the 2013 Update, base year, *and* first follow-up was 62.5 percent. A total of 18 variables were used for the student base-year to first follow-up to 2013 Update longitudinal unit nonresponse bias analysis. These 18 variables resulted in 67 comparisons (tests). Bias was detected for 41.8 percent of the 67 tests (see table 29) implemented with the student base-year to first follow-up to 2013 Update longitudinal weight (W3W1W2STU). After applying the nonresponse adjustments, no bias was statistically significant in any of the 67 tests. A 100.0 percentage point reduction was also seen in the median absolute relative bias. The detailed analyses are shown in table F-7 in appendix F. Additional comparisons between estimates produced after nonresponse adjustment and estimates produced after poststratification are provided in table F-8 in appendix F.

6.2.1.6 High School Transcript (W3HSTRANS) Unit Nonresponse Bias Analysis

The unit weighted response rate for the high school transcript collection was 87.7 percent. A total of 18 variables were used for the high school transcript collection unit nonresponse bias analysis. These 18 variables resulted in 67 comparisons (tests).

Bias was detected for 19.4 percent of the 67 tests (see table 29) implemented with the high school transcript weight (W3HSTRANS). After applying the nonresponse adjustments, one bias was statistically significant across the 67 tests. A 100.0 percentage point reduction was also seen in the median absolute relative bias. The detailed analyses are shown in table F-9 in appendix F. Additional comparisons between estimates produced after nonresponse adjustment and estimates produced after poststratification are provided in table F-10 in appendix F.

6.2.1.7 *High School Transcript and 2013 Update (W3STUDENTTR) Unit Nonresponse Bias Analysis*

The unit weighted response rate for response in both the high school transcript collection and 2013 Update questionnaire was 69.6 percent. A total of 18 variables were used for the high school transcript collection unit nonresponse bias analysis. These 18 variables resulted in 67 comparisons (tests). Bias was detected for 26.9 percent of the 67 tests (see table 29) implemented with the high school transcript and 2013 Update weight (W3STUDENTTR). After applying the nonresponse adjustments, no bias was statistically significant in any of the 67 tests. A 100.0 percentage point reduction was also seen in the median absolute relative bias. The detailed analyses are shown in table F-11 in appendix F. Additional comparisons between estimates produced after nonresponse adjustment and estimates produced after poststratification are provided in table F-12 in appendix F.

6.2.1.8 *High School Transcript and Base-Year to 2013 Update Longitudinal (W3W1STUTR) Unit Nonresponse Bias Analysis*

The unit weighted response rate for response in the high school transcript collection, base-year student questionnaire, and 2013 Update questionnaire was 64.4 percent. A total of 18 variables were used for the high school transcript collection unit nonresponse bias analysis. These 18 variables resulted in 67 comparisons (tests). Bias was detected for 35.8 percent of the 67 tests (see table 29) implemented with the high school transcript and base-year to 2013 Update longitudinal weight (W3W1STUTR). After applying the nonresponse adjustments, no bias was statistically significant in any of the 67 tests. A 100.0 percentage point reduction was also seen in the median absolute relative bias. The detailed analyses are shown in table F-13 in appendix F. Additional comparisons between estimates produced after nonresponse adjustment and estimates produced after poststratification are provided in table F-14 in appendix F.

6.2.1.9 *High School Transcript and First Follow-Up to 2013 Update Longitudinal (W3W2STUTR) Unit Nonresponse Bias Analysis*

The unit weighted response rate for response in the high school transcript collection, first follow-up student questionnaire, and 2013 Update questionnaire was 64.9 percent. A total of 18 variables were used for the high school transcript collection unit nonresponse bias analysis. These 18 variables resulted in 67 comparisons (tests). Bias was detected for 31.3 percent of the 67 tests (see table 29) implemented with the high school transcript and first follow-up to 2013 Update longitudinal weight (W3W2STUTR). After applying the nonresponse adjustments, no bias was statistically significant in any of the 67 tests. A 100.0 percentage point reduction was also seen in the median absolute relative bias. The detailed analyses are shown in table F-15 in appendix F. Additional comparisons between estimates produced after nonresponse adjustment and estimates produced after poststratification are provided in table F-16 in appendix F.

6.2.1.10 *High School Transcript and Base-Year to First Follow-Up to 2013 Update Longitudinal (W3W1W2STUTR) Unit Nonresponse Bias Analysis*

The unit weighted response rate for response in the high school transcript collection, base-year student questionnaire, first follow-up student questionnaire, and 2013 Update questionnaire was 59.8 percent. A total of 18 variables were used for the high school transcript collection unit nonresponse bias analysis. These 18 variables resulted in 67 comparisons (tests). Bias was detected for 43.3 percent of the 67 tests (see table 29) implemented with the high school transcript and base-year to first follow-up to 2013 Update longitudinal weight (W3W1W2STUTR). After applying the nonresponse adjustments, no bias was statistically significant in any of the 67 tests. A 100.0 percentage point reduction was also seen in the median absolute relative bias. The detailed analyses are shown in table F-17 in appendix F. Additional comparisons between estimates produced after nonresponse adjustment and estimates produced after poststratification are provided in table F-18 in appendix F.

6.2.2 Item Nonresponse Bias Analysis

Item nonresponse bias, as with unit nonresponse bias (section 6.2.1), affects the analytic results when those who should have provided a response but do not are different in some relevant way to the study from those who do provide a response. A description of the item nonresponse bias analysis conducted on the HSLS:09 2013 Update and transcript data is presented in section 6.2.2.1. The bias formula used is a function of the difference between the estimated values for item respondents and

item nonrespondents and (base) weighted item response rates among the eligible sample members.

Item response rates, in general, measure the proportion of responses obtained for a particular question among study respondents who were supposed to answer the question.[34] For example, if a student answers that he or she is not Hispanic, then the instrument routes around the subsequent Hispanic origin question. The value for the Hispanic origin variable is appropriately missing and is recoded to −7 in the HSLS:09 data file (see section 3.1 in chapter 3). Conversely, if a student responds "yes" to the Hispanic question but does not provide her or his Hispanic origin, then the missing value for the latter question is labeled as item nonresponse. The weighted-item response rate formula used in the nonresponse bias estimates is provided in section 6.2.2.1.

A weighted item response rate among study participants that is less than 85 percent, calculated with the final analytic weight as in the HSLS:09 base year, was used to identify 2013 Update and transcript variables for the nonresponse bias analysis while the HSLS:09 base weight was used to estimate bias. The complete list of variables is provided in section 6.2.2.2. Finally, the item nonresponse bias results are summarized in section 6.2.2.3 and detailed in appendix F.

The formula for estimating bias within HSLS:09 was first presented for unit nonresponse bias (section 6.2.1) among the set of eligible sample members selected for the study. An item-level analysis identifies detectable levels of item nonresponse bias specific to a certain variable within a given HSLS:09 study instrument among all eligible sample members.

The item nonresponse bias estimator has a similar form to the unit nonresponse bias estimator given in expression (6.4). Namely, item nonresponse bias is estimated as

$$\hat{B}ias\left(\overline{y}_{xR}\right) = \hat{\eta}_x\left(\overline{y}_{xR} - \overline{y}_{xNR}\right) \tag{6.5}$$

where x indicates the study item being analyzed for bias and $\hat{\eta}_x$ is the weighted item nonresponse rate among all eligible sample members calculated with the appropriate HSLS:09 base weight. Because item nonresponse negates the ability to calculate estimates for the item nonrespondents, the bias must be estimated using a characteristic y known for the item respondents *and* item nonrespondents. Here, the term "item nonrespondents" includes the set of unit respondents who were

[34] Item response rates differ from a unit response rate that measures the proportion of eligible sample members among those selected for the study who actually participate.

supposed to answer item-*x* but did not and the set of unit nonrespondents. Therefore, $\overline{y}_{xR}$ and $\overline{y}_{xNR}$ given in expression (6.5) are the estimated mean of *y* for the item respondents and nonrespondents, respectively. Note that the weighted nonresponse rate and the classification of unit respondents as item respondents or nonrespondents changes with each *x*-variable included in the analysis.

