NATIONAL CENTER FOR EDUCATION STATISTICS
Institute of Education Sciences

U.S. Department of Education
NCES 2006–604

User's Guide to Computing High School Graduation Rates

Volume 1

Technical report: Review of Current and Proposed Graduation Indicators

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Technical report: Review of Current and Proposed Graduation Indicators

August 2006

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Executive Summary

The increased focus on accountability in education in recent years has resulted in a growing interest in the accurate measurement of an on-time high school graduation rate. In fact, the No Child Left Behind Act of 2001 included an on-time graduation rate as an accountability-reporting requirement. The accurate reporting of such a rate requires student record data on student progression from grade to grade, data on graduation status, and data on students who transfer in and out of a school, district, or state during the high school years, or in other words cohort data (National Institute of Statistical Sciences (NISS) 2004 Task Force, NCES 2005-1105). At the time the on-time graduation rate reporting requirement was enacted, few states had data collection systems adequate to support the calculation of an accurate on-time graduation rate.

Absent the required cohort data, existing measures of high school completion have been considered and a number of new proxy graduation indicators have been proposed. The existing high school completion measures rely on cross-sectional data, but do not focus uniquely on on-time graduation and thus are not adequate for a measure of on-time graduation. Each of the newly proposed proxy measures can be calculated using existing cross-sectional data, but each requires a set of assumptions to bridge the gap from cross-sectional data to the desired cohort rate. Recognizing the need for an interim measure to use while individual states develop student record systems, the leadership in the Department of Education asked NCES to evaluate the array of current and proposed graduation indicators. This two-volume report describes that effort.

The first volume of this report examines the existing measures of high school completion and the newly proposed proxy measures. This includes a description of the computational formulas, the data required for each indicator, the assumptions underlying each formula, the strengths and weaknesses of each indicator relative to a true cohort on-time graduation rate, and a consideration of the conditions under which each indicator does or does not work.

The second volume of this report provides documentation of the technical work that the Department leadership used to select an interim graduation rate. The analysis in volume 2 draws upon the student record data from two states to compute the true cohort on-time graduation rate for each of those states, to compute the proxy graduation measures for each of these states, and to compare the performance of each proxy indicator to that of the true cohort rate. State and school district level rates were computed for three graduating classes in State 1 and four graduating classes in State 2. A combination of descriptive univariate statistics and regression analyses were employed. Although each of the four proxy measures of on-time graduation rates— the Freshman Graduation Rate (FGR) indicator, the Averaged Freshman Graduation Rate (AFGR) indicator, the Green Graduation Indicator (GGI), and the Swanson Cumulative Promotion Indicator (SCPI), perform well relative to the true cohort rate (EACGI) in one or more of the analyses, AFGR is the only measure that is consistently among the best performing indicators in each analysis.

Building on the performance of the Averaged Freshman Graduation Rate in the student record data comparisons from States 1 and 2, this rate was taken as the standard for comparison and the performance of this rate was compared to that of the other three proxy graduation rate measures using cross-sectional data for the 50 states and the District of Columbia for rates computed at the national and state levels. First, it was shown that in States 1 and 2 each of the four proxy measures computed using cross-sectional data correlate strongly with the same proxy measures computed using student record data and that the four proxy measures computed using cross-sectional data show the same patterns of correlation with the true cohort on-time graduation rate that were observed with the proxy measures computed using the student record data. Next, the analyses that compared the performance of each proxy graduation measure to the true cohort-on-time graduation rates in States 1 and 2 were repeated at the national and state levels comparing the performance of the other three proxy graduation rate measures to that of the Averaged Freshman Graduation Rate. The relative performance of each of the proxy measures repeated the patterns observed in the two states, with the performance of the Freshman Graduation Rate most closely approximating that of the Averaged Freshman Graduation Rate, and with weaker associations with the Greene Graduation Indicator and then with the Swanson Cumulative Promotion Indicator.

Preface

The fact that graduation rates are an important indicator of students' performance in American schools was highlighted by the inclusion of an on-time high school graduation rate in the monitoring requirements included in the 2001 No Child Left Behind Act. Unlike the assessment measures called out in the law, the calculation of an on-time graduation rate requires data that do not exist in most states. An on-time high school graduation rate requires data on student progression from grade to grade, data on graduation status, and data on students who transfer in and out of a school, district, or state during the four year period—in other words a student record system.

Absent the data required to compute an accurate on-time cohort high school graduation rate, a number of researchers have proposed different formulations that rely on existing data to estimate proxy indicators of high school graduation rates. Each measure is unique with it's own positive and negative attributes. In an attempt to sort out the various measures, the National Center for Education Statistics, on behalf of the Department of Education, asked the National Institute of Statistical Sciences (NISS) to convene a 2004 Task Force of experts to examine the array of measures and provide a recommendation for the calculation of graduation rates. The NISS Task Force concluded that the only way to accurately measure high school graduation rates in a mobile society like the United States is through the development and use of student record systems. They provided detailed specifications for the true cohort rate that will yield an accurate on-time graduation rate, and recommended that NCES work with the states to move the implementation forward (NCES 2005-105).

At that time, seven states reported that they had statewide student record systems in place, and a number of other states were in the planning and early developmental stages. Recognizing that even if all 50 states were to start collecting the required data elements for the cohort on-time graduation rate in the 2005-06 school year, the country would still be 4 years away from having one consistent graduation rate measure across the states, leadership in the Department of Education asked NCES to further evaluate the array of current and proposed graduation indicators. This report describes that effort.

This report consists of two volumes, the first takes an in-depth look at the various graduation indicators, with a description of the computational formulas, the data required for each indicator, the assumptions underlying each formula, the strengths and weaknesses of each indicator, and a consideration of the conditions under which each indicator does or does not work. In addition to the discussion in the body of the text, there is a summary description of each indicator and an accompanying spreadsheet that can be used to compute each indicator in appendix A.

The second volume of this report is more technical in nature. The analysis presented in this volume of the report provided the technical basis that Department policy makers used to identify an interim graduation indicator. Thus, using the information from volume 1 as a backdrop, volume 2 uses the best available national and state data to provide estimates of the various indicators. While this provides some basis for drawing comparisons across the indicators, the comparative analysis relies most heavily on student record data from two individual states. The state data represent the universe of students enrolled in public schools in each state over a sufficient number of years to compute the true cohort rate. The NISS panel recommended the true cohort rate as the only rate that will yield an accurate on-time graduation rate. The true cohort rate is thus used as the "gold standard" for a comparison of the performance of the various graduation indicators for the two individual states. The analysis of the state student record data then served as a basis for a related analysis of proxy graduation indicators computed for all 50 states and the District of Columbia at the national and state levels using NCES Common Core of Data.

Acknowledgments

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Review of Current and Proposed Graduation Indicators

The purpose of this volume is to provide a guide that describes the various graduation rate measures that have been used or proposed over the last several years. The guide includes descriptions of the purpose, data requirements, computational procedures, and the strengths and weaknesses of each measure. This information is provided with the goal of providing schools, school districts, and schools the background needed to understand the similarities and differences between the various measures that are in use or proposed for use. Included in this analysis are several measures that are typically reported at the national level; these measures are included primarily to provide the context of the range of graduation measures under consideration in the United States. It is hoped that this information will help staff and administrators at the school, district, state and federal levels better understand the measurement of high school graduation rates, and that this information may help inform decisions on the selection and use of rates at each level of reporting.

Introduction to High School Graduation Rates

The Hawkins-Stafford Elementary and Secondary School Improvement Amendments of 1988 reauthorizing the Elementary and Secondary Education Act (P.L. 100-297) required the National Center for Education Statistics (NCES) to collect and publish data annually on dropout and retention rates. Although the emphasis of the 1988 congressional mandate was on the measurement and monitoring of high school dropout rates, each of the annual NCES dropout reports produced since 1989 has included available data on high school completion and high school graduation rates.

Most recently, the No Child Left Behind Act (NCLB) of 2001(P.L. 107-110) reauthorized the Elementary and Secondary Education Act. Included in that reauthorization is a requirement for states and their schools to report an on-time graduation rate as one component of annual yearly progress. Specifically, this graduation rate is defined in the law as

> "…the percentage of students who graduate from secondary school with a regular diploma in the standard number of years …"(P.L. 107-110, Section 1111(b) (2) (C) (vi)).

Furthermore, states are required to

> "…ensure that the indicators described in those provisions are valid and reliable, and are consistent with relevant, nationally recognized professional and technical standards, if any; …" (P.L. 107-110, Section 1111(b) (2) (D) (i)).

At the time NCLB was enacted, NCES was routinely publishing three graduation measures: a population-based rate that measures the percentage of people in a specified population who have completed high school, a school-based rate that measures the percentage of students who graduate in a specific year, and a hybrid of the two that is the ratio of high school graduates to the population age 17 in a specific year. The first of these three measures is computed using population-based data from the Current Population Survey (CPS), the second is computed using school-based data for public schools from the NCES annual data collection known as the Common Core of Data (CCD), and the third is computed using both school-based data from the CCD and its private school counterpart the Private School survey (PSS) and population-based data from CPS (appendix A describes these three data collections). Although the NCLB Act includes guidance to draw upon graduation rate measures used in the CCD, the data elements necessary to calculate an on-time graduation rate are not currently collected as part of the CCD.

Differences among these three measures that NCES publishes and differences between each of these NCES rates and the rate defined in the NCLB Act have given rise to criticism of the NCES rates and to much debate in the research literature over the correct rate to use to meet the demands of the NCLB Act (Barton 2005, Greene 2002, Hall 2005, Swanson 2003, 2004, Wald and Losen, 2005)[1].

Monitoring the reporting of annual yearly progress measures from individual states and their schools is the responsibility of the Office of Elementary and Secondary Education within the U.S. Department of Education. However, as the statistical agency within the U.S. Department of Education, NCES has a responsibility to contribute to the development of a graduation rate that meets the definition specified in the NCLB Act. To this end, NCES commissioned the National Institute of Statistical Sciences (NISS) to convene a task force of experts to address conceptual, data, and implementation issues associated with the calculation of high school graduation and completion rates[2].

Background on this User's Guide

The NISS Task Force's review of existing and proposed measures of graduation and completion rates identified limitations in each existing measure and led to a recommendation for a new on-time high school graduation rate that is based on data from a student-level tracking system (Task Force on Graduation, Completion, and Dropout Indicators 2004). In particular, the recommended rate, which is identified as an Exclusion-Adjusted Cohort Graduation Indicator (EACGI), is tied to a group of students defined by their year of entry into the 9th grade (i.e., a 9th-grade cohort) and represents the

[1] In December 2005, while this report was undergoing peer review and revision, Warren entered this debate with his evaluation of some of the existing high school graduation indicators and the introduction of another proxy indicator. Three summary points are relevant to this report. First, his evaluation was based on simulations that were intended to show potential shortcomings, but these simulations vary one parameter in each formula at a time, holding all else constant. In reality the proxy graduation indicators take advantage of counterbalancing changes in the parameters. Second, Warren's measure uses total population change combined with public school data—ignoring migration between private and public schools. Third, and most important to finding a useful interim measure for use in monitoring annual yearly progress is the fact that Warren's measure cannot be computed below the state level.

