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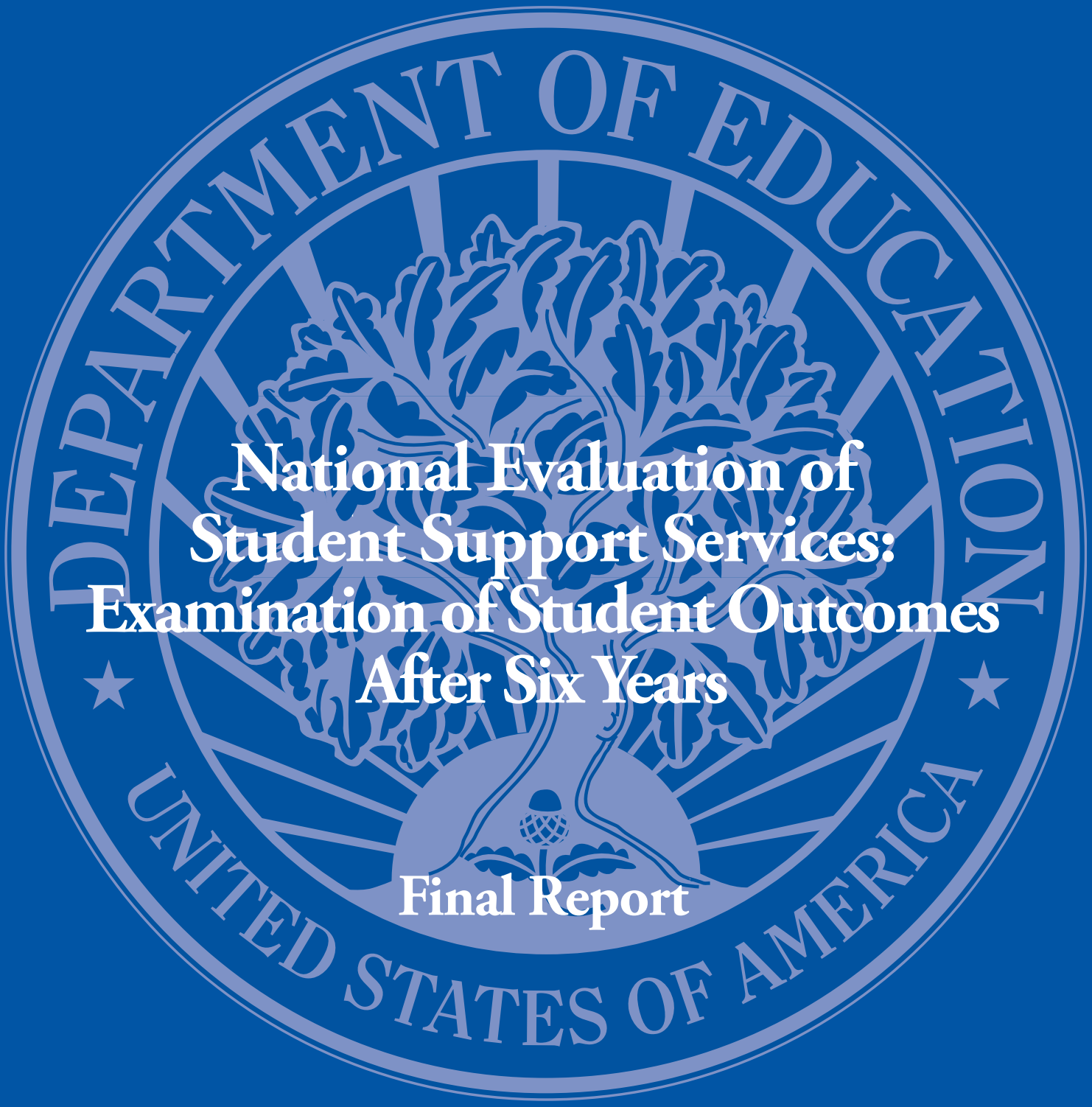

National Evaluation of Student Support Services: Examination of Student Outcomes After Six Years

Final Report

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Executive Summary

This is the final report of the National Evaluation of Student Support Services (SSS). SSS is one of eight federally funded grant programs that are administered as part of the Federal TRIO Programs within the U.S. Department of Education (ED). The SSS program, in particular, focuses on students while they are enrolled in college. In general, SSS provides the most services to first-year college students, though it does also provide services in later years.

The purpose of the study was to estimate the effects of SSS on the outcomes of the student participants. The full report discusses five academic outcomes. For brevity, this summary focuses only on the key outcomes: retention in college, transfers from two-year to four-year institutions, and degree completion.

Overview of SSS

The purposes of the SSS program, as stated in the *Higher Education Act of 1965*, as reauthorized by the *Higher Education Opportunity Act of 2008*, are to (1) increase college retention and graduation rates for eligible students, (2) increase the transfer rates of eligible students from two-year to four-year institutions, and (3) foster an institutional climate supportive of success for low-income and first-generation college students and individuals with disabilities. Two-thirds of the students served by an SSS project must be low-income (defined as at or below 150 percent of the poverty level) *and* first-generation college students or students with disabilities. The other third must be low-income *or* first-generation college students. One-third of the disabled students also must be low income.

SSS projects have great latitude to custom-design their services to fit the particular needs of their student population. All SSS projects provide academic advising as one of their services (although there is great variation in the amount students received), but the projects differ greatly with respect to offering other services to SSS students such as tutoring, labs, workshops, special instructional courses, and services specifically for students with disabilities. As a rule, SSS students are in full control of determining both the types and the amounts of services they receive, as long as the services are offered by the institutions and the students qualify for them (e.g., a student must have a disability in order to receive special services for individuals with disabilities).

Main Findings

The study used a variety of statistical methodologies to estimate the effects of participating in the SSS program as a college freshman (the only year for which it was possible to collect program participation data) and also the more general effect of receiving supplemental services during college.

The major finding is that analytic models that account for differences in service levels generally showed positive and statistically significant effects. Participation in SSS projects as measured by the amount of services received during the freshman year is associated with moderate increases on the key measures of college retention and degree completion but neither increases nor decreases student transfers from two-year to four-year institutions and neither increases nor decreases the outcomes on some of the key measures in the HLM models. Although these models controlled for student demographics and, whenever possible, prior achievement, one limitation of this model is the potential selection bias of participants who received more services.

Models that measure supplemental services regardless of whether they were offered by the SSS project or were offered by some other service provider on campus are associated with positive and statistically significant effects on all outcome measures of retention, transfers from two-year to four-year institutions, and degree completion.

In addition this report includes analyses that simply consider whether or not the student was classified as being in SSS as a college freshman, although this comparison was considered of limited validity given the structure of SSS grants. A major limitation of this analysis is that it does not account for the level of service received by SSS participants; nor does it account for the fact that comparison students may have received similar services that were not funded by the federal SSS program. This measure did not show any effect from participating in SSS as a college freshman.

Study Design

This report focuses on a statistical comparison of SSS and non-SSS students in order to estimate the effects of SSS. The study was designed as a longitudinal study, in which the academic progress of 5,800 freshman students in 1991–92 was tracked for six years. Half of the students were participants in SSS, and the other half were statistically chosen using propensity models to have similar characteristics to the SSS participants. Both quantitative and qualitative data were collected. It should be noted that this study utilizes data from the 1990s and may not capture the full nature of the SSS program as it operates today.

The sample was chosen in several steps. First, a nationally representative, stratified random sample of 200 SSS projects was surveyed in 1991–92. Second, 30 of these projects were randomly subsampled for site visits and other data collection activities, and 20 higher education institutions without SSS grants were selected to match the SSS sites, based on institutional characteristics. Three of the institutions later dropped out of the study. The 47 remaining institutions provided basic information on student characteristics, and the SSS projects also provided participant service records on each service contact through SSS for the sampled students, including the types of service, length in minutes, date, and number of students receiving the specific services. Student surveys were conducted at three different time points: 1991–92, 1994–95, and 1997–98. Student transcripts were collected from all institutions the students attended (not just the 47 original institutions) at the end of the first, third, and sixth years.

Methodology

This study had a quasi-experimental design. Regression models and propensity scores were used to select a group of comparison students that matched the SSS students as closely as possible on a variety of student characteristics, and both the SSS and comparison students were monitored through student surveys to determine what other supplemental services they received. Although the comparison students were highly disadvantaged, the SSS participants were even more so, and additional statistical adjustments were required in the analysis to allow appropriate comparisons between the two groups. Exposure to SSS was not randomized because of the way in which SSS is structured. By design, SSS students may receive supplemental services outside of SSS, and any attempt to deny services to needy students would raise ethical questions, threaten people's support of the institution, and potentially conflict with the institution's mission.

The lack of a uniform SSS experience, with considerable variation even within each institution, combined with the receipt of equivalent services outside of SSS, made it difficult to design statistical models that properly described students' experience. Rather than choosing a single methodology, therefore, this study used multiple approaches. All models included separate measures of SSS services for first-year students, supplemental services received outside of SSS or received after the first year, and measures of student and school characteristics. The models differed in the statistical techniques that were used, in the ways that SSS and other supplemental services were measured, and in the use of propensity scores.

- Some models used standard multivariate regression analysis while others use hierarchical linear modeling (HLM).

- Some models treated SSS participation as dichotomous (i.e., either a student was in SSS or he or she was not), while other models treated SSS participation as a collection of nine separate services, with each service measured separately in terms of the number of hours of participation by each student.
- Some models adjusted for differences among students solely through individual measures of student characteristics (such as academic strength, background, and attitudes), while other models also included propensity measures that are designed to estimate students' probability of receiving services.

This report includes all of the above approaches so that readers can see the implications of the various methodological choices. In principle, HLM provides better estimates than regressions because it is better able to handle the clustering of students within institutions. However, HLM did not always converge to a solution when using logistic models (for limited dependent variables), thus requiring the use of more standard regression models within HLM. Dichotomous measures of services avoid the difficulty that students' levels of participation may be related to other factors (such as neediness or motivation) that might have confounding relationships with student outcomes. However, due to the high correlation between SSS participation and the receipt of other supplemental services (91 percent of the SSS students received services outside of SSS), dichotomous measures primarily are useful for examining supplemental services in general. Only the models with continuous measures appear able to discriminate between SSS and other services. Propensity scores usually serve as a substitute for individually fitting each regression equation based on student characteristics, and they should be less necessary in these models that were individually fitted. In practice, the propensity scores often were statistically insignificant, and estimated SSS effects were increased when the statistically insignificant propensity scores were dropped. Thus, it is questionable whether they provided useful information, and they may sometimes have had confounding effects because of their interrelation with the measures of SSS services.

The regression estimates are presented here in two different formats: as regression coefficients to aid researchers to understand the structure of the models and to replicate the results, and as impact estimates to aid policymakers in applying the findings, because the regression estimates often do not translate easily into effects. (One difficulty is that for some models, one must know the amount of services that students received in order to interpret the regression coefficients; another is that when logistic regression is used, neither the regression coefficients nor the log odds ratios are easy to interpret.)

Normally, estimates of program effects would be presented by indicating both what students would have achieved if they did not participate in SSS and what they did achieve after participating in SSS. Unfortunately, because the comparison group was more advantaged than the SSS participants, and because students in the comparison group often also received supplemental services, there is no pure measure of what outcomes would be expected if students had not participated in SSS. There are actual measures of final student outcomes after six years, but the alternative outcomes if students had not participated in SSS could only be estimated through statistical models. Moreover, because this report uses multiple models as a tool for examining the implications of the methodological choices involved, there are multiple estimates of the effects of SSS from which to choose. The results across the various models are often highly consistent but not identical. Therefore this report presents only the estimated effects of the services along with the final measured outcomes. Readers can calculate what students would have achieved without SSS by first deciding which model appears most trustworthy, and then subtracting the estimated effects from the final outcomes.

This study was longitudinal in the sense that the selected students were tracked for six years with multiple data collections in order to determine their experiences during those six years and their academic outcomes. However, the data analysis has been largely cross-sectional, with the multiple data points all included in a single regression or HLM model rather seeking to model changes in the students from one time to another. An exception is that in the previously published analysis of student outcomes

after three years, structural equations models were used to model the interactions between SSS participation, first-year college GPAs, and college retention. That is, one might anticipate that students' academic successes in the first year, as measured by their GPAs, would influence their retention in college, but their academic successes could be influenced both by their own characteristics and by assistance they received from SSS or other sources. Thus, if first-year college GPAs are used to predict retention, a regression equation would tend to underestimate the effect of SSS and other supplemental services by only estimating that portion of the effect that was independent of students' GPAs, while ignoring the indirect contribution of supplemental services through their effects on GPAs. For that reason, structural equations models were used to separate students' GPAs into a latent GPA that would be expected without any receipt of supplemental services and the additional increment added through supplemental services; the latent GPA, rather than the actual GPA, was then used to predict retention so the model could estimate the full effects of SSS.

The structural equations model confirmed that SSS did indirectly influence retention through its effect on GPAs, and that the effect of SSS on retention was underestimated unless this relationship was properly modeled. This analysis helps to demonstrate the importance of structural equations and path analytic models in longitudinal studies. However, the same analysis also revealed that when a second measure of students' academic strengths (high school GPAs) was substituted for college GPAs (because high school GPAs would not have been influenced by SSS), essentially the same estimates of the effect of SSS were produced. If the purpose of this study was to develop a full theoretical model of what happens to students while in college, then it would be important to model the different paths through which SSS influences students. However, because the study goal was simply to estimate the total effects of SSS, and not to estimate how that effect was distributed among direct and indirect paths, this report uses surrogate measures such as high school GPAs that are independent of SSS rather than a structural equations approach. This choice avoided some technical complexities (such as imputation of missing data and the use of logistic regression within structural equations models) that would have been introduced with a structural equations approach.

Findings From Earlier Years of This Study

This report focuses on student outcomes six years after freshmen began participating in SSS. As part of the same longitudinal study, earlier reports discussed the effects of SSS on student outcomes after one year and after three years. The outcomes that were examined earlier were largely the same outcomes as those discussed here (effects on grade point averages, credits earned, and retention, though over shorter time frames), except that the one- or three-year time periods were too short to examine the effects on degree completion and on transfers from two-year to four-year institutions.

SSS showed a small but positive and statistically significant effect on students' GPAs, number of semester credits earned, and retention. The greatest effect generally occurred during the first year, when the most SSS services were received, but some SSS services received in the first year showed persisting effects in later years, and some services received in later years (not necessarily through SSS) also showed positive and statistically significant effects. The size of the effect depended on the degree to which students participated in SSS, with greater levels of participation resulting in a greater effect. The estimated effects of SSS also varied based on which particular services each student received and the structure of the SSS projects.

The average effect was small because most students received only a modest amount of services. Nine percent of students had only one service in their freshman year. The mean number of hours of services received in the first year was 32, and the median was 14. The mean for nonfreshmen was 15 hours, and the median was six. SSS projects appeared successful in targeting those students who were most disadvantaged from among the overall student population. In comparison with the national averages for college freshmen, SSS participants tended to be older, to be members of a minority group, to have had lower prior academic achievement, and to have dependent children. For additional highlights from the previous study, see page 7 in the *Final Report.*

Limitations

Except for services received during the first year, this study was not able to distinguish between services received through SSS and services received through other means. The reason is that to limit the burden on participating institutions and to obtain their cooperation, the data on later-year services were collected only through student questionnaires, and students were not expected to know the funding source of the services that they received (especially since SSS programs often were renamed). The third-year report found that effects from first-year services were greater on first-year outcomes than on later outcomes, so it is consistent that six-year outcomes show a stronger relationship to later-year services than to first-year services. Thus, though some findings specifically concerning SSS do appear in this report, many of the findings are more general in nature and apply to all supplemental services regardless of the source. In one sense, this is not a serious limitation; there is no specific reason that, say, peer tutoring would have a different level of effectiveness when provided through SSS than through other means. Findings about the effects of supplemental services can be interpreted as providing information about the effects of SSS when it supplies those same supplemental services. Also, participation in SSS was associated with receiving higher levels of services (whether through SSS or through other sources), suggesting that some of the improved outcomes from later-year services might be associated with SSS either because the services were provided by SSS or because SSS encouraged students to make fuller use of available services. However, the specific amount of the contribution provided by SSS in comparison to other sources of supplemental services generally cannot be determined.

In the case of services received after the first year, any student who received such services necessarily persisted beyond the first year, so that the presence of such services is partially correlated with academic success. This could lead to overstating the importance of later-year services. The problem is most likely to appear when dichotomous measures of SSS participation are used, while the greater amount of variation in the predictors when multiple and continuous measures are used helps to lessen the difficulty. To adjust for this issue, all of the models include a variable indicating whether the student attended higher education at any time during the five years after 1991–92. That way the changes in outcomes that are associated with persistence are measured through this variable, while the measure of the receipt of supplemental services will only capture any additional changes in student outcomes that are associated with the receipt of supplemental services. However, the addition of this variable may lead to underestimates of the effects of supplemental services (whether through SSS or through other means). Because persistence may be partially due to the receipt of supplemental services, the estimates for supplemental services may show only that effect that is independent of this measure of persistence, and not the effect that is related to the impact of supplemental services on persistence.

Some SSS services were received by only a small number of students, affecting the likelihood of finding statistically significant results. Of the 5,800 students originally in the study, 5,055 ultimately had sufficient data for inclusion in the six-year outcomes analysis, with 2,380 being SSS participants. Depending on the service, a range from 63 to 1,892 students received each service. The number of students was particularly an issue for analyses that were limited to students at two-year institutions. Among students at two-year institutions, between eight and 415 students received each service. The small number of students receiving some services may also have made it more difficult to measure the effects of SSS services than of general supplemental services (i.e., using measures that do not distinguish between SSS and non-SSS services), because roughly twice the number of students would have received services when using these more general measures.

Study Findings: Examination of Student Outcomes After Six Years

The single most consistent finding is that the receipt of supplemental services was correlated with improved student academic outcomes. This finding was consistent across all measures of academic outcomes and all types of statistical models (exhibit E-1). The findings for first-year SSS services in

particular were also largely consistent and positive, except that the models using dichotomous measures did not show any effect from SSS. The poor performance of the dichotomous measures was anticipated because of the difficulty of differentiating between SSS and non-SSS services in those models, and appears to be a methodological artifact. The continuous measures of SSS participation showed positive and statistically significant effects for each of the outcome measures except transfers from two-year to four-year institutions and selected models using HLM. Participation in SSS was also associated with receiving a higher level of supplemental services, including both those services specifically designed for SSS students and supplemental services in general.

A second finding is that supplemental services continued to be important after the freshman year. In fact, the later-year services appear to show a stronger relationship to long-term outcomes than first-year services. SSS programs typically give the greatest emphasis to providing services for freshmen, though they include services for later years as well. Based on this finding, some SSS programs may wish to reexamine their distribution of services to be sure that some program is in place to provide services in later years.

Exhibit E-1. Estimated improvement in academic outcomes associated with receiving first-year SSS services and with receiving supplemental services from any source and in any of the six academic years, using six analytic approaches: Six-year outcomes after freshman entry in 1991–92

Methodology	Six-year GPA	Credits earned	Retention or degree completion (combined)		Transfers from two-year to four-year institutions	Degree attainment	
			Same institution	Any institution		Bachelor's degree or higher	Associate's degree or higher
Observed six-year outcome	2.34 (Increase)	75.49	34%	63%	19% (Percentage point increase)	38%	49%
Dichotomous measures of services							
Regressions							
SSS services only	0.06	--	--	--	--	--	--
All supplemental services	0.23	21.97	12%	16%	11%	10%	8%
HLM							
SSS services only	--	--	--	--	--	--	--
All supplemental services	0.14	16.99	12%	18%	13%	10%	8%
Continuous measures of services							
No propensity scores							
Regressions							
SSS services only	0.12	2.60	4%	5%	--	6%	3%
All supplemental services	0.25	18.77	13%	21%	7%	14%	11%
HLM							
SSS services only	0.04	3.19	5%	9%	--	2%	1%
All supplemental services	0.17	19.17	15%	24%	10%	13%	12%
With propensity scores							
Regressions							
SSS services only	0.14	2.39	7%	8%	--	5%	--
All supplemental services	0.29	18.48	16%	23%	8%	14%	9%
HLM							
SSS services only	0.02	--	6%	4%	--	--	--
All supplemental services	0.16	16.27	17%	19%	10%	11%	11%

-- Not statistically significant. Statistical significance is based on p-value of 0.05.

NOTE: The six-year outcome is the mean outcome for all applicable SSS participants who were in the study, as measured through their transcripts and self-reports. The predicted outcome if students did not receive services can be calculated for any of the six analytic approaches by subtracting the percentage point improvement from the observed six-year outcome. For example, the mean retention rate at the same institution among all SSS participants in the study was 34 percent, and using the HLM model with propensity scores the mean retention rate is estimated at 17 percent (34 percent minus 17 percent) if they had not received any supplemental services.

Third, a few SSS services appeared to stand out by being related to improved student outcomes: home-based programs, blended programs, peer tutoring, labs, workshops, and services for students with disabilities. However, some additional types of services also were related to improved student outcomes, though they were not necessarily SSS services: counseling, field trips or cultural enrichment, referrals to outside resources, services for those with limited English ability, college re-entrance counseling, and recent contacts with support services. Also, there is some evidence that what may be most important is that students receive an appropriate "package" of services, and some individual measures may not have shown independent benefits because their benefits were included in measures of whether the students had received packages of services (e.g., through home-based or blended programs).

Finally, the stronger findings for supplemental services in general when compared with first-year SSS services in particular should not be interpreted as indicating that services outside of SSS were superior to SSS services. Instead, two reasons seem the best explanations for the differences: (1) later-year services may be more effective than first-year services when seeking to predict long-term outcomes (i.e., because they are more contemporaneous with the long-term outcomes); and (2) some of the effects of SSS services may be captured through the other measures of supplemental services, so that the SSS effect is underestimated. The latter explanation seems likely both because some of the later-year services were likely to have been provided by SSS services, and because of the difficulty of differentiating SSS from non-SSS services when using dichotomous measures of participation. Also, the use of propensity measures may sometimes also have led to underestimating the effects of SSS. Often the propensity scores were insignificant, suggesting that they were not important parts of the models, and if the insignificant measures were dropped from the models, the estimated effect of SSS was increased.

1. Introduction

Student Support Services (SSS) is one of eight federally funded grant programs that are administered as part of the Federal TRIO Programs within the U.S. Department of Education (ED).[1] All eight programs are designed to help economically disadvantaged and first-generation college students achieve success at the postsecondary level. Some programs work with students at the middle school or high school level to help them complete high school and prepare for postsecondary education. Other programs help students while they are attending postsecondary institutions. The SSS program, in particular, focuses on students while they are enrolled in college and is designed to help them complete their postsecondary degrees or certificates, to transfer to four-year institutions if they start at two-year schools, and to enroll in graduate school. Students may start participating in SSS immediately upon enrollment in postsecondary education or at a later stage. In general, SSS provides the most services to first-year college students, though it does provide services in later years as well.

SSS has grown from 121 projects and approximately 30,000 participants in 1970–71 to 947 projects and 198,940 participants in 2007–08. Its funding has increased from $10 million to $264 million ($52 million in 1970 dollars). Participating institutions comprise roughly 22 percent of the four-year and two-year colleges and universities serving freshmen in the United States. SSS is the second largest of the Federal TRIO Programs in terms of the number of students served (after Talent Search), and the second largest in terms of funding (after Upward Bound).

This report presents the final results of a longitudinal study of students who began participating in SSS during the 1991–92 academic year. This study was mandated by Congress to "examine the effectiveness of current programs and to identify program improvements" (P.L. 101-166). Earlier results were presented in an implementation study report, completed in 1994, which described the characteristics of the SSS program and the SSS students at the institutions participating in the study, and in a third-year update, completed in 1997, which provided additional information on the implementation of SSS as well as an analysis of the effects of SSS on participating students with regard to their grade point averages (GPAs), the number of credits they earned, and their retention in higher education. This study updates the previous analysis by examining the effects of SSS after six years. It continues the analysis of GPAs, total credits earned, and retention from the earlier study, but also expands the analysis by examining degree completion and transfers to four-year institutions. These last two measures could not have been meaningfully examined in earlier years because students often had not had sufficient time to complete their education. The measures are much more meaningful now when applied to six years of time, although even that amount of time is not always enough for all students to have finished their education.

This evaluation was conducted as a longitudinal study, in which both SSS participants and a comparison group of nonparticipants were tracked for six years following their entry into college. The students were selected by first selecting 200 SSS projects through a nationally representative random sample, subsampling 30 of those institutions and 20 comparable institutions without SSS projects for site visits, and selecting groups of SSS participants and nonparticipants from those institutions. Of these 50 institutions, 47 ultimately participated for all phases of the study. From these sites and their participating

[1] The eight federal programs are collectively known as the Federal TRIO Programs in the *Higher Education Act of 1965*, as reauthorized by the *Higher Education Opportunity Act of 2008*. The other TRIO programs are Upward Bound, Talent Search, the Educational Opportunity Centers (EOC), Staff Training, the McNair Fellowships, Dissemination Partnership Program, and Upward Bound Math-Science.

students, the following data were collected: student information files containing basic information on student characteristics; participant service records documenting each student's contact with SSS during the first year; student surveys conducted in 1991–92, 1993–94, and 1996–97; and student transcripts for students' six years of postsecondary education starting in 1991–92. Additional information about the research methodology is provided in chapter 2.

In many ways, this report builds upon the methodology and results of the third-year follow-up study. Some of the particularly important findings of that report that relate to the design of the study are listed below. Additional details about past findings are presented later in this chapter.

- The 2,900 non-SSS study participants tended to be relatively advantaged in comparison to the SSS students, in part due to a lack of sufficient information to identify similar students and in part due to the fact that some institutions did not have students who were comparable in their disadvantages to the SSS participants. As a result, multivariate analysis is used in this report (as it was previously) to statistically adjust for the differences between these two groups.

- SSS students were found to vary greatly in the types and amounts of services they received through SSS, both across SSS projects and within individual SSS projects. This report therefore uses a variety of methodological approaches to look at the importance of these variations.

- Student demographic characteristics were important, with blacks, Hispanics, and males often showing poorer academic outcomes on average. Thus, these types of variables were also examined in this report and retained when they were statistically significant.

- Similarly, the institution type (two-year or four-year) was associated with student outcomes and is retained here for use in the updated multivariate models.

This report makes selected use of the statistics and findings from the earlier reports but does not attempt to include all of them. Readers desiring additional information are particularly advised to examine the third-year follow-up report, which includes substantial information about the SSS program and the characteristics of SSS participants.

Organization of This Report

Because of the way that SSS programs are designed, with programs varying greatly from one institution to another, and students varying in the degree to which they participate, the design and analysis of the evaluation raised some complex methodological issues. The methodological choices potentially may have an important effect on the research findings, and researchers may legitimately disagree on the best methodological approach. Therefore, the methodological decision points are given special prominence in this report, and alternative methodologies are compared so that readers can determine the importance of the choices and give special attention to the approaches that they prefer. This report is structured to facilitate such comparisons.

This chapter provides an overview of the SSS program and its students. Chapter 2 presents an overview of the study design and discusses the key methodological issues and their implications for the study. The remainder of the report progressively examines the data using each approach and

discusses the findings in the context of each approach. Chapter 3 starts the analysis using the simplest statistical models, in which dichotomous measures of SSS and non-SSS participation are used. Some advantages of this approach are that it provides a single summary measure of the effects of SSS, and that differences in participation levels among SSS participants are ignored (because those differences might be indicators of differences in neediness or motivation, which also might be related to student outcomes). Chapter 3 includes both regression analysis and HLM so that readers can compare the two methodologies. Chapter 4 presents models in which SSS participation is measured through nine separate variables for each of the nine SSS services listed in exhibit 1-1, plus two organizational characteristics of SSS that were noted in the site visits. Some potential advantages of this approach are an increased ability to differentiate between SSS and non-SSS services (in order to measure the full effect of SSS), a better capacity to distinguish among SSS students to determine whether some students are helped more than others (e.g., based on their levels of participation in SSS), and the ability to compare features of SSS programs to determine whether some features are more effective than others.

Similar to chapter 3, chapter 4 also uses both regression analysis and HLM to examine the nine SSS services and two organizational characteristics. Besides the use of multiple measures of participation, chapter 4 also differs from chapter 3 by sometimes including separate propensity scores to statistically adjust for the likelihood that students will receive each of the services. The primary purpose of adding propensity scores is to separate students' tendency to receive services (which may in itself be related to student outcomes) from students' actual receipt of services, so that measures of the relationship between participation and student outcomes will not be confounded by the relationship between the tendency to participate and student outcomes. Again, so that the reader can compare the different methodological choices, the statistical results are presented both with and without the use of propensity scores. Finally, chapter 5 attempts to synthesize the various approaches, looking at which findings are consistently supported regardless of the approach, which findings depend on the particular approach being used, and which findings (from our perspective) best describe the association between participation in SSS and student outcomes.

Description of SSS

The purposes of SSS are:

- To increase college retention and graduation rates for eligible students;
- To increase the transfer rates of eligible students from two-year to four-year institutions; and
- To foster an institutional climate supportive of success of low-income and first-generation college students and individuals with disabilities.

Two-thirds of the students served by an SSS project must be low-income (defined as at or below 150 percent of the poverty level)[2] *and* first-generation college students or students with disabilities. The other third must be low-income *or* first-generation college students. One-third of the disabled students also must be low income. Services may include counseling, tutoring, workshops, laboratories, cultural events, special services for disabled students, and instructional courses that are solely for SSS students.