The *y*-variables for the item nonresponse bias analysis were chosen from a set of variables known for all sample members that were also associated with many important factors studied in HSLS:09. The following HSLS:09 first follow-up school characteristics were included in the analyses:[35]

- School type (public, private-total, private-Catholic, private-other);
- Region of the United States (Northeast, Midwest, South, West); and
- Locale (urban, suburban, town, rural).

The following student characteristics were also identified for the analyses:

- Sex; and
- Race/ethnicity (American Indian/Alaska Native, non-Hispanic; Asian, non-Hispanic; Black/African American, non-Hispanic; Hispanic, no race specified; Hispanic, race specified; More than one race, non-Hispanic; Native Hawaiian/Pacific Islander, non-Hispanic; White, non-Hispanic).

Prior to calculating the nonresponse bias estimates, the HSLS:09 data were edited for consistency, and imputed values were excluded from the nonresponse bias analysis. Public-use student-level variables, derived from the 2013 Update student survey were examined for potential nonresponse bias using the 2013 Update student analytic weight (W3STUDENT). Transcript-related variables were examined for potential nonresponse bias using the student transcript analytic weight (W3HSTRANS).

6.2.2.1 Item Response Rates

NCES Statistical Standards state that questionnaire items (or composite variables derived from a set of questionnaire items; see section 6.4 for details) with low item response should be examined for significant levels of nonresponse bias. This bias, as with unit nonresponse bias, could affect analysis results obtained from the study data and lead to erroneous conclusions.[36] All study items with a weighted response rate

[35] If school information was not available from the first follow-up data, base-year school characteristics were used in the analysis.
[36] Nonresponse bias is defined as the difference between the estimated parameter calculated from the respondent data and the true value and is estimated using weighted data from respondents and nonrespondents.

less than 85 percent, calculated with the final analytic weight as in the HSLS:09 base year, among the study participants were classified as having high item nonresponse and were included in the item nonresponse bias analyses.

Response rates for all HSLS:09 student items and composites were calculated as follows (see NCES Statistical Standard 1-3-5):

$$1 - \hat{\eta}_x = \frac{I_x}{I - V_x}, \tag{6.6}$$

the (weighted) number of sample members with a valid response to variable x (I_x) divided by the (weighted) total number of unit respondents (I) minus any cases for which the question was not applicable (V_x). The final analytic weights, adjusted for unit nonresponse and calibrated to population information, were used in the calculations.

The identification of the not applicable cases—study respondents who were excluded from the calculation—followed a specific set of rules. For example, if a student answered "no" to the following (gate) question on absence from school, then the subsequent set of questions on reasons for the absence would not be asked, and the associated variables would have a not-applicable reserve code set.

Gate: *Has it been 4 or more weeks since you last attended high school?*
Branch: *Were you suspended or put on probation from the school?*

The value for the skipped questions would be coded as "−7" (= legitimate skip/not applicable). All "−7" values were excluded from the item nonresponse bias analysis.

In contrast, if a question was not answered because the respondent (1) completed only a portion of the questionnaire or (2) completed an abbreviated questionnaire without the item after declining to complete the full instrument, then the respondent would be included as an item nonrespondent in the associated item nonresponse bias analysis.

6.2.2.2 High Item-Nonresponse Variables

All 288 public-use student-level variables, including 149 variables on or derived from the 2013 Update questionnaire and 139 variables derived from the high school transcript, were reviewed to identify variables with less than an 85 percent response rate. A total of 50 items on or derived from the 2013 Update questionnaire (17.4 percent unweighted of 288 items) were identified as having less than an 85 percent weighted response rate (table 30). The lowest weighted item response rate, 19.2 percent, was found for the "S3 A15C Has taken other (not math or science) IB course(s) -- CUIBOTH" question (S3IBOTHER). 30 percent of the item-nonresponse bias analysis variables (15 of 50 items) had a weighted item response rate of at least 80 percent.

Table 30. Student-level questionnaire items with a weighted item response rate below 85 percent using W3STUDENT weight

Variable name	Description	Percent of records by type of response[1]			Unweighted item response rate	Weighted item response rate[2]
		Valid	Not applicable	Item missing		
S3IB	S3 A13B Has taken IB course(s) -- CUIB	43.6	40.3	6.2	87.5	85.0
S3FALLHS	S3 F01A Attend previously identified high school as of Nov 1 2013 -- CUFALLHS	2.7	87.0	0.5	85.0	84.9
S3NOCLGOTHRSN	S3 D10D Not attending postsecondary school as of Nov 1 2013 - other reason coded	11.3	76.8	2.0	84.8	84.8
S3FIELD2	S3 C05B Major will be considering - 2-digit CIP code -- CUFIELDGEN01	56.5	24.4	9.2	86.0	84.6
S3LASTHSYR	S3 A08B Year dropout/alternative completer last attended high school -- CULASTHSYR	5.6	83.6	1.0	85.0	83.7
S3FIELD_STEM	S3 C05C Major will be considering - STEM code	55.8	24.4	9.9	84.9	83.6
S3NOV1JOB_STEM1	S3 E19D Nov 1 2013 job - STEM code 1 (sub-domain)	41.0	40.9	8.2	83.4	83.0
S3MILBRANCH	S3 B05 Branch of the military will be serving in as of Nov 1 2013 -- CUMILBRANCH	3.1	86.2	0.9	78.1	82.7
S3CHOICEACC	S3 C12 Teen's first choice among schools accepted to -- CUCHOICEACC	62.0	16.6	11.5	84.4	82.2
S3CHOICEAPPLVL	S3 First choice applied to college IPEDS level	62.6	15.2	12.3	83.6	81.7
S3CHOICEAPPCNTRL	S3 First choice applied to college IPEDS control	62.6	15.2	12.3	83.6	81.7
S3CLGAPPLVL1	S3 First applied to college IPEDS level	44.9	36.6	8.6	84.0	81.5
S3CLGAPPCNTRL1	S3 First applied to college IPEDS control	44.9	36.6	8.6	83.9	81.5
S3CLGAPPSEL1	S3 First applied to college IPEDS selectivity code	44.3	36.6	9.2	82.8	80.2
S3CHOICEAPPSEL	S3 First choice applied to college IPEDS selectivity code	61.4	15.2	13.5	82.0	80.0
S3APOTHER	S3 A14C Has taken other (not math or science) AP course(s) -- CUAPOTH	33.3	50.3	6.5	83.7	79.9
S3APMATH	S3 A14A Has taken AP math course(s) -- CUAPMTH	33.3	50.3	6.5	83.7	79.8
S3APSCIENCE	S3 A14B Has taken AP science course(s) -- CUAPSCI	33.3	50.3	6.5	83.6	79.7

See notes at end of table.