[2] The National Institute of Statistical Sciences, a highly respected independent research institute, was established in 1990 as the result of a competition conducted by the national statistics societies.

cumulative experience of those students over the 4 intervening years to their expected graduation.

At the state level, the proposed NISS on-time graduation indicator starts with the group of students in a state who enter the 9th grade for the first time in one school year, and then uses data on students who transfer in and out of schools in that state and on students who otherwise leave schools in that state over the next 4 years to calculate the percent of students in the initial 9th-grade group who graduate on time. The same rate can be computed for the nation, for states, for school districts, and for individual schools.

While recognizing that the data required to calculate their proposed on-time graduation rate do not currently exist, the task force recommended that NCES direct its efforts and resources towards the development and implementation of the student level data required to calculate the proposed rate, rather than to the national implementation of new alternative measures. Thus, the task force recommended continuing the current NCES graduation rate while working toward the goals identified by the task force. However, in recognition of the immediate need for the best possible measures of on-time graduation rates, NCES is issuing this guide to help provide information that will help states, districts, and schools make the decisions needed to produce interim high school graduation indicators that use currently available data.

The cross-sectional data currently available through CCD are aggregate summaries of the experiences of students. These data can be used to compute school-based graduation indicators that can be compared across states. These aggregates are based on annual snapshots of the number of students and dropouts at one point in time in the school year. These data do not allow for the detailed tracking of students as they progress through high school (i.e., transfers in and out, retentions, and dropouts). Similarly, the cross-sectional data are limited to counts of all students enrolled in each grade, while the on-time graduation rate requires data for the subset of 9th-graders who entered the 9th grade for the first time 4 years earlier. In addition, the current year data on graduates are limited to counts of *all* graduates in a particular year, while the on-time graduation rate requires data for the subset of graduates who entered 9th-grade for the first time 4 years earlier.

The alternative graduation indicators that have been developed by NCES staff and other education researchers each attempt to use available data to calculate estimates of graduation rates. But given the data limitations, the currently available indicators are limited in their ability to capture changes in enrollment associated with student transfers and none of them can accurately reflect on-time graduations. They are, at best, proxies for the true cohort indicator. In the next section of this volume, each of the existing indicators is described. Each indicator is compared to the true cohort rate proposed by the NISS Task Force as the most accurate on-time graduation rate. The effects of differences between each proxy and the true cohort rate due to approximations that are inherent in the data elements used in the proxy measures are discussed for each measure. Finally, consideration is given to the population conditions that yield reasonable versus unrealistic results for the different proxy measures.

Existing High School Graduation Rates

Each of the existing proxy indicators is described in this section. For each measure, the description will include the purpose or uses of the rate, the data elements required for the rate, a description of each step involved in the calculation of the rate, and a summary of how each rate differs from a true on-time graduation rate. Several of the rates have only been used at the national level, and data limitations preclude their disaggregations below the national level. Those rates will be presented first to provide context for the full range of measures currently in use; then the attention will turn to the rates for which the data elements are feasible at the national, state, district, and school levels. For ease of presentation, wherever possible state level data from CCD will be used to provide examples of the data components and the calculations needed for each rate. In addition, appendix B includes formulas and a summary of details for each measure, along with spreadsheets that can be used to compute each indicator.

Current Population Survey High School Completion Indicator (CPS HSCI)

Description and Computation: This population-based measure provides a measure of the proportion of the young adult population with the basic credential required to enter postsecondary education, the military, or jobs requiring a high school credential (figure B-1). The rate is based on CPS data and represents the percentage of 18- through 24-year-olds who are not enrolled in high school and who have earned a high school diploma or equivalent credential, including a GED. The rate includes individuals who may have completed their education outside of the United States, so the rate is not suited for measuring the performance of the education system in this country.

This rate requires counts of the number of persons ages 18-24 with a high school credential and of the number of persons ages 18-24 who are not enrolled in any elementary or secondary school program. These data are used to compute the ratio for each year of the number of persons in the age group who have a high school credential, to the number of persons in the age group who are not currently enrolled in high school or below in the same year, expressed as a percent. For example, using data from the civilian non-institutionalized population as measured by the Current Population Survey (CPS), 21,091,000 persons ages 18-24 had a high school credential in 1999. This number is divided by the 24,540,000 persons of the same ages who were not enrolled in high school or below in 1999 (table 1). The resulting proportion, multiplied by 100, yields an estimated high school completion rate of 86 percent. Thus, 86 out of every 100 young adults ages18-24 in the United States held a high school credential in 1999 (U.S. Bureau of Census, CPS 10/01; Kaufman et al. 2000, NCES 2001-022).

Table 1. Components of numerator and denominator used for calculation of CPS HSCI: United States, 1999-2000

Component	Numerator	Denominator
Overall	21,091,000	24,540,000
Number of persons ages 18-24 with a high school credential in 1999-2000	21,091,000	†
Number of persons ages 18-24 not enrolled in grades K-12 in 1999-2000	†	24,540,000

† Not applicable.

NOTE: CPS HSCI = Current Population Survey high school completion indicator.
SOURCE: U.S. Department of Commerce, Census Bureau, Current Population Survey (CPS), October supplement, 2001.

Limitations: This measure differs from the proposed on-time graduation rate in several ways. First, it is a population-based measure of outcomes for young adults in a seven-year age group, as opposed to a school-based measure that measures the success of a single cohort of students in attaining a high school diploma in 4 years. The fact that the data used are estimates of the civilian noninstitutionalized population further distinguishes this rate from the school-based measures in that prisoners and members of the military are both excluded. These exclusions have counterbalancing effects on each other; on the one hand, prisoners are more likely to be high school dropouts, while on the other hand, high school completion is a requirement for enlistment into the military. Of course imbalances in the sizes of these two populations would yield biased estimates—a larger military population ages 18-24 than a prison population of the same ages would result in a lower graduation rate; conversely, if the prison population is larger than the military population in this age range, the graduation rate would be higher.

This measure differs from most of the school-based measures in that it includes the experiences of young adults who attended both public and private schools, or who were home schooled. It also includes immigrants in the 18-24-year-old age range who may or may not have received their secondary education in the United States. This measure also differs in that it includes alternative forms of high school completion in addition to regular diplomas. In fact, if these alternative completers are removed from the numerator in the 1999 example by subtracting alternative completions from all completers, the rate shows that 77 percent of the population ages 18-24 who are no longer enrolled in high school or below had a regular high school diploma. Another difference is that in order to measure the educational attainment of the young adult population, this population-based measure excludes those young adults ages 18-24 still enrolled in an elementary or secondary program. To better understand the differences and similarities between this rate and others, adding these young adults who are still enrolled in elementary or secondary school to the denominator shows that 72 percent of all persons age 18-24 had a regular high school diploma by 1999. This number is on a par with the rates attained using the various school-based estimates of on-time graduation rates.

NCES Digest Graduation Indicator (DGI)

Description and Computation: This measure is published annually at the national level to provide a measure of the percentage of 17-year-olds who are graduates (figure B-2). This indicator requires counts of the graduates from public and private schools and counts of the number of 17-year-olds. These data are used to compute the ratio of the number of graduates from public and private schools in a specific year, to the number of 17-year-olds in that year, expressed as a percent. For example, there were 2,554,000 public school graduates plus 277,000 private school graduates in the 1999-2000 school year, resulting in a total of 2,831,000 high school graduates in 1999-2000 (table 2). This number is divided by the 4,057,000 persons who were17-year-olds in the fall of the 1999-2000 school year. The resulting proportion, multiplied by 100, yields an estimated high school graduation indicator of 70 percent. Thus, 70 out of every 100 persons age 17 at the start of the 1999-2000 school year graduated from high school that year (Digest of Education Statistics, 2003, table 102).

Table 2. Components of numerator and denominator used for calculation of DGI: United States, 1999-2000

Component	Numerator	Denominator
Overall	2,831,000	4,057,000
Public school graduates in 1999-2000	2,554,000	†
Private school graduates in 1999-2000	277,000	†
Number of 17-year-olds in the fall of 1999	†	4,057,000

† Not applicable.

NOTE: DGI = NCES Digest graduation indicator.
SOURCE: U.S. Department of Education, National Center for Education Statistics, *Digest of Education Statistics 2003,* table 102, 2003.

Limitations: This measure differs from the proposed on-time graduation rate in several ways. First, it differs from most of the school-based measures in that it includes the experiences of young adults who attended both public and private schools. Second, this measure uses a population-based estimate of the number of 17-year-olds as a proxy for the population who should be expected to graduate in a specific year. Using this age group ignores the fact that 2 percent of 17-year-olds completed high school before reaching age 17. Third, this measure assumes that all seniors start the year as 17-year-olds, when the CPS data show that in October of 1999 only 60 percent of the 12th-grade students were age 17, about 5 percent of the 12th-graders were younger, and the rest were older (U.S. Bureau of Census, P20, Oct. 1999, Internet Release 3/23/01).

Freshman Graduation Rate (FGR)

Description and Computation: This graduation measure (UGI_0 in the NISS report) provides an estimate of an on-time graduation rate (figure B-3). This indicator requires counts of the number of graduates in a specific year and the number of all incoming freshmen 4 years earlier. These data are used to compute the ratio of the number of graduates in a specific year to the number of students who enrolled in the 9th grade 4 years earlier, expressed as a percent. To use one state as an example, 50,883 students graduated from public schools in Maryland in the 2001-02 school year (table 3). The count of graduates divided by the 69,247 public school students who enrolled in the 9th grade in Maryland in the 1998-99 school year is 0.73. This proportion, multiplied by 100, yields an estimated on-time graduation rate of 73 percent for Maryland in school year 2001-02. Based on this estimated on-time graduation rate, approximately 73 of every 100 students who were high school freshmen in Maryland in 1998-99 graduated in 2001-02 (NCES, CCD, Dropout and Completer data files as of 12/04).

Table 3. Components of numerator and denominator used for calculation of FGR: Maryland, 2001-02

Component	Numerator	Denominator
Overall	50,833	69,247
Public school graduates in 2001-02	50,833	†
Public school 9th-graders in 1998-99	†	69,247

† Not applicable.

NOTE: FGR = Freshman graduation rate, all freshmen.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "Local Education Agency Universe Survey Dropout and Completion Data File," school years 1998-99 through 2002-03.

Limitations: This measure falls short of the proposed on-time graduation rate on three dimensions. First, by including all freshmen in 1998-99, the group of freshmen in this measure includes freshmen repeating the 9th grade who are not first-time freshmen. Second, by including all graduates in 2001-02, the graduates may include students who repeated a grade in high school and thus are not on-time graduates.[3] Third, although some students in their high school years moved in or out of Maryland between 1998-99 and 2001-02, there are no adjustments for these movements over this period.