[2] In 1999, the income level was $25,050 for a family of four in the 48 contiguous states.

SSS projects have great latitude to custom-design their services to fit the particular needs of the institution. They thus vary considerably in terms of which specific services are offered through SSS and how they are organized. There is no single "SSS experience" that describes the participation of all SSS students. All SSS projects provide academic advising as one of their services (although even here there is great variation in the amount of academic advising received), while they vary greatly with respect to offering other services such as tutoring, labs, workshops, special instructional courses, and services specifically for students with disabilities.

SSS students are more disadvantaged than the student population as a whole, not only with regard to the criteria used for eligibility but also in other ways that are interrelated with their disadvantaged background. Following are the characteristics of the SSS students who participated in the national study:[3]

- **Age.** SSS students entered college later than typical students. Sixty percent of the SSS students were either 18 or 19 years old, compared with 90 percent of all freshmen nationwide.

- **Gender.** Two-thirds (67 percent) of SSS participants were female, compared with 53 percent overall.

- **Race and ethnicity.** The three largest groups were whites (41 percent), African Americans (31 percent), and Hispanics (22 percent). By contrast, the respective percentages for freshmen overall are 80 percent, 9 percent, and 6 percent.

- **Marital status.** SSS participants were less likely than the general population of freshmen to be currently married (11 percent versus 27 percent), and more likely to be never married (80 percent versus 71 percent) or divorced or separated (9 percent versus 2 percent).

- **Disability.** Seventeen percent of SSS participants reported having some kind of disability. The most common was a specific learning disability, with 6 percent of SSS participants reporting one (compared with 2 percent among freshmen overall).

- **High school graduation.** Ninety-one percent of SSS participants graduated from high school (compared with 98 percent overall), 9 percent obtained a GED, and 1 percent left high school without receiving a diploma.

- **Academic major.** When they were freshmen, 18 percent of SSS participants selected health-related fields as their major, 17 percent chose business, 11 percent chose education, and 11 percent chose social sciences.

- **Residence.** Sixty-four percent of SSS participants attended colleges that were within 50 miles of home, compared with 46 percent of all freshmen.

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[3] More detailed information about the characteristics of the SSS participants is provided in chapter 2 and in *National Study of Student Support Services, Report Number 2, Profile of Freshmen Participants and Project Services: 1991–92*, U.S. Department of Education, 1994.

- **Financial aid.** SSS participants were much more likely to receive financial aid than undergraduates overall (82 percent versus 42 to 45 percent, depending on the dependency status of the students).

The SSS Services

Because SSS projects vary greatly, this study collected data on the number of services that each student received as a freshman in nine different areas (exhibit 1-1). The services that were most widely received were professional counseling (80 percent of all SSS students), peer tutoring (45 percent), instructional courses limited to SSS students (32 percent), and workshops (31 percent), while the remaining services were received by 17 percent or less of the students.

Institutions' packages of services varied, both in terms of what services were offered and whether the services were offered through SSS or some other mechanism. Thus, sometimes students did not have the opportunity to participate in some of the services listed in exhibit 1-1. At other times, the services may have been available, but they were provided through a mechanism other than SSS. For example, in order to help demonstrate that the funds for SSS were not supplanting existing institutional programs, an institution may have chosen to create special new services for SSS students, while also referring the SSS students to additional services outside of SSS that had already been offered at the institution. Thus, a list of the SSS services that a student received typically is not a complete list of all of the supplemental services that student received at the institution.

As a rule, SSS students are in full control of determining both the types and amounts of services they receive, as long as the services are offered by the institutions and the students qualify for those services (i.e., a student must have a disability in order to receive special services for individuals with disabilities). At least two exceptions were noted in the case studies, however: essentially all SSS students participated in academic advising at the time of their enrollment, and some institutions made a practice of calling in students for additional advising if their early performance at the college was poor.

In addition, the case studies revealed that SSS projects differed in their basic organization, and the analysis in this report focuses on two characteristics in particular. First, *home-based* programs provided a home base on campus that served the "whole student" by providing a broader range of services to facilitate the students' integration on the campus and by seeing that any needed supplemental services were provided. Often home-based programs made special attempts to have group activities for the SSS students, such as cultural events or service projects. They can be contrasted with *dominant service* programs, which primarily focused on providing a single service, and *all service* programs, which served as the only (or at least primary) provider of support services at the institution.[4] Second, SSS programs differed in the extent to which the SSS services were blended with other services on campus. In order to satisfy early federal requirements (up to 1992) for nonsupplanting and nonduplication, almost all of the programs had ways of maintaining their unique service and population served; still, some did this by coordination with other service providers and some by having a more separate service delivery model. SSS program regulations were later changed to allow a greater blending of services, but this distinction was important at least at the start and proved sometimes to be important in the statistical analysis.

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[4]These categories are not necessarily mutually exclusive. For this analysis, however, we chose to describe each program using only the single category that best described the program, rather than assigning multiple categories to a program. Further, because only three programs in our sample fit the *all service* category, and our initial investigation suggested that home-based programs deserved the closest analysis, we focus on the distinction between home-based programs and all other programs.

Exhibit 1-1. List of SSS services and the frequency that they were received in 1991–92

Service category and description	Types of services
Instructional courses Courses were developmental in focus Only includes courses that were offered exclusively to SSS students Courses may or may not have been for credit	study skills (16 percent of SSS students) writing (12 percent) developmental mathematics (11 percent) reading (7 percent) developmental English (4 percent) English proficiency (1 percent)
Professional tutoring Designed to provide assistance with course work All tutors were paid, but this group was distinguished by the use of graduate students or faculty and staff to perform the tutoring Includes both one-to-one and group tutoring	English (8 percent) general tutoring (3 percent) mathematics (3 percent) science (1 percent)
Peer tutoring Similar in design to professional tutoring but performed by undergraduates	mathematics (21 percent) English (17 percent) science (9 percent) social sciences (4 percent) general tutoring (3 percent)
Professional counseling Provision of advice or counseling (as distinct from content area instruction) Performed by graduate students or faculty and staff	academic counseling/advising (60 percent) personal counseling (20 percent) financial aid counseling (19 percent) career counseling (8 percent)
Peer counseling Performed by undergraduates Otherwise similar to professional counseling	academic counseling/advising (10 percent) personal counseling (4 percent) financial aid counseling (1 percent)
Labs Supplemental assistance in content areas Provided in group settings Similar to group tutoring	mathematics (7 percent) writing (4 percent) reading (3 percent) English (2 percent)
Workshops Designed to provide skill enhancement rather than content knowledge (e.g., study skills and orientation)	orientation to college (18 percent) study skills (8 percent) career guidance (3 percent)
Cultural events Group trips to concerts, museums, or other events	concerts (3 percent) museums (1 percent) lectures (1 percent) other events (4 percent)
Services for the disabled Special services, such as note-taking, counted as SSS services only if the services were provided through SSS (rather than referrals)	counseling (2 percent) note takers (1 percent)

Findings From Earlier Years of This Study

This report focuses on student outcomes six years after freshmen began participating in SSS. As part of the same longitudinal study, earlier reports discussed the effects of SSS on student outcomes after one year and after three years. The outcomes that were examined earlier were largely the same outcomes as those discussed here (effects on grade point averages, credits earned, and retention, though over shorter time frames), except that the one- or three-year time periods were too short to examine the effects on degree completion and on transfers from two-year to four-year institutions. Following are the main findings presented in those reports.

- SSS showed a small but positive and statistically significant effect on students' GPAs, number of semester credits earned, and retention. The greatest effect generally occurred during the first year, when the most SSS services were received, but some SSS services received in the first year showed persisting effects in later years, and some services received in later years (not necessarily through SSS) also showed positive and statistically significant effects.

  - Students' college GPAs were increased by a mean of 0.15 in the first year, resulting in a mean GPA of 2.29 on a four-point scale (e.g., "A"=4.0 and "C+"=2.3). In the second year, the mean increase was 0.11 (to 2.44), and in the first three years combined the increase was also 0.11 (to 2.59).
  - The number of semester credits earned was increased by a mean of 1.25 (to a total of 20.91 credits) in the first year, 0.79 (to 20.62) in the second year, 0.71 (to 20.58) in the third year, and 2.25 (to 73.38) in the first three years combined.
  - Retention was increased at the same institution by 7 percentage points (i.e., from 60 percent to 67 percent) for retention to the second year, and by 9 percentage points (i.e., from 40 percent to 49 percent) for retention to the third year. Retention to the third year at any higher education institution was increased by 3 percentage points (i.e., from 74 percent to 77 percent).

- The average effect was small because most students received only a modest amount of services. Nine percent of students had only one service contact in their freshman year. The mean number of hours of services received in the first year was 32, and the median was 14. The mean for nonfreshmen was 15 hours, and the median was 6.

- The size of the effect depended on the degree to which students participated in SSS, with greater levels of participation resulting in a greater effect.

- The estimated effects of SSS also varied based on which particular services each student received and the structure of the SSS projects.

- The effects of SSS generally appeared consistent across different subgroups of students. To the extent that some subgroups showed different effects than other subgroups, those differences appear attributable to differences in participation levels rather than to differing effects of individual services. In general, students who were more disadvantaged tended to participate more and thus experienced greater effects through SSS participation.

- SSS projects appeared successful in targeting those students who were most disadvantaged from among the overall student population. In comparison with the national averages for college freshmen, SSS participants tended to be older, to be members of a minority group, to have had lower prior academic achievement, and to have dependent children. Minority SSS participants composed 54 percent of the SSS student population, whereas minority populations represented only 25 percent of the total undergraduate population.

- SSS students received higher levels of supplemental services than did comparison students, including services offered outside of SSS. This suggests that SSS increased the amount of services obtained by students beyond what they would have received otherwise. This difference in service use declined substantially after the freshman year. For example, 63 percent of these students received tutoring at some point during their first three years compared with 36 percent of comparison group members. In the first term, 46 percent of SSS participants reported use of tutoring compared with 20 percent of comparisons. By the spring 1994 term, 11 percent of SSS and 8 percent of comparisons reported use of tutoring. There was less difference between the SSS participants and the comparison group in levels of counseling use.

- Although SSS has increased greatly in size, when adjusted for inflation, the funding per program and per participant was less than in 1970. SSS program funding went from its initial funding level of $10 million in 1970 to $143.5 million in 1995. Over the same time period, the number of projects funded grew from 121 to 706, and the total number of students served by the SSS program from 30,000 to 165,561. The number of students served peaked at 181,368 in 1981. In constant 1990 dollars, the average grant size declined from $278,393 in 1970 to $174,365 in 1995. The level of per-participant funding (in constant 1990 dollars) was highest in 1970 at $1,123, declined to $507 in 1981, and reached $744 in 1995. In 1995 current dollars, funding per participant was $867.

- SSS programs are concentrated at particular types of institutions. In 1994, approximately 24 percent of all higher education institutions serving freshmen had SSS projects. Because SSS projects tended to be located in larger schools, about 34 percent of all freshmen attended institutions having SSS projects. SSS projects tended to be concentrated in four-year institutions, public institutions, institutions enrolling more than 20,000 students, and institutions with 50 percent or more minority enrollment. Over 40 percent of doctoral institutions compared with 15 percent of baccalaureate institutions and 22 percent of two-year institutions had SSS programs. Relatively few highly selective institutions (19 percent) had SSS projects.

2. Study Design

This chapter discusses the key concepts in the design of this study: the outcome measures used, an overview of the study design, the longitudinal study, and the interpretation of the data. Additional information about the research methodology is provided in Appendix B.

Outcome Measures Used

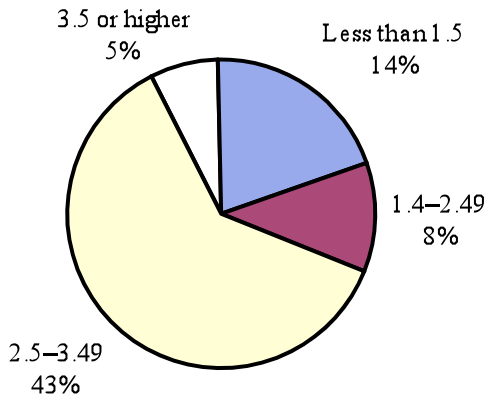
Five types of measures were used as outcome measures for the study (see Exhibit 2-1). The following discussion provides additional information about each variable as it applies to the SSS students.

Exhibit 2-1. Outcome measures for the sixth-year evaluation after freshman entry in 1991–92

Variable	Description	Source
GPA (cumulative)	Four-point scale (A=4.0)	Postsecondary transcripts
Total credits earned (cumulative)	Total number of semester credits	Postsecondary transcripts
Retention or degree completion	Student either earned a degree (bachelor's degree or higher) within six years, or was still in college in the sixth year	Postsecondary transcripts, 1996–97 survey of students
At the same institution		
At any institution		
Degree completion	Student earned the specified degree within six years	Postsecondary transcripts, 1996–97 survey of students
Bachelor's degree or higher		
Associate's degree or higher		
Transfers from two-year to four-year institutions	Student who originally enrolled at a two-year institution later transferred (within six years) to a four-year institution	Postsecondary transcripts, 1996–97 survey of students

Grade point average (GPA). After six years, SSS participants in the study had a mean GPA of 2.3 (i.e., about a C+ on a 4.0 scale), with most students (81 percent) getting Bs or Cs as their average grades (exhibit 2-2).

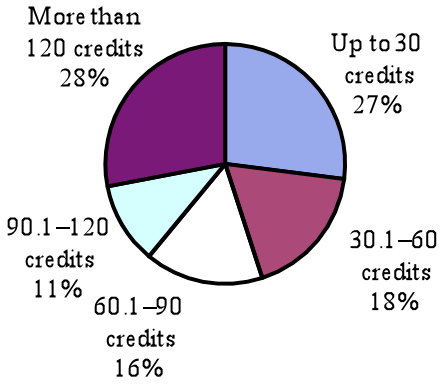
Exhibit 2-2. Percentage distribution of all SSS participants, by mean GPA levels six years after freshman entry in 1991–92



SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Number of credits earned. On average, the SSS participants in the study earned 75.5 semester credits over their first six years in college, or roughly the amount that would be earned through 2.5 years of full-time enrollment.[5] About one-fourth (28 percent) had earned more than enough to graduate (exhibit 2-3), although they had not necessarily met other graduation requirements (83 percent of them had completed a baccalaureate degree or higher). The total number of credits earned depends on several factors, including whether or not the students had graduated from college (having graduated means that students must have taken a certain minimum number of credits in order to qualify, but graduation also is a reason for students to consider their education completed and to stop earning further credits), whether the student was attending part-time or full-time, and whether the student had stopped attending (or dropped out) for one or more years. Disadvantaged students are more likely to be part-time and to interrupt their education than other students, so in general they would be expected to earn fewer credits over the same amount of time. Measures of the amount of credits earned can vary from one institution to another because institutions sometimes vary in which courses are for credit and which earn no credits; however, this distinction is probably less important in later years than in the first years, because some of the introductory courses show the most variation in how they are treated.

Exhibit 2-3. Percentage of SSS participants who earned various amounts of credits over six years after freshman entry in 1991–92



SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Retention, degree attainment, and transfers to four-year institutions. Two of the primary goals of SSS are to help disadvantaged students remain in college and ultimately to earn degrees (especially four-year, or baccalaureate, degrees). These goals are interrelated since students must remain in college for some minimum amount of time in order to earn degrees, and once students do earn degrees, they are likely to stop being enrolled in college (unless they seek more advanced degrees). A third goal also is closely related to these goals: encouraging students at two-year institutions to transfer to four-year institutions so they can earn four-year degrees. Transferring to four-year institutions is related to both retention (because one must remain in education a longer time) and degree attainment (especially because

[5] Credits earned under the quarter system were converted to semester credits to provide comparable measures across students and schools.

degree attainment is here usually defined in terms of receiving a bachelor's degree or higher). Because of the interrelationships among these three outcomes, all three are discussed together.

Now, with six years of data available, the analysis of retention can be expanded to cover more years, and it is possible to examine degree attainment and transfers to four-year institutions. Even six years is not enough time to come to a complete conclusion for all students, however. While four years is considered the traditional amount of time to complete a bachelor's degree, only about a third (36 percent) of college graduates complete a degree in that time after starting college.[6] By contrast, about one-fourth (26 percent) takes more than six years to complete their degrees. Further, disadvantaged and minority students tend to take longer to complete their degrees than other students. While 25 percent of white college graduates took more than six years to complete a bachelor's degree, 32 percent of blacks, 35 percent of Hispanics, and 43 percent of American Indians and Alaskan Natives took more than six years.[7]

After six years, 14 percent of the SSS participants had completed a baccalaureate degree and were continuing in postsecondary education, 23 percent had completed a baccalaureate degree and were no longer in college, 5 percent had completed an associate's degree and were continuing in college, 7 percent had completed an associate's degree and were no longer in college, 20 percent were still in college without completing a degree, and 31 percent neither were in college nor had completed a degree (exhibit 2-4). This rate of baccalaureate degree completion (37 percent after six years) was higher than that found for the most disadvantaged students in the Beginning Postsecondary Students (BPS) study, which showed completion rates of 25.7 percent for those with family incomes lower than $25,000, and 32.7 percent for those with incomes between $25,000 to $44,999.[8]

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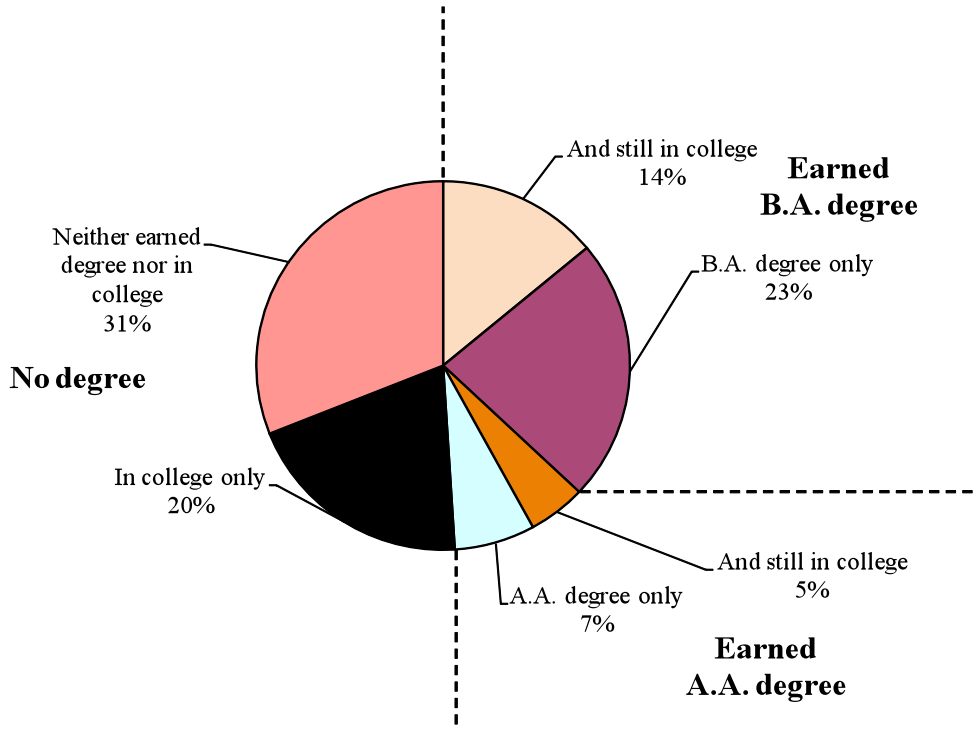
[6] Thomas M. Smith, *The Condition of Education 1996*, U.S. Department of Education, National Center for Education Statistics, NCES 96-304 (Washington, D.C.: 1996), 60.

[7] Ibid., p. 215. Asians and Pacific Islanders were an exception among minorities, with only 17 percent taking more than six years to complete a bachelor's degree. The three racial or ethnic categories used here are highly correlated with being disadvantaged and are used because statistics on the education status of these groups are more readily available.

[8] National Center for Education Statistics, *Descriptive Summary of 1995–96 Beginning Postsecondary Students: Six Years Later*, U.S. Department of Education, (Washington, D.C.: 2002), 57.

Exhibit 2-4. Retention and attainment of degrees by SSS participants six years after freshman entry in 1991–92



SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Degree completion alone. While retention and degree completion can be examined through combined measures, encouraging degree completion by itself is one of the primary goals of SSS. This study therefore examined participants' degree completion rates, regardless of whether they were still in college. Because this analysis is based on six years of data, and disadvantaged students often take a longer period of time to complete their degrees, these data reflect the effects of SSS *after six years*, but not necessarily the final SSS effect. The final effect might be larger (if additional SSS participants complete their degrees later, due in part to their participation) or smaller (if, say, SSS provides a temporary advantage, but nonparticipants eventually catch up).

This analysis uses three basic measures of degree attainment—whether participants earned a bachelor's degree or higher (a specific goal of SSS), whether participants earned any degree (including an associate's degree), and whether participants at two-year institutions earned any degree (again, including an associate's degree). The third measure is used to better understand the effects of SSS at two-year institutions, since students at such schools may be less likely to earn four-year degrees. While it would be possible to examine attainment of associate's degrees at two-year institutions (rather than an associate's degree or higher), such an analysis might produce misleading results: students who did not earn associate's degrees but did earn bachelor's degrees would be considered "failures" in such a measure (i.e., they had not earned associate's degrees), and the group of "failures" thus could include both students on whom SSS had no effect and students on whom SSS had a great effect.

Such a measure could easily lead to improper estimates of the effects of SSS. In fact, 65 percent of community college beginners who transferred to a four-year institution did so without first earning a degree at the two-year institution.[9] By instead counting the attainment of any degree (i.e., an associate's degree or higher), all students whose degree attainment may have been affected by SSS are included. However, data based on two-year institutions only should be considered as less reliable, particularly for testing statistical significance. With fewer cases available for analysis, combined with the fact that some SSS services were received by only a small number of SSS students, there is an increased prospect that some measures of SSS may not be statistically significant based on the number of cases alone. In fact, the standard demographic and attitudinal variables that were incorporated in the multivariate analysis also performed poorly and were often statistically insignificant. Further, diagnostic tests indicate that the logistic regression model may be providing questionable statistics, which again may be due to the reduced number of cases available for analysis.[10]

Transfers from two-year to four-year institutions. Because a purpose of SSS is to encourage disadvantaged students to earn four-year degrees, encouraging transfers from two-year to four-year institutions is a subsidiary goal. Among the SSS participants in the sample at two-year institutions, 19 percent transferred to four-year institutions. This percentage appears to be somewhat higher than would be expected based on other databases. According to data from the Beginning Postsecondary Students Longitudinal Study, 13 percent of full-time low-income freshmen at two-year institutions had transferred to four-year institutions within five years of starting their college careers.[11]

Two factors complicate the measurement of the SSS effect on transfers in this study. First, because the sample was not limited to two-year colleges, fewer cases were available for the analysis of transfers than for the preceding analyses, making statistically significant findings less likely to appear. Second, transfers to four-year institutions typically occur at the end of the second year (i.e., the typical end of a two-year program) or later, since many SSS students switched to part-time status and appeared to take longer to complete their academic careers. In that context, the focus on first-year SSS services may not necessarily be the best basis for examining transfers; it may be that decisions on transfers are made at a much later time, so that first-year services are not particularly relevant. For example, SSS advisors may primarily concentrate on survival and general academic strategies in the first year, and shift their focus to assisting with transfers in later years.

Employment. Another way of evaluating the effects of SSS participation is to examine the patterns of participants' employment. If participation in SSS helps students to be more successful in college (as indicated by the last two chapters in this report), and if attending college helps students to be more successful in employment, there logically should be some connection between SSS participation and students' success in their employment.

However, several factors complicate the search for such connections. First, many students might be expected to take more than six years to complete their college education, so students may not yet

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[9] A. McCormick and C.D. Carroll, *Transfer Behavior Among Beginning Postsecondary Students: 1989–94*, U.S. Department of Education, National Center for Education Statistics, NCES 97-266 (Washington, D.C.: 1997), vii.

[10] The models converge properly when the full database is used, but they do not consistently do so when used only for two-year institutions.

[11] 1989–90 Beginning Postsecondary Students Longitudinal Study, Second Follow-up (BPS:90/94), National Center for Education Statistics, U.S. Department of Education. Low-income freshmen here are defined as freshmen whose families were in the bottom quartile in their socioeconomic status.

have had time for their employment to be greatly affected by their college attendance. Second, in some ways employment and education reflect two competing ways for people to spend their time, and their choices depend in part on their families' financial resources. Employment may be an indicator of financial need rather than of success in education. Because SSS targets disadvantaged students, a high employment rate is likely as a response to the students' generally greater financial needs and may possibly interfere with academic progress rather than being a result of it. Third, the six-year period of this study is too short for many students to have become established in their careers (especially considering that much of that time may have been consumed by education), so that students' current careers may be poor indicators of their ultimate careers. Fourth, in the short term employment success sometimes is correlated more with seniority than education; people who have been employed continuously for six years may have greater temporary employment success (e.g., higher salaries due to experience and seniority) than people just entering employment with a college degree, even though the college degree ultimately may be correlated with greater lifetime earnings. Thus, if SSS encourages students to stay in college, in the short term the employment effects might appear to be negative. Fifth, there is no single perfect indicator of employment success; for example, while annual salaries are one potential measure, two people may be equally successful in their chosen careers and yet have very different incomes.

Given all of these limitations, this report does not look at employment outcomes for potential effects from SSS.

Overview of the Study Design

SSS provides a relatively moderate-sized intervention in students' educational experiences, and the nature of the SSS experience varies from one institution to another and from one student to another. These qualities make it a difficult program to evaluate. One would not expect to find large effects on students, given the moderate nature of the SSS experience, and may not necessarily find consistent effects, given the wide variation in projects and levels of participation.

Because of the potential difficulties in measuring the effects of SSS, the evaluation study was designed to provide multiple perspectives on SSS:

- A nationally representative, stratified random sample of 200 SSS projects was surveyed in 1991–92.

- Site visits were made to 50 higher education institutions, with 30 having SSS projects and 20 not having SSS grants. The 30 were randomly subsampled from the sample of 200 institutions for the project survey. The 20 non-SSS sites were selected to match the SSS sites, based on enrollment size, geographic region, selectivity, percentage receiving Pell Grants, institution type (two-year, four-year), and institutional control (public, private). Three of the institutions later dropped out of the study, leaving 47 institutions that became the primary focus of the analysis in this report.

- Project-reported data were collected from the annual performance reports submitted by each project, providing information on the students served and the types of services provided.

- Other basic data were collected from the Department of Education, the Council for Opportunity in Education (COE; formerly called the National Council of Educational Opportunity Associations, or NCEOA), the Integrated Postsecondary Education Data System (IPEDS), and a nationally representative Higher Education Survey (HES) on institutions' retention practices.

- A longitudinal study was conducted to compare the outcomes of 2,900 SSS participants and 2,900 comparison students who did not participate in SSS but had similar background characteristics. The students were selected from 28 of the 30 sampled SSS projects, and 19 of the 20 non-SSS institutions.

The Longitudinal Study

The longitudinal study is the primary focus of this report, though data from the other components of the study were used to help develop the longitudinal study and are also used here to supplement the data and help in interpreting the statistical results. Just as the evaluation study as a whole sought multiple perspectives, the longitudinal study also collected data from multiple sources. It should be noted that this study utilizes data from the 1990s and may not capture the full nature of the SSS program as it operates today.

- Student information files provided by the 47 participating institutions provided basic information on student characteristics, though the amount of information that was available varied from one site to another.

- Participant service records provided detailed information on each service contact through SSS with the sampled students, including the types of service, length in minutes, date, and number of students in the service.

- Student surveys were conducted at three different time points: (1) to provide baseline measures during students' initial enrollment as freshmen at the participating institutions in 1991–92, (2) in the third year (1994–95) to provide updated information on students' college experiences, plans, and attitudes, and (3) in the sixth year (1997–98) to provide further updates on the students, including potentially their graduation and attendance at postsecondary institutions.

- Student transcripts were collected at the end of the first year, at the end of the third year, and at the end of the sixth year to provide detailed information on students' academic progress. Because many students transferred to other institutions during the six-year course of the study, the total number of institutions involved in the transcript collection increased from an initial base of 47 institutions to roughly 850 institutions by the end of the third year, and to roughly 1,050 by the end of the sixth year.

The design of the longitudinal study raised a number of complex methodological issues. In the remainder of this section, we discuss these issues, the study design that was chosen, and the implications of the methodological issues for this study.

This study used a quasi-experimental design, in which two groups of students were chosen to have roughly similar characteristics, with one group receiving SSS services and the other not receiving

such services (at least during their freshman year). By comparing the outcomes of both groups, and also allowing for other supplemental services that might have been received outside of SSS, the study developed estimates of the impact of SSS and of supplemental services in general. If exposures to SSS had been randomized, the study could be classified as an experimental design, but there was no randomization. Additional discussion of the differences between experimental and quasi-experimental design, and on the reasons for choosing a quasi-experimental design for this study, is provided in Appendix B.