Table 30. Student-level questionnaire items with a weighted item response rate below 85 percent using W3STUDENT weight—Continued

Variable name	Description	Percent of records by type of response[1]			Unweighted item response rate	Weighted item response rate[2]
		Valid	Not applicable	Item missing		
S3CHOICEACCLVL	S3 First choice selected to college IPEDS level	59.9	16.7	13.5	81.6	79.5
S3CHOICEACCCNTRL	S3 First choice selected to college IPEDS control	59.9	16.7	13.5	81.6	79.5
S3CHOICEACCSEL	S3 First choice selected to college IPEDS selectivity code	58.8	16.7	14.6	80.1	77.8
S3APPSTATUS1	S3 C11A Admission status at first (other) school applied to/registered at [S3CLGAPPID1] -- CUAPP1STATUS	42.9	36.6	10.5	80.3	77.2
S3NOV1JOB2	S3 E19C Nov 1 2013 job - 2-digit SOC code -- CUJ2OCC2	38.2	40.9	11.0	77.7	77.2
S3HSCOMPYR	S3 A07B Year expects to receive high school credential -- CUHSCOMPYR	6.5	81.8	1.8	78.5	76.7
S3HIGHINCOME	S3 D03C Thought unqualified for FAFSA aid because income too high -- CUNOQUALINC	6.5	81.4	2.2	74.8	72.2
S3FAMNOTQUAL	S3 D03A Thought unqualified for FAFSA aid because other family member didn't qualify -- CUNOQUALFAM	6.4	81.4	2.3	73.5	71.4
S3CREDIT	S3 D03B Thought unqualified for FAFSA aid because concerns about credit score -- CUNOQUALCRED	6.3	81.4	2.3	73.0	70.9
S3LOWSCORES	S3 D03D Thought unqualified for FAFSA aid because grades/test scores too low -- CUNOQUALTEST	6.4	81.4	2.3	73.4	70.9
S3PTNOTQUAL	S3 D03E Thought unqualified for FAFSA aid because part-time enrollment -- CUNOQUALPT	6.4	81.4	2.3	73.2	70.6
S3CLGAPPLVL2	S3 Second applied to college IPEDS level	29.6	49.7	10.8	73.2	69.7
S3CLGAPPCNTRL2	S3 Second applied to college IPEDS control	29.6	49.7	10.8	73.2	69.7
S3CLGAPPSEL2	S3 Second applied to college IPEDS selectivity code	29.1	49.7	11.3	72.0	68.3
S3DUALSCIENCE	S3 A16B Has taken dual enrollment science course(s) -- CUDUALSCIENCE	15.7	67.9	6.5	70.8	67.6

See notes at end of table.

Table 30. Student-level questionnaire items with a weighted item response rate below 85 percent using W3STUDENT weight—Continued

Variable name	Description	Percent of records by type of response[1]			Unweighted item response rate	Weighted item response rate[2]
		Valid	Not applicable	Item missing		
S3DUALMATH	S3 A16A Has taken dual enrollment math course(s) -- CUDUALMATH	15.7	67.9	6.5	70.8	67.5
S3DUALOTHER	S3 A16C Has taken other (not math or science) dual enrollment course(s) -- CUDUALOTHER	15.7	67.9	6.5	70.8	67.5
S3APPSTATUS2	S3 C11B Admission status at second (other) school applied to/registered at [S3CLGAPPID2] -- CUAPP2STATUS	28.7	49.6	11.8	70.9	66.5
S3CLGGRANT	S3 D06 Scholarship/grant amount for Nov 1 2013 school for 2013-2014 school year -- CUFALLGRANT	44.3	24.4	21.5	67.3	64.2
S3CLGBORROW	S3 D05 Amount borrowing to pay for Nov 1 2013 school for 2013-2014 school year -- CUFALLBORROW	40.3	24.4	25.5	61.2	58.9
S3CHCSTAFFORD	S3 D09A Offered loan to attend 1st choice accepted school: 2013-2014 year -- CUCHSTAFFORD	12.4	68.8	8.9	58.3	57.0
S3CHCPELL	S3 D09C Offered scholarship/grant to attend 1st choice accepted school: 2013-2014 -- CUCHPELL	12.4	68.8	8.9	58.2	57.0
S3CHCWKSTUDY	S3 D09B Offered work-study to attend 1st choice accepted school: 2013-2014 year -- CUCHWKSTD	12.4	68.8	8.9	58.1	56.9
S3CHCOTHAID	S3 D09D Offered other financial aid to attend 1st choice accepted school: 2013-2014 -- CUCHOTHAID	12.3	68.8	9.0	57.8	56.7
S3CLGCOST	S3 D04 Cost of Nov 1 2013 school before financial aid for 2013-2014 school year -- CUCOSTFALLCLG	39.7	24.4	26.0	60.5	56.0
S3OTHJOBFT	S3 E15 Other job - works full-time or part-time -- CUOTHJOBHRSCAT	5.2	80.9	4.1	55.7	51.9
S3OTHJOBHRS	S3 E14 Other job - hours works per week -- CUOTHJOBHRS	5.0	80.9	4.2	54.2	50.6
X3EARNPERHR2[3]	X3 Other job earnings per hour	4.7	80.9	4.5	50.9	47.1

See notes at end of table.

Table 30. Student-level questionnaire items with a weighted item response rate below 85 percent using W3STUDENT weight—Continued

Variable name	Description	Percent of records by type of response[1]			Unweighted item response rate	Weighted item response rate[2]
		Valid	Not applicable	Item missing		
S3CHCCOST	S3 D08 Cost of 1st choice accepted school before financial aid for 2013-2014 year -- CUCOSTCHOICE	6.9	68.8	14.4	32.5	29.3
S3IBMATH	S3 A15A Has taken IB math course(s) -- CUIBMTH	2.0	81.9	6.3	23.9	19.4
S3IBSCIENCE	S3 A15B Has taken IB science course(s) -- CUIBSCI	2.0	81.9	6.3	24.0	19.2
S3IBOTHER	S3 A15C Has taken other (not math or science) IB course(s) -- CUIBOTH	2.0	81.9	6.3	23.8	19.2

[1] The reserve codes "−7" and "−6" identify the legitimately skipped/not applicable questionnaire items and "-1", "-8", and "-9" identify the questions that should have been answered but were not (item missing).
[2] Weighted response rates were calculated with the student analytic weight (W3STUDENT).
[3] Variable is a, derived, composite variable. Composite variable descriptions are provided in Appendix L.
SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update, Restricted-use Data File.

6.2.2.3 *Results for the 2013 Update and Transcript Study*

Nonresponse bias was evaluated for the items identified in the previous section as having low levels of item response by several important characteristics. Note that, like the analysis performed in the *HSLS:09 Base-Year to First Follow-up Data File Documentation* (Ingels et al., 2014), unit nonrespondents were classified as item nonrespondents for this analysis. The detailed analysis tables are included in appendix F. The frequency distribution of the bias ratios (estimated bias divided by the standard error) for the 50 student questionnaire variables are summarized in table 31, where ratios larger than 2.0 suggest non-negligible levels of item nonresponse bias. For example, 50.2 percent of the 800 bias tests (= 50 variables crossed with 16 school and student characteristics) on the student questionnaire, analyzed using the student base weight, had a bias ratio greater than 2.0.

Table 31. Frequency distribution of the estimated bias ratios by source

Source	Analysis weight	Range of bias ratio[1]	Frequency[2]	Percent[3]
Student Questionnaire	W3STUDENT	Total	800	100.0
		0 ≤ bias ratio < 2.0	402	50.3
		2.0 ≤ bias ratio < 5.0	259	32.4
		5.0 ≤ bias ratio	139	17.4

[1] The bias ratio is calculated as the estimated item nonresponse bias divided by the estimated respondent value. The "total" row identifies the total number of calculations completed source. [2] The number of calculations falling in the specified range of the bias ratio values. Unit nonrespondents were classified as item nonrespondents for this analysis. The student base weights were used for the analyses.
[3] Unweighted percent of calculations falling in the specified range of the bias ratio values.
SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update, Restricted-use Data File and Control System Data.

The bias was evaluated for various characteristics and is summarized in table 32. For example in table 32, 800 statistical tests (= 50 student items crossed with 16 school/student characteristics) for non-negligible item nonresponse bias in the student data were conducted. Approximately 58.4 percent of the tests indicated that estimated bias was statistically different from 0 at the 0.05 level. As shown in the next two columns of table 32, the overall average and median relative bias was small, suggesting that the level of bias across the 50 items and 16 characteristics may not be substantively meaningful. On average, the median absolute relative bias (which ignores the positive and negative signs on the individual calculations) is less than 8 points and fluctuates depending on the characteristic used in the analysis while the average absolute relative bias is 13.4 percent. The largest biases occur in Private schools and among Asian and Black students. The observed biases are similar to those observed in the item nonresponse bias analysis conducted for the HSLS:09 first follow-up.