Each of these limitations has separate potential effects on the resulting estimate. For example, the inclusion of freshmen who failed the 9th grade in 1997-98 and re-enrolled in the 9th grade in 1998-99 increases the number of freshmen. This inflates the denominator

[3] There may also be a small number of students who finish high school early, and as a result, are not strictly on time in the context of the 1999 graduating class.

of this rate. This should have the effect of producing a lower estimated rate than would be the case if only first-time freshmen were included in the denominator. Next, the inclusion of 2001-02 graduates who spent more than 4 years (or fewer than 4 years) in high school increases the number of graduates. This inflates the numerator of this rate. This should yield a higher estimated rate than would be the case if only on-time graduates were included in the numerator.[4] The effect of not including any adjustments for migration is not as straightforward. If more high school students moved out of Maryland than transferred in between 1998-99 and 2001-02, the number of graduates in the numerator would be smaller and the estimated graduation rate would be smaller. On the other hand, if more high school students moved into Maryland than moved out during this 4-year period, the number of graduates in the numerator would be increased and the estimated on-time graduation rate would be increased.

Averaged Freshman Graduation Rate (AFGR)

Description and Computation: The next graduation measure (UGI in the NISS report) is closely related to the previous measure FGR, but is closer to the proposed rate in that the denominator is an estimate of the number of first-time freshmen who enrolled in the 9th grade 4 years earlier (figure B-4). Thus, this measure requires counts of the number of graduates in a specific year for the numerator and the number of entering first-time freshmen 4 years earlier for the denominator. Returning to the example of Maryland, the numerator is unchanged with 50,883 graduates from public schools in Maryland in the 2001-02 school year (table 4). But, the estimated number of first-time freshmen in public schools is lower with 63,791 freshmen starting 9th grade for the first time in 1998-99.[5] These estimates result in an estimated on-time graduation rate of 80 percent for Maryland in 2001-02. This rate is 7 percentage points higher than the first rate that was computed including all freshmen (NCES, CCD, Dropout and Completer data files as of 12/04).

Limitations: This measure falls short of the proposed on-time graduation rate on two dimensions. First, by including all graduates in 2001-02, the graduates may include students who repeated a grade in high school or completed high school early and thus are not on-time graduates in 2001-02. Second, although it is likely that some students in their high school years moved in and out of Maryland between 1998-99 and 2001-02, there are no adjustments for these movements over this period and the effects here are the same as those described above for FGR.

The only estimate that changed between this rate and the previous one is the number of freshmen. In this case, an estimate of students who were not first-time freshmen was removed from the denominator. This leaves two problems to consider. The inclusion of 2001-02 graduates who spent more or less than 4 years in high school increases the

[4] Assuming there have been no major changes in retention policy over this 4-year period, these two effects will, at least partially, cancel each other out. However, this assumption is likely not to hold across the entire range of schools, districts, and states.

[5] Because there is no estimate of first-time freshmen in CCD, a smoothed average of 61,004 students who were 8th graders in 1997-98, 69,247 who were 9th graders in 1998-99, and 61,121 who were 10th graders in 1999-2000 was used to approximate first-time freshmen.

number of graduates in the numerator over the number of on-time graduates, and yields a higher estimated rate than would be the case if only on-time graduates were included in the numerator. As described earlier, the effect of ignoring movements in or out of the state could result in a decrease in the estimated rate with more departures than entrants or an increase with in the estimated rate with more entrants than departures.

Table 4. Components of numerator and denominator used for calculation of AFGR: Maryland, 2001-02

Component	Numerator	Denominator
Overall	50,833	63,791
Public school graduates in 2001-02	50,833	†
Public school first-time 9th-graders in 1998-99[1]	†	63,791

† Not applicable.
[1] First-time 9th-graders in 1998-99 is calculated by averaging the 8th-grade enrollment in 1997-98, the 9th-grade enrollment in 1998-99, and the 10th-grade enrollment in 1999-2000.

NOTE: AFGR = Averaged freshman graduation rate, first-time freshmen.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "Local Education Agency Universe Survey Dropout and Completion Data File," school years 1997-98 through 2002-03.

However, in the example given here using CCD data, the interpretation of this rate is not as straightforward. Since CCD does not currently include a count of first time freshmen, this count was estimated using the averaging approach advocated by Greene (2002); where a smoothed average of 61,004 students who were 8th graders in 1997-98, the 69,247 who were 9th graders in 1998-99, and the 61,121 who were 10th graders in 1999-2000 was used to approximate first-time freshmen. In most states, the freshman retention rate is higher than the retention rates evident in the other middle- and high-school grades and this tends to inflate the 9th grade enrollment counts. To account for this, Greene proposes using the 8th-grade enrollment from the previous year to help adjust (i.e., deflate) the 9th-grade enrollment for students who were retained in the 9th grade and thus are not first-time 9th-graders (the logic here is that the number of first-time freshmen should be tied to the number of 8th graders the previous year). He also posits that the average of the previous year's 8th-grade enrollment and the current year's 9th-grade enrollment provides an adjustment for transfers between public and private schools.[6] The smoothed rate proposed by Greene also includes the 10th-grade enrollment; the rationale

[6] The authors of this report agree with the need to remove the impact of 9th-grade retentions, but do not see a need to adjust for transfers between public and private schools—regardless of whether a public school freshman attended public or private school in the 8th grade, once enrolled in the public school in the 9th grade the student should be counted.

for this is that the 10th-grade enrollment is also lower than the 9th-grade enrollment with retentions.

Looking more closely at the Greene estimate for first-time freshmen, dropouts from grades 8 and 9 are not discussed in Greene's rationale for smoothing enrollments across grades 8, 9, and 10, but their impact should not be ignored. Logically, the 9th-grade enrollment should be lower than expected based on 8th-grade enrollments because those students who dropout in the 8th grade in one year are not eligible to be first-time freshmen in the next year, and these 8th-grade dropouts should not impact the count of first-time freshmen in the next year. Thus, including the dropouts from the 8th grade in the estimate of first-time freshmen increases the contribution of 8th grade enrollments and inflates the Greene estimate of first-time freshmen. At the same time, the observed 9th-grade enrollment in one year should be higher than the observed 10th-grade enrollment in the next year due to the loss of 9th-grade dropouts in 10th-grade enrollments. Because the 10th grade enrollments exclude the 9th-grade dropouts, the averaging of enrollments from grades 8, 9 and 10 reduces the contribution of 9th-grade dropouts to the estimate of first-time freshman enrollments. This deflates the Greene estimate of first-time freshmen. Since there are typically more 9th- than 8th-grade dropouts, the overall impact of ignoring 8th- and 9th-grade dropouts is to most likely reduce the Greene estimate of first-time freshmen.[7]

In addition, smoothing enrollments across these 3 grades to estimate first-time 9th-grade enrollment minimizes actual population changes in public school enrollments across these grades. For example, if there is an increase in the number of first-time freshmen relative to the number of 8th-graders the year before due to migration or transfers from private to public schools, the smoothing of 8th- and 9th-grade data would dampen this real increase in the size of the freshman class, causing an underestimate of the size of the first-time freshman class and an overestimate of the graduation rate.

The limitations associated with the Greene averaged estimate of first-time freshmen affect the two rates that use the Greene estimate, the Average Freshman Graduation Rate discussed here and the Greene Graduation Indicator, discussed later, but do not impact the other measures under consideration.

Returning to the Maryland example, the 7 percentage point increase in the estimated on-time graduation rate is partially due to the removal of a number of 9th-grade repeaters from the denominator, but also due to the impact of ignoring 8th- and 9th-grade dropouts. What is more, some of the increase is likely due also to the number of 2001-02 graduates who took longer than 4 years to graduate and thus increased the numerator. In addition, because the estimate for first-time freshmen is based on a smoothed average across 3 years, the increase could also be due to changes in the enrollment counts in Maryland

[7] Recall that the averaging is intended to adjust for the impact of variation in grade-to-grade retentions, because freshman retentions are much more frequent than 8th-grade dropouts, the harm from ignoring retentions exceeds that of ignoring 8th-grade dropouts.

between the 8th and 10th grade (NCES, CCD, Dropout and Completer data files as of 12/04).

CCD Graduation Leaver Indicator (CCD GLI)

Description and Computation: This graduation indicator (CCD GLI) differs from the last two measures in that it was not developed as an estimate of on-time graduation; rather it is a measure of departures (figure B-5). This rate requires counts of the number of students who graduated with a regular diploma in one year, the number of students who were alternative completers in the same year, and counts of students who dropped out of the 12th grade in that year, grade 11 in the previous year, grade 10 the year before, and grade 9 the year before that (i.e., counts of dropouts from 4 consecutive grades over 4 consecutive years). To compute this Graduation Leaver Indicator, the numerator is the number of students who graduate in a specified year, regardless of how long a student takes to complete high school, and the denominator is the number of current year graduates and completers, plus the sum of all of the students who dropped out over the 4-year period (i.e., all of the students who left). More specifically, using Maryland as the example, the number of graduates from Maryland public high schools in 2001-02 is, again, 50,883 (table 5). This is the numerator of this rate. Instead of focusing on an estimate of the starting population, this rate uses the sum of the graduates (50,883) and alternative completers (510) in 2001-02 plus the number of dropouts from 12th grade in 2001-02 (1,836), from 11th grade in 2000-01 (2,290), from 10th grade in 1999-2000 (2,582), and from 9th grade in 1998-99 (3,118) for a denominator total of 61,169 students who left public high schools in Maryland between 1998-99 and 2001-02. The estimated graduation leaver rate is 83 percent; or in other words, 83 percent of the students from the freshman class of 1998-99 who left Maryland's public high schools over this 4-year period did so with a regular high school diploma (NCES, CCD, Dropout and Completer data files as of 12/04).

Limitations: This measure differs from the proposed on-time graduation rate in several respects. As was the case with the previous graduation indicators, the graduates are not limited to on-time graduates (i.e., repeaters and early completers are included). The resulting number of graduates is larger than it otherwise would be and contributes to a higher rate. Most importantly this rate differs in that it is a leaver rate, rather than a graduation rate. Because the denominator includes the sum of the students from the freshman class of 1998-99 who dropped out of Maryland high schools over a 4-year period or graduated in 2002, students who started high school in Maryland in 1998-99 (or who moved into Maryland during the intervening years), but did not leave high school by the end of the 2001-02 school year, are not included in the numerator or the denominator. Thus, the exclusion of the number of students who started high school and did not finish on time decreases the denominator for the leaver rate and thus increases the leaver rate relative to an on-time measure. As a result, the graduation leaver rate is 3 percentage points higher than the Maryland graduation rate (AFGR) that used an estimate of first-time freshmen and 10 percentage points higher than the Maryland graduation rate (FGR) that included the larger number of all freshmen in the starting population.