The presence of self-selection of services in SSS raised difficult but unavoidable issues for the evaluation study. Therefore, this study used a variety of data and statistical approaches in order to estimate the importance of the self-selection on student outcomes. It presents separate analyses that either (1) treat all SSS students the same regardless of what services they have received or (2) specifically model the amount and type of services that each student received. It also used a large amount of supplemental data on student characteristics both to statistically adjust for the interrelationship between those characteristics and student outcomes and to model students' likelihood of participation.

To monitor students' use of supplemental services, the SSS study sites maintained detailed records of each service contact with the sampled students during the first year. (Students' level of participation in SSS is typically highest during the freshman year, though they can and sometimes do continue to receive services in later years. No official service records were maintained after the freshman year in order to reduce the burden on the participating institutions.) Also, the student surveys in the first, third, and sixth year of the study were used to collect students' self-reports on their receipt of supplemental services to capture information on SSS students' receipt of non-SSS services and services received after the first year, and on comparison students' receipt of any supplemental services.

Inclusion of institutions without SSS programs. To further strengthen the study design, and at the request of the U.S. Office of Management and Budget, this study included 19 institutions that did not have SSS programs as a source for additional comparison students. This design aspect has two main advantages:

- As noted, in order for random selection to be maximally useful, the randomization should be applied to all relevant characteristics. It is possible that institutions that have SSS programs differ systematically from other institutions; for example, they may have a greater orientation to accepting minority or disadvantaged students, they may be especially well administered (e.g., in order to win an SSS grant against competing institutions), or they may have a strong orientation to providing students with supplemental assistance and working to see that all students are integrated into the campus community. All of these factors could potentially be related to student outcomes, and their importance may affect the viability of expanding SSS to additional institutions, as has been the trend. Some of these characteristics also might lead to (or arise from) SSS institutions having a fundamentally different mixture of students than other institutions (at least with regard to certain characteristics). By including non-SSS institutions in the study, one has the capacity to check for differences in student characteristics, and the study can better be generalized to a larger set of institutions.

- There is the potential that SSS programs may "skim" the most disadvantaged students in an institution, so that there is not a truly comparable set of nonparticipating students facing the same disadvantages within that institution. By including institutions that

are similar to SSS institutions except that they lack SSS programs, one has a better potential for finding comparison students who collectively are similar to the SSS participants, even if SSS students and non-SSS students are not necessarily comparable within any particular institution.

Selection of comparison group. Because randomization was not used to produce equivalent sets of treatment and comparison students, it was necessary in some other way to select an appropriate group of comparison students. The comparison group was chosen by using regression analysis to calculate propensity scores of students' likelihood of participation in SSS based on demographic data that were available from the colleges.[12] The derived formulas were then used to choose a comparison group at each institution of students whose propensity scores showed similar distributions.

As shown in Exhibit 2-5, the propensity scoring was useful in selecting students who were more like the SSS participants than like typical students, but the differences were only partially overcome. In particular, SSS students tended to be more disadvantaged than the students in the comparison group; for example, they were more likely to have household incomes of $10,000 or less (30 percent versus 15 to 17 percent) and to have parents with less than a high school education (e.g., 35 percent versus 17 to 20 percent with regard to the father's education background).[13] The primary reason the SSS students and the comparison group were not more similar appears to be the lack of adequate data for fully comparing the two groups of students. For example, some institutions did not have information about the race or ethnicity of their students or about the students' finances, especially for those who were not receiving assistance. Thus, the fewer the items that were available, the less powerful were the propensity models, and most institutions were able to supply only a limited amount of data. Also, as revealed by case studies, it was sometimes difficult to select comparable non-SSS students because that the SSS programs were so highly targeted at a few institutions that there were no comparable non-SSS students with similar characteristics. The number of SSS students at such institutions, however, was sufficiently small as to have only a minor effect on the overall averages. Also, the students in the highly targeted programs were actually less likely to be disadvantaged than the other SSS students (e.g., 77 percent were white, compared with 35 percent of other SSS students), so that targeting was not the major source of the differences between the SSS and comparison groups. Whatever the cause, there were systematic differences between the SSS participants and the comparison group, with the SSS participants being more disadvantaged. The analysis therefore required the use of statistical adjustments to correct for these differences.

[12]The formulas that were used for calculating propensity scores varied from one institution to another because institutions differed in the amount of information that they were able to provide for use in the statistical model.

[13] The cited differences are all statistically significant at the 0.01 level based on t-tests.

Exhibit 2-5
Comparison of SSS students with comparison group and all freshmen, by student characteristics

Student characteristic	SSS	Comparison group		All freshmen
		SSS schools	Non-SSS	
Demographic data				
Percent male	33%	40%	40%	47%
Never married	81%	87%	86%	71%
Have dependent children	22%	15%	15%	24%
Percent white	42%	50%	55%	80%
Over 100 miles from home	18%	19%	24%	36%
Age 19 or under	75%	79%	70%	92%
Household income $10,000 or less	30%	17%	15%	7%
Other language besides English spoken at home	31%	23%	17%	--
Understand English very well	71%	88%	83%	--
Speak English very well	59%	82%	69%	--
Write English very well	48%	78%	67%	--
Read English very well	60%	82%	72%	--
Parental information				
Lived with father/male guardian	72%	77%	75%	--
Lived with mother/female guardian	94%	96%	97%	--
Father was manager/proprietor	18%	24%	24%	--
Mother in service occupation	51%	39%	36%	--
Father had less than high school education	35%	20%	17%	12%
Mother had less than high school education	30%	19%	15%	9%
Academic information				
Have taken SAT or ACT	81%	87%	85%	--
SAT Verbal (mean)	399.0	455.3	445.0	422
SAT Math (mean)	428.7	463.0	462.4	474
ACT Composite (mean)	18.8	20.2	20.4	21
"A" as average grade	10%	11%	17%	24%
Years of math (mean)	3.3	3.4	3.4	--
Took courses at other college	29%	36%	40%	--
Credits earned at this institution (mean)	21.1	21.5	22.3	--
Full-time student	90%	91%	90%	--
Work-study job	16%	13%	11%	--
College finances				
Received financial aid	82%	73%	73%	45%
High school counselor helped assemble	26%	19%	19%	--
College counselor helped assemble	27%	26%	16%	--
Self-assembled	50%	68%	60%	--
Listed as dependent by parents	43%	62%	64%	--
Received assistance of $600 or more	27%	43%	48%	--
Financing college is major concern	41%	34%	31%	--
Attitudes				
BA/higher as highest planned degree (this college)	67%	72%	68%	67%
BA/higher highest planned at any college	91%	95%	95%	90%
Definitely able to complete college	71%	79%	80%	--
Academic ability above average	43%	59%	57%	54%
Drive to achieve above average	65%	72%	73%	67%
Emotional health above average	58%	67%	71%	55%
Leadership ability above average	51%	62%	65%	50%
Mathematical ability above average	30%	42%	41%	37%
Physical health above average	57%	74%	73%	56%
Popularity above average	40%	52%	57%	38%
Intellectual self-confidence above average	57%	71%	71%	51%
Social self-confidence above average	56%	66%	66%	45%
Writing ability above average	38%	56%	54%	40%

--Data not available.

SOURCE: U.S. Department of Education, Planning and Evaluation Service, National Study of Student Support Services (SSS), *Service Record Analysis, 1991-92.*

It is important to note that though the distribution of characteristics among the SSS and comparison groups was different, both groups were diverse (though disadvantaged) and there was no discernable group of SSS students who were so disadvantaged that the comparison group lacked such students. If such a subgroup did exist, then statistical models might be limited in their ability to discuss program effects for such students. Fortunately, the two groups did overlap in their coverage of students, thus improving the chances that the results would be generalizable and that multivariate regression models could successfully adjust for these differences. The pooling of data across multiple institutions is especially helpful in this regard because it helps to provide groups of students with similar characteristics in both the SSS and comparison groups even if SSS students were highly distinct in a few institutions. The inclusion of students from institutions without SSS programs also helped by providing institutions in which skimming of the most disadvantaged students by SSS was not an issue. In order to maximize diversity among both SSS students and comparison students, the analyses were conducted with all of the institutions combined. A limited number of analyses were conducted on an institution-by-institution basis in the analysis after three years, but these models were considered inferior both because of the less adequate coverage of student characteristics and the reduced number of cases available for analysis. The multivariate regressions did include variables to measure some institution characteristics (whether the institutions were two-year, four-year, or doctorate-granting institutions, whether the SSS program included home-based or blended services, and whether the institutions had SSS programs), and the use HLM did model differences in variances on an institution-by-institution basis).

Exhibit 2-5 also shows that there generally were only small differences between the comparison students based on whether they were at SSS or non-SSS institutions. Because statistical adjustments for the differences between SSS and non-SSS students are required in any case, and these adjustments can also compensate for these small differences between the two types of institutions, the distinction between the two comparison groups is unnecessary. Accordingly, this report combines both groups of comparison students into a single group.

Intent to treat. One of the critical issues in conducting an evaluation can be the determination of which people are considered to have received treatment. For example, in a medical study, some patients might drop out because of the side effects they experience from the medication being studied. If those patients are ignored, then one would not have a proper measure of either the frequency of side effects or of the success of the medication. The solution is to consider the initial enrollment of a person into a treatment group as being the critical factor (i.e., that there was an "intent to treat") even if a person does not receive the full treatment. However, sometimes exceptions are appropriate, and it can be difficult to know precisely where to draw the line. Using another medical example, many antibiotics require multiple doses (e.g., often over a 10-day period), and not only is it ineffective to terminate the medicine prematurely, but it may also be counterproductive (if the infection is not eliminated completed, the bacteria may develop a resistance to the antibiotic and be harder to treat afterward). Should a patient who received only a partial treatment still be considered as part of the treatment group? The answer, which depends on whether the withdrawal was in some way related to the treatment or disease, may not always be straightforward.

Because SSS allows students to set their own levels of participation, and because the SSS programs also vary from one institution to another, the actual amount and types of services received vary greatly. Many students might be considered as dropouts from the program, whether based on the number of contacts or the hours of contacts: 9 percent received only a single service contact over the entire freshman year, 7 percent received less than 1 hour of total services in the first year, and 22 percent received between 1 and 5 hours of services. Though it is conceivable that even a single contact might be

sufficient to resolve a key intellectual problem or impart a needed skill, it would not be surprising if most or all of these students experienced little effect from their participation in SSS. In fact, many education policies are based on the assumption that the amount of time devoted to education is important, including many reform efforts aimed at increasing the time devoted to reading and mathematics, and even the way that graduation requirements are specified (in terms of the number of hours or credits of instruction received). Particularly if the students dropped out because they perceived the program as providing no benefit, it is reasonable to consider the students as "failures" in the sense that SSS failed to impart needed skills or to motivate students sufficiently to benefit from the SSS offerings. On the other hand, these students also consumed few of the resources in terms of the dollars spent for supplemental services. If one were conducting a cost-benefit analysis, one might even argue that allowing dropouts actually increases the program's efficiency by reducing the use of resources for those who do not benefit from them (e.g., assuming either that a reason that students drop out is that they do not perceive a program as being effective, or that the factor that leads to nonparticipation—such as low motivation—would lessen the likelihood of the student being helped). Thus, though it is important if some students are not helped through SSS, it would not necessarily be a complete failure if some students are helped and some are not, particularly if the resources are concentrated on those who are helped.

The question of how to measure participation is important because of how statistical significance is calculated. If some students benefit from SSS and other students do not, then the average benefit across all students may or may not be statistically significant when a dichotomous measure of participation is used, depending on the size of the benefit, the distribution of any benefits across the SSS population, and the number of students in the study. Estimates of the average benefit also would not provide any information on the differential effects of SSS. On the other hand, if there is an a priori means of predicting which students would benefit, and separate tests are run for each group, then the added precision is more likely to result in statistically significant findings for those students who benefit.[14] Two such methods are examined in this report: differentiating among students based on the amount of services they received, and also on the specific types of services they received. Potentially these two measurement tools can provide more precise information about which students and how students are helped.

In order to address these conflicting needs to consider dropouts as potential failures of the program but also to test for differential effects among students, this study uses multiple statistical measures of participation to provide multiple perspectives. More specifically,

- The study uses both dichotomous (yes or no) measures of participation that group all SSS participants together and continuous measures that differentiate among students in terms of the amount and types of services they received.

- Regardless of the measure used, average estimates of the total effect always include all SSS participants, including those who might be considered as dropouts.

[14] In statistical analyses, it is possible (but incorrect) to first identify those students with superior outcomes, and then calculate "impacts" just for these students. This approach could result in making even random differences in outcomes appear to support findings of positive and statistically significant outcomes. Thus, it is critical not to separate students based on their outcomes but rather to use prespecified and independent measures of participation. Differentiating among students based on the amounts and types of services they have received is one such a priori approach and has been part of this study since the initial design phase, when the decision was made to collect such information on the students.

- Some measures in this report provide estimates for those students who a priori might be considered to be most likely to have improved outcomes based on their participation in SSS.

However, the use of continuous measures of participation based on the amount of services received does create a risk of conflating participation with motivation or need (or other factors that might influence participation). This topic is discussed in greater detail in the section that immediately follows.

Separating motivation and need from participation. To the extent that students' levels of participation are based on student characteristics that themselves may be correlated with student outcomes, there is a risk that the measure of participation may serve as a surrogate for these other factors, and that any statistical association that is found between participation and student outcomes actually is due to these other factors and not participation in SSS itself. For example, students may participate more if they are highly motivated to succeed in their education, and this high degree of motivation might be associated with improved student outcomes. Alternatively, students may participate more if they had a high degree of academic need, and that neediness might be associated with poor student outcomes. These factors work in opposite directions but either could lead to misleading statistical results. A high association between motivation and participation could result in making participation highly correlated with positive student outcomes, thus overstating the effects of participation on student outcomes. Alternatively, a high association between academic need and participation could result in making participation highly correlated with poor student outcomes, thus understating the effects of participation on student outcomes (or, at the extreme, resulting in a negative association between participation and outcomes, so that it would appear that participation is associated with reduced student outcomes).

To investigate this issue, we attempted to predict students' levels of participation using a variety of statistical models:

- Logistic regressions to predict whether or not a student is a participant in SSS;
- Multiple regression to predict the total number of hours of services received; and
- Multiple regressions to predict the number of hours of services received for each specific service.

We found that participation is a complex phenomenon that is related both to measures associated with academic need and measures associated with motivation. We also found that there is no single propensity to participate that works uniformly across all types of services, but rather that participation in one type of service often shows little or no relationship to participation in another (exhibit 2-6).

Exhibit 2-6. Correlation of the number of hours received of each SSS service as freshmen in 1991–92 with the number of hours received each other SSS service in the same year

Service	Instructional courses	Professional tutoring	Peer tutoring	Professional counseling	Peer counseling	Workshops	Labs	Cultural events	Services for disabled
Instructional courses	--	0.08	-0.01	0.28	-0.12	-0.07	0.23	0.03	-0.04
Professional tutoring	0.08	--	0.40	0.22	0.29	0.13	0.24	0.09	0.19
Peer tutoring	-0.01	0.40	--	0.22	0.36	0.05	0.13	0.12	0.10
Professional counseling	0.28	0.22	0.22	--	0.01	0.15	0.57	0.32	0.02
Peer counseling	-0.12	0.29	0.36	0.01	--	-0.02	0.06	0.08	0.01
Workshops	-0.07	0.13	0.05	0.15	-0.02	--	0.23	0.33	0.10
Labs	0.23	0.24	0.13	0.57	0.06	0.23	--	0.23	0.04
Cultural events	0.03	0.09	0.12	0.32	0.08	0.33	0.23	--	0.23
Services for disabled	-0.04	0.19	0.10	0.02	0.01	0.10	0.04	0.23	--

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Based on these findings, students' propensity to participate is not a monolithic force, and to the extent that measures of participate act as surrogates for these other factors, it is not clear whether there would be a bias or the direction of that bias.

To lessen the potential for bias, this study used several procedures:

- One of the measures of participation is dichotomous, so that SSS participants with high propensities to participate will not be treated separately from SSS participants with low propensities. (However, even a dichotomous measure can be subject to bias if there are different propensities between SSS and non-SSS students.)
- Multivariate models were used to adjust for students' demographic differences, academic background, and attitudes.
- Separate propensity measures were created and included in some multivariate models to further adjust statistically for differences in the propensity to participate.

Services received outside of SSS. One of the complicating factors for this study is that institutions also offer supplemental services through other means than SSS. In fact, one SSS program may offer a specific service through SSS, while another institution refers students to an equivalent program outside of SSS. Further, non-SSS students often receive services that are equivalent to those provided in SSS. In the longitudinal sample for this study, 91 percent of the SSS students and 53 percent of the comparison students received services outside of SSS.

One potential approach to the outside services is to ignore them, based on the logic that the purpose of the evaluation is to determine what extra difference is made by SSS. However, then the study

would not be measuring the effects of SSS (versus not receiving services) but rather the comparative effect of SSS relative to other supplemental services, which would be risky. For example, this approach in a medical setting could lead to saying that one antibiotic is not effective because its cure rate for strep throat is little different from that of another while, in fact, both may be effective. Thus, failing to account for alternative treatments could lead to incorrect inferences. Presumably, policymakers do not expect that, say, peer tutoring offered through SSS must be superior to peer tutoring offered through other sources but, rather, are satisfied if peer tutoring (or any other SSS service) offered through SSS is effective. Thus, to accurately assess the association between SSS participation and student outcomes, it is necessary to adjust for the receipt of other services.

All of the models in this analysis therefore adjust in some way for students' receipt of supplemental services outside of SSS. The method that is used depends on how SSS participation is measured in order to provide a consistent approach. When dichotomous measures of SSS participation are used, a dichotomous measure of non-SSS participation is also used, and when multiple measures of SSS participation are used, multiple measures of non-SSS services are also used. Unfortunately, because essentially all of the SSS participants also received non-SSS services, the models using dichotomous measures are not very powerful with respect to distinguishing effects received through SSS from those received from supplemental services in general. There are two main alternatives, but each encounters the same difficulty:

- The measure of participation in non-SSS services could be assigned a value of 1 for all comparison students receiving such services, and 0 for all other comparison students and also for all SSS students. If supplemental services have positive effects on student outcomes, then both the measure of SSS services and this measure of non-SSS services should be positive and statistically significant. However, because the measure of non-SSS services would not include any non-SSS services received by SSS students, the measure of SSS services would include the average effects of the non-SSS services as well as the effects of the SSS services. The measure therefore would tend to overstate the effects of the SSS services. If there is a sizable difference between the effects for SSS students and non-SSS students receiving supplemental services, one might be tempted to infer that the added benefit was associated with SSS participation; however, the measure would not be adequate to prove this because there would be no way of separating the SSS and non-SSS services received by the participant.[15] Similarly, if the estimated effects are basically equivalent, one might be tempted to infer that both groups received an equivalent package of services, but the model would not indicate whether the SSS services were an important part of the package.

- Alternatively, the measure of non-SSS supplemental services could be assigned a value of 1 for both SSS and non-SSS students who received services outside of SSS, and 0 otherwise. This approach has the advantage that the measure of SSS services should in principle show only the effects of SSS and not of the other services. If a substantial number of SSS students did not receive non-SSS services, such a measure might be successful. However, because 91 percent of SSS students also received non-SSS services, the two measures of services are largely identical for SSS students, and

[15] One cannot assume that non-SSS services have the same effect on SSS students as on non-SSS students because the measure does not indicate whether both groups received equivalent amounts of non-SSS services.

the statistical model is unlikely to be able to differentiate between the two sources of services. Suppose, for example, that both SSS students and those non-SSS students receiving supplemental services ultimately received the same amount of services, though from different sources, and therefore showed the same total effect with regard to the supplemental services. Because the single measure of non-SSS services would largely be effective in identifying almost all students who received supplemental services, it would tend to show the full value of all supplemental services combined, while the SSS variable would show no added benefit of SSS services. The lack of differentiation between the two measures for SSS students would probably result in the SSS measure being statistically insignificant, even if the SSS services made a positive difference.

For this report, the second alternative was chosen because it potentially provides a greater ability to differentiate between SSS and non-SSS services. However, it is likely to understate the effects of SSS because some of effect is likely to instead be captured through the other measure of supplemental services.

By contrast, when multiple measures of SSS participation (and non-SSS participation) are used, there is a much greater ability to differentiate among students. For example, while 91 percent of SSS students received some non-SSS supplemental service, the percentage receiving non-SSS peer tutoring (or whatever service being considered) is much smaller. As a result, there is a greater ability to differentiate between the effects of SSS and non-SSS services.

Services received after the first year. To reduce burden on the institutions, the SSS projects only collected detailed information on students' service contacts during the first year. Thus, all information that is available on services received in later years is based on students' responses to the questionnaires. Students were not asked about the source of those services, both to reduce the questionnaire length and complexity and because students were not expected to know.[16] Thus, while this study is able to examine whether supplemental services after the first year are associated with improved student outcomes, it is not able to examine the effects of SSS services in later years.

As with both the SSS services and the first-year services received outside of SSS, the treatment of these services varies depending on the particular model being used. When participation in SSS is treated as a dichotomous variable, then these services are also measured through a single separate variable for all services received after the first year.[17] As with the measure of non-SSS first year services, there is substantial overlap between this measure and the other two measures of supplemental services: 80 percent of SSS students received supplemental services, along with 82 percent of students receiving non-SSS first year services. Thus, if either this measure of later-year services or the measure of non-SSS first year services is positive and statistically significant, the variable may be capturing some of the SSS

[16] One reason is that students might think only of the services as being provided by the institution, rather than by a particular office within the institution, and another is that SSS projects sometimes create special institution-specific names for the projects, so that students might not know that the projects were SSS projects even if they remembered the specific source of the services.

[17] Another option would have been to use a single dichotomous variable to account both for first-year non-SSS services and all later services. This latter option was not chosen because the other first-year services can be distinctly labeled as non-SSS services, while the services in later years cannot, and also because such a large proportion of students would have received either a first-year non-SSS service or a later year supplemental service that the variable would provide little capacity to distinguish one student from another.

effect, possibly making the measure of SSS services statistically insignificant. If so, the lack of statistical significance for the SSS variable would not necessarily indicate that SSS had no effect but, rather, that no additional benefit of SSS could be identified beyond that benefit that was already captured in the other two measures of supplemental services.

Especially when the dichotomous measure of non-first-year services is used, there is some risk that the variable acts as a surrogate for other factors that may be correlated with academic success. For example, the fact that a student received services after the first year necessarily requires that the student "persisted" for at least one year.[18] Among the combined group of SSS and non-SSS students in the study, 92 percent of those who persisted also received at least one supplemental service in those later years, making these two measures largely similar. Alternatively, the variable might also be considered a measure of academic need and motivation because it applies to students who have chosen to receive supplemental services. Still another possibility is that to the degree the measure is related to persistence, it may also be modeling some of the effects of SSS participation rather than allowing the SSS measure to show all SSS-related effects; this might be an issue mostly when examining retention, and the estimate of the SSS effect might therefore be an underestimate.

The problem is especially an issue for the dichotomous models because then the measures of persistence and receipt of supplemental services are the most similar. When the measure of supplemental services is divided into multiple continuous measures, the greater amount of variation provides a better capacity for relating specific services to variations in student outcomes. As an adjustment in all of the models (i.e., using dichotomous measures and using multiple continuous measures of participation), an additional dichotomous variable is added that measures whether students attended higher education at any time during the five years after 1991–92. Thus, the changes in outcomes that are associated with persistence are measured through this variable, while the measure of the receipt of supplemental services will only capture any additional changes in student outcomes that are associated with the receipt of supplemental services.

A weakness of this approach, however, is that the model is still somewhat recursive: SSS participation may affect persistence, which in turn may affect the student outcome being examined, so that the total effect associated with participation in SSS may be some combination of the estimate for SSS participation plus some component of the estimate for persistence.[19] Thus, the models may tend to understate the effects of SSS. Conceivably, one could create a latent variable to separate that component of persistence that is associated with participation in SSS from the level of persistence that would appear in any case; however, given the wide overlap between the three measures of supplemental services (first-year SSS services, first-year non-SSS services, and later services from any source), the dichotomous models would not be well designed for measuring the effects of SSS even after creating the latent variable. The dichotomous models are primarily useful for testing whether supplemental services (of some kind) are associated with improved student outcomes, while the more precise measures of participation used elsewhere in this report are the best for estimating the effects specifically associated with participation in SSS.

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[18] This is a liberal definition of persistence because it includes students who stopped out for a time and then later returned to postsecondary education. It is therefore not the same as retention to the second year.

[19] The problem would remain even if the measure of persistence is omitted because the measure of services received in later years would then have much the same effect. The only way to completely avoid this issue is to avoid any reference to services received in later years, but that would create a different problem: SSS participants would be compared to other students as if the other students had not received supplemental services, and the estimated effects of SSS (for some students) would therefore be the estimated difference between SSS and other services rather than the estimate difference between SSS and no services.

The three types of services (first-year SSS services, other first-year services, and later services) all show substantial overlap, especially when measured through dichotomous variables. In fact, only 2 percent of SSS students did not receive some type of supplemental service besides first-year SSS services.

Because of the inability to distinguish between SSS and non-SSS services received after the first year, parts of this report focus on the more general question of whether the receipt of supplemental services is associated with improved academic outcomes. This general question has policy relevance for SSS. First, if supplemental services are found to improve student outcomes, then it is logical to assume that supplemental services provided through SSS also improve student outcomes. That is, there is no clear reason why services provided outside of SSS should be superior to SSS. If anything, given that institutions must win the SSS grants through a competitive process while the other services may not go through such a process, there are reasons to expect the SSS services to have better quality control. Second, to the extent that later-year services are found to be important, that information could lead SSS programs to increase the level of services provided in later years, thus potentially increasing the effects of SSS. Third, because part of the function of SSS is to refer students to needed services even if those services are outside of SSS, the effects of those other services is relevant to SSS and in some ways might be attributed to SSS. In fact, SSS students received a higher level of services than the comparison group both in the first year and also in next two years (Exhibit 2-7). The rates of receiving services were roughly comparable for both groups after 1993–94, except that the SSS students received more tutoring. Unfortunately, the study did not provide data on why the SSS students received more services (e.g., whether it was through the influence of SSS or for other reasons such as greater academic need).

Exhibit 2-7. Percent of SSS and non-SSS students receiving services in the six-year period starting with freshman entry in 1991–92

	Non-SSS	SSS
First-year services from any source		
Services for disabled	1	8
Counseling services	50	93
Classroom instruction	20	74
Cultural events	16	34
Tutoring	25	73
Services for limited-English ability	1	6
Student orientation	82	85
Referrals to agencies/resources	12	26
Services after the first year		
Counseling in 1992–93	41	48
Tutoring in 1992–93	18	30
Counseling in 1993–94	37	40
Tutoring in 1993–94	12	18
Tutoring after 1993–94	30	38
Advising/counseling after 1993–94	51	51
Services for disabled after 1993–94	2	5
Field trip after 1993–94	23	20
Contact with support services after 1993–94	50	48

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Hierarchical clustering of data. Both the SSS participants and comparison group students were chosen by first selecting the institutions and then selecting the applicable students in the institutions. Though highly efficient, this selection method violates the classical statistical assumption that each student observation is independent of the others. To some degree, the inclusion of variables at the institution level within the regression models helps to adjust for such clustering. Still, the nesting of students within schools creates the potential that standard multivariate regression may not properly estimate the variances. This report therefore used both standard multivariate regression and HLM modeling so that readers may compare the results using both approaches.

To develop the HLM modeling approach, we first used HLM to examine several preliminary multivariate models, using a variety of measures and models. HLM was not able to estimate a solution unless most of the variables were treated as fixed. We therefore used a stepwise procedure of adding variables to test for each variable whether including a residual provided significant benefits. Based on these tests, we determined that for all HLM models for this report, only the intercept would not be treated as fixed. All of the independent variables were centered around the grand mean in order to increase the stability of the model. The HLM software that we used does offer an option for limited dependent variables, but this approach generally did not converge to a solution. Thus, ordinary HLM models were used instead for all outcome variables, whether or not they had limited dependent variables.

Number of cases. As noted, the longitudinal study was of 2,900 SSS participants and 2,900 comparison students. Because of nonresponse, the actual database for examining six-year student outcomes consisted of 5,055 students, with 2,380 SSS participants and 2,675 comparison students. However, as shown in Exhibit 1-1 the number of students receiving any particular service varied widely, and the receipt of some services was relatively rare. The wide variations occurred for a variety of reasons: some services were not relevant for all students (especially services for the disabled), institutions varied in the packages of services they provided, and students could choose which services they received. Because of these variations, and because the amounts of services received often were also small (so that only small effects were likely), modeling the effects of specific supplemental services sometimes was hampered by the lack of adequate variation. Sometimes the finding of statistically significant results for one service and insignificant results for another may be based more on the numbers of students receiving each service rather than indicating that one service was more effective than another. The small number of students receiving some services could also be a reason why general measures of supplemental services (that do not distinguish between SSS and non-SSS students) would perform better than measures of SSS services, because the general measures would have roughly twice as many students receiving services. It especially imposed limitations on those analyses that were limited students at two-year institutions; that is, models to predict transfers from two-year to four-year institutions and to predict degree completion at two-year institutions were tested using substantially fewer students and the models performed less well. Many variables that were statistically significant when all students were included were not significant when restricted to students at two-year institutions, and the models did not always converge to a solution. Exhibit 2-8 shows the number of students receiving each SSS service for students in the dataset.