Table 32. Summary statistics for student-level item nonresponse bias analyses using W3STUDENT weight

Characteristic	Number of *t* tests	Percent[1] of significant *t* tests	Relative bias[2]		Absolute relative bias[3]	
			Average	Median	Average	Median
Total	800	58.4	1.1	-0.4	13.4	7.6
School type						
Public	50	80.0	-2.4	-1.9	2.8	2.1
Private	50	80.0	29.4	27.9	38.2	33.1
Region						
Northeast	50	42.0	-4.1	-1.8	8.0	5.2
Midwest	50	46.0	14.6	9.3	15.3	9.3
South	50	48.0	-5.9	-4.2	6.5	4.4
West	50	34.0	-0.3	-1.3	9.5	3.1
Locale						
City	50	44.0	3.4	2.6	8.3	4.6
Suburban	50	30.0	-1.7	-0.9	6.7	3.5
Town	50	34.0	-7.0	-5.4	11.8	9.6
Rural	50	38.0	0.3	1.7	9.6	2.6
Race/ethnicity						
Hispanic	50	70.0	-14.1	-12.8	15.5	13.3
Asian	50	70.0	18.8	11.9	30.0	23.2
Black	50	62.0	-21.3	-16.3	25.8	19.8
Other	50	78.0	8.5	6.7	9.9	6.9
Student sex						
Male	50	90.0	-6.3	-6.9	8.4	8.3
Female	50	88.0	5.9	6.6	8.7	7.8

[1] Unweighted percent of statistical tests with an item nonresponse bias significantly different from zero at the 0.05 significance level.
[2] The relative bias is calculated as the estimated bias divided by the estimated value.
[3] The absolute relative bias is the absolute value of the relative bias.
SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update, Restricted-use Data File and Control System Data.

6.3 Assessment of Responsive Design

The responsive design approach, which was based on approaches used in previous National Center for Education Statistics (NCES) studies, aims to reduce nonresponse bias in survey estimates by targeting sample members who are most unlike the current responding cases. The responsive design approach was not implemented as an experimental design; therefore, there are no treatment and control groups to compare to assess the effects on nonresponse bias. Instead,

responsive design was assessed by examining if (1) cases that were targeted and responded at each phase were different from the existing respondents on key estimates; (2) key estimates calculated at phase 3 (the start of the responsive design case targeting) were different from the estimates calculated at the conclusion of data collection; and (3) estimates shifted by targeting were more like population estimates on variables known for all sample members (i.e., demographics). If key estimates did not change between phase 3 and the conclusion of data collection, the participation of targeted cases likely had little influence on the final survey estimates for key variables.

The variables examined in this analysis are shown in table 33. Table 34 shows these variable estimates[37] from the 2013 Update student survey across different data collection phases. A way to understand how targeting nonrespondents might work would be to look at the distribution of select survey estimates prior to targeting and post-targeting. Therefore, in table 34, the column "Overall estimate at the start of phase 3" shows the distribution prior to targeting and the column "Final survey estimate" shows the distribution after targeting. The concept would be that the targeted cases are important to include because their survey responses differ from those of the nontargeted cases. In looking at the distribution of estimates across the table, a contention is that targeting results in a different final distribution than would have otherwise resulted without targeting. Take, for example, the characteristic "Taking postsecondary classes." The weighted estimate for the percentage of students taking postsecondary classes at the beginning of phase 3 was 87.59 percent. At the start of phases 4 and 5, the percent taking postsecondary classes estimates for targeted cases appears to be much lower than those for nontargeted cases, which suggests that the targeted set may have indeed been different on this variable. Furthermore, the nontargeted set of cases appear to be very similar to respondents on this characteristic, suggesting that the targeting approach identified cases that were different from respondents even for key variables not included in the targeting model. At the conclusion of data collection, the final estimate for the percent taking postsecondary classes fell nearly 10 percentage points from the estimate calculated at the start of phase 3 (87.59 percent to 77.73 percent). This suggests that targeting the cases resulted in a final distribution that was markedly different from the distribution at the end of phase 3. In other words, the case-targeting approach appears to have changed the estimate over the course of data collection. In general, these analyses suggest that targeting cases as a strategy for nonresponse follow-up can be an

[37] Estimates weighted by the student base weight. For purposes of these comparisons, no adjustments were made for differential nonresponse.

effective approach for identifying nonresponding cases who differ from existing respondents on key survey variables.

Next, it is important to examine if case targeting through the responsive design approach could bring survey estimates more in line with true population estimates through targeting nonresponding cases that differ from respondents on key survey variables. Because population estimates are not available for survey items, some variables known for all sample members were incorporated into the analyses in order to provide some population estimates against which estimates for targeted, nontargeted, and targeted plus nontargeted respondents could be compared. Race/ethnicity and sex variables were examined. On the race/ethnicity variable, phase 3 estimates, for example, were higher for Whites and lower for Blacks and Hispanics than the population estimates. However, by the end of data collection, the final estimates changed to more closely reflect the population estimates. So on the race/ethnicity variable, the targeting approach does appear to have brought estimates more in line with the population. Over time, changes for sex appear to be less obviously affected.

Table 33. 2013 Update key variables examined

Variable	Label
S3HSCRED	Teenager has high school credential
S3CLASSES)	Taking postsecondary classes
S3APPRENTICE	Apprenticing
S3CURWORK	Currently working for pay
S3MILITARY	Serving in the military
S3FAMILY	Starting family/taking care of children
S3HS	Attending high school or homeschool
S3GEDCOURSE	In a course to prepare for GED
S3APPFAFSA	Completed a Free Application for Student Aid (FAFSA)
X2RACE	Student's race/ethnicity
X2SEX	Student's sex

SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update.

Table 34. Weighted estimates of key 2013 Update variables, by data collection phase

Variable	Overall estimate at the start of phase 3	Overall estimate at the start of phase 4			Overall estimate at the start of phase 5			Final survey estimate
		Targeted respondents	Non-targeted respondents	All cases	Targeted respondents	Non-targeted respondents	All cases	
Teenager has earned a high school credential								
Yes	90.72	83.10	91.70	90.51	86.10	90.55	90.18	89.09
No	9.28	16.90	8.30	9.49	13.90	9.45	9.82	10.91
Taking postsecondary classes								
Yes	87.59	71.16	88.11	85.99	62.94	85.80	84.11	77.73
No	12.41	28.84	11.89	14.01	37.06	14.20	15.89	22.27
Apprenticing as of Nov. 1, 2013								
Yes	2.85	7.82	2.91	3.56	8.06	3.45	3.83	3.91
No	97.15	92.18	97.09	96.44	91.94	96.55	96.17	96.09
Working for pay as of Nov. 1, 2013								
Yes	63.24	79.29	62.59	64.98	77.26	64.66	65.76	64.70
No	36.76	20.71	37.41	35.02	22.74	35.34	34.24	35.30
Serving in the military as of Nov. 1, 2013								
Yes	4.61	4.40	4.34	4.35	5.73	4.30	4.42	4.13
No	95.39	95.60	95.66	95.65	94.27	95.70	95.58	95.87
Starting family/taking care of children as of Nov. 1, 2013								
Yes	3.87	10.37	3.59	4.51	12.21	4.56	5.19	6.19
No	96.13	89.63	96.41	95.49	87.79	95.44	94.81	93.81

See notes at end of table.