Table 5. Components of numerator and denominator used for calculation of CCD GLI: Maryland, 2001-02

Component	Numerator	Denominator
Overall	50,833	61,169
Public school graduates in 2001-02	50,833	50,833
Alternative completers in 2001-02	†	510
Number of 9th-grade dropouts in 1998-99	†	3,118
Number of 10th-grade dropouts in 1999-2000	†	2,582
Number of 11th-grade dropouts in 2000-01	†	2,290
Number of 12th-grade dropouts in 2001-02	†	1,836

† Not applicable.

NOTE: CCD GLI = Common Core of Data graduation leaver indicator.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "Local Education Agency Universe Survey Dropout and Completion Data File," school years 1998-99 through 2002-03.

Swanson's Cumulative Promotion Indicator (SCPI)
Description and Computation: This graduation measure (SCPI) is another approach to estimating an on-time graduation rate (figure B-6). In this case, the indicator is a cumulative product of the proportion of students who progress from one grade to the next at the end of the school year for grades 9, 10, and 11 multiplied by the proportion of seniors who graduate at the end of the school year. This measure requires counts of the number of graduates and the number of students in each of the 9th, 10th, 11th and 12th grades in year one and counts of the number of students in the 10th, 11th, and 12th grades in the next year. To compute this indicator, the grade specific promotion rates are computed by dividing the number of students enrolled in each of grades 10, 11, and 12 in the fall of one year by the number of students enrolled in each of grades 9, 10 and 11 in the fall of the previous year to compute the promotion rate from the first year to the next by grade. Similarly, the number of students graduating at the end of the first school year is divided by the number of 12th graders enrolled in the fall of that year to compute the promotion rate for the 12th grade (i.e., 12th grade graduation rate). More specifically, the number of students in grade 10 in the next year is divided by the number of students in grade 9 in year one, this is repeated for the number of 11th-graders in the next year as a ratio to the number of 10th-graders in year one, for the number of 12th-graders in the next year to the number of 11th-graders in year one, and for the number of graduates in year one divided by the number of 12th-graders in year one; then the rate is the product of these 4 proportions multiplied by 100. In Maryland, the 63,951 10th-graders in 2001-02 divided by the 72,204 9th-graders in 2000-01 is 0.89, the 57,681 11th-graders in 2001-02 divided by the 62,839 10th-graders in 2000-01 is 0.92, the 53,014 12th-graders in 2001-02 divided by the 56,147 11th-graders in 2000-01 is 0.94, and the 49,222 diploma recipients in 2000-01 divided by the 51,312 12th-graders in the same year is 0.96 (table 6). The

cumulative product for these 4 proportions is .736. Thus this measure yields an estimate of 74 percent for 2000-01; according to this cumulative promotion indicator 74 of each 100 students who start the 9th grade complete high school on time 4 years later (NCES, CCD, Dropout and Completer data files as of 12/04).[8]

Table 6. Components of numerator and denominator used for calculation of SCPI: Maryland, 2001-02

Component	Numerator	Denominator
10th-graders in 2001-02	63,951	†
11th-graders in 2001-02	57,681	†
12th-graders in 2001-02	53,014	†
Diploma recipients in 2000-01	49,222	†
9th-graders in 2000-01	†	72,204
10th-graders in 2000-01	†	62,389
11th-graders in 2000-01	†	56,174
12th-graders in 2000-01	†	51,312

† Not applicable.
NOTE: SCPI = Swanson's cumulative promotion indicator. The numerator and denominator are both the products are all their components.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "Local Education Agency Universe Survey Dropout and Completion Data File," school years 2000-01 through 2002-03.

Limitations: This measure differs from the NISS proposed on-time graduation rate in some of the same ways described for FGR and AFGR. In particular, all graduates are included, rather than just on-time graduates, thus inflating the rate. Movements in and out of the state are not taken into account; in this case if the migration scale were tipped toward students moving in, the numerator of each proportion would be inflated, thus inflating the rate. However, if the state were losing students, the smaller numerators would yield a lower graduation rate. There is one additional difference in that rather than relying on the experiences over a 4-year period, this cross-sectional rate uses data from only 2 consecutive years as proxies for data drawn from all 4 years**.** Thus in this case, although the graduates for any specific year are actually from the 9th-graders 4 years earlier, this group of 9th-graders is not included in the rate. Instead, the promotion rates are computed using enrollment data for the year of the graduates and the following year combined with the ratio of graduates to starting seniors in the specific year. This rate is in effect, a type of synthetic cohort rate, in which it is assumed that the experiences of the population over the 4-year period from high school entry in grade 9 through graduation

[8] Because this rate requires enrollment data for individual grades in the subsequent year to compute rates for specific years, using the same years of data used for the other graduation measures yields the rate for one year earlier in time.

are captured in 2 years of data for consecutive grades. This would only hold true if the retention policies or patterns or other education policies or practices that impact student grade progression were the same in the 2 years used as they were over the graduating seniors high school years. Additionally, this would only hold true if the characteristics of the students enrolled in each grade in the 2 years were the same as those of students in each of the grades as the graduating seniors progressed through high school.

It is also important to note that when Swanson proposed this measure, he cautioned against using it for populations that do not include each of grades 9 through 12, that were not in existence for the two consecutive years required to compute the rate, or that have had significant changes in the boundaries of the population (Swanson 2003). Furthermore, Swanson recommended trimming and censoring population estimates that exceed 100 percent by recoding rates between 100 and 110 percent to 100 percent and by treating any larger percents as missing.

Returning to the Maryland example, note that the cumulative promotion rate of 74 percent is for school year 2000-01, not school year 2001-02 used to illustrate the three preceding measures. For comparison purposes, for Maryland, the 2000-01 unadjusted graduation rate, using all freshmen is 73 percent; the 2000-01 unadjusted graduation rate using estimated first-time freshmen is 79 percent, and the CCD graduation leaver rate is 83 percent. In this example, the cumulative promotion rate estimation of the graduation rate is closest to the unadjusted graduation rate based on all freshmen.

Greene's Graduation Indicator (GGI)

Description and Computation: This graduation measure (GGI) uses a simulated cohort approach to estimating an on-time graduation rate (figure B-7). This measure requires a multi-step process to reach the final estimate. The data required to estimate the number of first-time freshmen include counts of the number of 8^{th}-graders 5 years before the graduation year, 9^{th}-graders 4 years prior to the graduation year, and the number of 10^{th}-graders from 3 years before the graduation, and a count of diplomas awarded in the graduation year. Counts of 9^{th}- through 12^{th}-grade enrollment in the graduation year and 4 years before the graduation year are also needed.

The first step in computing this measure involves estimating the rate of change in the high school population from the time a freshman class started to the time it was to have graduated. This rate is intended to approximate the amount of population change from migration in grades 9 through 12. The numerator is the number of students enrolled in grades 9 through 12 in the graduation year minus the number of students enrolled in grades 9 through 12 four years earlier. The denominator is the number of students enrolled in grades 9 through 12 four years earlier. This rate of change is multiplied by the Greene estimate of the number of first-time freshmen 4 years earlier to yield an adjusted estimate of first-time freshmen that takes changes due to migration into account. Greene describes this adjusted estimate as an estimate of the number of on-time seniors eligible to graduate assuming no one drops out.[9] Then in the final step, the number of diplomas awarded in the graduating year is divided by the estimated number of potential on-time seniors. Computationally, the resulting rate is the AFGR, based on first-time freshmen, with the rate of change in the size of 9th- to 12th-grade enrollments applied to the averaged freshmen data.

By way of example, recall that for Maryland, the Greene estimate of first-time freshmen in 1998-99 was 63,791 ((61,004 8th-graders in 1997-98 plus 69,247 9th-graders in 1998-99 plus 61,121 10th-graders in 1999-2000) divided by 3). The enrollment for grades 9 through 12 in 2001-02 was 248,445 and the enrollment for grades 9 through 12 in 1998-99 was 233,541; thus the difference of 14,904 divided by the starting enrollment of 233,541 in 1998-99 yields a rate of change of 0.0638 (table 7). Increasing the first-time freshman count of 63,791 by the growth rate of 0.0638, results in an estimate of 67,862 on-time seniors in 2001-02. Finally, 50,883 diplomas were awarded to public high school students in Maryland in 2001-02. That number divided by the estimate of 67,862 potential on-time seniors results in an on-time graduation rate estimate of 75 percent. Using this approach, 75 out of every 100 first-time freshmen in Maryland public high schools in 1998-99 graduated from a Maryland public high school in 2001-02 (NCES, CCD, Dropout and Completer data files as of 12/04).

Table 7. Components of numerator and denominator used for calculation of GGI: Maryland, 2001-02

Component	Numerator	Denominator
Overall	50,833	67,862
Public school graduates in 2001-02	50,833	†
Enrollment for grades 9-12 in 2001-02	†	248,445
Enrollment for grades 9-12 in 1998-99	†	233,541
First-time 9th-graders in 1998-99[1]	†	63,791

† Not applicable.
[1] First-time 9th-graders in 1998-99 is calculated by averaging the 8th-grade enrollment in 1997-98, the 9th-grade enrollment in 1998-99, and the 10th-grade enrollment in 1999-2000.

NOTE: GGI = Greene's graduation indicator. The denominator is first-time 9th graders in 1998-99 adjusted by the rate of change of enrollment from the years 1998-99 to 2001-02. This gives an estimate for the number of potential seniors in 2001-02.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "Local Education Agency Universe Survey Dropout and Completion Data File," school years 1997-98 through 2002-03.

[9] Recall from the discussion of the unadjusted graduation rate based on first-time freshmen that first-time freshmen are estimated summing the number of 8th-graders from 5 years before the graduation year, the number of 9th-graders from 4 years before the graduation and the number of 10th-graders from 3 years before the graduation year and dividing by 3 for a smoothed average.

Limitations: This measure falls short of the proposed on-time graduation rate on three dimensions. First, by including all graduates in 2001-02, the graduates may include students who repeated a grade in high school or completed high school in less than 4 years and thus are not on-time graduates. Comparing all graduates to the estimate for on-time 12th-graders includes graduates who repeated a grade between the 9th and 12th grades and graduates who finished high school in less than 4 years in the numerator, but they are not in the denominator estimate of first-time 12th-graders.

Second, as discussed in the case of the AFGR, while the assumptions introduced in the estimate Greene proposed for first-time freshmen serve to adjust the estimate of 9th-graders for the increased rate of retentions that occur in the freshman year, the averaging that occurs also reduces the estimate of first-time freshmen by ignoring 8th- and 9th-grade dropouts. The assumptions also overlook the impact of ignoring any population changes in the enrolled student population between the 8th and 10th grades due to differential migration.