Exhibit 2-8. Number of students receiving SSS services in 1991–92 in database used for outcomes analysis

Category of student	Instruc-tional courses	Profes-sional tutoring	Peer tutoring	Profes-sional counseling	Peer counseling	Labs	Work-shops	Cultural events	Services for the disabled
All students	746	384	1,082	1,892	318	390	723	226	63
At two-year institutions	110	56	250	415	23	157	90	8	11

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Presentation of effect estimates. The regression estimates are presented here in two different formats: as regression coefficients to aid researchers to understand the structure of the models and to replicate the results, and as effect estimates to aid policymakers in applying the findings, because the regression estimates often do not translate easily into effects. (One difficulty is that for some models, one must know the amount of services that students received in order to interpret the regression coefficients; another is that when logistic regression is used, neither the regression coefficients nor the log odds ratios are easy to interpret.)

Normally, estimates of program effects would be presented by indicating both what students would have achieved if they did not participate in SSS and what they did achieve after participating in SSS. Unfortunately, because the comparison group was more advantaged than the SSS participants, and since students in the comparison group often also received supplemental services, there is no pure measure of what outcomes would be expected if students had not participated in SSS. There are actual measures of final student outcomes after six years, but the alternative outcomes if students had not participated in SSS could only be estimated through statistical models. Moreover, because this report uses multiple models as a tool for examining the implications of the methodological choices involved, there are multiple estimates of the effects of SSS from which to choose. The results across the various models are often highly consistent but not identical. Therefore this report presents only the estimated effects of the services along with the final measured outcomes. Readers can calculate what students would have achieved without SSS by first deciding which model appears most trustworthy, and then subtracting the estimated effect from the final outcomes.

Negative and statistically significant findings. In some cases, SSS or other supplemental services showed negative but statistically significant findings. As a general rule these findings seem implausible, though there are situations in which negative findings could be the result of interactions between variables.

- For example, if SSS helps students to graduate, this could lead to their no longer being enrolled in higher education; thus, one might simultaneously find positive effects on degree attainment and negative effects on retention. To handle this particular situation, this report primarily focuses on a composite measure (i.e., students either received a degree or were retained in higher education) as the best measure in this area.

- Similarly, in the short term it is not clear how to interpret the relationship between SSS and employment; for example, those students who dropped out of higher education might be the ones who have had the most time to get established in their careers, possibly leading to higher employment rates and higher salaries. Thus, again a positive effect on retention could be correlated with an apparent negative effect on

employment. Because of the difficulty of interpreting employment outcomes in the short term, and because employment outcomes are not specifically a goal of SSS, this report does not look at such outcomes.

- More generally, negative findings can be the result of differences between the SSS and comparison groups. To the extent that the SSS students were more disadvantaged, one would expect them to have worse academic outcomes unless they receive supplemental services that compensate for their disadvantages. If the statistical models do not adequately adjust for these disadvantages and the effects of SSS are not sufficiently large to make up for the differences between the two groups, then one could find negative correlations between SSS participation and student outcomes. In earlier analyses, this particularly appeared to be a factor with regard to first-year professional counseling received by SSS students because of the way in which it was administered. While some models in this study do show positive outcomes from counseling (especially for counseling that is not specifically associated with SSS), first-year counseling through SSS often showed negative relationships to student outcomes. The reason appears to be that some SSS institutions proactively brought in students for counseling if they were doing badly in their academics; this action had the statistical effect of making high participation in counseling correlated with poor academic outcomes.

All three of these explanations could result in underestimating the positive effect of SSS, either because of a failure to model a positive contribution from SSS (such as improved retention) or a failure to fully adjust for students' disadvantages.

Of course, one could generate alternative hypotheses as to why SSS might be harmful. For example, the tutors could be so poorly qualified that they teach incorrect material, or the sessions could be so ineffective that they take time away from more constructive uses of students' time. These latter explanations seem implausible, though, both because the institutions won competitive SSS grants based on the quality of their proposals, and because the students would be unlikely to keep returning for additional sessions if they found the sessions not to be helpful (or even counterproductive).

For completeness, and so that readers may be aware of such indicators of inadequacies in the models, all negative regression coefficients and low odds ratios (i.e., odds ratios below 1.0) for SSS variables are included in the tables if they were statistically significant. However, because they are not considered reliable indicators of the effects of SSS, they are not included in the effect estimates. That is, the statistical findings are always presented through a combination of two tables, with the first showing regression coefficients and odds ratios and the second showing effect estimates. The negative findings are included in the first, but not in the second. For the third-year report, we also examined alternative models in which the SSS variables with negative coefficients were dropped from the models to see if the estimates for the other SSS variables would be affected; both types of models produced similar results, suggesting that the dropping of the negative coefficients does not artificially result in high effect estimates.

3. Research Findings Based on Dichotomous Measures of Participation

Highlights of Findings

- Exhibit 3-1 summarizes the major results from the statistics presented in this chapter. There were consistent and statistically significant improvements in students' academic outcomes if they received supplemental services in general, whether using regression or HLM analysis. By contrast, the regression analysis showed positive effects from SSS participation only with regard to cumulative GPA, and the HLM analysis, which better accounts for the clustering of students in institutions, showed no effects that are specifically associated with SSS. However, the dichotomous models lack sufficient power to discriminate among the different types of supplemental services, and the effects that were identified for supplemental services may include effects from SSS.

Exhibit 3-1. Summary of findings for each outcome using dichotomous measures of participation, by method used: Six-year outcomes after freshman entry in 1991–92

Outcome measure	Regressions			HLM		
	First-year services		Later services	First-year services		Later services
	SSS	Other		SSS	Other	
GPA	■		■			■
Credits			■			■
Retention or degree completion at the same institution						
All institutions			■			■
Four-year institutions			■			■
Two-year institutions						
Retention or degree completion at any institution						
All institutions			■			■
Four-year institutions			■			■
Two-year institutions			■			■
Bachelor's degree or higher			■			■
Associate's degree or higher						
All institutions			■			■
Two-year institutions		■	■		■	
Transfers to four-year institutions			■			■

■=Positive and statistically significant; ─ =Negative and statistically significant.
SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

- The average total amount of improvement from the HLM analysis that could be associated with the receipt of supplemental services (from any source) ranged from 12 to 19 percentage points with regard to retention or degree completion, 8 to 10 percentage points with regard to degree attainment, 16 percentage points with regard to transfers from two-year to four-year institutions, GPA increases of 0.14 on a 4.0 scale, and an increase of 17 credits in the total credits earned over the six years.

Introduction

This chapter starts the presentation of the research findings by examining the simplest method of modeling student participation in SSS: through a dichotomous (yes or no) measure of whether students participated in SSS.[20] Such an approach has both advantages and disadvantages.

Advantages

- This method provides a single summary measure of the effects of SSS, and when multivariate linear regression is used, the applicable coefficient can be directly interpreted as the average overall effect among all SSS students.

- The "intent to treat" issue is resolved by treating all SSS participants in the same way, regardless of whether some students participated more or in different ways than others. Thus, if there are confounding factors such as motivation or academic neediness that affect students' level of participation, those factors will not be allowed to give some SSS students greater weight than others.

Disadvantages

- This approach treats dosage as unimportant, as if all students are expected to experience the same effect regardless of which services they received or how much they received.

- Because only a single measure of SSS participation is used, and because the corresponding measures of alternative services are also dichotomous and highly interrelated with the receipt of SSS services, the statistical ability to distinguish the effects of SSS from the effects of other services is greatly lessened. Often it may only be possible to draw a conclusion about supplemental services in general, rather than to specifically estimate the association between SSS participation and student outcomes.

- The estimates of the SSS effect shown here may be underestimates because of a failure to account for the potential indirect effects of SSS through its effects on persistence after the second year. This is a greater issue when using dichotomous measures than it would be with more refined measures.

Limitations

- This approach to the "intent to treat" issue does not eliminate the need to statistically adjust for such factors as motivation and academic neediness. Because the SSS

[20] Though this is the simplest method of modeling SSS participation, it is not the simplest method overall. The simplest approach would be a comparison of the mean outcomes for SSS and non-SSS outcomes. However, because the SSS students were more disadvantaged than the comparison group, such results would be likely to be misleading. All of the statistics presented here are based on multivariate models in which student and institution characteristics (such as academic background, demographic characteristics, and student attitudes) are included to adjust for the differences between the two groups.

students tended to be more disadvantaged than non-SSS students (and possibly may also have differed in motivation as shown by their choice to participate), it is necessary to adjust for such characteristics anyway.

The dichotomous measures were examined using two different statistical techniques: (1) multivariate and logistic regression, and (2) hierarchical linear modeling.

Multivariate and Logistic Regressions

Exhibits 3-2 and 3-3 present the findings using the dichotomous approach, with exhibit 3-2 showing the regression coefficients or log-odds ratios, and exhibit 3-3 showing the estimated effects across all SSS students. In general, the exhibits show that the receipt of supplemental services was associated with improved student outcomes for every academic outcome but one (the one exception was retention at the same institution for students starting at two-year institutions). However, the findings were much more limited with regard to first-year SSS participation in particular. First-year SSS participation was associated with improvements in grade point averages and receipt of an associate's degree or higher among students at two-year institutions but not with improvements on any of the other outcome measures. Because the three measures of supplemental services are highly interrelated, it is possible that some of the effects of first-year SSS participation may be captured through the other variables. Also, the measure of services after the first year does include SSS services as well as non-SSS services, so any effect of SSS participation after the first year would be included within this more general measure of participation. The following improvements were identified as being associated with the receipt of supplemental services:

- **Grade point averages.** SSS students' cumulative GPAs over six years were increased from an estimated 2.11 (if they had received no supplemental services) to an actual 2.34, with 0.06 of that increase being associated with first-year SSS participation and the remainder with supplemental services received after the first year.

- **Total credits earned.** The total number of credits earned for six years was increased from an estimated mean of 53.5 credits (if no supplemental services were received) to an actual mean of 75.5. None of that increase could be specifically associated with first-year SSS participation.

- **Retention or baccalaureate degree completion.** SSS students were 12 to 18 percentage points more likely to be either still in college during the sixth year or to have received a baccalaureate degree than would be estimated if they had not received services. (However, no statistically significant improvements were found for retention or degree completion at the same institution for students starting at two-year institutions, possibly in part because of the reduced number of cases available for analysis.) For example, 22 percent are estimated to have remained at the same institution or completed a degree if they had not received supplemental services, compared with an actual 34 percent. None of the increases could be specifically associated with first-year SSS participation.

Exhibit 3-2. Regression coefficients concerning effects of SSS and non-SSS supplemental services, by outcome measure: Six-year outcomes after freshman entry in 1991–92

Outcome measure	SSS participation in first year	Non-SSS supplemental services	Services after the first year
Cumulative (six-year) GPA	0.063**	--	0.178**
Cumulative (six-year) credits earned	--	--	21.967**
Retention or degree completion (combined)[1]			
Same institution			
All institutions	--	--	2.271**
Four-year institutions only	--	--	2.523**
Two-year institutions only	--	--	--
Any institution			
All institutions	--	--	3.090**
Four-year institutions only	--	--	4.074**
Two-year institutions only	--	--	3.861**
Degree attainment[1]			
Bachelor's degree or higher	--	--	2.135**
Associate's degree or higher			
All institutions	--	--	1.814**
Two-year institutions only	--	1.603**	1.594*
Transfers from two-year to four-year institutions[1]	--	--	4.177**

-- Not statistically significant.

*p<.05. **p<.01. Only outcomes that were statistically significant at the 0.05 level are shown.

[1] For these measures, logistic regression was used, and the statistics shown are log-odds ratios. A student's probability or being retained (or of completing a degree) can be expressed as an odds (e.g., if the probability is 60 percent, the odds is 60/(100-60)=60/40=1.5). The odds ratio expresses the improvement in the probability that is associated with participation in SSS (e.g., if the odds ratio is 2, then doubling the odds of 1.5 would result in an odds of 3, which is equivalent to a probability of 75 percent (75/(100-75)=75/25=3). A log-odds ratio that is less than 1 reflects a negative association between the receipt of supplemental services and the outcome indicated.

NOTE: This table presents only the findings when dichotomous measures of SSS participation were used. See other chapters for alternative models and alternative measures of SSS.

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit 3-3. Estimated effects of SSS and non-SSS supplemental services on SSS students, by outcome measure: Six-year outcomes after freshman entry in 1991–92

Outcome measure	Estimated outcome without supplemental services	Improvement associated with SSS participation in first year	Improvement associated with other services	Observed outcome
Cumulative (six-year) GPA	2.11	0.063	0.178	2.34
Cumulative (six-year) credits earned	53.52	--	21.967	75.49
Retention or degree completion (combined)				
Same institution				
All institutions	22%	--	12%	34%
Four-year institutions only	26%	--	16%	42%
Two-year institutions only	8%	--	0%	8%
Any institution				
All institutions	47%	--	16%	63%
Four-year institutions only	52%	--	18%	70%
Two-year institutions only	19%	--	16%	35%
Degree attainment				
Bachelor's degree or higher	28%	--	10%	38%
Associate's degree or higher				
All institutions	41%	--	8%	49%
Two-year institutions only	23%	7%	6%	36%
Transfers from two-year to four-year institutions	8%	--	11%	19%

--Not statistically significant. All effect estimates are based on regression coefficients that were statistically significant when using 0.05 as the required p-value.
NOTE: The separate estimates for the improvement associated with SSS participation and the improvement associated with other services may not sum to the total effect, due to the transformation used to estimate probabilities based on the logistic regression coefficients. This table presents only the findings when dichotomous measures of SSS participation were used. See other chapters for alternative models and alternative measures of SSS.
SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

- **Degree completion.** SSS students were 8 to 13 percentage points more likely to have received either a bachelor's degree or higher or associate's degree or higher than if they had not received supplemental services. For example, 28 percent are estimated to have received a bachelor's degree or higher if they had received no supplemental services, compared with 38 percent as the actual rate. None of the increases could be specifically associated with first-year SSS participation.

- **Transfers from two-year to four-year institutions.** The rate of transfer from two-year to four-year institutions was increased from an estimated 8 percent (if no services had been received) to an actual 19 percent. None of that increase was specifically associated with first-year SSS participation.

Because the three types of supplemental services are so highly interrelated when measured through dichotomous variables, it is difficult to differentiate among them. One cannot be confident either that the two findings of positive and statistically significant relationships with first-year participation measure

only SSS effects, or that the other measures exclude SSS effects. The safest conclusion is that supplemental services in general appear to be associated with improved student outcomes.

Hierarchical Linear Modeling

As discussed in chapter 2, the variance estimates for the statistics in exhibit 3-1 may be incorrect due to a failure to account for the nesting of students within institutions, possibly leading to incorrect conclusions about the statistical significance of the findings. To examine this possibility, the regressions in exhibit 3-2 were rerun using HLM. Exhibit 3-4 presents the regression coefficients from the HLM runs, and exhibit 3-5 presents the average estimated effect on the various academic outcomes.

Exhibit 3-4. HLM regression coefficients concerning effects of SSS and non-SSS supplemental services, by outcome six years after freshman entry in 1991–92

Outcome measure	SSS participation in first year	Non-SSS supplemental services	Services after the first year
Cumulative (six-year) GPA	--	--	0.177**
Cumulative (six-year) credits earned	--	--	22.206**
Retention or degree completion (combined)			
Same institution			
All institutions	--	--	0.151**
Four-year institutions only	--	--	0.198**
Two-year institutions only	--	--	--
Any institution			
All institutions	--	--	0.229**
Four-year institutions only	--	--	0.213**
Two-year institutions only	--	--	0.255**
Degree attainment			
Bachelor's degree or higher	--	--	0.128**
Associate's degree or higher			
All institutions	--	--	0.103*
Two-year institutions only	--	0.093*	--
Transfers from two-year to four-year institutions	--	--	0.212**

-- Not statistically significant.
*p<.05. **p<.01. Only outcomes that were statistically significant at the 0.05 level are shown.
NOTE: This table presents only the findings when dichotomous measures of SSS participation were used. See other chapters for alternative models and alternative measures of SSS.
SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit 3-5. Estimated effects of SSS and non-SSS supplemental services on SSS students, by outcome six years after freshman entry in 1991–92 (HLM analysis)

Outcome measure	Estimated outcome without supplemental services	Improvement associated with SSS participation	Improvement associated with other services	Observed outcome
Cumulative (six-year) GPA	2.20	--	0.136	2.34
Cumulative (six-year) credits earned	58.50	--	16.991	75.49
Retention or degree completion (combined)				
Same institution				
All institutions	22%	--	12%	34%
Four-year institutions only	26%	--	16%	42%
Two-year institutions only	8%	--	0%	8%
Any institution				
All institutions	45%	--	18%	63%
Four-year institutions only	53%	--	17%	70%
Two-year institutions only	19%	--	16%	35%
Degree attainment				
Bachelor's degree or higher	28%	--	10%	38%
Associate's degree or higher				
All institutions	41%	--	8%	49%
Two-year institutions only	28%	--	8%	36%
Transfers from two-year to four-year institutions	6%	--	13%	19%

--Not statistically significant. All effect estimates are based on regression coefficients that were statistically significant when using 0.05 as the required p-value.
NOTE: This table presents only the findings when dichotomous measures of SSS participation were used. See other chapters for alternative models and alternative measures of SSS.
SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

The HLM results indicate that no statistically significant improvements can specifically be associated with SSS participation on any of the student outcomes. Still, despite the lack of positive findings concerning SSS, the HLM results do indicate that supplemental services are associated with improved student outcomes: on two measures with regard to non-SSS services received in the first year (receiving an associate's degree, when measured either across all institutions or only among two-year institutions) and on 10 measures with regard to services received after the first year. Note, however, that because of the broadness of the dichotomous measures and the high degree to which they are interrelated, the findings should be interpreted as providing general support on the benefits of supplemental services rather than as indicating that one form of supplemental services is superior to another. Following are the specific estimates of the amount of improvement in outcomes that was associated with receiving supplemental services:

- **Grade point averages.** SSS students' cumulative GPAs over six years were increased from an estimated 2.20 (if they had received no supplemental services) to an actual 2.34. None of that increase could be specifically attributed to first-year participation in SSS.

- **Total credits earned.** The total number of credits earned for six years was increased from an estimated mean of 58.5 credits (if no supplemental services were received) to

an actual mean of 75.5. None of that increase could be specifically associated with first-year SSS participation.

- **Retention or baccalaureate degree completion.** SSS students were 12 to 18 percentage points more likely to be either still in college during the sixth year or to have received a baccalaureate degree than would be estimated if they had not received services. (The one exception is that no statistically significant improvements were found for retention or degree completion at the same institution for students starting at two-year institutions, possibly because of the reduced number of cases available for analysis.) For example, 22 percent are estimated to have remained at the same institution or completed a degree if they had not received supplemental services, compared with an actual 34 percent. None of the increases could be specifically attributed to first-year participation in SSS.

- **Degree completion.** SSS students were 8 to 10 percentage points more likely to have received either a bachelor's degree or higher or associate's degree or higher than if they had not received supplemental services. For example, 28 percent are estimated to have received a bachelor's degree or higher if they had received no supplemental services, compared with 38 percent as the actual rate. None of the increases were specifically associated with first-year SSS participation.

- **Transfers from two-year to four-year institutions.** The rate of transfer from two-year to four-year institutions was increased from an estimated 6 percent (if no services had been received) to an actual 19 percent. None of that increase was specifically associated with first-year SSS participation.

Summary

Though some minor differences appeared when using HLM rather than with multivariate and logistic regressions, both approaches largely produced similar results. The HLM results did not show positive and statistically significant associations between SSS participation and any of the 12 outcome measures, while the regression results showed such associations for only one of the 12 outcome measures. In general, the HLM estimates should be considered superior because they better account for the clustering of students within institutions. Both HLM and the regression results show positive and statistically significant associations for the same 11 academic outcomes when using general measures of supplemental services, and failed to show such associations for the remaining outcomes (i.e., retention or degree institution at the same institutions for students at two-year institutions only). The size of the estimated effect was highly similar using both approaches, with the total effect of all supplemental services typically varying by only 1 or 2 percentage points.

Both statistical approaches also present the same difficulty with regard to drawing conclusions about the effects of SSS. Because of the substantial overlap among students in receiving all three types of supplemental services (SSS services during the first year, non-SSS services received during the first year, and SSS or non-SSS services received during later years), some effects of SSS may be included within the measures of supplemental services. Also, the measure of services received after the first year (which is the measure that most consistently showed positive and statistically significant relationships) includes SSS services as well as non-SSS services. Thus, the results cannot properly be

interpreted as indicating that SSS services do not show any effect while other supplemental services do. Rather, the best interpretation based on these results is that supplemental services in general have a positive effect, and we need more precise measures that better differentiate among the various types of services in order to estimate the specific contribution of each.

4. Research Findings Based on Continuous Measures of Participation

Highlights of Findings

- Exhibit 4-1 summarizes the major results from the statistics presented in this chapter. There were consistent and statistically significant improvements in students' academic outcomes if they received supplemental services. Unlike when dichotomous measures of participation were used, academic improvements often were specifically associated with SSS participation. The HLM analysis, which better accounts for the clustering of students in institutions, showed effects on cumulative GPA, retention or degree completion at the same institution, retention or degree completion at any institution, and degree attainment.[21]

Exhibit 4-1. Summary of findings for each outcome using continuous measures of participation, by method used: Six-year outcomes after freshman entry in 1991–92

Outcome measure	Regressions			HLM		
	First-year services		Later services	First-year services		Later services
	SSS	Other		SSS	Other	
GPA	■	■	■	■	■	■
Credits	■	■	■	●	■	■
Retention or degree completion at the same institution						
All institutions	■		■	■		■
Four-year institutions	■	○	■	■	○	■
Two-year institutions	●		■	●	■	■
Retention or degree completion at any institution						
All institutions	■		■	■		■
Four-year institutions	■	■	■	■	●	■
Two-year institutions	■		■			■
Bachelor's degree or higher	■		■	●		■
Associate's degree or higher						
All institutions	●		■	●		■
Two-year institutions			■			■
Transfers to four-year institutions		●	■		●	■

■ Significant both with and without propensity scores; ● Significant only without propensity scores; ○ Significant only with propensity scores.

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

- Using the HLM estimates, the average total amount of improvement that could be associated with the receipt of supplemental services (from any source) ranged from 15 to 24 percentage points with regard to retention or degree completion across all institutions, 11 to 13 percentage points with regard to degree attainment across all institutions, 10 percentage points with regard to transfers from two-year to four-year

[21] All of the estimates concerning employment outcomes should be considered preliminary because the time period may have been too short to properly reflect the effect of education on employment.

institutions, GPA increases of 0.16 to 0.17 on a 4.0 scale, and an increase of 16 to 18 credits in the total credits earned over the six years.

- Using the HLM estimates, first-year participation in SSS was correlated with the following improvements in student outcomes: an increase of 0.02 to 0.04 in the cumulative GPA, and increases of 4 to 9 percentage points in the likelihood of either remaining in college or completing a baccalaureate degree or higher across all institutions combined. For degree attainment, the HLM models were split on whether or not first-year participation in SSS was related to improvements in outcomes: models that included propensity scores showed no effect, while models that excluded propensity scores show improvements of 1 to 2 percent in degree attainment across all institutions. First-year participation did not show any association with improvements in transfers from two-year to four-year institutions.

Introduction

Chapter 3 provided evidence that the receipt of supplemental services is associated with improved academic outcomes but at best only weak evidence concerning the effect of SSS. Still, the dichotomous measures of participation that were used in chapter 3 were not well designed to differentiate between SSS participation and the receipt of other supplemental services: once participation in supplemental services was known, no additional benefit could be found that was associated with participating in SSS services, perhaps because most or all of the SSS benefit was already captured through the other measures. In this chapter, the extent and nature of SSS participation are measured more precisely through the use of nine distinct measures of SSS services, each based on the number of hours of services received in that area. The nine types of SSS services examined are instructional courses that are specially designated for SSS students, professional tutoring, peer tutoring, professional counseling, peer counseling, labs, workshops, cultural events, and services for the disabled.

In addition, two dichotomous measures describing the SSS programs are also used: whether the programs were home-based, and whether the SSS services were blended with other services. Similarly, just as first-year SSS participation is modeled through multiple variables, the receipt of other supplemental services is also modeled through multiple variables, though in most cases (except for some of the measures of tutoring and counseling) participation is measured through a dichotomous variable rather than quantifying the extent of participation. The use of multiple, continuous measures of SSS participation has both advantages and disadvantages.

Advantages

- The use of multiple, continuous measures provides a better capacity than the original dichotomous measures to differentiate between SSS services and other supplemental services. For example, while 91 percent of the SSS students received services outside of SSS, the correlations would tend to be much lower if one related a particular SSS service to a particular non-SSS service. Thus, there is a greater potential for measuring the effects specifically of SSS services rather than of supplemental services in general.

- The resulting regression coefficients represent the improvements that are associated with specific services and thus provide a means of determining whether some services might especially be helpful.

- The statistical models are more realistic in that they take account of dosage, so that students who receive more services might be found to have different levels of improvement than students who receive few services.

Disadvantages

- It is more difficult to determine the average effects across all SSS students because there is no single summary measure of participation that applies to all students. Because no service was received universally by all SSS students, any particular regression coefficient applies only to a subset of SSS students rather than to all of them. Because a student may receive more than one service, determining the total effect may also require summing multiple effects from individual services. Further, the total effect also depends on the amount of services received, so the regression coefficient must be multiplied by the amount of services rather than directly providing the average benefit from receiving the service.

- Because the amount of services received is being modeled, there is the potential that confounding factors (such as motivation or academic neediness) may be associated with both the level of services and students' academic outcomes, possibly creating false associations between the receipt of services and student outcomes. To explore the importance of this possibility and to adjust the estimates appropriately, the statistical models were estimated both with and without the use of separate propensity measures that were created to measure students' likelihood of receiving services. In principle, the propensity measures should capture the importance of students' tendency to receive services, while the measures of participation would then only be associated with any additional change in student outcomes beyond that change that is associated with the propensity to receive services.

Limitations

- It continues to be important to statistically adjust for such factors as motivation and academic neediness. Because the SSS students tended to be more disadvantaged than non-SSS students (and possibly may also have differed in motivation as shown by their choice to participate), it is necessary to adjust for such characteristics even when propensity measures are added to the models.

- The estimates of the SSS effect shown here still may be underestimates because of a failure to account for the potential indirect effect of SSS through its effect on persistence after the second year. Though this is a greater issue when using the dichotomous measures in chapter 3 than with the more refined measures used here, it remains a risk.

Part of the structural design of this report is to use multiple research methodologies in order to allow readers to evaluate the implications of the various methodologies that might be applied. Thus, like chapter 3, this chapter presents the results of both multivariate and logistic regression, and

hierarchical linear modeling—which should provide the most accurate estimates because HLM is better able to account for the clustering of students within institutions. In addition to presenting these two methodological alternatives, this chapter presents the results both with and without propensity scores added to the model. Propensity scores are used here to estimate the number of hours of a particular type of service that a student would take if that option were available (i.e., if the student were in SSS and the service were offered at that institution).[22]

The purpose of including the propensity scores is to separate a student's general tendency to receive a service from the actual effect of that service, because the tendency itself could be correlated with student outcomes (e.g., a high level of motivation might be associated with improved student outcomes, and a high level of academic need might be associated with lower student outcomes). However, determining the value of including propensity scores is more difficult than determining the value of using HLM. Clearly it is necessary in some way to account for factors such as students' motivation and academic need, and otherwise the measures of participation may be conflated with these other factors. Still, it is arguable whether it is sufficient to adjust for these factors through the addition of variables measuring these student characteristics, or whether it is also necessary to adjust for these characteristics by adding propensity scores to the model. Both types of adjustments have similar purposes, so their simultaneous use may not be necessary. One reason for providing statistics both with and without propensity measures is to allow researchers to evaluate these changes to the statistical models.

Combining both of these methodological variations, the chapter is organized using the following structure, starting with the simplest models and advancing to the most complex:

- Multivariate and logistic regressions
  - Without propensity scores
  - With propensity scores
- Hierarchical linear modeling
  - Without propensity scores
  - With propensity scores

This chapter primarily seeks to describe the results for each of the four models, and compare how they are different, without coming to a conclusion about which approach provides the best estimates. A final synthesis of these results and those from chapter 3 is provided in chapter 5.

Multivariate and Logistic Regressions

This section presents the research results when using multivariate and logistic regressions. As indicated, multivariate and logistic regressions are here used in two ways: without the use of propensity scores, and with their use.

[22] Propensity scores are also discussed in chapter 2 as part of the discussion on research methodology.

Without propensity scores

Exhibits 4-2 and 4-3 present the findings using multiple measures of participation and no separate measures of propensity to receive services, with exhibit 4-2 showing the regression coefficients or log-odds ratios and exhibit 4-3, the estimated effects across all SSS students. To simplify the presentation of the effect estimates, and because ED's primary interest is in the net effect of SSS and other supplemental services, only the net effects are presented in exhibit 4-3. (One still can determine which particular first-year SSS services showed positive and statistically significant relationships by examining exhibit 4-2.)

These measures differ substantially in their performance from the dichotomous measures used in chapter 3 with regard both to finding effects of supplemental services in general (statistically significant improvements in performance appeared for all of the 12 measures, compared with 11 of the 12 measures in chapter 3) and especially the ability to differentiate SSS effects from general effects (separate first-year SSS effects appeared for 11 of the 12 measures, compared with 1 of the 12 when using the dichotomous measures). The improved performance of the SSS participation measures is consistent with the increased capacity to differentiate among the different types of services, while the dichotomous models had little ability to distinguish between SSS and non-SSS services.