Table 34. Weighted estimates of key 2013 Update variables, by data collection phase—Continued

Variable	Overall estimate at the start of phase 3	Overall estimate at the start of phase 4			Overall estimate at the start of phase 5			Final survey estimate
		Targeted respondents	Non-targeted respondents	All cases	Targeted respondents	Non-targeted respondents	All cases	
Did not complete FAFSA because teen does not plan to continue education								
Yes	19.42	23	18.32	19.16	27.53	19.08	20.02	22.12
No	80.58	77	81.68	80.84	72.47	80.92	79.98	77.88
Currently working for pay								
Yes	50.8	45.94	51.85	51.04	44.43	50.24	49.75	50.02
No	49.2	54.06	48.15	48.96	55.57	49.76	50.25	49.98

SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update, Restricted-use Data File and Control System Data.

Table 35. Weighted estimates of race/ethnicity and sex by phase and compared with population estimates

Race/ethnicity and sex	Overall estimate at the start of phase 3	Overall estimate at the start of phase 4			Overall estimate at the start of phase 5			Final survey estimate	Population estimate
		Targeted respondent	Nontargeted respondents	All cases	Targeted respondent	Nontargeted respondents	All cases		
Race/ethnicity									
American Indian/Alaska Native, non-Hispanic	0.50	1.15	0.44	0.54	0.58	0.54	0.55	0.70	.69
Asian, non-Hispanic	4.42	2.51	4.68	4.38	2.02	4.37	4.17	3.60	3.70
Black/African-American, non-Hispanic	8.60	20.71	8.35	10.06	28.41	10.00	11.56	13.49	13.93
Hispanic, no race specified	1.10	3.83	0.95	1.35	2.57	1.25	1.36	1.76	2.56
Hispanic, race specified	17.06	29.33	16.46	18.24	27.17	17.83	18.63	20.48	20.02
More than one race, non-Hispanic	6.85	5.99	6.83	6.71	8.29	6.85	6.98	7.40	7.23
Native Hawaiian/Pacific Islander, non-Hispanic	0.50	0.44	0.47	0.47	0.35	0.45	0.44	0.51	.49
White, non-Hispanic	60.98	36.04	61.82	58.26	30.62	58.70	56.32	52.07	51.38
Sex									
Male	49.87	54.31	49.57	50.23	49.63	49.87	49.85	50.51	50.77
Female	50.13	45.69	50.43	49.77	50.37	50.13	50.15	49.49	49.23

SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update, Restricted-use Data File and Control System Data.

6.4 Composite Variables

Composite variables—also called constructed, derived, or created variables—are usually generated with responses from two or more questionnaire items or from the recoding of a variable (typically for disclosure avoidance reasons). Some are copied from another source (e.g., a variable supplied in sampling or imported from an external database). Examples of composite variables include school variables (school sector, school locale, region of the country); math assessment scores (achievement quintile in math); demographic variables (sex, race, Hispanic ethnicity, and month and year of birth); and the socioeconomic variables. Composite variable descriptions can be found in appendix L.

Most of the composite variables can be used as classification variables or independent variables in data analysis. Many of the composites have undergone imputation to address any missing responses in an attempt to lower item nonresponse bias. Note that all imputed versions of variables have been flagged and are available in composite variables that are named with an IM suffix.

Recent additions to the data files include a number of composite variables based on high school transcript data. The composites are mainly developed from the student course file and aggregate course information into the following types of composites:

- Achievement scores (available on restricted use only ECB);
- Number of credits earned in various subject areas (i.e., overall, English, math, science, etc.);
- Highest level course taken across various subject areas;
- GPA calculated various ways (i.e., overall, academic courses, weighted, by subject, etc.);
- Number of high schools attended; and
- Current enrollment status.

6.5 Single-Value Item Imputation

Missing data in an otherwise complete study instrument occurs when a study respondent does not answer a particular question either intentionally (e.g., declined to answer a sensitive question) or unintentionally (e.g., missed one item within a set of related questions). Most statistical software packages exclude records that do not contain complete information. This is of great concern for multivariate analyses where a combination of missing values could greatly reduce the utility of the data file.

To alleviate the problem of missing data from a respondent record, statistical imputation methods were employed for the 2013 Update and high school transcript study similar to those used for the HSLS:09 base year and first follow-up. Advantages of using imputed values include the ability to use all study respondent records in an analysis, which affords greater statistical power. Additionally, if the imputation procedure is effective (i.e., the imputed value is equal to [or close to] the true value), then the analysis results are possibly less biased than those produced with the incomplete data file.

A set of key analytic variables were identified for item imputation on data obtained from 9th-grade students as of fall 2009 who responded to the 2013 Update and high school transcript study. Values were assigned in place of missing responses through single-value imputation (or through derivation from imputed values) for five variables from the student questionnaires (section 6.5.1). Indicator variables (flags) were included on the analysis file to allow users to easily identify the imputed values. The quality control and evaluative procedures are summarized in section 6.5.2.

6.5.1 Imputed Student Questionnaire Items

Five key analysis variables were identified for single-value imputation (table 36) from the edited 2013 Update and High School Transcript Study data. Additional variables were considered for this list but were excluded because of either high-item response rate or they were deemed to be of little analytic importance.

Table 36. Student questionnaire variables included in the single-value imputation by number and weighted percent of values imputed

Student questionnaire variables	Number of values imputed	Weighted percent imputed	Method of imputation
Teenager has high school credential (S3HSCRED)	2	0.03	Statistical
Type of high school credential (S3HSCREDTYPE)	32	0.15	Statistical
S3 B01A Taking postsecondary classes as of Nov. 1, 2013 (S3CLASSES)	59	0.29	Statistical
S3 B01C Working for pay as of Nov. 1, 2013 (S3WORK)	98	0.44	Statistical
Date dropout/alternative completer last attended high school (X3LASTHSDATE)	252	1.76	Statistical

SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update.

6.5.1.1 Imputation Methodology

The imputation methodology implemented to address the missing data items for the variables in table 36 varied by (1) the type of variable (e.g., categorical vs. continuous), (2) the relationship(s) between this variable and other HSLS:09 variables, and (3) the rate and pattern of missing values.

Stochastic methods were used to impute the missing values. Specifically, a weighted sequential hot-deck (WSHD; statistical) imputation procedure (Cox 1980; Iannacchione 1982) using the final student analysis weight associated with the 2013 Update component (W3STUDENT) was applied to the missing values for the variables in table 36 in the order in which they are listed. The WSHD procedure replaces missing data with valid data from a donor record (i.e., item respondent) within an imputation class. In general, variables with lower item nonresponse rates were imputed earlier in the process.

Imputation classes were identified using a recursive partitioning function in R®.[38] In addition to questionnaire items used to form the imputation classes, sorting variables were used within each class to increase the chance of obtaining a close match between donor and recipient. If more than one sorting variable was chosen, a serpentine sort was performed where the direction of the sort (ascending or descending) changed each time the value of a variable changed. The serpentine sort minimized the change in the student characteristics every time one of the variables changed its value. With recursive partitioning (also known as a nonparametric classification tree or classification and regression tree [CART] analysis), the association of a set of questionnaire items and the variable requiring imputation is statistically tested (Breiman et al. 1984). The result is a set of imputation classes formed by the partition of the questionnaire items that are most predictive of the variable in question. The pattern of missing items within the imputation classes is expected to occur randomly so that the WSHD procedure can be used. The input questionnaire items included the sampling frame variables and variables imputed earlier in the ordered sequence or that were identified through skip patterns in the instrument and literature suggesting an association. The list of variables used as input to the CART procedure is provided in table G-1 of appendix G.

Cycling through the imputation variables, i.e., the variables that will have imputed values, was part of the imputation process. Once the imputation variables have been imputed the first time, cycling goes back and replaces the imputed values for the first imputation variable with the missing code. Then the imputation process re-imputes

[38] http://www.r-project.org.

the first imputed variable using all variables, including the variables with imputed values, on the dataset. Next the imputation process moves to the second imputation variable, replaces the imputed values with missing values, and re-imputes the second variable. This process continues through all the imputation variables and is referred to as the second cycle. There were five cycles implemented for these imputation variables. The reasoning behind the use of cycling is that the imputed values will converge to a reasonable variable.