Third, because the rate of change estimate compares the size of the enrolled population in grades 9-12 in one year to the size of the enrolled population in those grades 4 years earlier Greene assumes that the change in the size of the 9th to 12th grade population over the 4-year period is due to migration. However, the students in grades 9, 10, 11, and 12 in the later year come from four different cohorts of starting freshmen. The relative change captured by comparing these two groups of students would reflect migration alone only if each of the starting freshman cohorts were the same size.10 However, differences in the birth rates and in migration patterns over time, along with differences in elementary school retention policies over time, result in variations in the size of the freshman cohort from year to year. For example, in Maryland the size of the freshman class grew by approximately 2 percent each year between 1998-99 and 2001-02. These were the students making up the 9th to 12th grade population in 2001-02, thus much of the .0638 growth rate was due to the increasing size of the freshman classes rather than due to migration during the high school years. This suggests that a portion of the increase in the rate of growth in the Maryland example is due to underlying population changes that occur before the freshman year, not to the effects of net migration during the high school years. If this is true, this adjustment is artificially increasing the denominator of GGI and as a result unnecessarily lowering the graduation rate. In other words, if the rate of change is due to growth in the incoming cohorts rather than to growth associated with migration during the high school years, the Greene rate without the growth adjustment is closer to the observed population changes (i.e., the AFGR).

It is also important too note that when Greene and Winter proposed this measure, they cautioned against using it for small populations or for populations that have undergone large changes in size over the 4 year high school period (Greene and Winters 2005). In particular, they treated cases with fewer than 200 9th graders as missing. In addition, cases with a change in the population larger than 30 percent were also set to missing, as were cases that had both fewer than 2,000 9th graders and a change in the population of more than 20 percent.

[10] This also assumes that there are no major changes in dropout rates over the 4-year period.

The on-time graduation rate of 75 percent in 2001-02 from the Greene graduation indicator can be compared with other rates computed for 2001-02—73 percent for the FGR, 80 percent for the AFGR, and 83 percent for the CCD graduation leaver rate. Numerically, the Greene graduation indicator, like the Swanson measure, is closest to the FGR.

In-Transfer Adjusted Graduation Indicator (IAGI)

Description and Computation: Like the other measures presented thus far, this graduation measure (IAGI) uses cross-sectional data to estimate an on-time graduation rate (figure B-8). The difference here is that in addition to the number of graduates in a specific year, this indicator requires both the count of first-time freshmen 4 years earlier and counts of the number of students transferring into each grade between the 9th and 12th grades. Of these data elements, only the number of graduates is currently included in the CCD data collection. Assuming these data were available, this indicator would be computed by dividing the number of graduates by the sum of the number of first-time freshmen 4 years earlier plus the number of students who transferred into the 9th grade plus transfers into each successive grade over the intervening years. To illustrate this indicator, data are needed for counts of first-time freshmen and grade- and year-specific transfers. For the sake of illustration, the estimate of first-time freshmen used earlier in the unadjusted graduation rate based on first-time freshmen and in the Greene graduation indicator is used again. In addition, to illustrate the computational procedures for this rate, an annual in-transfer rate of 2 percent is assumed. Thus, returning to the Maryland example, the denominator, which is only illustrative, is the sum of the estimated 63,791 first-time freshmen in 1998-99 plus the estimate of 1,276 9th-grade transfers during 1998-99, some 1,301 10th-grade transfers during 1999-2000, some 1,328 11th-grade transfers in 2000-01, and 1,354 12th-grade transfers in 2001-02 for a total of 69,050 students who were eligible to be in the 12th grade in 2001-02 (table 8). This number divided into the 50,883 graduates from Maryland high schools in 2001-02 yields a graduation rate of 74 percent. Thus, given the assumptions used in this example, 74 out of 100 freshmen in 1998-99 would have graduated in 2001-02 (NCES, CCD, Dropout and Completer data files as of 12/04).

Limitations: If, in fact, the counts for the number of first-time freshmen in 1998-99 and the counts for the number of transfers into each consecutive year of high school were available, this rate would still differ from the NISS proposed on-time graduation rate because the numerator includes all graduates, rather than just on-time graduates. This will contribute to an inflated rate. This rate also differs, in that although it takes students transferring in to the state into account, it fails to incorporate data for students transferring out of the state. This has the effect of inflating the denominator (because students who left are still included) and thus will decrease the graduation rate. In addition, the fact that cross-sectional estimates for individual grades are being used results in a simulation of a cohort rate, as opposed to a true cohort rate. This will yield different results than would be obtained by following the experiences of a set of students across the 4 years of high school.

Table 8. Components of numerator and denominator used for calculation of IAGI: Maryland, 2001-02

Component	Numerator	Denominator
Overall	50,833	69,050
Public school graduates in 2001-02	50,833	†
First-time 9th-graders in 1998-99[1]	†	63,791
9th-grade transfers in 1998-99	†	1,276
10th-grade transfers in 1999-2000	†	1,301
11th-grade transfers in 2000-01	†	1,328
12th-grade transfers in 2001-02	†	1,354

† Not applicable.
[1] First-time 9th-graders in 1998-99 is calculated by averaging the 8th-grade enrollment in 1997-98, the 9th-grade enrollment in 1998-99, and the 10th-grade enrollment in 1999-2000.

NOTE: IAGI = In-transfer adjusted graduation indicator. Data on the number of transfers are hypothetical and were used only for illustrative purposes.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "Local Education Agency Universe Survey Dropout and Completion Data File," school years 1997-98 through 2002-03.

Cohort Graduation Indicator (CGI)
Description and Computation: This cohort indicator yields an on-time graduation rate. Because it is cohort based, this measure requires actual counts of first-time freshmen, transfers into the 9th grade and transfers into each successive grade over the intervening years, and counts of graduates from each of these five groups of students (figure B-9).[11] The numerator for this measure is the sum of the students who entered this cohort, either in the 9th grade or by transferring in, and who graduated on time. The denominator is the sum of all students who entered this cohort. CCD includes only cross-sectional data, and thus does not include these cohort data. To illustrate how this rate is constructed, the Maryland estimate of 63,791 first-time freshmen in 1998-99 is used as a starting point for the cohort, along with the hypothetical data on grade specific transfers in (i.e., 1,276 9th-grade transfers during 1998-99, some 1,301 10th-grade transfers during 1999-2000, some 1,328 11th-grade transfers in 2000-01, and 1,354 12th-grade transfers in 2001-02) (table 1.9). These hypothetical numbers yield a denominator of 69,050 students from the cohort who could have been in the 12th grade in 2001-02. Then, assuming, for the sake of this example, that 75 percent of the original first-time freshmen graduated on time, and that 70 percent of the transfer students graduated on time, the numerator is the sum of all of the students in the cohort who graduate on time in 2001-02. Under these assumptions, there are 47,843 first-time 9th-graders who graduate on time, plus the sum of 893 graduates from the 9th-grade transfer students, 911 graduates from the 10th-grade transfer

[11] Although the NISS formula did not explicitly mention transfers into the 9th grade, they are also required. Thus, there are two sets of graduates who are from the 9th grade.

students, 930 graduates from the 11th-grade transfer students, and 948 graduates from the 12th-grade transfer students, for 3,682 graduates who transferred into the state and an overall total of 51,525 graduates in 2001-02. The 51,525 graduates divided by the 69,050 students from the cohort who could have been in the 12th grade in 2001-02 yields a graduation rate of 75 percent (NCES, CCD, Dropout and Completer data files as of 12/04).

Table 9. Components of numerator and denominator used for calculation of CGI: Maryland, 2001-02

Component	Numerator	Denominator
Overall	51,525	69,050
Public school graduates in 2001-02	51,525	†
First-time 9th graders in 1998-99[1]	†	63,791
9th-grade transfers in 1998-99	†	1,276
10th-grade transfers in 1999-2000	†	1,301
11th-grade transfers in 2000-01	†	1,328
12th-grade transfers in 2001-02	†	1,354

† Not applicable.
[1] First-time 9th graders in 1998-99 is calculated by averaging the 8th grade enrollment in 1997-98, the 9th grade enrollment in 1998-99, and the 10th grade enrollment in 1999-2000.

NOTE: CGI = Cohort graduation indicator. Data on the number of transfers are hypothetical and were used only for illustrative purposes.
SOURCE: Data from a state student record system.

Limitations: This rate is a cohort rate that requires detailed data on individual students' status over time. However, even if each of the required data elements were available, it falls short of the NISS proposed graduation rate in that it does not include any adjustments for students leaving the cohort. That is to say, although students entering the cohort are accounted for, the data on exits due to transfers or deaths are not directly included. The absence of these data serves to increase the size of the denominator and thus decreases the graduation rate.

Proposed NISS High School Graduation Rate

Although a general description of the proposed rate was included in the background discussion earlier in this report, the details of the data elements required and the computational procedures are included here.

Exclusion-Adjusted Cohort Graduation Indicator (EACGI)

Description and Computation: This cohort graduation rate takes all possible changes in status into account, thus following the movement of students from one freshman class, and new entrants to that class, over time as they progress towards graduation (figure B-10). This rate requires counts of first-time freshmen; counts of students who leave the 9th grade and each successive grade over the intervening years due to documented transfers, imprisonment, or death (i.e., exclusions); transfers into the 9th grade and each successive grade over the intervening years; and counts of graduates for the starting first-time freshmen and for students who transfer into the cohort.[12] The computational formula is similar to the one described above for the cohort graduation rate, the only difference being that students who are documented exclusions are subtracted from transfers in for the grade and year in which they leave. The numerator for this measure is the sum of the students who entered this cohort, either in the 9th grade or by transferring in, and who graduated on time. Using the same 1998-99 to 2001-02 time period, this includes first-time freshmen from 1998-99 who graduated in 2001-02, plus students who transferred in as first-time freshmen in 1998-99 who graduated in 2001-02, plus students who were first-time freshmen in 1998-99 and transferred in as 10th-graders in 1999-2000 and graduated in 2001-02, plus students who were first-time freshmen in 1998-99 and transferred in as 11th-graders in 2000-01 and graduated in 2001-02, plus students who were first-time freshmen in 1998-99 and transferred in as 12th-graders in 2001-02 and graduated in 2001-02.[13] The denominator is the sum of all students who entered this cohort less those who exited for one of the documented allowable reasons (i.e., transfers, imprisonment, or death, but not dropping out). More specifically this includes first-time freshmen from 1998-99 minus the documented exclusions from this group during the 9th, 10th, 11th, or 12th grade, plus students who transferred in as first-time freshmen in 1998-99 minus the documented exclusions from this group during the 9th, 10th, 11th, or 12th grade, plus students who were first-time freshmen in 1998-99 and transferred in as 10th-graders in 1999-2000 minus the documented exclusions from this group during the 10th, 11th, or 12th grade, plus students who were first-time freshmen in 1998-99 and transferred in as 11th-graders in 2000-01 minus the documented exclusions from this group during the 11th or 12th grade, plus students who were first-time freshmen in 1998-99 and transferred in as 12th-graders in 2001-02 minus the documented exclusions from this group during the 12th grade.