The following improvements were identified as being associated with the receipt of supplemental services:

- **Grade point averages.** SSS students' cumulative GPAs over six years were increased from an estimated 2.09 (if they had received no supplemental services) to an actual 2.34, with 0.12 of that increase being associated with first-year SSS participation and the remainder with other supplemental services.

- **Total credits earned.** The total number of credits earned for six years was increased from an estimated mean of 56.7 credits (if no supplemental services were received) to an actual mean of 75.5. First-year SSS participation was associated with 2.6 credits of that increase, while the remainder was associated with the receipt of other supplemental services.

- **Retention or baccalaureate degree completion.** SSS students were 13 to 21 percentage points more likely (across all institutions) either to be still in college during the sixth year or to have received a baccalaureate degree than would be estimated if they had not received services. For example, 21 percent are estimated to have remained at the same institution or completed a degree if they had not received supplemental services, compared with an actual 34 percent. First-year SSS participation was associated with improvements of between 4 and 5 percentage points across all institutions.

- **Degree completion.** SSS students were 11 to 14 percentage points more likely (across all institutions) to have received either a bachelor's degree or higher or associate's degree or higher than if they had not received supplemental services. For example, 24 percent are estimated to have received a bachelor's degree or higher if they had received no supplemental services, compared with 38 percent as the actual

Exhibit 4-2. Regression coefficients concerning effects of SSS services using continuous measures of SSS participation and no measures of propensity to receive services, by outcome six years after freshman entry in 1991–92

Outcome measure	Instruc-tional courses	Profes-sional tutoring	Peer tutoring	Profes-sional counseling	Peer counseling	Labs	Workshops	Cultural events	Services for the disabled	Home-based	Blended
Cumulative (six-year) GPA	--	--	0.006**	-0.019**	--	--	--	--	--	0.159**	--
Cumulative (six-year) credits earned	--	--	0.281**	-1.176**	-4.581**	--	--	1.763**	--	--	--
Retention or degree completion (combined)[1]											
Same institution											
All institutions	--	--	--	0.929**	--	--	1.044*	--	1.048**	--	1.454**
Four-year institutions only	--	--	--	0.926**	--	--	1.044*	--	--	--	1.466**
Two-year institutions only	--	--	--	--	--	--	--	--	--	3.515*	--
Any institution											
All institutions	--	--	1.017**	--	--	--	--	--	--	--	1.649**
Four-year institutions only	--	--	1.025**	0.923**	--	--	--	--	--	--	1.581**
Two-year institutions only	--	--	--	--	--	--	--	--	--	3.641**	1.859*
Degree attainment[1]											
Bachelor's degree or higher	1.004*	--	1.018**	0.930**	--	0.945**	--	--	--	1.440**	--
Associate's degree or higher											
All institutions	1.003*	--	1.013**	0.941**	--	0.963**	--	--	--	--	--
Two-year institutions only	--	--	--	--	--	--	--	--	--	--	--
Transfers from two-year to four-year institutions[1]	--	--	--	--	--	--	--	--	--	--	--

-- Not statistically significant.

*p<.05. **p<.01. Only outcomes that were statistically significant at the 0.05 level are shown.

[1] For these measures, logistic regression was used, and the statistics shown are log-odds ratios. A student's probability or being retained (or of completing a degree) can be expressed as an odds (e.g., if the probability is 60 percent, the odds is 60/(100-60)=60/40=1.5). The odds ratio expresses the improvement in the probability that is associated with participation in SSS (e.g., if the odds ratio is 2, then doubling the odds of 1.5 would result in an odds of 3, which is equivalent to a probability of 75 percent (75/(100-75)=75/25=3). The estimated effect of SSS is based on observed retention rates at the same institution of 34 percent across all institutions, and 43 percent across two-year institutions.

NOTE: In order to present the results compactly, only those variables that showed statistically significant relationships (either positive or negative) are shown. The complete list of SSS services that were tested is instructional courses, professional tutoring, peer tutoring, professional counseling, peer counseling, labs, workshops, cultural events, and services for the disabled. This table presents only the findings when continuous measures of SSS participation were used. See chapter 2 and the summary in chapter 5 for the findings when using dichotomous measures of SSS.

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit 4-3. Estimated effects of SSS and non-SSS supplemental services on SSS students using continuous measures of SSS participation and no measures of propensity to receive services, by outcome six years after freshman entry in 1991–92

Outcome measure	Estimated outcome without supplemental services	Improvement associated with SSS participation in first year	Improvement associated with other services	Observed outcome
Cumulative (six-year) GPA	2.09	0.121	0.131	2.34
Cumulative (six-year) credits earned	56.72	2.601	16.170	75.49
Retention or degree completion (combined)				
Same institution				
All institutions	21%	4%	10%	34%
Four-year institutions only	25%	5%	12%	42%
Two-year institutions only	6%	1%	2%	8%
Any institution				
All institutions	42%	5%	18%	63%
Four-year institutions only	47%	5%	16%	70%
Two-year institutions only	19%	6%	11%	35%
Degree attainment				
Bachelor's degree or higher	24%	6%	3%	38%
Associate's degree or higher				
All institutions	38%	3%	8%	49%
Two-year institutions only	31%	0%	5%	36%
Transfers from two-year to four-year institutions	12%	0%	7%	19%

NOTE: The separate estimates for the improvement associated with SSS participation and the improvement associated with other services may not sum to the total effect, due to the transformation used to estimate probabilities based on the logistic regression coefficients. This table presents only the findings when continuous measures of SSS participation were used. See chapter 2 and the summary in chapter 5 for the findings when using dichotomous measures of SSS. All effect estimates are based on regression coefficients that were statistically significant when using 0.05 as the required p-value.

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

rate. First-year SSS participation was associated with an improvement of 6 percentage points with regard to completing a bachelor's degree or higher, 3 percentage points with regard to completing an associate's degree or higher at any institution, and no improvement with regard to completing an associate's degree or higher at two-year institutions.

- **Transfers from two-year to four-year institutions.** The rate of transfer from two-year to four-year institutions was increased from an estimated 12 percent (if no services had been received) to an actual 19 percent. None of that increase was specifically associated with first-year SSS participation.

With propensity scores

Repeating the same structure used previously, but now using models that include propensity scores, exhibits 4-4 and 4-5 present the findings using multiple measures of participation: Exhibit 4-4 shows the regression coefficients or log-odds ratios, and exhibit 4-5 shows the estimated effects across all SSS students. Like exhibits 4-2 and 4-3, these measures show more a more consistent association between the receipt of supplemental services and students outcomes than the dichotomous measures used in chapter 3, with regard both to finding effects of supplemental services in general (statistically significant improvements in performance appeared for all of the 12 measures, compared with 11 of the 12 measures in chapter 3) and the ability to differentiate SSS effects from general effects (separate first-year SSS effects appeared for 8 of the 12 measures, compared with 1 of the 12 when using the dichotomous measures). The results for first-year SSS participation were somewhat weaker with propensity scores than without them, with statistically significant improvements appearing for 8 of 12 measures (rather than 11 of 12), and fewer SSS services showing positive and statistically significant relationships with student outcomes.

The following improvements were identified as being associated with the receipt of supplemental services:

- **Grade point averages.** SSS students' cumulative GPAs over six years were increased from an estimated 2.05 (if they had received no supplemental services) to an actual 2.34, with 0.14 of that increase being associated with first-year SSS participation and the remainder with other supplemental services.

- **Total credits earned.** The total number of credits earned for six years was increased from an estimated mean of 57.0 credits (if no supplemental services were received) to an actual mean of 75.5. First-year SSS participation was associated with 2.4 credits of that increase, while the remainder was associated with the receipt of other supplemental services.

- **Retention or baccalaureate degree completion.** SSS students were 2 to 28 percentage points more likely either to be still in college during the sixth year or to have received a baccalaureate degree than would be estimated if they had not received services. For example, 18 percent are estimated to have remained at the same

Exhibit 4-4. Regression coefficients concerning the effects of SSS services using continuous measures of SSS participation and adding propensity scores, by outcome six years after freshman entry in 1991–92

Outcome measure	Instruc-tional courses	Profes-sional tutoring	Peer tutoring	Profes-sional counseling	Peer counseling	Labs	Workshops	Cultural events	Services for the disabled	Home-based	Blended
Cumulative (six-year) GPA	--	--	0.006**	-0.036**	-0.056*	--	--	--	--	0.195**	--
Cumulative (six-year) credits earned	--	--	0.366**	-1.864*	-4.098**	--	--	--	--	--	--
Retention or degree completion (combined)[1]											
Same institution											
All institutions	--	--	--	0.908*	--	--	--	--	--	1.558**	1.369**
Four-year institutions only	--	--	--	0.874*	--	--	--	--	--	1.687**	1.356*
Two-year institutions only	--	--	--	--	--	0.925*	--	--	--	--	--
Any institution											
All institutions	0.995*	--	--	--	--	--	--	--	--	1.657**	1.605**
Four-year institutions only	--	--	--	0.816**	--	--	--	--	--	1.860**	1.581**
Two-year institutions only	0.989*	--	--	--	--	--	--	--	--	2.822*	--
Degree attainment[1]											
Bachelor's degree or higher							--			1.655**	--
Associate's degree or higher											
All institutions	--	--	--	--	--	--	--	--	--	--	--
Two-year institutions only	--	--	--	--	--	--	--	--	--	--	--
Transfers from two-year to four-year institutions[1]	0.9834*	--	--	--	--	--	--	--	--	--	--

-- Not statistically significant.

*p<.05. **p<.01. Only outcomes that were statistically significant at the 0.05 level are shown.

[1] For these measures, logistic regression was used, and the statistics shown are log-odds ratios. A student's probability or being retained (or of completing a degree) can be expressed as an odds (e.g., if the probability is 60 percent, the odds is 60/(100-60)=60/40=1.5). The odds ratio expresses the improvement in the probability that is associated with participation in SSS (e.g., if the odds ratio is 2, then doubling the odds of 1.5 would result in an odds of 3, which is equivalent to a probability of 75 percent (75/(100-75)=75/25=3). A log-odds ratio that is less than 1 reflects a negative association between the receipt of supplemental services and the outcome indicated.

NOTE: In order to present the results compactly, only those variables that showed statistically significant relationships (either positive or negative) are shown. The complete list of SSS services that were tested is instructional courses, professional tutoring, peer tutoring, professional counseling, peer counseling, labs, workshops, cultural events, and services for the disabled. This table presents only the findings when continuous measures of SSS participation were used. See chapter 2 and the summary in chapter 5 for the findings when using dichotomous measures of SSS.

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit 4-5. Estimated effects of SSS and non-SSS supplemental services on SSS students using continuous measures of SSS participation and adding propensity scores, by outcome six years after freshman entry in 1991–92

Outcome measure	Estimated outcome without supplemental services	Improvement associated with SSS participation in first year	Improvement associated with other services	Observed outcome
Cumulative (six-year) GPA	2.05	0.143	0.144	2.34
Cumulative (six-year) credits earned	57.01	2.386	16.091	75.49
Retention or degree completion (combined)				
Same institution				
All institutions	18%	7%	9%	34%
Four-year institutions only	21%	9%	12%	42%
Two-year institutions only	6%	0%	2%	8%
Any institution				
All institutions	40%	8%	17%	63%
Four-year institutions only	42%	9%	16%	70%
Two-year institutions only	32%	2%	1%	35%
Degree attainment				
Bachelor's degree or higher	24%	5%	10%	38%
Associate's degree or higher				
All institutions	40%	0%	9%	49%
Two-year institutions only	29%	0%	7%	36%
Transfers from two-year to four-year institutions	11%	0%	8%	19%

NOTE: The separate estimates for the improvement associated with SSS participation and the improvement associated with other services may not sum to the total effect, due to the transformation used to estimate probabilities based on the logistic regression coefficients. This table presents only the findings when continuous measures of SSS participation were used. See chapter 2 and the summary in chapter 5 for the findings when using dichotomous measures of SSS. All effect estimates are based on regression coefficients that were statistically significant when using 0.05 as the required p-value.

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

institution or completed a degree if they had not received supplemental services, compared with an actual 34 percent. First-year SSS participation was associated with improvements of between 7 and 9 percentage points at four-year institutions and across all institutions, and of 0 to 2 percentage points at two-year institutions.

- **Degree completion.** SSS students were 7 to 14 percentage points more likely to have received either a bachelor's degree or higher or associate's degree or higher than if they had not received supplemental services. For example, 24 percent are estimated to have received a bachelor's degree or higher if they had received no supplemental services, compared with 38 percent as the actual rate. First-year SSS participation was associated with an improvement of 5 percentage points with regard to completing a bachelor's degree or higher, and no improvement with regard to completing an associate's degree or higher.

- **Transfers from two-year to four-year institutions.** The rate of transfer from two-year to four-year institutions was increased from an estimated 11 percent (if no services had been received) to an actual 19 percent. None of that increase was specifically associated with first-year SSS participation.

Hierarchical Linear Modeling

As suggested earlier, HLM is better designed to estimate variances than ordinary least squares regression when students are clustered within institutions. This section repeats the analysis in the previous section of the report, but using HLM.

Without propensity scores

Exhibit 4–6 presents the regression coefficients from the HLM runs when no propensity scores are included in the HLM models, and exhibit 4-7 presents the average estimated effects on the various academic outcomes. These results are quite similar to the results in the previous section of this chapter, though one outcome (retention or degree completion at any institution for students at two-year institutions) did not show statistically significant relationships with the receipt of SSS. However, the results were very unlike the HLM results in chapter 3, with first-year SSS participation showing positive and statistically significant associations with 9 of the 12 outcomes (compared with 0 of 12 when using the dichotomous models). The specific findings were as follows:

- **Grade point averages.** SSS students' cumulative GPAs over six years were increased from an estimated 2.17 (if they had received no supplemental services) to an actual 2.34. Of that increase, 0.04 was associated with first-year participation in SSS, and the remainder with the receipt of other supplemental services.

- **Total credits earned.** The total number of credits earned for six years was increased from an estimated mean of 56.3 credits (if no supplemental services were received) to an actual mean of 75.5. Three credits of the 19-credit increase were specifically associated with first-year SSS participation.

Exhibit 4–6. HLM regression coefficients concerning the effects of SSS services using continuous measures of SSS participation and no measures of propensity, by outcome six years after freshman entry in 1991–92

Outcome measure	Instruc-tional courses	Prof. tutoring	Peer tutoring	Prof. counseling	Peer counseling	Labs	Work-shops	Cultural events	Services for the disabled	Home-based	Blended
Cumulative (six-year) GPA	--	--	0.006**	-0.014*	--	--	--	--	--	--	--
Cumulative (six-year) credits earned	--	--	0.391**	-0.887*	--	--	--	1.476**	--	--	--
Retention or degree completion (combined)[1]											
Same institution											
All institutions	--	--	0.003**	-0.011**	--	--	--	--	0.006**	--	0.064*
Four-year institutions only	--	--	0.003**	-0.012**	--	--	--	--	--	--	0.074*
Two-year institutions only	--	-0.016**	--	--	--	--	--	--	0.009**	0.085*	0.058*
Any institution											
All institutions	--	--	0.003**	--	--	--	--	--	--	0.077**	0.065*
Four-year institutions only	--	--	0.003**	--	--	--	--	--	--	0.059*	0.069*
Two-year institutions only	--	--	--	--	--	--	--	-0.061**	--		--
Degree attainment[1]											
Bachelor's degree or higher	--	--	0.002**	-0.009*	--	--	--		--	--	--
Associate's degree or higher							--	--	--	--	--
All institutions	--	--	0.002*	-0.009*	--	-0.005**	--	--	--	--	--
Two-year institutions only	--	--	--	--	--	--	--		--	--	--
Transfers from two-year to four-year institutions[1]	--	--	--	--	--	--	-0.020*	-0.039*	--	--	--

-- Not statistically significant.
*p<.05. **p<.01. Only outcomes that were statistically significant at the 0.05 level are shown.
[1] For these measures, logistic regression was used, and the statistics shown are log-odds ratios. A student's probability or being retained (or of completing a degree) can be expressed as an odds (e.g., if the probability is 60 percent, the odds is 60/(100-60)=60/40=1.5). The odds ratio expresses the improvement in the probability that is associated with participation in SSS (e.g., if the odds ratio is 2, then doubling the odds of 1.5 would result in an odds of 3, which is equivalent to a probability of 75 percent (75/(100-75)=75/25=3). A log-odds ratio that is less than 1 reflects a negative association between the receipt of supplemental services and the outcome indicated.
NOTE: In order to present the results compactly, only those variables that showed statistically significant relationships (either positive or negative) are shown. The complete list of SSS services that were tested is instructional courses, professional tutoring, peer tutoring, professional counseling, peer counseling, labs, workshops, cultural events, and services for the disabled. This table presents only the findings when continuous measures of SSS participation were used. See chapter 2 and the summary in chapter 5 for the findings when using dichotomous measures of SSS.
SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit 4-7. Estimated effects of SSS and non-SSS supplemental services on SSS students when using continuous measures and no propensity scores, by outcome six years after freshman entry in 1991–92 (HLM analysis)

Outcome measure	Estimated outcome without supplemental services	Improvement associated with SSS participation in first year	Improvement associated with other services	Observed outcome
Cumulative (six-year) GPA	2.17	0.039	0.136	2.34
Cumulative (six-year) credits earned	56.32	3.191	15.978	75.49
Retention or degree completion (combined)				
Same institution				
All institutions	19%	5%	10%	34%
Four-year institutions only	24%	5%	13%	42%
Two-year institutions only	1%	4%	3%	8%
Any institution				
All institutions	39%	9%	15%	63%
Four-year institutions only	46%	9%	15%	70%
Two-year institutions only	24%	--	11%	35%
Degree attainment				
Bachelor's degree or higher	25%	2%	11%	38%
Associate's degree or higher				
All institutions	37%	1%	11%	49%
Two-year institutions only	28%	--	8%	36%
Transfers from two-year to four-year institutions	9%	--	10%	19%

--Not statistically significant. All effect estimates are based on regression coefficients that were statistically significant when using 0.05 as the required p-value.
NOTE: The separate estimates for the improvement associated with SSS participation and the improvement associated with other services may not sum to the total effect, due to the transformation used to estimate probabilities based on the logistic regression coefficients.
SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

- **Retention or baccalaureate degree completion.** Overall, SSS students were 15 to 24 percentage points more likely (across all institutions) either to be still in college during the sixth year or to have received a baccalaureate degree than would be estimated if they had not received services. For example, 19 percent are estimated to have remained at the same institution or completed a degree if they had not received supplemental services, compared with an actual 34 percent. Between 5 and 9 percentage points of the increases were associated with first-year participation in SSS.

- **Degree completion.** Overall, SSS students were 12 to 13 percentage points more likely (across all institutions) to have received either a bachelor's degree or higher or associate's degree or higher than if they had not received supplemental services. For example, 25 percent are estimated to have received a bachelor's degree or higher if they had received no supplemental services, compared with 38 percent as the actual rate. Between 1 and 2 percentage points of that increase were associated with first-year participation in SSS.

- **Transfers from two-year to four-year institutions.** The rate of transfer from two-year to four-year institutions was increased from an estimated 9 percent (if no services had been received) to an actual 19 percent. None of that increase was specifically associated with first-year SSS participation.

With propensity scores

Because of the potential that the level of participation in SSS might be confounded with factors such as motivation and academic need, the HLM models were also run with propensity scores included. Exhibit 4-8 presents the regression coefficients from the HLM runs, and exhibit 4-9 presents the average estimated effects on the various academic outcomes.

Similar to the regression results, the HLM results show that the receipt of supplemental services was associated with improved student outcomes for every academic outcome that was tested. However, the results were weaker with regard to outcomes that could specifically be associated with first-year SSS participation: there was an association between such participation and improved outcomes with regard to cumulative GPA, and retention or degree completion (at four-year institutions and at all institutions combined), but no SSS effect was identified with regard to degree attainment (if examined alone and not in combination with retention), transfers from two-year to four-year institutions, and retention or degree completion at two-year institutions. The results with regard to first-year SSS participation were also weaker when compared with the HLM models that did not use propensity measures: they showed positive and statistically significant relationships to only 5 of the 12 outcomes, compared with 11 of 12 when no propensity scores were included, and typically only one SSS measure achieved statistical significance per outcome, rather than up to three measures as shown in exhibit 4–6. Still, these results were stronger than when dichotomous measures of participation were used (in chapter 3), suggesting that the greater ability to differentiate among students was helpful in identifying the effects of services.

Exhibit 4-8. HLM regression coefficients concerning the effects of SSS services using continuous measures of SSS participation with propensity scores, by outcome six years after freshman entry in 1991–92

Outcome measure	Instruc-tional courses	Prof. tutoring	Peer tutoring	Prof. counseling	Peer counseling	Labs	Workshops	Cultural events	Services for the disabled	Home-based	Blended
Cumulative (six-year) GPA	--	--	--	--	--	0.010*	--	--	--	--	--
Cumulative (six-year) credits earned	--	--	--	--	--	--	--	--	--	--	--
Retention or degree completion (combined)[1]											
Same institution											
All institutions	--	--	--	--	--	--	--	--	--	0.063*	0.060*
Four-year institutions only	--	--	--	--	--	--	--	--	--	0.074*	--
Two-year institutions only	--	--	--	--	--	--	--	--	--	--	--
Any institution											
All institutions	--	--	--	--	--	--	--	--	--	0.077**	--
Four-year institutions only	--	--	--	--	--	--	--	--	--	0.072*	--
Two-year institutions only	--	--	--	--	--	--	--	--	--	--	--
Degree attainment[1]											
Bachelor's degree or higher	--	--	--	--	--	--	--	--	--	--	--
Associate's degree or higher											
All institutions	--	--	--	--	--	--	--	--	--	--	--
Two-year institutions only	--	--	--	--	--	--	--	--	--	--	--
Transfers from two-year to four-year institutions[1]	--	--	--	--	--	--	--	--	--	--	--

-- Not statistically significant.
*p<.05. **p<.01. Only outcomes that were statistically significant at the 0.05 level are shown.
[1] For these measures, logistic regression was used, and the statistics shown are log-odds ratios. A student's probability or being retained (or of completing a degree) can be expressed as an odds (e.g., if the probability is 60 percent, the odds is 60/(100-60)=60/40=1.5). The odds ratio expresses the improvement in the probability that is associated with participation in SSS (e.g., if the odds ratio is 2, then doubling the odds of 1.5 would result in an odds of 3, which is equivalent to a probability of 75 percent (75/(100-75)=75/25=3). A log-odds ratio that is less than 1 reflects a negative association between the receipt of supplemental services and the outcome indicated.
NOTE: In order to present the results compactly, only those variables that showed statistically significant relationships (either positive or negative) are shown. The complete list of SSS services that were tested is instructional courses, professional tutoring, peer tutoring, professional counseling, peer counseling, labs, workshops, cultural events, and services for the disabled. This table presents only the findings when continuous measures of SSS participation were used. See chapter 2 and the summary in chapter 5 for the findings when using dichotomous measures of SSS.
SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit 4-9. Estimated effects of SSS and non-SSS supplemental services on SSS students when using continuous measures and propensity scores, by outcome six years after freshman entry in 1991–92 (HLM analysis)

Outcome measure	Estimated outcome without supplemental services	Improvement associated with SSS participation in first year	Improvement associated with other services	Observed outcome
Cumulative (six-year) GPA	2.18	0.021	0.137	2.34
Cumulative (six-year) credits earned	59.22	0.0	16.265	75.49
Retention or degree completion (combined)				
Same institution				
All institutions	17%	6%	11%	34%
Four-year institutions only	24%	5%	13%	42%
Two-year institutions only	6%	0%	2%	8%
Any institution				
All institutions	44%	4%	15%	63%
Four-year institutions only	51%	4%	15%	70%
Two-year institutions only	24%	0%	11%	35%
Degree attainment				
Bachelor's degree or higher	27%	0%	11%	38%
Associate's degree or higher				
All institutions	38%	0%	11%	49%
Two-year institutions only	28%	0%	8%	36%
Transfers from two-year to four-year institutions	9%	0%	10%	19%

NOTE: The separate estimates for the improvement associated with SSS participation and the improvement associated with other services may not sum to the total effect, due to the transformation used to estimate probabilities based on the logistic regression coefficients. This table presents only the findings when continuous measures of SSS participation were used. See chapter 2 and the summary in chapter 5 for the findings when using dichotomous measures of SSS. All effect estimates are based on regression coefficients that were statistically significant when using 0.05 as the required p-value.

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Following are the specific estimates of the amount of improvement in outcomes that was associated with receiving supplemental services:

- **Grade point averages.** SSS students' cumulative GPAs over six years were increased from an estimated 2.18 (if they had received no supplemental services) to an actual 2.34. Of that increase, 0.02 was specifically associated with first-year participation in SSS.

- **Total credits earned.** The total number of credits earned for six years was increased from an estimated mean of 59.2 credits (if no supplemental services were received) to an actual mean of 75.5. None of that increase could be specifically associated with first-year SSS participation.

- **Retention or baccalaureate degree completion.** SSS students were 17 to 19 percentage points more likely (across all institutions) either to be still in college during the sixth year or to have received a baccalaureate degree than would be estimated if they had not received services. Between 4 and 6 percentage points of that increase was specifically associated with first-year SSS participation.

- **Degree completion.** SSS students were 8 to 11 percentage points more likely to have received either a bachelor's degree or higher or associate's degree or higher than if they had not received supplemental services. For example, 27 percent are estimated to have received a bachelor's degree or higher if they had received no supplemental services, compared with 38 percent as the actual rate. None of the increases were specifically associated with first-year SSS participation.

- **Transfers from two-year to four-year institutions.** The rate of transfer from two-year to four-year institutions was increased from an estimated 9 percent (if no services had been received) to an actual 19 percent. None of that increase was specifically associated with first-year SSS participation.

Types of Services

Because the measures of supplemental services in this chapter were tied to specific services, it is possible to examine whether some types of services were especially likely to be effective. Exhibit 4-10 shows which specific first-year SSS services were found to have positive effects for each outcome measure. Similarly, because the focus is on types of services, and a given type of service presumably could be effective whether offered through SSS or through other sources, exhibit 4-11 shows which other supplemental services were found to have positive effects for each outcome measure. For brevity, only those variables that were positive and statistically significant are shown.[23] Also for brevity, only the findings from the HLM analyses are included, because these models should have the most reliable standard errors and thus provide the best test of whether a service had a significant effect. However, because deciding whether or not to include propensity scores is a less straightforward decision, the exhibits cover both methodologies, and show whether the statistical significance was based on either or both methodologies.

[23] Statistical significance is based on the 0.05 level.

Some services stood out as being statistically significant both with and without the use of propensity scores:[24]

- Home-based SSS programs (for two outcome measures);
- Blended programs (for one outcome measure);
- College re-entrance counseling (for one outcome measure);
- Cultural enrichment (outside of SSS) in the first year (for two outcome measures) or cultural trips in later years (for 10 outcome measures);
- Referrals to resources in the first year (for one outcome measure);
- Counseling in 1993–94 (for 9 outcome measures), or in later years (for 11 outcome measures);
- Tutoring in 1992–93 (for one outcome measure) or 1993–94 (for 7 outcome measures); or
- Recent contacts with supplemental services (for 11 outcome measures).

A few other services were statistically significant either one way or the other, but not both:

Significant only without the use of propensity measures:

- SSS peer tutoring
- SSS cultural events in the first year
- SSS services for the disabled in the first year
- Non-SSS services in the first year for students with limited English ability

Significant only with the use of propensity measures:

- SSS labs in the first year
- Non-SSS services for the disabled in the first year

A few other patterns also are apparent in exhibits 4-10 and 4-11:

- Services received after the first year appear to be significantly related to long-term student outcomes much more frequently than services received in the first year.

- Among those services received in the first year, SSS services more frequently were statistically significant that non-SSS services.

[24] The counts provided here are the counts of outcome measures that showed statistical significance both with and without the use of propensity measures. In addition, some of the variables listed below also were significant for other outcome measures using only one approach (i.e., either with or without the use of propensity measures but not for both for the same outcome measure).

Exhibit 4-10. First-year SSS services that showed positive and statistically significant effects on student outcomes, by outcome six years after freshman entry in 1991–92

Outcome measure	Peer tutoring	Labs	Cultural events	Services for the disabled	Home-based	Blended
Cumulative (six-year) GPA	●	○				
Cumulative (six-year) credits earned	●		●			
Retention or degree completion (combined)						
Same institution						
All institutions	●			●	○	■
Four-year institutions only	●				○	●
Two-year institutions only				●	●	●
Any institution						
All institutions	●				■	●
Four-year institutions only	●				■	●
Two-year institutions only						
Degree attainment						
Bachelor's degree or higher	●					
Associate's degree or higher						
All institutions	●					
Two-year institutions only						
Transfers from two-year to four-year institutions						

■ Significant both with and without propensity scores; ● Significant only without propensity scores; ○ Significant only with propensity scores.

NOTE: Statistical significance is based on the 0.05 level. This table presents only the findings when continuous measures of SSS participation were used. See chapter 2 and the summary in chapter 5 for the findings when using dichotomous measures of SSS.