Finally, analysis weights were used to ensure that the population estimate calculated with data including the imputed values (post-imputation) did not change significantly from the estimate calculated prior to imputation (pre-imputation). See, for example, the HOTDECK procedure in SUDAAN®.[39]

6.5.1.2 Imputation Results

Student questionnaire variables in table 36 are listed in the order in which they were imputed in addition to the method of imputation used to resolve the missing data problems. At each step, several quality control procedures were used to maximize the utility of the imputed values. These are summarized in section 6.5.2.

6.5.2 Evaluation of the Imputed Values

After each value was imputed, a set of quality control checks was implemented to ensure the highest quality. The unweighted distribution of the values before and after the imputation procedure was also compared, both within and across the imputation classes, to identify large areas of change (see table G-2 of appendix G). Differences greater than 5 percent at the 0.05 significance level were flagged and examined to determine whether changes should be made to the imputation sort or class variables. Finally, data visualizations that encompass the aforementioned quality control checks and combined data checks were reviewed.

Multivariate consistency checks ensured that relationships between the imputation variables were maintained and that any special instructions for the imputation were implemented properly. For these checks, it was important to ensure that the imputation process did not create any new relationships that did not already exist in the item respondent data.

[39] http://www.rti.org/sudaan/.

In any of the aforementioned checks, if there was any evidence of substantial deviation from the weighted sums or any identified inconsistencies, the imputation process was revised and rerun.

6.6 Estimation: Standard Errors

Analysis of HSLS:09 data requires statistical software that can calculate either (1) balanced repeated replication (BRR) variance estimates using the BRR weights and the associated analytic weight or (2) linearization variance estimates through a Taylor series approximation using only the analytic weight.[40] Some standard software packages, however, do not calculate estimates that account for the random sampling of students clustered within schools. This incorrect design assumption can lead to estimated variances and confidence intervals that are too small, which may lead to incorrect results from hypothesis tests. Therefore, researchers are advised to use appropriate software such as SUDAAN and Stata and are provided with example code in the next section.

The importance of correct variance estimation is further emphasized in this section through a discussion of the BRR and linearization methodologies.

The two methods of variance estimation available for HSLS:09 are BRR and Taylor series linearization. BRR variance estimation is available with either the HSLS:09 restricted-use or public-use files. This method does not need the analytic stratum and primary sampling unit (PSU) identifiers but does require a large set of replicate weights along with the associated analytic weight. As discussed in the *HSLS:09 Base-Year Data File Documentation* (Ingels et al. 2011) and *Base Year to First Follow-Up Data File Documentation* (Ingels et al. 2013), the replicate weights account for several random processes including sampling and weighting and produce estimates that are in general slightly larger than the corresponding estimates calculated with linearization (Wolter 2007).

To create the school BRR weights, the original analytic strata were collapsed into 199 BRR strata with representation across the characteristics used in sampling (i.e., school type, region, and locale) and two BRR PSUs were formed. The BRR strata were randomly assigned to rows of a 200 × 200 Hadamard matrix containing a sequence of +1 and -1 values that were used to form BRR base weights. The base

[40] NCES Statistical Standards recommend the use of replicate variance estimation over linearization methods. The sample design variables, strata and PSUs, were suppressed from the public-use file as one measure of disclosure avoidance (see section 6.8 for the disclosure risk analysis and protection).

weights were then adjusted using procedures similar to those implemented for the analytic weights.

The general formula for calculating a BRR variance estimate, used in software packages designed for survey estimation, is as follows:

$$var\left(\hat{\theta}\right) = \frac{1}{200}\sum_{a=1}^{200}\left(\hat{\theta}_{(a)} - \hat{\theta}\right)^2$$

where 200 is the number of HSLS:09 BRR weights, $\hat{\theta}$ is the estimated value for a statistic of interest (e.g., mean) calculated with a particular analytic weight, and $\hat{\theta}_{(a)}$ is the corresponding value calculated with the *a*th BRR (replicate) weight (*a* = 1, . . . , 200).

Taylor Series linearization variance estimation requires software that constructs a first-order Taylor-series approximation of the statistic being analyzed (e.g., mean) and data sources containing the relevant analytic weight and the analytic stratum and PSU identifiers (see, e.g., Binder [1983]; Woodruff [1971]). The PSU variable STRAT_ID is a unique value randomly generated for each sampled school. The 450 analytic strata were constructed in the base year by combining two to three schools into one stratum in such a way as to maximize retention of the original two-stage sample design and also the precision of the estimates through the degrees of freedom (Chromy 1981). To lower disclosure risk, linearization variance estimation is only permitted through the HSLS:09 restricted-use file, which, unlike the public-use file, contains the stratum and PSU variables.

Software currently available for survey data analysis includes SUDAAN®, SAS® survey procedures,[41] WesVar®,[42] Stata®,[43] R®,[44] and SPSS®.[45] Example SUDAAN code for producing estimated means and standard errors using the linearization and BRR methods are shown in figures 8 and 9, respectively. The corresponding Stata code is provided in figures 10and 11.

[41] See the most recent *SAS/STAT User's Guide*, located at http://support.sas.com/documentation/.
[42] See http://www.westat.com/our-work/information-systems/wesvar®-support.
[43] See http://www.stata.com/.
[44] See http://www.r-project.org/.
[45] See http://www-01.ibm.com/software/analytics/spss/.

Figure 8. Example SAS-SUDAAN code to calculate an estimated mean and linearization standard error for a 2013 Update student-level analysis

```
PROC SORT DATA=<filename>;          *File sorted by nest variables;
  BY STRAT_ID PSU;
RUN;

PROC DESCRIPT DATA=<filename> DESIGN=WR;
  NEST STRAT_ID PSU / MISSUNIT;           *Analysis stratum/PSU;
  SUBPOPN (<domain variable = level>);       *Subset to reporting domain;
  WEIGHT W3STUDENT;                         *Main analytic weight;
  VAR <analysis variable>;                     *Analysis variable;
  PRINT MEAN SEMEAN / STYLE=NCHS;      *Mean and standard error;
RUN;
```

Figure 9. Example SUDAAN code to calculate an estimated mean and replicate (BRR) standard error for a 2013 Update student-level longitudinal analysis

```
PROC DESCRIPT DATA=<filename> DESIGN=BRR;
  WEIGHT W3STUDENT;                          *Main analytic weight;
  REPWGT W3STUDENT001- W3STUDENT200;      *BRR replicate weights;
  SUBPOPN (<domain variable = level>);        *Subset to reporting domain;
  VAR <analysis variable>;                          *Analysis variable;
  PRINT MEAN SEMEAN / STYLE=NCHS;       *Mean and standard error;
RUN;
```

NOTE: BRR = balanced repeated replication.

Figure 10. Example STATA code to calculate an estimated mean and linearization standard error for a 2013 Update student-level analysis

```
SVYSET PSU [PWEIGHT=W3STUDENT], STRATA (STRAT_ID) VCE(LINEAR),
singleunit(centered)
SVY, SUBP (<domain variable >) : MEAN < analysis variable >
```

Figure 11. Example STATA code to calculate an estimated mean and replicate (BRR) standard error for 2013 Update student-level analysis

```
SVYSET [PWEIGHT=W3STUDENT], BRRWEIGHT(W3STUDENT001-W3STUDENT200)
VCE(BRR) MSE
SVY, SUBP (<domain variable >) : MEAN < analysis variable >
```

NOTE: BRR = balanced repeated replication.

Standard errors for a select number of variables are provided in appendix E along with their design effects as discussed in the next section.