To illustrate this rate, data are needed for counts of first-time freshmen and grade- and year-specific transfers in and exclusions. For the sake of illustration, the estimate of first-time freshmen used earlier in the unadjusted graduation rate based on first-time freshmen and in the Greene graduation rate is used again. In addition, to illustrate the computational procedures for this rate, the in-transfer counts and the graduation rates used in the CGI example, and an annual exclusion rate of 3 percent is used for each year's starting enrollment and for each year's in-transfer counts. Thus, returning to the

[12] Although the NISS formula did not explicitly mention transfers into the 9th grade, they are also required. In addition, transfers in must be assigned to the cohort that corresponds with their first-time freshman year.
[13] Although not included in this detailed discussion, students who graduate ahead of schedule could be included in the count of on-time graduates for the cohort, reported as a subtotal and as part of the total number of graduates.

Maryland example based on hypothetical data, the numerator is the same as the numerator in the CGI, with 51,525 graduates (table 10). The first term in the denominator is the sum of the estimated 63,791 first-time freshmen in 1998-99 minus the 7,317 exclusions (1,914 in 9th grade, 1,856 in 10th grade, 1,801 in 11th grade, and 1747 in 12th grade); this is added to the estimate of 1,276 who are 9th-grade transfers-in less the 146 exclusions from this group over the 9th, 10th, 11th, and 12th grades (38, 37, 36, and 35); plus the 1,301 who are10th-grade transfers-in less the 114 exclusions from this group over the 10th, 11th, and 12th grades (39, 38, 37); plus the 1,328 11th-grade transfers-in less the 78 exclusions from this group in the 11th and 12th grades (40 and 39); plus the 1,354 who are 12th-grade transfers-in less the 41 exclusions from this group. This resulted in a total of 61,354 students who were eligible to be in the 12th grade in 2001-02. This number divided into the 51,525 graduates from Maryland high schools in 2001-02 yields a graduation rate of 84 percent. Thus, given the assumptions used in this example with a slightly higher exclusion rate than in-transfer rate, 84 out of 100 freshmen in 1998-99 would have graduated in 2001-02 (NCES, CCD, Dropout and Completer data files as of 12/04).

Table 10. Components of numerator and denominator used for calculation of EACGI: Maryland, 2001-02

Component	Numerator	Denominator
Overall	51,525	61,354
Public school graduates in 2001-02	51,525	†
First-time 9th-graders in 1998-99[1]	†	63,791
Exclusions from first-time 9th-graders	†	7,317
9th-grade transfers in 1998-99	†	1,276
Exclusions from 9th-grade transfers	†	146
10th-grade transfers in 1999-2000	†	1,301
Exclusions 10th-grade transfers	†	114
11th-grade transfers in 2000-01	†	1,328
Exclusions from 11th-grade transfers	†	78
12th-grade transfers in 2001-02	†	1,354
Exlusions from 12th-grade transfers	†	41

† Not applicable.

[1] First-time 9th-graders in 1998-99 is calculated by averaging the 8th-grade enrollment in 1997-98, the 9th-grade enrollment in 1998-99, and the 10th-grade enrollment in 1999-2000.

NOTE: EACGI = Exclusion-adjusted cohort graduation indicator. Data on the number of transfers and exclusions are hypothetical and were used only for illustrative purposes.
SOURCE: Data from a state student record system.

Discussion and Summary

The indicators that are intended to be estimates of a 4-year on-time graduation rate require data for graduates and for enrollments in grades 9 through 12. Insofar as these data are available at both the national and state levels, each of the measures can be computed at both of these levels. At the school and district levels, the utility of these measures is limited to those districts that include and have data available for grades 9 through 12. (Note that, by definition, a 4-year on-time graduation rate cannot be computed for districts or schools serving only grades 10 through 12.) Two measures, AFGR and GGI have the additional constraint of requiring 8th grade enrollment counts to compute the averaged freshman estimate of first-time freshman enrollment. Thus, while these two rates (AFGR and GGI) can be computed at the national, state, district, and school levels where grade 8 enrollments are included, they cannot be computed for secondary level districts or schools that start at grade 9. While this precludes the analysis of these two rates at the district or school level using CCD data, it is important to note that at the individual school or district levels direct knowledge of students can be used to identify students who enroll in grade 9 for the first time in a specific year. Then, instead of estimating first time freshman enrollment through the averaging approach used in AFGR and GGI, the school or district can use the observed count of first-time freshmen in the denominator, in place of the averaged count of freshman enrollment, to yield rates that are comparable to AFGR or GGI computed using aggregate data at the state and national levels.

The examples presented in this section were included for illustrative purposes. They were constructed as a means to walk through the step-by-step process required to compute each rate; indeed, in some cases key elements of a formula were either approximated or hypothetical. Tables 11 and 12 summarize some of the key points and may serve as a convenient reference to use in reading the next volume of the report. Table 11 identifies the various components of the numerators and denominators of each of the indicators, and table 12 identifies the limitations of each indicator.

The second volume of this report explores in more detail the statistical properties and strengths and weaknesses of each measure that can be computed using detailed student record based cohort data from two states to examine and compare each of the proxy rates to the proposed NISS exclusion-adjusted cohort graduation rate. Then existing CCD data are used to compare the performance of the full set of available proxy rates across all states to the proxy measure identified as the closest approximation of the true rate using the cohort data. Briefly, those analyses show that although each of the four proxy measures of on-time graduation rates—FGR, AFGR, GGI, and SCPI, perform well relative the true cohort rate (EACGI)[14] in one or more of the analyses, AFGR is the only measure that is consistently among the best performing indicators in each analysis.

[14] FGR, AFGR, SCPI, and GGI have statistical properties that are relatively close to those observed for the true cohort rate (EACGI) in one or more analysis.

Table 11. Summary of components of specific graduation indicators

Selected characteristic	Indicator[1]										
	CPS HSCI	DGI	FGR	AFGR	GLI	SCPI	GGI rate of change	GGI rate component	IAGI	CGI	EACGI
Population data											
Civilian noninstitutionalized population ages 18-24 with a high school credential 1999	N										
Civilian noninstitutionalized population ages 18-24 not enrolled in K-12 1999	D										
Graduates from public and private schools 1999-2000		N									
17-year-olds in the civilian noninstitutionalized population fall 1999		D									
Public School Cross-sectional data											
Enrollments											
8th grade 1997-98				D				D			
10th grade 1999-2000				D				D	D		
9th grade 1998-99			D	D			N/D	D	D		
10th grade 1998-99							N/D				
11th grade 1998-99							N/D				
12th grade 1998-99							N/D				
9th grade 2000-01						D					
10th grade 2000-01						D					
11th grade 2000-01						D					
12th grade 2000-01						D					
9th grade 2001-02							N				
10th grade 2001-02						N	N				
11th grade 2001-02						N	N				
12th grade 2001-02						N	N				
Leavers											
Graduates 2001-02			N	N	N/D	N		N	N		
Alternative completers 2001-02					D						
9th grade dropouts 1998-99					D						
10th grade dropouts 1999-2000					D						
11th grade dropouts 2000-01					D						
12th grade dropouts 2001-02					D						
9th grade transfers 1998-99									D		
10th grade transfers 1999-2000									D		
11th grade transfers 2000-01									D		
12th grade transfers 2001-02									D		
Public School Cohort data											
On-time 9th-graders 1998-99										D	D
On-time transfers into cohort 1998-99 through 2002-02										D	D
Validated exclusions from cohort 1998-99 through 2001-02											D
On-time graduates from cohort and on-time transfers 2001-02										N	N

[1] CPS HSCI = Current Population Survey high school completion indicator; DGI = NCES Digest graduation indicator; FGR = Freshman Graduation Rate, all freshmen; AFGR= Averaged Freshman Graduation Rate, first-time freshmen; GLI = CCD Graduation Leaver Indicator; SCPI = Swanson's Cumulative Promotion Indicator; GGI = Greene's Graduation Indicator; IAGI = In-transfer adjusted graduation indicator; CGI = Cohort graduation indicator; EACGI = Exclusion-Adjusted Cohort Graduation Indicator.

NOTE: N = numerator, D = denominator, and N/D = numerator and denominator.

Table 12. Summary of limitations of specific graduation indicators

Limitation	Indicator[2]										
	CPS HSCI	DGI	FGR	AFGR	GLI	SCPI	GGI rate of change	GGI rate component	IAGI	CGI	EACGI
Ignores dropouts		X		X				X	X[1]		
Includes retained 9th-graders			X	X[1]			X[1]	X[1]	X[1]		
Includes late and early graduates	X	X	X	X	X	X		X	X[1]		
Includes alternative completers	X										
Ignores out migration			X	X		X		X	X	X	
Ignores in migration			X	X	X	X		X			
Ignores students still enrolled in school					X						
Does not represent a 4-year time span	X	X				X					

[1] The averaging is an attempt to adjust for retained freshmen since the 9th grade year typically has the highest retention rates of any of the middle and high school grades.
[2] CPS HSCI = Current Population Survey high school completion indicator; DGI = NCES Digest graduation indicator; FGR = Freshman Graduation Rate, all freshmen; AFGR= Averaged Freshman Graduation Rate, first-time freshmen; GLI = CCD Graduation Leaver Indicator; SCPI = Swanson's Cumulative Promotion Indicator; GGI = Greene's Graduation Indicator; IAGI = In-transfer adjusted graduation indicator; CGI = Cohort graduation indicator; EACGI = Exclusion-Adjusted Cohort Graduation Indicator.

NOTE: X = indicates limitations.
SOURCE: *User's Guide to Computing High School Graduation Rates,* U.S. Department of Education, National Center for Education Statistics.

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APPENDIX A
Description of Common Core of Data, Private School Universe Survey, and Current Population Survey

Common Core of Data

NCES uses the Common Core of Data (CCD) survey to acquire and maintain statistical data from each of the 50 states, the District of Columbia, the Bureau of Indian Affairs, Department of Defense Dependents' Schools (overseas and domestic) and the other jurisdictions. Information about staff and students is collected annually at the school, local education agency or school district (LEA), and state levels. Information about revenues and expenditures is also collected at the state and LEA levels.

Data are collected for a particular school year via survey instruments sent to the state education agencies during the school year. Almost all of the states submit the six CCD survey instruments each year, but submissions are sometimes incomplete or too late for publication.

Understandably, when 58 education agencies compile and submit data for approximately 92,000 public schools and 16,000 local school districts, misreporting can occur. Typically, this results from varying interpretations of NCES definitions and differing record keeping systems. NCES attempts to minimize these errors by working closely with the state education agencies through the National Forum on Education Statistics.

The state education agencies report data to NCES from data collected and edited in their regular reporting cycles. NCES encourages the agencies to incorporate into their own survey systems the NCES items they do not already collect so that those items will also be available for the subsequent CCD survey. Over time, this has meant fewer missing data cells in each state's response, reducing the need to impute data.