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit 4-11. Other supplemental services that showed positive and statistically significant effects on student outcomes, by outcome six years after freshman entry in 1991–92

Outcome measure	Non-SSS first-year services					Later-year services						
	Services for the disabled	Limited English ability	College re-entrance counseling	Cultural enrich-ment	Referrals to resources	Counsel-ing in 1992	Counsel-ing in 1993	Tutor-ing in 1992	Tutor-ing in 1993	Recent counsel-ing	Recent trip	Recent contact
Cumulative (six-year) GPA				■	■		■			■	■	■
Cumulative (six-year) credits earned				■			■	■	■	■	■	■
Retention or degree completion (combined)												
Same institution												
All institutions							■	○	■	■	■	■
Four-year institutions only	○						■		■	■	■	■
Two-year institutions only												■
Any institution												
All institutions							■		■	■	■	■
Four-year institutions only		●							■	■	■	■
Two-year institutions only			■						■	■	■	■
Degree attainment												
Bachelor's degree or higher							■			■	■	■
Associate's degree or higher												
All institutions							■			■	■	■
Two-year institutions only							■			■		■
Transfers from two-year to four-year institutions			●				■		■	■	■	

■ Significant both with and without propensity scores; ● Significant only without propensity scores; ○ Significant only with propensity scores;
NOTE: Statistical significance is based on the 0.05 level. This table presents only the findings when continuous measures of SSS participation were used. See chapter 2 and the summary in chapter 5 for the findings when using dichotomous measures of SSS.
SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

- SSS peer tutoring in the first year is unique among first-year services in reaching statistical significance for 8 of the 12 measures, although only when propensity scores were not used.

- Home-based and blended SSS programs were the other SSS characteristics that were statistically significant for more than two student outcomes.

Summary

All of the models considered in this chapter models showed statistically significant improvements for the 12 student outcomes if students had received supplemental services. The measures of SSS participation, which were limited to the first year, performed less well than many of the other measures of supplemental services. This is consistent with a general pattern that the relationships were stronger for services received after the first year than for first-year services. (Students' participation in SSS was not limited to the first year, but the data do not discriminate between SSS and non-SSS services after the first year.) Still, depending on the methodological approach that was used, between 5 and 10 student outcomes were positively related to first-year SSS participation.

The regression and HLM models differed primarily by the HLM models being less likely to show statistically significant relationships for first-year SSS participation: fewer outcomes showed such relationships, and fewer SSS services had positive and statistically significant coefficients. Fundamentally, however, the results were not greatly different. Perhaps the greatest difference was that the negative but statistically significant results that appeared in the regression models largely disappeared in the HLM models.

Much greater differences appeared when comparing the models with and without propensity measures. The models that excluded propensity measures showed a greater variety of first-year SSS services as being positive and statistically significant, and across a greater number of outcomes. In fact the models that included propensity measures primarily indicated the importance of home-based programs for selected student outcomes, rather than showing a mixture of services as affecting student outcomes.

5. Summary and Conclusions

This chapter compares the findings from the four types of approaches used in chapters 3 and 4 to determine which findings are consistently supported regardless of the approach, which findings depend on the particular approach being used, and the importance of the alternative methodological approaches. It then presents an overall conclusion about which findings (from our perspective) best describe the association between participation in SSS and student outcomes, and the implications of the findings for the SSS program.

Overview

The results varied depending on whether one focuses specifically on first-year SSS services or on supplemental services in general (exhibit 5-1). With regard to first-year SSS services, none of the 12 outcome measures showed consistent positive findings across all six methodologies. This was primarily due to the poor performance of the SSS measures when using the dichotomous measures of participation, because none of the dichotomous HLM models and only one of the dichotomous regression models showed positive effects from SSS. The poor performance of the dichotomous models was expected because of the weaknesses of the dichotomous measures of participation. The remaining four models showed consistent positive effects for five outcome measures, mixed results for five measures, and no significant effects for two measures. However, even the models using continuous measures of SSS participation performed less well with regard to first-year SSS participation than they did for supplemental services in general. This was most noticeable when the propensity scores were included, with the HLM findings showing positive effects for 5 of the 12 student outcomes and the regression results showing positive effects for 8 of the 12 outcomes. First-year SSS participation did better when the propensity scores were excluded (i.e., with positive outcomes for 9 of the 12 outcomes in the HLM results and 10 of the 12 outcomes in the regression results), though still less well than other supplemental services (11 of 12 outcomes). Also, though the differences were often small, the regression results tended to result in higher effects for SSS services than did the HLM results (13 times versus 5 times in which the HLM effects were greater).

Exhibit 5-1. Comparison of estimated effects of first-year SSS services using each of six methodologies: Six-year outcomes after freshman entry in 1991–92

Outcome measure	Dichotomous measures of services				Continuous measures of services								Six-year outcome
					No propensity scores				With propensity scores				
	Regressions		HLM		Regressions		HLM		Regressions		HLM		
	Start	Gain	Start	Gain	Start	Gain	Start	Gain	Start	Gain	Start	Gain	
Cumulative (six-year) GPA (A=4.0)	2.28	0.06	2.34	--	2.22	0.12	2.3	0.04	2.2	0.14	2.32	0.02	2.34
Cumulative (six-year) credits earned	75.49	--	75.49	--	72.89	2.60	72.3	3.19	73.1	2.39	75.49	--	75.49
Retention or degree completion (combined)													
Same institution													
All institutions	34%	--	34%	--	30%	4%	29%	5%	27%	7%	28%	6%	34%
Four-year institutions only	42%	--	42%	--	37%	5%	37%	5%	33%	9%	37%	5%	42%
Two-year institutions only	8%	--	8%	--	7%	1%	4%	4%	8%	--	8%	--	8%
Any institution													
All institutions	63%	--	63%	--	58%	5%	54%	9%	55%	8%	59%	4%	63%
Four-year institutions only	70%	--	70%	--	65%	5%	61%	9%	61%	9%	66%	4%	70%
Two-year institutions only	35%	--	35%	--	29%	6%	35%	--	33%	2%	35%	--	35%
Degree attainment													
Bachelor's degree or higher	38%	--	38%	--	32%	6%	36%	2%	33%	5%	38%	--	38%
Associate's degree or higher													
All institutions	49%	--	49%	--	46%	3%	48%	1%	49%	--	49%	--	49%
Two-year institutions only	36%	--	36%	--	36%	--	36%	--	36%	--	36%	--	36%
Transfers from two-year to four-year institutions	19%	--	19%	--	19%	--	19%	--	19%	--	19%	--	19%

-- Not statistically significant. All effect estimates are based on regression coefficients that were statistically significant when using 0.05 as the required p-value.

NOTE: The column labeled *start* shows the estimated outcome if the SSS students had not participated in SSS but had still received the same other supplemental services as in the study, while the gain shows the estimated improvement according to the statistical model that was used. Note that the starting level is a statistical estimate, calculated by subtracting the estimated improvement from the actual (six-year) outcome. For this reason, the starting level varies depending on the statistical model that was used. The six-year outcome is the mean outcome for all applicable SSS participants who were in the study, as measured through their transcripts and self-reports. For example, the mean six-year cumulative GPA among all SSS participants in the study was 2.34, and, among all SSS students in the study who started as freshmen in two-year institutions, 19 percent transferred to a four-year institution at some time during the six years of the study. Shaded cells indicate positive and statistically significant improvements in student outcomes.

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

The results were stronger and more consistent when looking at supplemental services in general (exhibit 5-2). Often the results were quite similar across all six alternative methodologies. For 11 outcomes, all six methodologies showed significant improvement in outcomes, while they were split on one outcome. For the only outcome for which there were mixed results, it was the dichotomous models that failed to find significant improvements, while the continuous models did find significant improvements. The effect estimates tended to fall within a small range and generally could not be considered as being significantly different from each other. Counting even the smallest differences in order to detect overall patterns, the HLM results produced higher estimates of effects 15 times and the regression results did so 14 times. The models that did not include propensity scores tended to produce higher estimates of effects slightly more often (10 times) than the models with propensity scores (eight times), but this difference is too small to be meaningful. The continuous measures producing higher estimates of effects 32 times and the dichotomous measures producing higher estimates 13 times.

When comparing exhibits 5-1 and 5-2, it is clear that there is a stronger case that supplemental services make a difference than that SSS services do. Several alternative explanations might be offered for such a difference.

- *Non-SSS services may be more effective.* However, there is no clear reason for such a difference. Since institutions need to submit plans for their SSS programs to win grants, and since the grants are awarded competitively, it seems likely that they are administered in a competent manner; if anything one might expect that they would perform better rather than doing more poorly than other supplemental services.

- *SSS services may be hindered by federal requirements for the programs.* Again, such an explanation is theoretically possible but seems premature without evidence of such hindrances, especially given that the programs have an extra source of funds (i.e., federal funding for SSS).

- *Later-year services may be more effective than first-year services, especially with regard to long-term outcomes.* This explanation seems more likely than the previous two, and in fact some researchers might be surprised to see first-year services still showing an effect in the sixth year. In fact, this could be a reason why SSS program characteristics (home-based programs, and blended programs) in some models seem to be more important than measures of specific first-year services; these general program characteristics may be acting as surrogates for SSS participation over multiple years.

- *The models may not be fully differentiating between SSS and non-SSS services, so that some of the effect of SSS services is captured through the alternative measures.*

    - One reason is that any SSS services received after the first year are included within the alternative measures (because of an inability to determine the source of the services), rather than being treated as SSS services. In fact, it is possible that because the comparison group was chosen to have comparable disadvantages as the SSS students, non-SSS students in the study may have qualified for and received SSS services in later years, so even the comparison group may have benefited from SSS services after the first year.

Exhibit 5-2. Comparison of estimated effects of supplemental services using each of six methodologies: Six-year outcomes after freshman entry in 1991–92

Outcome measure	Dichotomous measures of services				Continuous measures of services								Six-year outcome
					No propensity scores				With propensity scores				
	Regressions		HLM		Regressions		HLM		Regressions		HLM		
	Start	Gain	Start	Gain	Start	Gain	Start	Gain	Start	Gain	Start	Gain	
Cumulative (six-year) GPA (A=4.0)	2.11	0.23	2.20	0.14	2.09	0.25	2.17	0.17	2.05	0.29	2.18	0.16	2.34
Cumulative (six-year) credits earned	53.52	21.97	58.50	16.99	56.72	18.77	56.32	19.17	57.01	18.48	59.22	16.27	75.49
Retention or degree completion (combined)													
Same institution													
All institutions	22%	12%	22%	12%	21%	13%	19%	15%	18%	16%	17%	17%	34%
Four-year institutions only	26%	16%	26%	16%	25%	17%	24%	18%	21%	21%	24%	18%	42%
Two-year institutions only	8%	--	8%	--	6%	2%	1%	7%	6%	2%	6%	2%	8%
Any institution													
All institutions	47%	16%	45%	18%	42%	21%	39%	24%	40%	23%	44%	19%	63%
Four-year institutions only	52%	18%	53%	17%	47%	23%	46%	24%	42%	28%	51%	19%	70%
Two-year institutions only	19%	16%	19%	16%	19%	16%	24%	11%	22%	13%	24%	11%	35%
Degree attainment													
Bachelor's degree or higher	28%	10%	28%	10%	24%	14%	25%	13%	24%	14%	27%	11%	38%
Associate's degree or higher													
All institutions	41%	8%	41%	8%	38%	11%	37%	12%	40%	9%	38%	11%	49%
Two-year institutions only	23%	13%	28%	8%	31%	5%	28%	8%	29%	7%	28%	8%	36%
Transfers from two-year to four-year institutions	8%	11%	6%	13%	12%	7%	9%	10%	11%	8%	9%	10%	19%

-- Not statistically significant. All effect estimates are based on regression coefficients that were statistically significant when using 0.05 as the required p-value.

NOTE: The column labeled *start* shows the estimated outcome if the SSS students had not participated in supplemental services, while the gain shows the estimated improvement according to the statistical model that was used. Note that the starting level is a statistical estimate, calculated by subtracting the estimated improvement from the actual (six-year) outcome. For this reason, the starting level varies depending on the statistical model that was used. The six-year outcome is the mean outcome for all applicable SSS participants who were in the study, as measured through their transcripts and self-reports. For example, the mean six-year cumulative GPA among all SSS participants in the study was 2.34, and, among all SSS students in the study who started as freshmen in two-year institutions, 19 percent transferred to a four-year institution at some time during the six years of the study. Shaded cells indicate positive and statistically significant improvements in student outcomes.

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

- With the dichotomous models, the overlap between receiving SSS services and other services was so great that apparently little variation was left to explain after the other supplemental services had been modeled. Though the better differentiation between services with the use of multiple continuous measures should have lessened this problem (and in fact these models did show a greater effect for SSS when compared with the dichotomous models), it may not have eliminated it completely. It may be that the most critical question is whether a student is a recipient of a package of services, and that the measures of later-year services and first-year non-SSS services are largely sufficient to identify students receiving such packages. In that case, there may be little variation left to be explained by the first-year SSS variables.

- *The inclusion of a measure of whether students had attended school some time after the first year could result in underestimating the effect of SSS.* This danger was noted in chapter 2. However, the inclusion of this variable might have similar effects on the other measures of supplemental services, and thus it is not clear why this should result in weaker findings for SSS than for the other measures of supplemental services.

- *The use of propensity scores may have contributed to underestimating the effects of first-year SSS services*. In the models without propensity scores, the first-year SSS services were more likely to be significant than when the propensity scores were included, though they were still less likely to show significant relationships than some of the measures of recent services. This issue is discussed in greater detail later in this chapter.

Of all of these explanations, the third and fourth appear to provide the most credible explanations for the weaker findings concerning SSS than for supplemental services in general: later-year services may be more critical with regard to affecting long-term outcomes, or the models may be failing to fully differentiate between SSS and non-SSS services, so that some of the effect of SSS is captured through the other measures. The last explanation concerning the use of propensity scores might also help to partially explain the weaker findings for SSS, though it would not provide a complete explanation because the results were still somewhat weaker even when propensity scores were excluded.

Choosing Among the Six Models

Though the models are largely consistent in finding positive effects from supplemental services in general, and more limited positive effects from first-year SSS participation in particular, the differences in the models raise the question as to which estimates should be considered the most reliable.

- One part of the answer should be relatively straightforward: the HLM estimates should generally be considered to be superior to the regression estimates because HLM is better designed for accounting for the clustering of students within institutions. The greatest handicap of HLM is that no

accommodation was made for the fact that some outcome variables were dichotomous, because HLM did not converge to a solution when using this option. In this regard, it is reassuring that the logistic regressions (which did account for the limited dependent variables) often produced similar results.

- Choosing between the dichotomous measures and continuous measures may be more difficult. The advantage of the dichotomous measures is that one does not risk introducing other factors (such as academic need and motivation) that may be correlated with students' levels of participation. On the other hand, such a large proportion of SSS students also received supplemental services from other sources that the dichotomous models are likely to underestimate the effects of SSS and, instead, absorb some of that effect within the other measures of supplemental services. The continuous measures, through their greater level of detail, are better designed to discriminate between SSS and other services, while the inclusion of propensity scores or a variety of measures of student characteristics should help to statistically adjust for any bias associated with conflating participation with academic need or motivation. Thus, the continuous measures seem to be the best designed for measuring the effects of SSS.

- Perhaps the most difficult choice is the decision whether to include or not include propensity measures. The argument for including propensity measures is that students' level of involvement in SSS may be interrelated with factors such as motivation and academic need; thus, there is a risk that the statistical models might measure the importance of these factors with regard to student outcomes rather than giving accurate measures of the effects of SSS. The purpose of adding propensity measures is to model the likelihood of participation separately, so that the SSS participation measures will only capture the added benefit from participating in SSS, distinct from these other factors. This argument is an important one, and there clearly is a need to somehow account for the importance of these other factors. On the other hand, there are also arguments against the need for or benefit from using propensity measures.

    - Factors such as motivation and academic need are included in the statistical models in any case, and the regression equations should be better able to individually fit those variables when they are measured as multiple variables in the context of a particular student outcome, rather than through standardized formulas that are the same for every model.

    - While the propensity scores were derived individually (i.e., one score at a time), they are used in combination. The reason for using nine separate propensity measures is that participation in one service showed little relation to participation in another. On the other hand, when all nine are used together in a single model, they may interact in a way that might confuse the measurement process.

- If irrelevant variables are added to a regression correlation and they are correlated with other variables of importance, their inclusion may result in increased standard errors that may interfere with examining those other variables. The propensity scores do show a fairly high correlation with the measures of first-year SSS services (ranging from 0.22 for services for disabled students to 0.64 for peer tutoring), so this is a real possibility. The facts that peer tutoring especially had a high correlation and that the results for peer tutoring were the most sensitive to the inclusion of propensity scores (i.e., peer tutoring was the SSS variable that performed the best when propensity scores were excluded but that never was statistically significant when including propensity scores) are consistent with this explanation.

- As one test of whether the propensity scores belonged in the model, few if any of the propensity scores were statistically significant. For six of the 12 outcome measures, no propensity score was statistically significant, while one was significant for four outcome measures, two were significant for one outcome measures, and three were significant for one outcome measure. The propensity scores were retained under the principle that they were theoretically necessarily. However, an alternative approach is to consider the other measures of student characteristics as also adjusting for students' propensity to participate, in which case it would be reasonable to drop those propensity scores that were not significant. Exhibit 5-3 shows which SSS services would be considered to have positive and statistically significant effects in that case.

- The actual performance of the propensity measures is in some ways counterintuitive. The SSS variable that stood out most strongly was home-based programs, while the actual services generally were not statistically significant when propensity scores were included. Yet even if the organization of the programs is important, presumably the actual effect comes from the receipt of supplemental services; one would not expect a student who officially belonged to SSS but never received any SSS services to experience much benefit.[25] There is at least one possible explanation why the variable for home-based programs may be capturing all of the first-year effects: it is possible that it acts as a surrogate for receiving a full package of services (because one of the purposes of a home-based program is to see that students receive such a package), and that there is little or no extra benefit to be measured once the effect of the "package" is measured. Alternatively, the absence of significant results for individual services but not home-based programs could be

[25] It is possible that simply belonging to SSS may help to create some identification with the institution and with other students, so home-based services may provide some benefit that extends beyond the receipt of services. Still, it seems unlikely that all of the benefit from SSS is independent of the receipt of services.

considered as a sign that the statistical model was not performing well.

Weighing all these factors together, the best choice appears to be to include propensity scores only when they are statistically significant.

Policy Findings Concerning SSS

The single largest finding is that both supplemental services in general and first-year SSS services in particular have a positive effect on students' academic outcomes, though SSS effects were not detected for as many outcome measures as supplemental services in general. This section reviews which particular outcomes were affected by SSS or by supplemental services in general. It also examines what implications these findings have for how SSS might best be administered. More specifically, these findings involve the relative importance of specific SSS services and the importance of receiving services beyond the first year.

Exhibit 5-3. First-year SSS services that showed positive and statistically significant effects on student outcomes when only statistically significant propensity scores are retained, by outcomes six years after freshman entry in 1991–92

Outcome measure	Peer tutoring	Services for the disabled	Home-based	Blended
Cumulative (six-year) GPA	✓			
Cumulative (six-year) credits earned				
Retention or degree completion (combined)				
Same institution				
All institutions	✓	✓		✓
Four-year institutions only	✓			✓
Two-year institutions only		✓	✓	✓
Any institution				
All institutions			✓	
Four-year institutions only	✓		✓	✓
Two-year institutions only				
Degree attainment				
Bachelor's degree or higher				
Associate's degree or higher				
All institutions	✓			
two-year institutions only				
Transfers from two-year to four-year institutions				

✓ Statistically significant at 0.05 level.

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Types of outcomes affected by SSS. Based on the hypothesis that the HLM models with continuous measures of SSS services provide the most reliable measures of effect, and that propensity scores are used only when statistically significant, SSS appeared to have a positive effect on seven measures of student outcomes, while the remaining five outcomes showed no effect. However, supplemental services in general appeared to have positive effects on all 12 outcomes, providing some justification for inferring that SSS might be helpful in those areas as

well. Following are the complete findings, together with some speculations about why some outcome measures showed no SSS effects.

- **GPAs.** Both first-year SSS services and other supplemental services were shown to have a positive effect on students' cumulative GPAs.

- **Credits earned.** No effect from first-year SSS participation was found on the total credits earned, though other supplemental services did have an effect.

- **Retention or degree completion (combined measure).** First-year SSS participation had a positive effect on retention or degree completion for every measure but retention or degree completion at any institution (for two-year institutions only). Other supplemental services were found to have a positive effect for the remaining measure (as well as on the measures where first-year SSS participation showed a positive association with improved student outcomes).

- **Degree attainment (alone).** First-year SSS participation was positively related to earning an associate's degree or higher at all institutions but not to the other two measures of degree attainment. Supplemental services were found to have a positive effect on all three measures. Possibly the weaker findings for degree attainment alone as compared with degree attainment when combined with retention are because the six-year time span may not be adequate for many disadvantaged students to complete a degree. As shown in exhibit 2-4, 25 percent of SSS students were still in college though they had not yet attained a baccalaureate degree.

- **Transfers from two-year to four-year institutions.** No specific effect from first-year SSS participation was detected, though supplemental services were found to have a positive effect. All models that were limited only to two-year institutions tended to perform poorly, very likely due to the limited number of cases available for analysis.

The importance of specific SSS services. The specific SSS services that were found to have a positive effect were home-based programs, blended programs, peer tutoring, and services for the disabled. Other services that had a positive effect, and that may or may not have been offered through SSS, were counseling, field trips or cultural enrichment, referrals to outside resources, services for the disabled and for those with limited English ability, college reentrance counseling, and recent contacts with support services.

One should be wary of judging that any remaining services failed to have an effect. From a statistical viewpoint, the failure to find a statistically significant difference only means that the difference could have occurred by chance, but not that it did. Further, some of the findings, including the performance of the measures of home-based programs, referrals to other services, and recent contacts with support services, may suggest both that it is important that students receive a package of services and that the contributions of specific services may not appear independently but rather be incorporated within indicators that students received such a package.

The importance of services beyond the first year. As noted elsewhere, some of the services that most consistently were statistically significant were those received after the first year, and especially in the most recent years. No data are available on whether or not those services were offered through SSS. However, these findings suggest that SSS should not be viewed simply as a first-year program but that the continued provision of resources is an important tool in improving student outcomes.

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Appendix A: Detailed Tables

NOTE: This appendix provides the complete regression models used in the analysis. For brevity, because of the large number of models that were tested, only the results of the HLM analysis are shown (under the assumption that they provide more accurate estimates of the standard errors).

Exhibit A-1. HLM analysis to predict cumulative GPAs six years after freshman entry in 1991–92 using dichotomous measures of participation

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	2.4102	0.0246	98.0840	0.0000
Two-year institution	0.0695	0.0656	1.0600	0.2960
Doctorate-granting institution	-0.0721	0.0538	-1.3400	0.1870
Age in 1991	0.0273	0.0027	10.0700	0.0000
Black student	-0.3321	0.0354	-9.3730	0.0000
Hispanic student	-0.1301	0.0450	-2.8900	0.0040
American Indian student	-0.2584	0.0800	-3.2310	0.0020
Asian student	-0.0733	0.0577	-1.2720	0.2040
Female student	0.1410	0.0238	5.9170	0.0000
High school GPA	0.2944	0.0274	10.7410	0.0000
Percentile on SAT/ACT	0.2387	0.0558	4.2790	0.0000
Took any developmental course	-0.1558	0.0238	-6.5370	0.0000
Hours on school activities	0.0036	0.0006	6.1760	0.0000
Attended college after first year	0.6618	0.0577	11.4650	0.0000
No parental education beyond high school	0.0259	0.0203	1.2710	0.2040
Family income greater than $20,000	0.0248	0.0246	1.0110	0.3120
Above average academic ability	0.1408	0.0193	7.3030	0.0000
Would attend free tutoring	-0.0779	0.0255	-3.0520	0.0030
Have major concerns about ed. finances	-0.0375	0.0181	-2.0750	0.0380
Once I start something, I finish it	0.0467	0.0190	2.4540	0.0140
Feel comfortable on this campus	0.0597	0.0253	2.3590	0.0180
Participated in SSS in first year	0.0282	0.0339	0.8300	0.4110
Received non-SSS services in first year	0.0186	0.0292	0.6370	0.5240
Received services after first year	0.1775	0.0362	4.9060	0.0000
Missing data on student age	0.6446	0.0790	8.1570	0.0000
Missing data on student race	0.0432	0.0741	0.5840	0.5590
Missing data on high school GPA	0.7922	0.1186	6.6770	0.0000
Missing data on SAT/ACT	0.0259	0.0409	0.6330	0.5260
Missing data on developmental courses	-0.2461	0.0657	-3.7490	0.0000
Missing data for hours on school activities	0.1413	0.0425	3.3230	0.0010
Missing data on first generation	-0.0922	0.0576	-1.6000	0.1090
Missing data on income	-0.0362	0.0350	-1.0340	0.3020
Missing data on perceived ability	0.1391	0.1084	1.2830	0.2000
Missing data on attending free tutoring	-0.0864	0.1661	-0.5200	0.6020
Missing data on financial concerns	-0.0562	0.1084	-0.5190	0.6040
Missing data on finishing tasks	0.1792	0.1206	1.4850	0.1370
Missing data on comfort on campus	-0.1804	0.1848	-0.9760	0.3300
Missing data on services in later years	0.2412	0.0896	2.6920	0.0080

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit A-2. HLM analysis to predict the number of credits earned six years after freshman entry in 1991–92 using dichotomous measures of participation

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	76.1699	1.7481	43.5730	0.0000
Two-year institution	-20.0641	3.5524	-5.6480	0.0000
Doctorate-granting institution	4.5546	5.0934	0.8940	0.3760
Black student	-6.2885	1.4786	-4.2530	0.0000
Hispanic student	0.8139	1.8453	0.4410	0.6590
American Indian student	-18.5136	3.6791	-5.0320	0.0000
Asian student	5.1328	2.9719	1.7270	0.0840
Female student	3.1824	1.4458	2.2010	0.0280
Student was full-time	14.0263	3.1303	4.4810	0.0000
High school GPA	10.5841	1.4056	7.5300	0.0000
Percentile on SAT/ACT	10.0523	4.0474	2.4840	0.0130
Took any developmental course	-6.3317	1.6473	-3.8440	0.0000
Hours on school activities	0.2194	0.0381	5.7560	0.0000
Attended college after first year	41.0143	2.5731	15.9400	0.0000
No parental education beyond high school	-1.2227	1.2949	-0.9440	0.3450
Family income greater than $20,000	-1.7380	1.6204	-1.0730	0.2840
Above average academic ability	2.5914	1.4739	1.7580	0.0780
Have major concerns about ed. finances	-3.6605	1.3501	-2.7110	0.0070
Once I start something, I finish it	4.5540	1.4359	3.1720	0.0020
Feel comfortable on this campus	7.2484	1.9053	3.8040	0.0000
Participated in SSS in first year	3.6342	2.3208	1.5660	0.1170
Received non-SSS services in first year	0.6991	1.2667	0.5520	0.5810
Received services after first year	22.2065	1.9249	11.5360	0.0000
Missing data on student race	-2.2149	4.4667	-0.4960	0.6200
Missing data on full-time status	25.4795	7.2609	3.5090	0.0010
Missing data on high school GPA	29.2348	5.2492	5.5690	0.0000
Missing data on SAT/ACT	-2.3667	1.9763	-1.1980	0.2310
Missing data on developmental courses	-6.9558	4.8878	-1.4230	0.1550
Missing data for hours on school activities	6.0046	3.5506	1.6910	0.0900
Missing data on first generation	-3.2014	2.5629	-1.2490	0.2120
Missing data on income	-2.4127	1.7562	-1.3740	0.1700
Missing data on perceived ability	1.4748	5.2493	0.2810	0.7790
Missing data on financial concerns	-9.8968	4.4124	-2.2430	0.0250
Missing data on finishing tasks	9.5735	7.2156	1.3270	0.1850
Missing data on comfort on campus	-1.0909	8.4039	-0.1300	0.8970
Missing data on services in later years	1.7242	5.2594	0.3280	0.7430

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit A-3. HLM analysis to predict retention or baccalaureate degree completion at the same institution six years after freshman entry in 1991–92 using dichotomous measures of participation

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	0.3188	0.0111	28.6890	0.0000
Two-year institution	-0.2671	0.0254	-10.5100	0.0000
Doctorate-granting institution	0.0550	0.0290	1.8960	0.0640
Female student	0.0260	0.0138	1.8850	0.0590
Student was full time	0.0463	0.0260	1.7790	0.0750
High school GPA	0.0669	0.0129	5.1790	0.0000
Percentile on SAT/ACT	0.1297	0.0435	2.9840	0.0030
Took any developmental course	-0.0533	0.0160	-3.3360	0.0010
Hours on school activities	0.0010	0.0003	3.0730	0.0030
Attended college after first year	0.1462	0.0254	5.7620	0.0000
No parental education beyond high school	-0.0006	0.0145	-0.0390	0.9690
Family income greater than $20,000	-0.0196	0.0158	-1.2370	0.2160
Once I start something, I finish it	0.0313	0.0133	2.3520	0.0190
Feel comfortable on this campus	0.0622	0.0181	3.4380	0.0010
Participated in SSS in first year	0.0180	0.0222	0.8110	0.4170
Received non-SSS services in first year	-0.0071	0.0125	-0.5720	0.5670
Received services after first year	0.1505	0.0216	6.9710	0.0000
Missing data on full-time status	0.0886	0.0739	1.1990	0.2310
Missing data on high school GPA	0.2175	0.0454	4.7870	0.0000
Missing data on SAT/ACT	0.0209	0.0205	1.0190	0.3090
Missing data on developmental courses	-0.1219	0.0294	-4.1460	0.0000
Missing data for hours on school activities	0.0065	0.0309	0.2100	0.8340
Missing data on first generation	0.0146	0.0291	0.5020	0.6150
Missing data on income	-0.0233	0.0209	-1.1170	0.2650
Missing data on finishing tasks	0.0135	0.0850	0.1580	0.8750
Missing data on comfort on campus	-0.0003	0.0892	-0.0030	0.9970
Missing data on services in later years	0.0723	0.0386	1.8710	0.0610