6.7 Design Effects

Design effects (*deff*) measure the relative efficiency of a sample design using particular items collected in the survey. These values are calculated as the ratio of two estimated variances,

$$deff = \frac{\hat{V}_d\left(\hat{\theta}\right)}{\hat{V}_s\left(\hat{\theta}\right)}, \tag{6-7}$$

for an estimated HSLS:09 characteristic $\hat{\theta}$. The numerator value, $\hat{V}_d\left(\hat{\theta}\right)$, is the estimated variance that properly accounts for the complex sample design and the variability associated with the analytic weights. The denominator value, $\hat{V}_s\left(\hat{\theta}\right)$, is the estimated variance from a simple random sample (*srs*) design of the same size.

In addition to *deff*, the root design effect or *deft* was also calculated. Like *deff*, this statistic also provides a measure of relative efficiency of a sample design but in terms of the standard errors:

$$deft = \sqrt{\frac{\hat{V}_d\left(\hat{\theta}\right)}{\hat{V}_s\left(\hat{\theta}\right)}}, \tag{6-8}$$

where the components are the same as defined for expression (6.7).

The HSLS:09 2013 Update deff/deft analysis included 65 variables; 35 variables associated with the 2013 Update student questionnaire and 30 variables associated with the high school transcript. As with the estimated standard errors, the deff and deft estimates were produced using final analytic weights and data that were edited, imputed (if applicable), and treated to limit disclosure risk. The deff estimates were calculated using a model-based formulation, deff4 in SUDAAN. The estimates subject to this analysis included 35 student questionnaire variables and 30 high school transcript variables. As in the first follow-up, the items were chosen using three criteria: (1) variables common to the HSLS:09 base-year design effect analysis; (2) variables common to the HSLS:09 first follow-up design effect analysis; and (3) variables included in several other NCES studies such as the Education Longitudinal Study of 2002 (ELS:2002) and the National Education Longitudinal Study of 1988 (NELS:88). The deff and deft estimates for the 65 study items within a set of important characteristics are provided in appendix E. The average deff and deft across the 35 student questionnaire items is presented in table 37 while the

average deff and deft across the 30 high school transcript items is presented in table 38.

Table 37. Average design effects (deff) and root design effects (deft) for 2013 Update student questionnaire variables.

Characteristic	Student respondents	Final student weight	
		Average *deff*[2]	Average *deft*[3]
Total	18,558	3.7	1.9
School type			
Public	15,039	3.3	1.8
Private	3,519	4.2	2.0
Region			
Northeast	2,872	3.7	1.9
Midwest	5,019	3.0	1.7
South	7,464	3.7	1.9
West	3,203	4.0	1.9
Locale			
City	5,401	5.2	2.2
Suburban	6,672	2.8	1.7
Town	2,140	3.1	1.7
Rural	4,345	3.2	1.8
Student sex			
Male	9,298	3.1	1.8
Female	9,260	3.2	1.8
Student race/ethnicity[4]			
Hispanic	2,902	3.5	1.8
Asian	1,539	5.2	2.2
Black	1,914	3.1	1.8
Other	12,203	2.7	1.6
Socioeconomic status[5]			
Low SES	2,788	3.0	1.7
Middle SES	10,674	3.0	1.7
High SES	5,080	2.7	1.6

[1] The school characteristics (school type, region, and locale) presented here reflect the information obtained during the HSLS:09 base year and do not contain updated information presented on the cumulative first follow-up data file to enable comparison with the base-year documentation. The demographic characteristics (sex, race/ethnicity, and socioeconomic status) presented here reflect information obtained during the HSLS:09 base year and updated in the first follow-up because these demographics were not updated in the 2013 Update round of sampling.
[2] The formula for the design effect (*deff*) is provided in expression (6.7).
[3] The formula for the root design effect (*deft*) is provided in expression (6.8).
[4] Race/ethnicity as defined in the student questionnaire.
[5] Categories for socioeconomic status (SES) were defined using the SES quintile variable from the first follow-up (X2SESQ5), where X2SESQ5 = 1 (20th percentile) represents low SES and X2SESQ5 = 5 (80th percentile) represents high SES. All others were classified as middle SES.
SOURCE: U.S. Department of Education, National Center for Education Statistics. High School Longitudinal Study of 2009 (HSLS:09) 2013 Update, Public-use Data File.

Table 38. Average design effects (deff) and root design effects (deft) for 2013 Update high school transcript variables

Characteristic	Student respondents	Final student weight	
		Average *deff*[2]	Average *deft*[3]
Total	21,928	9.1	3.0
School type			
Public	18,123	8.4	2.8
Private	3,805	13.2	3.5
Region			
Northeast	3,425	13.2	3.5
Midwest	5,835	8.6	2.9
South	8,932	7.9	2.8
West	3,736	9.9	3.1
Locale			
City	6,218	12.8	3.5
Suburban	7,792	7.4	2.7
Town	2,630	8.5	2.9
Rural	5,288	8.5	2.8
Student sex			
Male	11,146	5.8	2.4
Female	10,782	6.7	2.6
Student race/ethnicity[4]			
Hispanic	3,563	4.8	2.2
Asian	1,800	8.2	2.8
Black	2,247	5.4	2.3
Other	14,318	6.2	2.4
Socioeconomic status[5]			
Low SES	3,514	4.1	2.0
Middle SES	12,853	6.0	2.4
High SES	5,491	4.6	2.1

[1] The school characteristics (school type, region, and locale) presented here reflect the information obtained during the HSLS:09 base year and do not contain updated information presented on the cumulative first follow-up data file to enable comparison with the base-year documentation. The demographic characteristics (sex, race/ethnicity, and socioeconomic status) presented here reflect information obtained during the HSLS:09 base year and updated in the first follow-up because these demographics were not updated in the 2013 Update round of sampling.
[2] The formula for the design effect (*deff*) is provided in expression (6.7).
[3] The formula for the root design effect (*deft*) is provided in expression (6.8).
[4] Race/ethnicity as defined in the student questionnaire.
[5] Categories for socioeconomic status (SES) were defined using the SES quintile variable from the first follow-up (X2SESQ5), where X2SESQ5 = 1 (20th percentile) represents low SES and X2SESQ5 = 5 (80th percentile) represents high SES. All others were classified as middle SES.
SOURCE: U.S. Department of Education, National Center for Education Statistics, High School Longitudinal Study of 2009 (HSLS:09) 2013 Update, Public-use Data File.

6.8 Disclosure Risk Analysis and Protections

Extensive confidentiality and data security procedures were employed for the HSLS:09 Update and High School Transcript data collection and data-processing activities. Data were prepared in accordance with NCES-approved disclosure avoidance plans. The data disclosure guidelines were designed to minimize the likelihood of identifying individuals on the file by matching outliers or other unique data from external data sources. Because of the paramount importance of protecting the confidentiality of NCES data that contain information about specific individuals, data files were subject to various procedures to minimize disclosure risk. The HSLS:09 Update and High School Transcript data products and some of the disclosure treatment methods employed to produce them are described in the following sections. Details have been suppressed from this document to maintain the desired level of confidentiality.

6.8.1 2013 Update and High School Transcript Data Products

Data produced for the HSLS:09 Update and High School Transcript data collection include restricted-use data and public-use data. Both the restricted- and public-use data include a student-level file. The student files contain responses and associated derived variables from the HSLS:09 Update student survey instrument and variables derived from high school transcripts, as well as all variables included in the student-level first follow-up data files. Additional variables include those associated with survey-based analysis such as analysis strata and final analysis weights that are described in section 6.1.

The disclosure treatment developed for the HSLS:09 Update and High School Transcript data collection consisted of several steps:

- reviewed the collected data and identified items that may increase risk of disclosure;
- applied disclosure treatment to the high-risk items to lower the risk of disclosure;
- produced restricted-use data files that incorporate the disclosure-treated data; and
- produced public-use data files, constructed from the disclosure-treated restricted-use files, using additional disclosure limitation methods.

The disclosure treatment methods used to produce the HSLS:09 Update and High School Transcript data files include variable recoding, variable suppression, and swapping. These methods are described below.