NCES subjects data from the education agencies to a comprehensive edit. Where data are determined to be inconsistent, missing, or out of range, NCES contacts the education agencies for verification. NCES–prepared state summary forms are returned to the state education agencies for verification. Each year, states are also given an opportunity to revise their state-level aggregates from the previous survey cycle.

Further information on CCD may be obtained from:

John Sietsema
Elementary/Secondary Cooperative System and Institutional Studies Division (ESCSISD)
National Center for Education Statistics
1990 K Street NW
Washington, DC 20006
john.sietsema@ed.gov
http://nces.ed.gov/ccd/

Private School Universe Survey

The purposes of Private School Survey (PSS) data collection activities are (1) to build an accurate and complete list of private schools to serve as a sampling frame for NCES sample surveys of private schools; and (2) to report data on the total number of private schools, teachers, and students in the survey universe. The PSS is conducted every 2 years with collections in 1989–90, 1991–92, 1993–94, 1995–96, 1997–98, 1999–2000, and 2001-02 school years. The survey data for the 2003-04 school year is currently being edited.

The PSS produces data similar to that of the CCD for the public schools, and can be used for public-private comparisons. The data are useful for a variety of policy and research–relevant issues, such as the growth of religiously affiliated schools, the number of private high school graduates, the length of the school year for various private schools, and the number of private school students and teachers.

The target population for the universe survey consists of all private schools in the United States that meet NCES criteria of a school (i.e., private school is an institution which provides instruction for any of grades K through 12, has one or more teachers to give instruction, is not administered by a public agency, and is not operated in a private home). The survey universe is composed of schools identified from a variety of sources. The main source is a list frame, initially developed for the 1989–90 PSS. The list is updated regularly by matching it with lists provided by nationwide private school associations, state departments of education, and other national guides and sources that list private schools. The other source is an area frame search in approximately 120 geographic areas, conducted by the Census Bureau.

Further information on PSS may be obtained from:

Steve Broughman
Elementary/Secondary Sample Survey Studies Program (ESLSD)
National Center for Education Statistics
1990 K Street NW
Washington, DC 20006
stephen.broughman@ed.gov
http://nces.ed.gov/surveys/pss/

Current Population Survey

Prior to July 2001, estimates of school enrollment rates, as well as social and economic characteristics of students, were based on data collected in the Census Bureau's monthly household survey of about 50,000 dwelling units. Beginning in July 2001, this sample was expanded to 60,000 dwelling units. The monthly Current Population Survey (CPS) sample consists of 754 areas comprising 2,007 geographic areas, independent cities, and minor civil divisions throughout the 50 states and the District of Columbia. The samples are initially selected based on the decennial census files and are periodically updated to reflect new housing construction.

The monthly CPS deals primarily with labor force data for the civilian noninstitutional population (i.e., excluding military personnel and their families living on post and inmates of institutions). In addition, in October of each year, supplemental questions are asked about highest grade completed, level and grade of current enrollment, attendance status, number and type of courses, degree or certificate objective, and type of organization offering instruction for each member of the household. In March of each year, supplemental questions on income are asked. The responses to these questions are combined with answers to two questions on educational attainment: highest grade of school ever attended, and whether that grade was completed.

The estimation procedure employed for monthly CPS data involves inflating weighted sample results to independent estimates of characteristics of the civilian noninstitutional population in the United States by age, sex, and race. These independent estimates are based on statistics from decennial censuses; statistics on births, deaths, immigration, and emigration; and statistics on the population in the armed services. Generalized standard error tables are provided in the Current Population Reports. The data are subject to both nonsampling and sampling errors.

Caution should also be used when comparing data from 1993 to 1999 which reflect 1990 census-based population controls, with data from March 1993 and earlier years, which reflect 1980 or earlier census-based population controls. This change in population controls had relatively little impact on summary measures such as means, medians, and percentage distributions. It did have a significant impact on levels. For example, use of 1990-based population controls results in about a 1 percent increase in the civilian noninstitutional population and in the number of families and households. Thus, estimates of levels for data collected in 1994 and later years will differ from those for earlier years by more than what could be attributed to actual changes in the population. These differences could be disproportionately greater for certain subpopulation groups than for the total population.

Further information on CPS may be obtained from:

Education and Social Stratification Branch
Population Division
Census Bureau
U.S. Department of Commerce
Washington, DC 20233
http://www.bls.census.gov/cps/cpsmain.htm

APPENDIX B

Formulas and Details of Each Indicator

Figure B-1. Current Population Survey High School Completion Indicator (CPS HSCI)

Formula:

$$HSCI = \frac{Gy}{P_y}$$

Where: G = Number of persons ages 18-24 with a high school credential
Y = School year
P = Population of 18-24-year olds not enrolled in grades K-12

Purpose:

This status indicator calculates high school credential recipients as a percent of the 18-24-year old population

Data:

Calculation of HSCI requires information on:

- Total number of persons ages 18-24 with a high school credential in a single year
- Population of 18-24-year-olds who are not enrolled in grades K-12

Steps:

To calculate HSCI for students who graduated in the 2001-02 school year:

1. **The numerator is equal to:**
   Number of students with a high school credential in the 2001-02 school year
2. **The denominator is equal to:**
   Population of 18-24-year-olds who are not enrolled in grades K-12
3. **Divide the numerator (1) by the denominator (2).**

Figure B-2. NCES Digest Graduation Indicator (DGI)

Formula:

$$DGI = \frac{G_y}{P_y}$$

Where: G = Number of graduates
Y = School year
P = Population of 17-year-olds

Purpose:

This status indicator calculates the percentage of 17-year-olds who are high school graduates

Data:

Calculation of DGI requires information on:

- Total number of students graduating with a regular diploma in a single year
- Population of 17-year-olds for that same year

Steps:

To calculate DGI for students who graduated in the 2001-02 school year:

1. **The numerator is equal to:**
   Number of students graduating with a regular diploma in the 2001-02 school year
2. **The denominator is equal to:**
   Population of 17-year-olds for the 2001-02 school year
3. **Divide the numerator (1) by the denominator (2).**

Figure B-3. Freshman GraduationRate, All Freshmen (FGR)

Formula:

$$FGR = \frac{G_y}{S^*_{9,y-3}}$$

Where: G = Number of graduates receiving a regular diploma
Y = School year
S^*_9 = all 9th grade-students

Purpose:

This status indicator calculates an estimate of on-time graduation rates, taking into consideration total diploma recipients in the chosen year and all freshman students from three years prior to the selected year

Data:

Calculation of FGR requires information on:

- Total number of students graduating with a regular diploma in a single year
- Total number of 9th-grade students from three years prior to the chosen year

Steps:

To calculate FGR for students who began high school in, for example, the 1998-99 school year and who graduated in the 2001-02 school year:

1. **The numerator is equal to:**
   Number of students graduating in the 2001-02 school year
2. **The denominator is equal to:**
   Number of 9th-grade students (first-time and non-first-time) enrolled in the 1998-99 school year
3. **Divide the numerator (1) by the denominator (2).**

Figure B-4. Averaged Freshman Graduation Rate, First-Time Freshmen (AFGR)

Formula:

$$\text{AFGR} = \frac{G_y}{S_{9,y-3}}$$

Where: G = Number of graduates receiving a regular diploma

Y = School Year

S_9 = Number of first-time 9th-graders

Purpose:

This indicator calculates graduation rates in year y for first-time 9th-grade students in year y-3.

Data:

Calculation of AFGR requires information on:

- Total number of students graduating with a regular diploma in a single year (y)
- Total number of first-time 9th-grade students from three years prior to the chosen year (y-3)

Steps:

To calculate AFGR for students who began high school in, for example, the 1998-99 school year and who graduated in the 2001-02 school year:

1. **The numerator is equal to:**

   The number of students graduating in the 2001-02 school year

2. **The denominator is equal to:**

   The number of students enrolled in 9th grade for the first time in the 1998-99 school year

3. **Divide the numerator (1) by the denominator (2).**

Figure B-5. CCD Graduation Leaver Indicator (CCD GLI)

Formula:

$$GLI = \frac{G_y}{G_y + A_y + D_{12,y} + D_{11,y-1} + D_{10,y-2} + D_{9,y-3}}$$

Where:

G = Number of graduates receiving a regular diploma
Y = School year
A = Number of alternative completers
D = Number of dropouts in a specified grade and year

Purpose:

This departure classification indicator calculates graduation rates by examining three types of students (leavers): graduates, alternative completers, and dropouts at various grades.

Data:

Calculation of GLI requires information on:

- Number of graduates receiving a regular diploma in a single year
- Number of alternative completers in a single year
- Number of dropouts specified by grade and year for four consecutive years up to the year of graduation data

Steps:

To calculate GLI for students who began high school in, for example, the 1998-99 school year and who graduated in the 2001-02 school year:

1. **The numerator is equal to:**
   Number of students graduating in the 2001-02 school year
2. **The denominator is equal to:**
   Number of students graduating in the 2001-02 school year
   plus
   Number of alternative completers for the 2001-02 school year
   plus
   Number of 12th-grade dropouts in the 2001-02 school year
   plus
   Number of 11th grade-dropouts in the 2000-01 school year
   plus
   Number of 10th-grade dropouts in the 1999-2000 school year
   plus
   Number of 9th grade-dropouts in the 1998-99 school year
3. **Divide the numerator (1) by the denominator (2).**

Figure B-6. Swanson's Cumulative Promotion Indicator (SCPI)

Formula:

$$SCPI = \frac{S_{10,y+1}}{S_{9,y}} * \frac{S_{11,y+1}}{S_{10,y}} * \frac{S_{12,y+1}}{S_{11,y}} * \frac{G_y}{S_{12,y}}$$

Where: Sgrade = Number of students in a specified grade
Y = School year
G = Number of graduates receiving regular diplomas

Purpose:

This cumulative indicator calculates an estimate of on-time completion rates taking into consideration enrollments by grade in two consecutive years.