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit A-4. HLM analysis to predict retention or baccalaureate degree completion at any institution six years after freshman entry in 1991–92 using dichotomous measures of participation

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	0.6187	0.0115	53.8190	0.0000
Two-year institution	-0.2134	0.0280	-7.6180	0.0000
Doctorate-granting institution	0.0485	0.0292	1.6600	0.1040
Black student	0.0211	0.0189	1.1210	0.2630
Hispanic student	0.0622	0.0237	2.6250	0.0090
American Indian student	-0.1069	0.0567	-1.8860	0.0590
Asian student	0.0967	0.0342	2.8250	0.0050
Female student	0.0453	0.0141	3.2080	0.0020
Newly married	-0.1065	0.0284	-3.7430	0.0000
High school GPA	0.0530	0.0121	4.3800	0.0000
Percentile on SAT/ACT	0.0876	0.0339	2.5810	0.0100
Took any developmental course	-0.0561	0.0146	-3.8470	0.0000
Hours on school activities	0.0012	0.0004	2.6610	0.0080
Attended college after first year	0.3285	0.0301	10.9110	0.0000
No parental education beyond high school	-0.0568	0.0146	-3.8940	0.0000
Family income greater than $20,000	0.0032	0.0152	0.2140	0.8310
Above average academic ability	0.0258	0.0139	1.8500	0.0640
Participated in SSS in first year	0.0202	0.0158	1.2760	0.2020
Received non-SSS services in first year	-0.0029	0.0160	-0.1800	0.8580
Received services after first year	0.2292	0.0228	10.0660	0.0000
Missing data on student race	0.0986	0.0526	1.8760	0.0600
Missing data on full-time status	-0.0258	0.0722	-0.3570	0.7210
Missing data on high school GPA	0.1514	0.0486	3.1150	0.0020
Missing data on SAT/ACT	-0.0438	0.0212	-2.0700	0.0380
Missing data on developmental courses	-0.0568	0.0333	-1.7070	0.0870
Missing data for hours on school activities	-0.0011	0.0408	-0.0270	0.9790
Missing data on first generation	-0.0522	0.0359	-1.4560	0.1450
Missing data on income	-0.0234	0.0229	-1.0200	0.3080
Missing data on perceived ability	0.0350	0.0587	0.5970	0.5500
Missing data on services in later years	0.0700	0.0511	1.3680	0.1710

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit A-5. HLM analysis to predict baccalaureate degree completion (or higher) at any institution six years after freshman entry in 1991–92 using dichotomous measures of participations

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	0.3988	0.0148	27.0210	0.0000
Two-year institution	-0.2272	0.0309	-7.3620	0.0000
Doctorate-granting institution	0.0654	0.0369	1.7700	0.0830
Black student	-0.0369	0.0241	-1.5300	0.1260
Hispanic student	0.0041	0.0221	0.1840	0.8540
American Indian student	-0.1613	0.0542	-2.9730	0.0030
Asian student	0.0929	0.0285	3.2660	0.0010
Female student	0.0309	0.0156	1.9750	0.0480
Live in college housing or frat./sorority	0.0703	0.0190	3.6990	0.0000
Student was full-time	0.0597	0.0272	2.2000	0.0280
Newly married	-0.0715	0.0298	-2.4000	0.0170
High school GPA	0.0962	0.0145	6.6330	0.0000
Percentile on SAT/ACT	0.1246	0.0315	3.9540	0.0000
Took any developmental course	-0.0904	0.0163	-5.5320	0.0000
Hours on school activities	0.0017	0.0005	3.1120	0.0020
Attended college after first year	0.1574	0.0335	4.7040	0.0000
No parental education beyond high school	-0.0256	0.0150	-1.7060	0.0880
Family income greater than $20,000	0.0203	0.0141	1.4320	0.1520
Above average academic ability	0.0419	0.0134	3.1360	0.0020
Have major concerns about ed. finances	-0.0398	0.0121	-3.2770	0.0010
Once I start something, I finish it	0.0541	0.0143	3.7860	0.0000
Participated in SSS in first year	0.0196	0.0197	0.9990	0.3180
Received non-SSS services in first year	0.0042	0.0132	0.3210	0.7480
Received services after first year	0.1279	0.0201	6.3780	0.0000
Missing data on student race	0.0485	0.0496	0.9780	0.3290
Missing data on college housing	0.0790	0.1173	0.6740	0.5000
Missing data on full-time status	0.0966	0.1388	0.6960	0.4860
Missing data on high school GPA	0.2809	0.0409	6.8670	0.0000
Missing data on SAT/ACT	-0.0233	0.0241	-0.9630	0.3360
Missing data on developmental courses	-0.1171	0.0321	-3.6470	0.0000
Missing data for hours on school activities	0.0329	0.0381	0.8640	0.3880
Missing data on first generation	-0.0459	0.0346	-1.3270	0.1850
Missing data on income	0.0159	0.0201	0.7910	0.4290
Missing data on perceived ability	0.0460	0.0555	0.8280	0.4080
Missing data on financial concerns	-0.1006	0.0486	-2.0700	0.0380
Missing data on finishing tasks	-0.0372	0.0612	-0.6080	0.5430
Missing data on services in later years	0.0800	0.0598	1.3390	0.1810

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit A-6. HLM analysis to predict associate's degree completion (or higher) at any institution six years after freshman entry in 1991–92 using dichotomous measures of participation

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	0.5401	0.0151	35.8150	0.0000
Two-year institution	-0.0412	0.0349	-1.1790	0.2450
Doctorate-granting institution	0.0445	0.0399	1.1160	0.2710
Black student	-0.0764	0.0280	-2.7240	0.0070
Hispanic student	-0.0499	0.0237	-2.1020	0.0350
American Indian student	-0.2518	0.0551	-4.5710	0.0000
Asian student	0.0282	0.0302	0.9320	0.3520
Live in college housing or frat./sorority	0.0534	0.0181	2.9440	0.0040
Student was full-time	0.0872	0.0308	2.8300	0.0050
High school GPA	0.1184	0.0157	7.5480	0.0000
Took any developmental course	-0.0960	0.0146	-6.5700	0.0000
Hours on school activities	0.0014	0.0006	2.4830	0.0130
Attended college after first year	0.3060	0.0388	7.8940	0.0000
No parental education beyond high school	-0.0217	0.0169	-1.2810	0.2000
Family income greater than $20,000	0.0190	0.0174	1.0890	0.2770
Above average academic ability	0.0451	0.0158	2.8530	0.0050
Have major concerns about ed. finances	-0.0357	0.0142	-2.5140	0.0120
Feel comfortable on this campus	0.0480	0.0206	2.3320	0.0200
Participated in SSS in first year	0.0005	0.0197	0.0230	0.9820
Received non-SSS services in first year	0.0207	0.0129	1.6030	0.1090
Received services after first year	0.1034	0.0248	4.1730	0.0000
Missing data on student race	-0.0175	0.0544	-0.3210	0.7480
Missing data on college housing	-0.0279	0.1464	-0.1900	0.8490
Missing data on full-time status	0.1408	0.1860	0.7570	0.4490
Missing data on high school GPA	0.3089	0.0597	5.1710	0.0000
Missing data on developmental courses	-0.1356	0.0384	-3.5270	0.0010
Missing data for hours on school activities	0.0219	0.0400	0.5490	0.5830
Missing data on first generation	-0.0665	0.0344	-1.9310	0.0530
Missing data on income	0.0147	0.0190	0.7730	0.4400
Missing data on perceived ability	0.0250	0.0721	0.3460	0.7290
Missing data on financial concerns	-0.0214	0.0899	-0.2380	0.8120
Missing data on comfort on campus	0.0387	0.0836	0.4620	0.6430
Missing data on services in later years	0.1240	0.0632	1.9630	0.0490

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit A-7. HLM analysis to predict transfers from two-year to four-year institutions using dichotomous measures six years after freshman entry in 1991–92 of participation

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	0.2124	0.0176	12.0660	0.0000
Female student	-0.0728	0.0261	-2.7880	0.0060
Live in college housing or frat./sorority	0.3242	0.0785	4.1290	0.0000
Newly married	-0.0960	0.0368	-2.6110	0.0090
High school GPA	0.0483	0.0181	2.6680	0.0080
Took any developmental course	-0.0789	0.0259	-3.0440	0.0030
Attended college after first year	0.0355	0.0358	0.9920	0.3220
No parental education beyond high school	-0.1133	0.0265	-4.2700	0.0000
Family income greater than $20,000	0.0160	0.0261	0.6120	0.5400
Expect harder time than most	-0.0531	0.0281	-1.8880	0.0590
Participated in SSS in first year	-0.0043	0.0284	-0.1530	0.8790
Received non-SSS services in first year	0.0410	0.0269	1.5270	0.1270
Received services after first year	0.2118	0.0311	6.8200	0.0000
Missing data on college housing	-0.0140	0.0926	-0.1510	0.8800
Missing data on high school GPA	0.0714	0.0696	1.0250	0.3060
Missing data on developmental courses	-0.1050	0.0613	-1.7120	0.0860
Missing data on first generation	-0.0707	0.0494	-1.4310	0.1520
Missing data on income	0.0122	0.0359	0.3390	0.7350
Missing data on expect harder time	-0.0348	0.0768	-0.4530	0.6500
Missing data on services in later years	-0.0149	0.0708	-0.2110	0.8330

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit A-8. HLM analysis to predict cumulative GPAs six years after freshman entry in 1991–92 using continuous measures of participation and no measures of propensity to receive services

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	2.4089	0.0248	97.1910	0.0000
SSS services are home-based	0.1215	0.0667	1.8220	0.0750
Two-year institution	0.1369	0.0623	2.1980	0.0340
Doctorate-granting institution	-0.0758	0.0653	-1.1600	0.2530
No SSS programs at institution	0.0371	0.0667	0.5570	0.5800
SSS services are blended	-0.0494	0.0687	-0.7190	0.4760
Age in 1991	0.0272	0.0020	13.9180	0.0000
Black student	-0.3281	0.0307	-10.7000	0.0000
Hispanic student	-0.1416	0.0393	-3.6030	0.0010
American Indian student	-0.2643	0.0880	-3.0050	0.0030
Asian student	-0.0551	0.0537	-1.0250	0.3060
Female student	0.1365	0.0219	6.2450	0.0000
High school GPA	0.2883	0.0194	14.8380	0.0000
Percentile on SAT/ACT	0.2148	0.0547	3.9230	0.0000
Took any developmental course	-0.1453	0.0235	-6.1770	0.0000
Hours on school activities	0.0034	0.0007	4.9680	0.0000
Attended college after first year	0.7027	0.0338	20.7800	0.0000
No parental education beyond high school	0.0243	0.0230	1.0560	0.2910
Family income greater than $20,000	0.0249	0.0239	1.0430	0.2980
Above average academic ability	0.1384	0.0219	6.3230	0.0000
Would attend free tutoring	-0.0824	0.0233	-3.5320	0.0010
Feel comfortable on this campus	0.0641	0.0266	2.4080	0.0160
Number of hours: instr. Courses	0.0003	0.0005	0.5550	0.5790
Number of hours: profl. tutoring	-0.0032	0.0090	-0.3570	0.7210
Number of hours: peer tutoring	0.0059	0.0013	4.5090	0.0000
Number of hours: profl. counseling	-0.0141	0.0057	-2.4650	0.0140
Number of hours: peer counseling	-0.0331	0.0217	-1.5240	0.1270
Number of hours: labs	0.0009	0.0024	0.3790	0.7040
Number of hours: workshops	0.0106	0.0062	1.7180	0.0850
Number of hours: cultural events	0.0086	0.0094	0.9060	0.3650
Number of hours: handicapped srvc.	0.0006	0.0034	0.1670	0.8670
Services for physically disabled	-0.0126	0.0353	-0.3560	0.7210
Services for limited-English ability	0.0121	0.0603	0.2000	0.8420
Student orientation	-0.0347	0.0295	-1.1750	0.2400
College reentrance counseling	-0.0521	0.0292	-1.7860	0.0740
Classroom instr.--basic skills	-0.0523	0.0358	-1.4610	0.1440
Classroom instr.--dvlpmntl. English	0.0038	0.0408	0.0940	0.9260
Classroom instr.--dvlpmntl. math	0.0086	0.0361	0.2370	0.8130
Cultural enrichment activities	0.0118	0.0053	2.2050	0.0270
Referrals to agencies/resources	0.0649	0.0286	2.2720	0.0230
# of counseling sessions in 1991–92	-0.0042	0.0027	-1.5520	0.1200

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# of counseling sessions in 1992–93	0.0002	0.0027	0.0870	0.9310
# of counseling sessions in 1993–94	0.0076	0.0027	2.8290	0.0050
# of tutoring sessions in 1991–92	-0.0002	0.0016	-0.1480	0.8830
# of tutoring sessions in 1992–93	-0.0005	0.0017	-0.3010	0.7630
# of tutoring sessions in 1993–94	0.0013	0.0019	0.6960	0.4860
Some tutoring in years 4–6	-0.0116	0.0034	-3.3910	0.0010
Some counseling in years 4–6	0.0111	0.0037	2.9710	0.0030
Some services for disabled in years 4–6	-0.0637	0.0555	-1.1490	0.2510
Field trip in years 4–6	0.1254	0.0265	4.7270	0.0000
Contact with support services in years 4–6	0.0164	0.0031	5.3740	0.0000
Missing data on student age	0.5991	0.0855	7.0050	0.0000
Missing data on student race	0.0296	0.0856	0.3460	0.7290
Missing data on high school GPA	0.7650	0.0791	9.6740	0.0000
Missing data on SAT/ACT	0.0356	0.0348	1.0230	0.3070
Missing data on developmental courses	-0.1948	0.0809	-2.4080	0.0160
Missing data for hours on school activities	0.1400	0.0581	2.4080	0.0160
Missing data on first generation	-0.0917	0.0516	-1.7760	0.0750
Missing data on income	-0.0212	0.0355	-0.5990	0.5490
Missing data on perceived ability	0.1268	0.1051	1.2060	0.2280
Missing data on attending free tutoring	0.0243	0.1935	0.1250	0.9010
Missing data on comfort on campus	-0.2178	0.1928	-1.1290	0.2590
Missing data on services in later years	0.2291	0.0686	3.3380	0.0010
Missing data on services for limited-English	-0.1189	0.4893	-0.2430	0.8080
Missing data on student orientation	-0.1051	0.1237	-0.8490	0.3960
Missing data on re-entrance counseling	0.1733	0.0712	2.4350	0.0150
Missing data on classroom instr.--basic skills	-0.1131	0.1043	-1.0850	0.2790
Missing data on cultural enrichment activities	-0.2931	0.2373	-1.2350	0.2170
Missing data on referrals to agencies/resources	0.5182	0.5420	0.9560	0.3390
Missing data on tutoring in 1991–92	-0.0611	0.0753	-0.8110	0.4180
Missing data on tutoring in years 4–6	-0.0929	0.1311	-0.7090	0.4780
Missing data on counseling in years 4–6	-0.0660	0.0882	-0.7490	0.4540
Missing data on services for disabled in years 4–6	-0.0711	0.1298	-0.5480	0.5830
Missing data on field trip in years 4–6	0.4276	0.1805	2.3700	0.0180
Missing data on contact with support services in yrs. 4–6	-0.2436	0.1759	-1.3850	0.1660

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit A-9. HLM analysis to predict the number of credits earned six years after freshman entry in 1991–92 using continuous measures of participation and no measures of propensity to receive services

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	76.1473	1.7824	42.7210	0.0000
SSS services are home-based	4.5830	4.8039	0.9540	0.3460
Two-year institution	-14.5154	4.4250	-3.2800	0.0020
Doctorate-granting institution	4.1163	4.7266	0.8710	0.3890
No SSS programs at institution	3.1919	4.7665	0.6700	0.5070
SSS services are blended	-2.5910	4.9978	-0.5180	0.6060
Black student	-6.3235	1.7780	-3.5560	0.0010
Hispanic student	-1.3367	2.2859	-0.5850	0.5580
American Indian student	-18.8912	5.1443	-3.6720	0.0000
Asian student	6.4593	3.0902	2.0900	0.0360
Female student	3.9224	1.2552	3.1250	0.0020
Student was full-time	13.7099	2.2520	6.0880	0.0000
High school GPA	10.2556	1.1129	9.2150	0.0000
Percentile on SAT/ACT	11.3196	3.1250	3.6220	0.0010
Took any developmental course	-6.0028	1.3548	-4.4310	0.0000
Hours on school activities	0.1716	0.0395	4.3460	0.0000
Attended college after first year	43.7484	1.9238	22.7410	0.0000
No parental education beyond high school	-0.7331	1.3206	-0.5550	0.5780
Family income greater than $20,000	-1.8817	1.3812	-1.3620	0.1730
Have major concerns about ed. finances	-4.1052	1.2510	-3.2820	0.0010
Once I start something, I finish it	3.6691	1.4058	2.6100	0.0090
Feel comfortable on this campus	6.8203	1.5466	4.4100	0.0000
Number of hours: instr. courses	0.0514	0.0278	1.8520	0.0640
Number of hours: profl. tutoring	-0.3803	0.5231	-0.7270	0.4670
Number of hours: peer tutoring	0.3910	0.0758	5.1580	0.0000
Number of hours: profl. counseling	-0.8865	0.3333	-2.6600	0.0080
Number of hours: peer counseling	-0.6247	1.2633	-0.4940	0.6210
Number of hours: labs	-0.0248	0.1371	-0.1810	0.8570
Number of hours: workshops	0.0276	0.3594	0.0770	0.9390
Number of hours: cultural events	1.4762	0.5487	2.6910	0.0080
Number of hours: handicapped srvc.	0.1528	0.1954	0.7820	0.4340
Services for physically disabled	1.5046	2.0381	0.7380	0.4600
Services for limited-English ability	0.3152	3.4657	0.0910	0.9280
Student orientation	-0.3259	1.7005	-0.1920	0.8480
College reentrance counseling	-4.2336	1.6798	-2.5200	0.0120
Classroom instr.--basic skills	-5.0660	2.0673	-2.4500	0.0140
Classroom instr.--dvlpmntl. English	1.2470	2.3485	0.5310	0.5950
Classroom instr.--dvlpmntl. math	-1.6766	2.0798	-0.8060	0.4200
Cultural enrichment activities	0.6065	0.3078	1.9700	0.0480
Referrals to agencies/resources	-1.7362	1.6520	-1.0510	0.2940
# of counseling sessions in 1991–92	-0.1195	0.1567	-0.7620	0.4460

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# of counseling sessions in 1992–93	0.0498	0.1554	0.3200	0.7480
# of counseling sessions in 1993–94	0.4968	0.1562	3.1810	0.0020
# of tutoring sessions in 1991–92	-0.1099	0.0927	-1.1850	0.2360
# of tutoring sessions in 1992–93	0.4678	0.0980	4.7740	0.0000
# of tutoring sessions in 1993–94	0.3040	0.1106	2.7480	0.0060
Some tutoring in years 4–6	0.0091	0.1977	0.0460	0.9640
Some counseling in years 4–6	1.4312	0.2165	6.6100	0.0000
Some services for disabled in years 4–6	-12.2753	3.2296	-3.8010	0.0000
Field trip in years 4–6	12.9644	1.5348	8.4470	0.0000
Contact with support services in years 4–6	2.1192	0.1768	11.9850	0.0000
Missing data on student race	-3.9126	4.9972	-0.7830	0.4340
Missing data on full-time status	20.6079	7.1663	2.8760	0.0040
Missing data on high school GPA	26.7383	4.5542	5.8710	0.0000
Missing data on SAT/ACT	0.2429	1.9648	0.1240	0.9020
Missing data on developmental courses	-2.6660	4.6790	-0.5700	0.5680
Missing data for hours on school activities	5.3797	3.5652	1.5090	0.1310
Missing data on first generation	-2.2715	3.0565	-0.7430	0.4570
Missing data on income	-1.8068	2.0460	-0.8830	0.3770
Missing data on perceived ability	1.6111	6.1057	0.2640	0.7920
Missing data on financial concerns	-8.8075	5.6964	-1.5460	0.1220
Missing data on finishing tasks	9.3706	6.0911	1.5380	0.1240
Missing data on comfort on campus	-5.2128	7.5539	-0.6900	0.4900
Missing data on B32	-1.6215	3.9603	-0.4090	0.6820
Missing data on services for limited-English	-20.8979	28.1960	-0.7410	0.4590
Missing data on student orientation	0.8228	7.1110	0.1160	0.9080
Missing data on reentrance counseling	-1.0399	4.1092	-0.2530	0.8000
Missing data on classroom instr.--basic skills	7.7590	5.8813	1.3190	0.1870
Missing data on cultural enrichment activities	-29.4697	13.6924	-2.1520	0.0310
Missing data on referrals to agencies/resources	45.3459	31.2358	1.4520	0.1470
Missing data on tutoring in 1991–92	-3.0130	4.3513	-0.6920	0.4880
Missing data on tutoring in years 4–6	-0.0991	7.6381	-0.0130	0.9900
Missing data on counseling in years 4–6	-5.3820	5.0868	-1.0580	0.2910
Missing data on services for disabled in years 4–6	-8.6346	7.5275	-1.1470	0.2520
Missing data on field trip in years 4–6	7.6529	10.6411	0.7190	0.4720
Missing data on contact with support services in yrs. 4–6	6.0809	10.3418	0.5880	0.5560

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit A-10. HLM analysis to predict retention or baccalaureate degree completion at the same institution six years after freshman entry in 1991–92 using continuous measures of participation and no measures of propensity to receive services

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	0.3184	0.0109	29.2890	0.0000
SSS services are home-based	0.0545	0.0291	1.8760	0.0670
Two-year institution	-0.2288	0.0279	-8.2000	0.0000
Doctorate-granting institution	0.0433	0.0284	1.5240	0.1350
No SSS programs at institution	0.0561	0.0297	1.8900	0.0650
SSS services are blended	0.0692	0.0292	2.3730	0.0230
Female student	0.0295	0.0128	2.3050	0.0210
High school GPA	0.0620	0.0111	5.6070	0.0000
Percentile on SAT/ACT	0.1309	0.0314	4.1620	0.0000
Took any developmental course	-0.0511	0.0139	-3.6810	0.0000
Attended college after first year	0.1635	0.0197	8.3030	0.0000
No parental education beyond high school	0.0029	0.0135	0.2160	0.8290
Family income greater than $20,000	-0.0198	0.0139	-1.4250	0.1540
Feel comfortable on this campus	0.0630	0.0156	4.0250	0.0000
Number of hours: instr. courses	0.0003	0.0003	1.0160	0.3100
Number of hours: profl. tutoring	-0.0021	0.0053	-0.3960	0.6920
Number of hours: peer tutoring	0.0026	0.0008	3.3280	0.0010
Number of hours: profl. counseling	-0.0109	0.0034	-3.2410	0.0020
Number of hours: peer counseling	-0.0009	0.0127	-0.0730	0.9420
Number of hours: labs	0.0003	0.0014	0.2480	0.8050
Number of hours: workshops	0.0051	0.0036	1.4090	0.1590
Number of hours: cultural events	0.0029	0.0055	0.5180	0.6040
Number of hours: handicapped srvc.	0.0058	0.0020	2.8930	0.0040
Services for physically disabled	0.0343	0.0209	1.6410	0.1000
Services for limited-English ability	0.0266	0.0353	0.7550	0.4500
Student orientation	0.0127	0.0173	0.7330	0.4640
College reentrance counseling	-0.0184	0.0172	-1.0680	0.2860
Classroom instr.--basic skills	-0.0190	0.0213	-0.8940	0.3720
Classroom instr.--dvlpmntl. English	0.0032	0.0241	0.1320	0.8960
Classroom instr.--dvlpmntl. math	-0.0048	0.0214	-0.2250	0.8220
Cultural enrichment activities	-0.0022	0.0032	-0.7050	0.4810
Referrals to agencies/resources	-0.0198	0.0169	-1.1750	0.2400
# of counseling sessions in 1991–92	-0.0022	0.0016	-1.4050	0.1600
# of counseling sessions in 1992–93	-0.0005	0.0016	-0.2880	0.7730
# of counseling sessions in 1993–94	0.0036	0.0016	2.2370	0.0250
# of tutoring sessions in 1991–92	-0.0010	0.0009	-1.0520	0.2930
# of tutoring sessions in 1992–93	0.0017	0.0010	1.7350	0.0820
# of tutoring sessions in 1993–94	0.0025	0.0011	2.1610	0.0300
Some tutoring in years 4–6	0.0015	0.0020	0.7350	0.4620
Some counseling in years 4–6	0.0113	0.0022	5.0640	0.0000

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Some services for disabled in years 4–6	-0.0735	0.0327	-2.2450	0.0250
Field trip in years 4–6	0.0740	0.0158	4.6990	0.0000
Contact with support services in years 4–6	0.0177	0.0018	9.7580	0.0000
Missing data on high school GPA	0.1997	0.0449	4.4490	0.0000
Missing data on SAT/ACT	0.0361	0.0197	1.8270	0.0670
Missing data on developmental courses	-0.1330	0.0479	-2.7750	0.0060
Missing data for hours on school activities	-0.0070	0.0318	-0.2200	0.8260
Missing data on first generation	0.0206	0.0297	0.6930	0.4880
Missing data on income	-0.0148	0.0207	-0.7160	0.4740
Missing data on comfort on campus	-0.0059	0.0514	-0.1150	0.9090
Missing data on services in later years	0.0615	0.0406	1.5150	0.1290
Missing data on services for limited-English	-0.4768	0.2914	-1.6370	0.1010
Missing data on student orientation	0.0104	0.0714	0.1450	0.8850
Missing data on reentrance counseling	0.0076	0.0416	0.1820	0.8560
Missing data on classroom instr.--basic skills	0.0391	0.0601	0.6510	0.5150
Missing data on cultural enrichment activities	0.2479	0.1411	1.7570	0.0790
Missing data on referrals to agencies/resources	0.1910	0.3226	0.5920	0.5540
Missing data on tutoring in 1991–92	0.0173	0.0447	0.3870	0.6990
Missing data on tutoring in years 4–6	-0.0060	0.0766	-0.0780	0.9380
Missing data on counseling in years 4–6	-0.0510	0.0523	-0.9760	0.3300
Missing data on services for disabled in years 4–6	-0.0059	0.0772	-0.0770	0.9390
Missing data on field trip in years 4–6	0.0540	0.1070	0.5050	0.6130
Missing data on contact with support services in yrs. 4–6	0.0102	0.1045	0.0970	0.9230

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit A-11. HLM analysis to predict retention or baccalaureate degree completion at any institution six years after freshman entry in 1991–92 using continuous measures of participation and no measures of propensity to receive services

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	0.6167	0.0101	61.2400	0.0000
SSS services are home-based	0.0766	0.0269	2.8420	0.0070
Two-year institution	-0.1518	0.0262	-5.7910	0.0000
Doctorate-granting institution	0.0323	0.0259	1.2470	0.2200
No SSS programs at institution	0.0701	0.0276	2.5370	0.0150
SSS services are blended	0.0647	0.0266	2.4300	0.0200
Female student	0.0463	0.0131	3.5450	0.0010
High school GPA	0.0459	0.0114	4.0430	0.0000
Percentile on SAT/ACT	0.0827	0.0317	2.6110	0.0090
Took any developmental course	-0.0526	0.0138	-3.8160	0.0000
Hours on school activities	0.0005	0.0004	1.2350	0.2170
Attended college after first year	0.3491	0.0234	14.9450	0.0000
No parental education beyond high school	-0.0468	0.0136	-3.4370	0.0010
Family income greater than $20,000	0.0008	0.0141	0.0590	0.9530
Above average academic ability	0.0114	0.0130	0.8740	0.3820
Number of hours: instr. courses	-0.0002	0.0003	-0.8800	0.3790
Number of hours: profl. tutoring	-0.0026	0.0057	-0.4580	0.6470
Number of hours: peer tutoring	0.0029	0.0008	3.7890	0.0000
Number of hours: profl. counseling	-0.0015	0.0034	-0.4320	0.6650
Number of hours: peer counseling	-0.0083	0.0129	-0.6460	0.5180
Number of hours: labs	-0.0006	0.0014	-0.4640	0.6420
Number of hours: workshops	-0.0003	0.0036	-0.0860	0.9320
Number of hours: cultural events	-0.0014	0.0054	-0.2620	0.7930
Number of hours: handicapped srvc.	0.0017	0.0019	0.9320	0.3520
Services for physically disabled	-0.0141	0.0238	-0.5910	0.5540
Services for limited-English ability	0.0647	0.0370	1.7460	0.0800
Student orientation	0.0170	0.0177	0.9640	0.3350
College reentrance counseling	0.0052	0.0191	0.2730	0.7850
Classroom instr.--basic skills	-0.0068	0.0216	-0.3150	0.7530
Classroom instr.--dvlpmntl. English	-0.0237	0.0243	-0.9770	0.3290
Classroom instr.--dvlpmntl. math	-0.0137	0.0217	-0.6330	0.5270
Cultural enrichment activities	0.0030	0.0035	0.8450	0.3980
Referrals to agencies/resources	-0.0280	0.0170	-1.6440	0.1000
# of counseling sessions in 1991–92	-0.0032	0.0016	-1.9630	0.0490
# of counseling sessions in 1992–93	-0.0015	0.0015	-1.0020	0.3170
# of counseling sessions in 1993–94	0.0033	0.0015	2.1780	0.0290
# of tutoring sessions in 1991–92	-0.0011	0.0009	-1.1760	0.2400
# of tutoring sessions in 1992–93	0.0005	0.0010	0.5460	0.5850
# of tutoring sessions in 1993–94	0.0047	0.0011	4.1940	0.0000
Some tutoring in years 4–6	-0.0016	0.0019	-0.8310	0.4060