6.8.2 Recoding, Suppression, and Swapping

The disclosure treatment methods used to produce data files include variable recoding, suppressing, and swapping. Some variables that had values with extremely low frequencies were recoded to ensure that the recoded values occurred with a reasonable frequency. Other variables were recoded from continuous to categorical values. In this way, rare events or characteristics have been masked for certain variables.

Some variables were classified as high risk and were suppressed from the public-use file. The suppressing techniques included removing the response from the file (i.e., reset to a "suppressed" reserve code) or removing records entirely from the public-use file (e.g., student nonrespondents).

Swapping was applied to certain HSLS:09 Update and High School Transcript data items. All respondents were given a positive probability of being selected for swapping, and swapping was carried out under specific targeted, but undisclosed, swap rates. In data swapping, the values of the variables being swapped are exchanged between carefully selected pairs of records: a target record and a donor record. By doing so, even if a tentative identification of an individual is made, uncertainty remains about the accuracy and interpretation of the match because every record had some undisclosed probability of having been swapped.

Because perturbation (swapping) of the HSLS:09 Update and High School Transcript data could have changed the relationships between data items, an extensive data-quality check was carried out to assess and limit the impact of swapping on these relationships. For example, a set of utility measures for a variety of variables was evaluated pre- and post-treatment to verify that the swapping did not greatly affect the associations. Also, if the analysis determined that the components of a composite variable should be swapped, then the composite variable was reconstructed after swapping.

However, in contrast to swapping, composite variables and their components could have been independently suppressed or recoded for inclusion in public-use files, resulting in a potential mismatch in the public-use file. In cases where recoding or suppression of composite variables and their components was carried out independently, public-use data users may not be able to recreate some of the composite variables provided in the public-use files. An example of this situation included variables where the response categories have been collapsed for disclosure protection. The corresponding composite variable was derived from the full set of response categories as collected. Therefore, users who recalculate the composite variable with public-use information may see different results.

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Chapter 7. Combined 2013 Update and High School Transcript Data Delivery

HSLS:09 2013 Update and High School Transcript data have been made available in a public-use version via the web-based Education Data Analysis Tool (eDAT) available at http://nces.ed.gov/edat/ (this is a public use data tool) and (for licensed users), restricted-use versions[46] have been made available in an ECB format. The NCES number for the public use files is 2015-315, and for restricted use, 2015-038. The restricted-use ECB is installed from a DVD and is designed to be run in a Windows environment. The ECB is available at no cost from the National Center for Education Statistics (NCES).

The ECB system serves as an electronic version of a fully documented survey codebook. It allows the data user to browse through all HSLS:09 variables contained on the data files; search variable and value names for key words related to particular research questions; review the wording of these items along with notes and other pertinent information related to them; examine the definitions and logic used to develop composite and classification variables; and export SAS, SPSS, or Stata syntax programs for statistical analysis. The ECB also provides an electronic display of the distribution of counts and percentages for each variable in the dataset. Analysts can use the ECB to select or "tag" variables of interest, export codebooks that display the distributions of the tagged variables, and generate SAS, SPSS, and Stata program code (including variable and value labels) that can be used with the analyst's own statistical software.

The ECB consists of six files from student-level information to school-level information and transcripts.

1. The student-level file has one record for each student, including 25,206 records on the restricted-use file and 23,503 records on the public use file. The public-use file only includes students who responded in either the base year or first follow-up, or for 88 students (as explained in 2.2.3) deemed in scope for the 2013 update. The remaining 1,703 students who did not respond in the base year

[46] A license is required to access the restricted-use ECB (http://nces.ed.gov/statprog/confid6.asp).

or first follow-up are excluded from the public use file. The student-level file encompasses:

- Base-year student-level weights
- First follow-up student-level weights
- 2013 Update student-level weights
- High school transcript student-level weights
- Base-year student-level composites
- First follow-up student-level composites
- 2013 Update student-level composites
- High school transcript student-level composites
- Base-year student questionnaire
- First follow-up student questionnaire
- Base-year parent questionnaire
- First follow-up parent questionnaire
- Base-year teacher questionnaires
- Base-year administrator questionnaire replicated at student level
- First follow-up administrator questionnaire replicated at student level
- Base-year counselor questionnaire replicated at student level
- First follow-up counselor questionnaire replicated at student level
- 2013 Update questionnaire
- Taylor series primary sampling unit (PSU) and Stratum identifiers
- Balanced repeated replication (BRR) weights

Analysts should be aware that the base-year school data may be used as a standalone, nationally representative sample of 2009–10 schools with 9th grades; however, the school data collected in the first follow-up are not generalizable to the nation's high schools with 11th grades and therefore are not available as a separate school file. First follow-up administrator and counselor questionnaires are available only at the student level as these data apply only to student-level analyses.

2. The school-level file has not changed since the base-year ECB and encompasses:

   - Base-year school-level composite variables and weights
   - Base-year administrator questionnaire
   - Base-year counselor questionnaire

High school transcript data are available on the public-use file as student-level composite variables. Additional transcript data are available to restricted users as follows:

3. High school transcript school file—provides school-level information (i.e., school type, types of diplomas, grade scale, etc.) related to transcripts and accounts for each school referenced in the high school transcript student course file. This file accounts for all schools, regardless of whether a school provided transcripts.
4. High school transcript student school file—provides student information (i.e., completion type, reason left school, transcript reported GPA, etc.) for each school a student attends. This file accounts for all schools linked to a student, regardless of whether the school provided a transcript for the student.
5. High school transcript school course file—provides school course information (i.e., course name, School Codes for the Exchange of Data [SCED] code, course attributes, etc.) for base-year schools that provided course catalogs. The school course records were linked to student transcripts to help code course information, but the school course records also provide a complete listing of courses offered by the school.
6. High school transcript student course file—provides student course information (i.e., course name, SCED code, credits earned, grade received, etc.) from transcripts received for each student. These course records are used directly to construct student-level high school transcript composite variables.

Data users should find naming conventions for variables, composites, and weights intuitive. Variables begin with an indicator of the data source, followed by a wave indicator, and finished with a descriptive name that easily identifies the variable. Specifics for the two-character prefix are below.

The first character distinguishes among components:

- X—composite variables
- W—weights
- S—student questionnaire
- P—parent questionnaire
- A—administrator questionnaire
- C—counselor questionnaire
- M—math teacher questionnaire (base year only)
- N—science teacher questionnaire (base year only)
- T—transcripts

The second character distinguishes the wave:

- 1—base year
- 2—first follow-up
- 3—2013 Update and high school transcripts

Variable labels begin with the same two-character variable name prefix; however, additional information is provided to link users to the facsimiles and flowcharts, which include the section of the questionnaire (e.g., A, B, C), followed by the sequential numbering within the section. Some items have multiple components within the sequential numbering scheme, and the section number receives a letter indicator (e.g., A04A, A04B, and A04C). Appendix K provides a detailed listing of all variable names and labels, and appendix N provides a listing of the critical items.

When data are missing for a particular item, negative value reserve codes are used to indicate why the item is missing. The following reserve code scheme is used:

- −1: "Don't know" represents within continuous variables respondents who indicated that they did not know the answer to the question.

- −4: "Item not administered: abbreviated interview" is filled for questions that were not administered because an abbreviated version of the questionnaire was administered (e.g., first follow-up [F1] parent paper and pencil interview [PAPI]).

- −5: "Suppressed" represents values that have been suppressed on the public-use data files for disclosure reasons.

- −6: "Component not applicable" is filled for all variables across the entire questionnaire when a component did not apply (e.g., parents not included in the F1 subsample).

- −7: "Item legitimate skip/NA" is filled for questions that are not answered because prior answers route the respondent elsewhere.

- −8: "Unit nonresponse" is filled for all variables across the entire questionnaire when a sample member did not respond to the questionnaire.

- −9: "Missing" is filled for questions that are not answered within the questionnaire

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