Data:

Calculation of SCPI requires information on:

- Number of students in 9th, 10th, 11th, and 12th grades in the year of analysis
- Number of students in 10th, 11th, and 12th grades in the year after the year of analysis
- Number of graduates receiving regular diplomas in the year of analysis

Steps:

To calculate SCPI for students who began high school in, for example, the 1998-99 school year and who graduated in the 2001-02 school year:

1. **The numerator is equal to:**

   Number of students enrolled in 10th grade for the 2002-03 school year
   times
   Number of students enrolled in 11th grade for the 2002-03 school year
   times
   Number of students enrolled in 12th grade for the 2002-03 school year
   times
   Number of students graduating with regular diplomas during the 2001-02 school year

2. **The denominator is equal to:**

   Number of students enrolled in 9th grade for the 2001-02 school year
   times
   Number of students enrolled in 10th grade for the 2001-02 school year
   times
   Number of students enrolled in 11th grade for the 2001-02 school year
   times
   Number of students enrolled in 12th grade for the 2001-02 school year

3. **Divide the numerator (1) by the denominator (2).**

Figure B-7. Greene's Graduation Indicator (GGI)

Formula:

$$GGI = \frac{G_y}{S'_{12,y}}$$

Where: $S'_{12,y} = (1 + \Delta P_{HS}) * (S'_{9,y-3})$

$$\Delta P_{HS} = \frac{(S_{9,y} + S_{10,y} + S_{11,y} + S_{12,y}) - (S_{9,y-3} + S_{10,y-3} + S_{11,y-3} + S_{12,y-3})}{(S_{9,y-3} + S_{10,y-3} + S_{11,y-3} + S_{12,y-3})}$$

$$S'_{9,y-3} = \frac{S_{8,y-4} + S_{9,y-3} + S_{10,y-2}}{3}$$

Where:
- G = Number of graduates receiving a regular diploma
- Y = School Year
- S_{grade} = Number of students enrolled in a specific grade
- ΔP_{HS} = High school population change over 4 year period
- $S'_{9,y-3}$ = Smoothed estimator for first-time 9th grade enrollment

When: **DO NOT** apply formula when the following statements are true:

$S'_{9,y-3}$ is less than 200

or

ΔP_{HS} is greater than 30 percent

or

if $S'_{9,y-3}$ is less than 2000 and ΔP_{HS} is greater than 20 percent

Purpose:

This cumulative indicator calculates an on-time graduation rate. This is done by first estimating the number of students in a graduating cohort. Next, an estimation is made of the number of students in a 9th-grade cohort who should be expected to graduate four years later. The 9th-grade enrollment is not a direct cohort measure but a smoothed estimate to control for 1) population changes between 8th and 9th grade due to the transfers between the public and private sector, 2) artificially inflated 9th-grade enrollments due to the significant number of students held back in that grade, and 3) depreciated 10th-grade enrollement due to the inflated 9th-grade enrollment and because students often begin dropping out between 9th and 10th grades. The population change (enrollment change) is calculated to control for changes in enrollment due to students moving in and out of state rather than by dropping out of school.

Data:

Calculation of GGI requires information on:

- Number of graduates receiving a regular diploma in a specified year
- High school population (grades 9 through 12) for a specified year
- High school population (grades 9 through 12) for three years prior to the specified year
- Number of 8th grade students enrolled four years prior to the specified year
- Number of 9th grade students enrolled three years prior to the specified year
- Number of 10th grade students enrolled two years prior to the specified year

This measure can be computed using aggregated data at the school, district, state or national level.

Steps:

To calculate GGI for students who began high school in, for example, the 1998-99 school year and who graduated in the 2001-02 school year:

1. **The numerator is equal to:**
   Number of students graduating in the 2001-02 school year
2. **Create a smoothed enrollment estimate for the 9th grade cohort by determining the mean of:**
   Number of 8th grade students enrolled in the 1997-98 school year
   plus
   Number of 9th grade students enrolled in the 1998-99 school year
   plus
   Number of 10th grade students enrolled in the 1999-2000 school year
3. **Determine the total high school populations for the 1998-99 and 2001-02 school years by summing the:**
   Number of 9th, 10th, 11th, and 12th grade students in 1998-99 and 2001-02
4. **Determine the percent change in population by:**
   Subtracting the 1998-99 high school population from the 2001-02 high school population (step 3)
   and dividing that figure by the
   High school population in the 1998-99 school year (step 3)
5. **Create an estimate for the potential 12th grade population in the 2001-02 school:**
   Adding one to the percent change in population (step 4)
   and multiplying that figure by the
   Number of students in the estimated 9th grade cohort (step 2)

6. Divide the numerator (1) by the figure in step 5 unless the 'When' statement in the formula section is true.

Figure B-8. In-transfer Adjusted Graduation Indicator (IAGI)

Formula:

$$IAGI = \frac{G_y}{S_{9,y-3} + TI_{9,y-3} + TI_{10,\,y-2} + TI_{11,y-1} + TI_{12,y}}$$

Where: S_9 = Number of first-time 9^{th-}graders
Y = School year
G = Number of graduates receiving a regular diploma
TI = Number of students transfering into a grade level

Purpose:

This indicator calculates graduation rates for students who began 9th grade for the first time three school years earlier (i.e., y-3) taking into consideration the number of students who transfer into 9th, 10th, 11th, or 12th grade.

Data:

Calculation of IAGI requires information on:

- Total number of first-time 9th-graders each year
- Total number of students transferring to a high school and to a particular grade level each year
- Total number of students graduating each year

Steps:

To calculate IAGI for students who began high school in, for example, the 1998-99 school year and who graduated in the 2001-02 school year:

1. The numerator is equal to:

Number of students graduating in the 2001-02 school year

2. The denominator is equal to:

Number of students entering 9th grade for the first time in Sept 1998

plus

Number of students transferring into 9th grade during the 1998-99 school year

plus

Number of students transferring into 10th grade during the 1999-2000 school year

plus

Number of students transferring into 11th grade during the 2000-01 school year

plus

Number of students transferring 12th grade during the 2001-02 school year

3. Divide the numerator (1) by the denominator (2).

Figure B-9. Cohort Graduation Indicator (CGI)

Formula:

$$CGI = \frac{S_{9,c}G_{c+3} + TI_{9,c}G_{c+3} + TI_{10,c+1}G_{c+3} + TI_{11,c+2}G_{c+3} + TI_{12,c+3}G_{c+3}}{S_{9,c} + TI_{9,c} + TI_{10,c+1} + TI_{11,c+2} + TI_{12,c+3}}$$

Where: S_9 = Number of first-time 9th-graders
C = Cohort school year (i.e., the school year a student entered high school)
G = Number of graduates receiving a regular diploma
TI = Number of students transferring into a grade level

Purpose:

This cumulative indicator calculates on-time graduation rates taking into consideration students who transfer in within a four-year period. This is a cohort-based indicator, which means that each student is considered part of a group of students who graduated in a particular year and began high school four years earlier. For example, a student who is part of the 2001-02 school-year-graduation cohort, began high school in the 1998-99 school year. Students can join a cohort by transferring into it.

Data:

Calculation of CGI requires the following information at student level:

- Year a student enters the 9th grade and whether he/she enters 9th grade for the first time
- Year and grade level a student transfers into a cohort
- Year of graduation
- A reason for a student's departure prior to graduation and documentation related to the departure

It is necessary to collect this information annually for each student. In other words, CGI requires schools to track individual students as they progress through high school.

Steps:

To calculate CGI for students who began high school in, for example, the 1998-99 school year and who graduated in the 2001-02 school year:

1. **The numerator is equal to:**

   Entered the 9th grade for the first time in Sept of 1998 and graduated in 2001-02 school year
   plus
   Transferred into 9th grade during the school year of 1998-99 and graduated in 2001-02 school year
   plus
   Transferred into 10th grade during the school year of 1999-2000 and graduated in 2001-02 school year
   plus
   Transferred into 11th grade during the school year of 2000-01 and graduated in 2001-02 school year
   plus
   Transferred into 12th grade during the school year of 2001-02 and graduated in 2001-02 school year

2. **The denominator is equal to:**

   Entered 9th grade for the first time in Sept 1998
   plus
   Transferred into 9th grade during 1998-99 school year
   plus
   Transferred into 10th grade during 1999-2000 school year
   plus
   Transferred into 11th grade during 2000-01 school year
   plus
   Transferred into 12th grade during 2001-02 school year

3. **Divide the numerator (1) by the denominator (2).**

Figure B-10. Exclusion-Adjusted Cohort Graduation Indicator (EACGI)

Formula:

$$EACGI = \frac{S_{9,c}G_{c+3} + TI_{9,c}G_{c+3} + TI_{10,c+1}G_{c+3} + TI_{11,c+2}G_{c+3} + T_{12,c+3}G_{c+3}}{(S_{9,c} - E_{c,c+1,c+2,\ c+3}) + (TI_{9,c} - E_{c,c+1,c+2,\ c+3}) + (TI_{10,c+1} - E_{c+1,c+2,\ c+3}) + (TI_{11,c+2} - E_{c+2,c+3}) + (TI_{12,c+3} - E_{c+3})}$$

Where:
- S_9 = Number of first-time $9^{th\text{-}}$graders
- C = Cohort school year (i.e., the school year a student entered high school)
- G = Number of graduates receiving a regular diploma
- TI = Number of students transferring into a grade level
- E = Number of students excluded (documented transfers to state-designated diploma granting programs, death, or imprisonment)

Purpose:

This cumulative indicator calculates on-time graduation rates taking into consideration students who transfer in and students who transfer out within a four year period. It is a cohort-based indicator, which means that each student is considered part of a group of students who graduated in a particular year and began high school four years earlier. For example, a student who is part of the 2001-02 school-year-graduation cohort, began high school in the 1998-99 school year. Students can join a cohort by transferring into it and they are excluded from a cohort if they leave school for the three specific reasons prior to graduation.

Data:

Calculation of EACGI requires the following information at student level:

- Year a student enters the 9th grade and whether he/she enters 9th grade for the first time
- Year and grade level a student transfers into a cohort
- Year of graduation
- A reason for a student's departure prior to graduation and documentation related to the departure (Qualified departures for which schools need to obtain appropriate documentation are 1) transfers to other institutions offering a state-designated diploma-granting program 2) imprisonment and 3) death)

It is necessary to collect this information annually for each student. In other words, EACGI requires schools to track individual students as they progress through high school.

Steps:

To calculate EACGI for students who began high school in, for example, the 1998-99 school year and who graduated in the 2001-02 school year:

1. **The numerator is equal to:**

   Entered the 9th grade for the first time in Sept of 1998 and graduated in 2001-02 school year

   plus

   Transferred into 9th grade during the school year of 1998-99 and graduated in 2001-02 school year

   plus

   Transferred into 10th grade during the school year of 1999-2000 and graduated in 2001-02 school year

   plus

   Transferred into 11th grade during the school year of 2000-01 and graduated in 2001-02 school year

   plus

   Transferred into 12th grade during the school year of 2001-02 and graduated in 2001-02 school year

2. **The denominator is equal to:**

   Entered 9th grade for the first time in Sept 1998 minus qualifying departures between Sept 1998 and end of May 2002 without graduating

   plus

Transferred into 9th grade during 1998-99 school year minus qualifying departures between Sept 1998 and end of May 2002 without graduating

plus

Transferred into 10th grade during 1999-2000 school year minus qualifying departures between Sept 1999 and end of May 2002 without graduating

plus

Transferred into 11th grade during 2000-01 school year minus qualifying departures between Sept 2000 and end of May 2002 without graduating

plus

Transferred into 12th grade during 2001-02 school year minus qualifying departures between Sept 2001 and end of May 2002 without graduating

3. Divide the numerator (1) by the denominator (2).