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Some counseling in years 4–6	0.0209	0.0021	10.0440	0.0000
Some services for disabled in years 4–6	-0.0308	0.0306	-1.0060	0.3150
Field trip in years 4–6	0.1337	0.0147	9.0900	0.0000
Contact with support services in years 4–6	0.0193	0.0017	11.3650	0.0000
Missing data on full-time status	0.0064	0.0662	0.0960	0.9240
Missing data on high school GPA	0.1174	0.0456	2.5760	0.0100
Missing data on SAT/ACT	-0.0267	0.0200	-1.3360	0.1820
Missing data on developmental courses	0.0302	0.0540	0.5590	0.5760
Missing data for hours on school activities	0.0017	0.0384	0.0450	0.9640
Missing data on first generation	-0.0338	0.0334	-1.0110	0.3130
Missing data on income	-0.0159	0.0214	-0.7430	0.4580
Missing data on perceived ability	0.0640	0.0563	1.1370	0.2560
Missing data on B32	-0.0522	0.0468	-1.1150	0.2650
Missing data on services for limited-English	-0.1851	0.2716	-0.6810	0.4950
Missing data on student orientation	0.0444	0.0743	0.5970	0.5500
Missing data on reentrance counseling	0.0125	0.0406	0.3070	0.7580
Missing data on classroom instr.--basic skills	-0.0182	0.0603	-0.3020	0.7630
Missing data on cultural enrichment activities	-0.2675	0.1320	-2.0260	0.0420
Missing data on referrals to agencies/resources	0.4141	0.3010	1.3760	0.1690
Missing data on tutoring in 1991–92	-0.0901	0.0572	-1.5760	0.1150
Missing data on tutoring in years 4–6	0.1907	0.0720	2.6510	0.0080
Missing data on counseling in years 4–6	-0.0330	0.0487	-0.6760	0.4990
Missing data on services for disabled in years 4–6	-0.1130	0.0719	-1.5720	0.1160
Missing data on field trip in years 4–6	0.2344	0.0997	2.3510	0.0190
Missing data on contact with support services in yrs. 4–6	0.1208	0.0975	1.2400	0.2150

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit A-12. HLM analysis to predict baccalaureate degree completion (or higher) at any institution six years after freshman entry in 1991–92 using continuous measures of participation and no measures of propensity to receive services

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	0.3973	0.0137	28.9700	0.0000
SSS services are home-based	0.0520	0.0370	1.4060	0.1670
Two-year institution	-0.1663	0.0351	-4.7320	0.0000
Doctorate-granting institution	0.0633	0.0358	1.7660	0.0840
No SSS programs at institution	0.0413	0.0370	1.1160	0.2710
SSS services are blended	0.0251	0.0377	0.6650	0.5090
Black student	-0.0411	0.0191	-2.1500	0.0310
Hispanic student	-0.0047	0.0241	-0.1960	0.8450
American Indian student	-0.1626	0.0549	-2.9600	0.0040
Asian student	0.0989	0.0337	2.9330	0.0040
Student was female	0.0249	0.0136	1.8260	0.0670
Live in college housing or frat./sorority	0.0580	0.0168	3.4560	0.0010
High school GPA	0.0960	0.0119	8.0580	0.0000
Percentile on SAT/ACT	0.1474	0.0334	4.4130	0.0000
Took any developmental course	-0.0875	0.0143	-6.1000	0.0000
Hours on school activities	0.0011	0.0004	2.4640	0.0140
Attended college after first year	0.1448	0.0242	5.9870	0.0000
No parental education beyond high school	-0.0229	0.0143	-1.6020	0.1090
Family income greater than $20,000	0.0161	0.0149	1.0800	0.2810
Have major concerns about ed. finances	-0.0451	0.0136	-3.3200	0.0010
Once I start something, I finish it	0.0424	0.0151	2.8080	0.0050
Number of hours: instr. courses	0.0002	0.0003	0.6140	0.5390
Number of hours: profl. tutoring	0.0008	0.0060	0.1390	0.8900
Number of hours: peer tutoring	0.0023	0.0008	2.8690	0.0050
Number of hours: profl. counseling	-0.0089	0.0035	-2.4980	0.0130
Number of hours: peer counseling	-0.0011	0.0139	-0.0790	0.9370
Number of hours: labs	-0.0004	0.0015	-0.2420	0.8090
Number of hours: workshops	-0.0012	0.0038	-0.3210	0.7480
Number of hours: cultural events	0.0052	0.0057	0.9130	0.3620
Number of hours: handicapped srvc.	-0.0004	0.0020	-0.2050	0.8380
Services for physically disabled	0.0179	0.0247	0.7260	0.4680
Services for limited-English ability	0.0098	0.0391	0.2510	0.8020
Student orientation	0.0083	0.0186	0.4490	0.6530
College reentrance counseling	-0.0192	0.0198	-0.9700	0.3330
Classroom instr.--basic skills	-0.0048	0.0225	-0.2150	0.8300
Classroom instr.--dvlpmntl. English	-0.0010	0.0254	-0.0410	0.9680
Classroom instr.--dvlpmntl. math	-0.0150	0.0227	-0.6610	0.5090
Cultural enrichment activities	-0.0016	0.0036	-0.4530	0.6500
Referrals to agencies/resources	-0.0035	0.0179	-0.1950	0.8460
# of counseling sessions in 1991–92	-0.0033	0.0017	-1.9530	0.0500
# of counseling sessions in 1992–93	0.0021	0.0016	1.3360	0.1820

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# of counseling sessions in 1993–94	0.0041	0.0016	2.5750	0.0100
# of tutoring sessions in 1991–92	0.0005	0.0010	0.4700	0.6380
# of tutoring sessions in 1992–93	0.0011	0.0010	1.0490	0.2940
# of tutoring sessions in 1993–94	0.0003	0.0012	0.2270	0.8210
Some tutoring in years 4–6	-0.0042	0.0020	-2.1470	0.0320
Some counseling in years 4–6	0.0118	0.0022	5.4970	0.0000
Some services for disabled in years 4–6	-0.1077	0.0316	-3.4100	0.0010
Field trip in years 4–6	0.1345	0.0152	8.8600	0.0000
Contact with support services in years 4–6	0.0163	0.0018	9.2790	0.0000
Missing data on student race	0.0205	0.0531	0.3860	0.6990
Missing data on college housing	0.1069	0.0781	1.3690	0.1710
Missing data on high school GPA	0.2676	0.0481	5.5660	0.0000
Missing data on SAT/ACT	-0.0050	0.0211	-0.2390	0.8110
Missing data on developmental courses	-0.0298	0.0575	-0.5180	0.6040
Missing data for hours on school activities	0.0468	0.0402	1.1650	0.2450
Missing data on first generation	-0.0530	0.0351	-1.5080	0.1310
Missing data on income	0.0216	0.0225	0.9630	0.3360
Missing data on financial concerns	-0.0428	0.0645	-0.6630	0.5070
Missing data on finishing tasks	-0.0294	0.0557	-0.5280	0.5970
Missing data on B32	0.0144	0.0503	0.2850	0.7750
Missing data on services for limited-English	0.5156	0.2800	1.8410	0.0650
Missing data on student orientation	0.0193	0.0771	0.2510	0.8020
Missing data on reentrance counseling	0.0088	0.0422	0.2090	0.8340
Missing data on classroom instr.--basic skills	0.0192	0.0622	0.3090	0.7580
Missing data on cultural enrichment activities	-0.1149	0.1364	-0.8420	0.4000
Missing data on referrals to agencies/resources	-0.4777	0.3103	-1.5400	0.1230
Missing data on tutoring in 1991–92	-0.0837	0.0617	-1.3560	0.1750
Missing data on tutoring in years 4–6	0.1515	0.0748	2.0260	0.0420
Missing data on counseling in years 4–6	0.0394	0.0503	0.7830	0.4330
Missing data on services for disabled in years 4–6	-0.1299	0.0742	-1.7500	0.0800
Missing data on field trip in years 4–6	0.3293	0.1033	3.1890	0.0020
Missing data on contact with support services in yrs. 4–6	0.0853	0.1007	0.8470	0.3970

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit A-13. HLM analysis to predict associate's degree completion (or higher) at any institution six years after freshman entry in 1991–92 using continuous measures of participation and no measures of propensity to receive services

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	0.5381	0.0148	36.3290	0.0000
SSS services are home-based	0.0258	0.0398	0.6490	0.5200
Two-year institution	0.0005	0.0372	0.0120	0.9900
Doctorate-granting institution	0.0523	0.0388	1.3490	0.1850
No SSS programs at institution	0.0099	0.0399	0.2480	0.8050
SSS services are blended	-0.0124	0.0408	-0.3050	0.7620
Black student	-0.0929	0.0202	-4.5970	0.0000
Hispanic student	-0.0658	0.0259	-2.5350	0.0120
American Indian student	-0.2512	0.0593	-4.2380	0.0000
Asian student	0.0385	0.0363	1.0610	0.2890
Student was female	0.0536	0.0148	3.6190	0.0010
Student was full-time	0.0939	0.0265	3.5400	0.0010
High school GPA	0.1035	0.0129	8.0380	0.0000
Took any developmental course	-0.0891	0.0153	-5.8220	0.0000
Attended college after first year	0.2742	0.0262	10.4650	0.0000
No parental education beyond high school	-0.0221	0.0154	-1.4290	0.1530
Family income greater than $20,000	0.0160	0.0161	0.9940	0.3210
Above average academic ability	0.0345	0.0146	2.3670	0.0180
Have major concerns about ed. finances	-0.0391	0.0147	-2.6620	0.0080
Number of hours: instr. courses	0.0002	0.0003	0.4710	0.6370
Number of hours: profl. tutoring	-0.0066	0.0064	-1.0400	0.2990
Number of hours: peer tutoring	0.0021	0.0009	2.4340	0.0150
Number of hours: profl. counseling	-0.0088	0.0039	-2.2820	0.0220
Number of hours: peer counseling	0.0008	0.0150	0.0510	0.9600
Number of hours: labs	-0.0046	0.0016	-2.8440	0.0050
Number of hours: workshops	0.0062	0.0041	1.5050	0.1320
Number of hours: cultural events	0.0010	0.0062	0.1550	0.8770
Number of hours: handicapped srv.	0.0014	0.0021	0.6790	0.4970
Services for physically disabled	0.0115	0.0261	0.4410	0.6590
Services for limited-English ability	0.0065	0.0421	0.1540	0.8780
Student orientation	0.0179	0.0201	0.8930	0.3720
College reentrance counseling	-0.0084	0.0214	-0.3900	0.6960
Classroom instr.--basic skills	-0.0145	0.0244	-0.5960	0.5510
Classroom instr.--dvlpmntl. English	-0.0100	0.0275	-0.3620	0.7170
Classroom instr.--dvlpmntl. math	-0.0221	0.0246	-0.8980	0.3690
Cultural enrichment activities	-0.0016	0.0039	-0.4030	0.6860
Referrals to agencies/resources	0.0153	0.0193	0.7940	0.4270
# of counseling sessions in 1991–92	-0.0018	0.0018	-0.9660	0.3340
# of counseling sessions in 1992–93	0.0007	0.0017	0.4050	0.6850
# of counseling sessions in 1993–94	0.0052	0.0017	3.0190	0.0030
# of tutoring sessions in 1991–92	0.0004	0.0011	0.3640	0.7160

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# of tutoring sessions in 1992–93	0.0013	0.0011	1.1350	0.2570
# of tutoring sessions in 1993–94	0.0002	0.0013	0.1790	0.8580
Some tutoring in years 4–6	-0.0052	0.0021	-2.4370	0.0150
Some counseling in years 4–6	0.0088	0.0023	3.7350	0.0000
Some services for disabled in years 4–6	-0.1053	0.0344	-3.0620	0.0030
Field trip in years 4–6	0.1188	0.0165	7.1870	0.0000
Contact with support services in years 4–6	0.0179	0.0019	9.4140	0.0000
Missing data on student race	-0.0624	0.0577	-1.0810	0.2800
Missing data on full-time status	0.1267	0.0800	1.5830	0.1130
Missing data on high school GPA	0.2653	0.0519	5.1100	0.0000
Missing data on developmental courses	-0.1008	0.0625	-1.6130	0.1060
Missing data on first generation	-0.0720	0.0380	-1.8930	0.0580
Missing data on income	0.0111	0.0243	0.4570	0.6470
Missing data on perceived ability	0.0441	0.0674	0.6550	0.5120
Missing data on financial concerns	0.0093	0.0700	0.1320	0.8950
Missing data on B32	0.0174	0.0538	0.3240	0.7460
Missing data on services for limited-English	0.1449	0.3052	0.4750	0.6350
Missing data on student orientation	0.0142	0.0834	0.1710	0.8650
Missing data on reentrance counseling	-0.0060	0.0458	-0.1320	0.8950
Missing data on classroom instr.--basic skills	0.0349	0.0677	0.5160	0.6060
Missing data on cultural enrichment activities	-0.1672	0.1486	-1.1260	0.2610
Missing data on referrals to agencies/resources	-0.0284	0.3382	-0.0840	0.9340
Missing data on tutoring in 1991–92	-0.0116	0.0672	-0.1730	0.8630
Missing data on tutoring in years 4–6	0.1392	0.0818	1.7020	0.0880
Missing data on counseling in years 4–6	0.0586	0.0548	1.0690	0.2850
Missing data on services for disabled in years 4–6	0.0078	0.0809	0.0970	0.9230
Missing data on field trip in years 4–6	0.1999	0.1123	1.7800	0.0750
Missing data on contact with support services in yrs. 4–6	0.0568	0.1097	0.5180	0.6040

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit A-14. HLM analysis to predict transfers from two-year to four-year institutions six years after freshman entry in 1991–92 using continuous measures of participation and no measures of propensity to receive services

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	0.2155	0.0175	12.3210	0.0000
SSS services are home-based	0.0473	0.0603	0.7830	0.4490
No SSS programs at institution	0.0868	0.0438	1.9820	0.0700
SSS services are blended	0.0142	0.0491	0.2890	0.7770
Female	-0.0837	0.0245	-3.4150	0.0010
High school GPA	0.0531	0.0178	2.9920	0.0030
Took any developmental course	-0.0555	0.0253	-2.1990	0.0280
Attended college after first year	0.0923	0.0294	3.1430	0.0020
No parental education beyond high school	-0.1112	0.0255	-4.3570	0.0000
Family income greater than $20,000	-0.0106	0.0251	-0.4220	0.6720
Once I start something, I finish it	-0.0337	0.0261	-1.2910	0.1970
Number of hours: instr. courses	-0.0003	0.0008	-0.3800	0.7040
Number of hours: profl. tutoring	-0.0159	0.0091	-1.7430	0.0810
Number of hours: peer tutoring	0.0021	0.0017	1.2020	0.2300
Number of hours: profl. counseling	0.0097	0.0060	1.6040	0.1080
Number of hours: peer counseling	0.0572	0.0565	1.0130	0.3120
Number of hours: labs	0.0008	0.0015	0.5440	0.5860
Number of hours: workshops	-0.0196	0.0084	-2.3370	0.0200
Number of hours: cultural events	-0.0388	0.0170	-2.2870	0.0220
Number of hours: handicapped srvc.	-0.0060	0.0031	-1.9520	0.0510
Services for physically disabled	0.0202	0.0328	0.6160	0.5370
Services for limited-English ability	-0.0480	0.0564	-0.8520	0.3940
Student orientation	0.0096	0.0256	0.3730	0.7080
College reentrance counseling	0.0542	0.0261	2.0750	0.0380
Classroom instr.--basic skills	-0.0690	0.0392	-1.7590	0.0780
Classroom instr.--dvlpmntl. English	0.0332	0.0417	0.7970	0.4260
Classroom instr.--dvlpmntl. math	-0.0769	0.0383	-2.0080	0.0440
Cultural enrichment activities	-0.0134	0.0181	-0.7420	0.4580
Referrals to agencies/resources	-0.0028	0.0328	-0.0870	0.9310
# of counseling sessions in 1991–92	-0.0044	0.0031	-1.3850	0.1660
# of counseling sessions in 1992–93	-0.0052	0.0030	-1.7260	0.0840
# of counseling sessions in 1993–94	0.0162	0.0035	4.6120	0.0000
# of tutoring sessions in 1991–92	0.0030	0.0022	1.3730	0.1700
# of tutoring sessions in 1992–93	-0.0043	0.0023	-1.8530	0.0630
# of tutoring sessions in 1993–94	0.0078	0.0024	3.2140	0.0020
Some tutoring in years 4–6	-0.0030	0.0045	-0.6820	0.4950
Some counseling in years 4–6	0.0303	0.0051	5.9350	0.0000
Some services for disabled in years 4–6	0.0233	0.0647	0.3600	0.7190
Field trip in years 4–6	0.1411	0.0368	3.8400	0.0000
Contact with support services in years 4–6	0.0064	0.0042	1.5150	0.1300
Missing data on high school GPA	0.0741	0.0676	1.0970	0.2730

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Missing data on developmental courses	0.0304	0.0798	0.3810	0.7030
Missing data on first generation	-0.0722	0.0465	-1.5530	0.1200
Missing data on income	-0.0016	0.0344	-0.0450	0.9640
Missing data on finishing tasks	-0.0670	0.0665	-1.0070	0.3140
Missing data on B32	-0.0618	0.0673	-0.9190	0.3580
Missing data on services for limited-English	-0.0977	0.1664	-0.5870	0.5570
Missing data on student orientation	0.0671	0.1350	0.4970	0.6180
Missing data on reentrance counseling	0.0183	0.0668	0.2730	0.7850
Missing data on classroom instr.--basic skills	-0.0155	0.1661	-0.0930	0.9260
Missing data on tutoring in 1991–92	-0.0855	0.0704	-1.2150	0.2250
Missing data on tutoring in years 4–6	0.1713	0.1432	1.1970	0.2320
Missing data on counseling in years 4–6	-0.1320	0.0814	-1.6210	0.1050
Missing data on services for disabled in years 4–6	-0.1946	0.1608	-1.2100	0.2270
Missing data on field trip in years 4–6	0.3026	0.2087	1.4500	0.1470
Missing data on contact with support services in yrs. 4–6	-0.2193	0.2083	-1.0530	0.2930

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit A-15. HLM analysis to predict cumulative GPAs six years after freshman entry in 1991–92 using continuous measures of participation and adding propensity scores

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	2.4096	0.0251	95.9680	0.0000
SSS services are home-based	0.1059	0.0677	1.5640	0.1250
Two-year institution	0.1204	0.0635	1.8960	0.0650
Doctorate-granting institution	-0.1433	0.0938	-1.5280	0.1340
No SSS programs at institution	0.0283	0.0682	0.4140	0.6810
SSS services are blended	-0.0524	0.0697	-0.7510	0.4570
Age in 1991	0.0274	0.0020	13.3710	0.0000
Black student	-0.3484	0.0374	-9.3130	0.0000
Hispanic student	-0.1754	0.0655	-2.6760	0.0080
American Indian student	-0.2598	0.0900	-2.8880	0.0040
Asian student	-0.0920	0.0662	-1.3890	0.1650
Female student	0.1384	0.0220	6.2780	0.0000
High school GPA	0.2885	0.0199	14.5140	0.0000
Percentile on SAT/ACT	0.2007	0.0549	3.6570	0.0000
Took any developmental course	-0.1403	0.0235	-5.9650	0.0000
Hours on school activities	0.0035	0.0007	5.0620	0.0000
Attended college after first year	0.7135	0.0339	21.0210	0.0000
No parental education beyond high school	0.0208	0.0242	0.8620	0.3890
Family income greater than $20,000	0.0279	0.0265	1.0550	0.2920
Above average academic ability	0.1446	0.0249	5.8090	0.0000
Would attend free tutoring	-0.0803	0.0265	-3.0320	0.0030
Feel comfortable on this campus	0.0590	0.0274	2.1550	0.0310
Number of hours: instr. courses	-0.0009	0.0007	-1.3460	0.1780
Number of hours: profl. tutoring	0.0205	0.0478	0.4290	0.6680
Number of hours: peer tutoring	-0.0005	0.0027	-0.1690	0.8660
Number of hours: profl. counseling	0.0052	0.0124	0.4180	0.6760
Number of hours: peer counseling	-0.0452	0.0305	-1.4850	0.1370
Number of hours: labs	0.0096	0.0040	2.4360	0.0150
Number of hours: workshops	0.0207	0.0111	1.8690	0.0610
Number of hours: cultural events	-0.0255	0.0459	-0.5570	0.5770
Number of hours: handicapped srvc.	0.0077	0.0097	0.7930	0.4280
Propensity to receive instr. courses	0.0002	0.0009	0.1990	0.8420
Propensity to receive profl. tutoring	0.0109	0.0274	0.3990	0.6900
Propensity to receive peer tutoring	0.0010	0.0027	0.3710	0.7100
Propensity to receive profl. counseling	-0.0109	0.0270	-0.4040	0.6860
Propensity to receive peer counseling	0.0357	0.0195	1.8290	0.0670
Propensity to receive labs	-0.0011	0.0029	-0.3660	0.7140
Propensity to receive workshops	-0.0056	0.0067	-0.8390	0.4010
Propensity to receive cultural events	0.0066	0.0167	0.3970	0.6910
Propensity to receive handicapped srvc.	0.0031	0.0028	1.1160	0.2650
Services for physically disabled	-0.0042	0.0345	-0.1210	0.9040

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Services for limited-English ability	0.0272	0.0605	0.4490	0.6530
Student orientation	-0.0403	0.0296	-1.3620	0.1730
College reentrance counseling	-0.0479	0.0292	-1.6420	0.1000
Classroom instr.--basic skills	-0.0570	0.0359	-1.5880	0.1120
Classroom instr.--dvlpmntl. English	0.0005	0.0409	0.0130	0.9900
Classroom instr.--dvlpmntl. math	-0.0014	0.0362	-0.0390	0.9690
Cultural enrichment activities	0.0128	0.0052	2.4590	0.0140
Referrals to agencies/resources	0.0607	0.0286	2.1210	0.0340
# of counseling sessions in 1991–92	-0.0040	0.0028	-1.4600	0.1440
# of counseling sessions in 1992–93	-0.0006	0.0027	-0.2210	0.8250
# of counseling sessions in 1993–94	0.0084	0.0027	3.1170	0.0020
# of tutoring sessions in 1991–92	-0.0012	0.0016	-0.7230	0.4700
# of tutoring sessions in 1992–93	0.0004	0.0017	0.2310	0.8180
# of tutoring sessions in 1993–94	0.0010	0.0019	0.5410	0.5880
Some tutoring in years 4–6	-0.0111	0.0034	-3.2530	0.0020
Some counseling in years 4–6	0.0114	0.0037	3.0550	0.0030
Some services for disabled in years 4–6	-0.0625	0.0544	-1.1490	0.2510
Field trip in years 4–6	0.1279	0.0266	4.8070	0.0000
Contact with support services in years 4–6	0.0159	0.0031	5.1840	0.0000
Missing data on student age	0.5994	0.0871	6.8820	0.0000
Missing data on student race	0.0143	0.0932	0.1540	0.8780
Missing data on high school GPA	0.7643	0.0863	8.8590	0.0000
Missing data on SAT/ACT	0.0318	0.0350	0.9090	0.3640
Missing data on developmental courses	-0.1736	0.0812	-2.1390	0.0320
Missing data for hours on school activities	0.1479	0.0584	2.5330	0.0120
Missing data on first generation	-0.0885	0.0535	-1.6540	0.0980
Missing data on income	-0.0210	0.0372	-0.5650	0.5710
Missing data on perceived ability	0.1212	0.1069	1.1340	0.2570
Missing data on attending free tutoring	-0.0017	0.1941	-0.0090	0.9930
Missing data on comfort on campus	-0.1926	0.1933	-0.9960	0.3200
Missing data on services in later years	0.2334	0.0688	3.3920	0.0010
Missing data on services for limited-English	-0.0591	0.4906	-0.1210	0.9050
Missing data on student orientation	-0.0896	0.1243	-0.7210	0.4710
Missing data on reentrance counseling	0.1698	0.0723	2.3500	0.0190
Missing data on classroom instr.--basic skills	-0.1490	0.1041	-1.4310	0.1520
Missing data on cultural enrichment activities	-0.3003	0.2369	-1.2680	0.2050
Missing data on referrals to agencies/resources	0.4740	0.5429	0.8730	0.3830
Missing data on tutoring in 1991–92	-0.0946	0.0754	-1.2540	0.2100
Missing data on tutoring in years 4–6	-0.0940	0.1313	-0.7160	0.4740
Missing data on counseling in years 4–6	-0.0617	0.0883	-0.6980	0.4850
Missing data on services for disabled in years 4–6	-0.0701	0.1301	-0.5390	0.5890
Missing data on field trip in years 4–6	0.4124	0.1808	2.2810	0.0230
Missing data on contact with support services in yrs. 4–6	-0.2307	0.1762	-1.3090	0.1910

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit A-16. HLM analysis to predict the number of credits earned six years after freshman entry in 1991–92 using continuous measures of participation and adding propensity scores

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	76.1127	1.8124	41.9950	0.0000
SSS services are home-based	4.5506	4.8904	0.9310	0.3580
Two-year institution	-14.5028	4.5225	-3.2070	0.0030
Doctorate-granting institution	10.5614	6.1001	1.7310	0.0900
No SSS programs at institution	3.4131	4.8785	0.7000	0.4880
SSS services are blended	-3.1692	5.0891	-0.6230	0.5370
Black student	-5.6227	2.2409	-2.5090	0.0120
Hispanic student	1.1283	4.6401	0.2430	0.8080
American Indian student	-20.4032	5.2886	-3.8580	0.0000
Asian student	4.2210	4.1520	1.0170	0.3100
Female student	4.5071	1.2706	3.5470	0.0010
Student was full-time	10.6999	4.6545	2.2990	0.0220
High school GPA	10.5388	1.1386	9.2560	0.0000
Percentile on SAT/ACT	10.0531	3.1568	3.1850	0.0020
Took any developmental course	-5.7366	1.3569	-4.2280	0.0000
Hours on school activities	0.1775	0.0397	4.4690	0.0000
Attended college after first year	43.8911	1.9326	22.7110	0.0000
No parental education beyond high school	-0.5416	1.3889	-0.3900	0.6960
Family income greater than $20,000	-1.2707	1.6757	-0.7580	0.4480
Have major concerns about ed. finances	-3.8501	1.2561	-3.0650	0.0030
Once I start something, I finish it	3.7426	1.4220	2.6320	0.0090
Feel comfortable on this campus	7.1031	1.5924	4.4600	0.0000
Number of hours: instr. courses	-0.0339	0.0406	-0.8350	0.4040
Number of hours: profl. tutoring	-2.9658	2.6790	-1.1070	0.2690
Number of hours: peer tutoring	0.2252	0.1579	1.4270	0.1540
Number of hours: profl. counseling	0.6705	0.7233	0.9270	0.3540
Number of hours: peer counseling	0.4628	1.7842	0.2590	0.7950
Number of hours: labs	0.1704	0.2287	0.7450	0.4560
Number of hours: workshops	-0.0199	0.6439	-0.0310	0.9760
Number of hours: cultural events	-3.9044	2.6594	-1.4680	0.1420
Number of hours: handicapped srvc.	-0.0996	0.5648	-0.1760	0.8600
Propensity to receive instr. courses	0.0626	0.0491	1.2730	0.2030
Propensity to receive profl. tutoring	4.5855	1.5797	2.9030	0.0040
Propensity to receive peer tutoring	-0.2307	0.1380	-1.6720	0.0940
Propensity to receive profl. counseling	1.3736	2.7236	0.5040	0.6140
Propensity to receive peer counseling	-0.7014	1.1361	-0.6170	0.5370
Propensity to receive labs	-0.0658	0.1668	-0.3940	0.6930
Propensity to receive workshops	0.1878	0.3882	0.4840	0.6280
Propensity to receive cultural events	0.0710	0.9661	0.0740	0.9420
Propensity to receive handicapped srvc.	-0.0636	0.1636	-0.3880	0.6970
Services for physically disabled	1.7497	1.9916	0.8790	0.3800

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Services for limited-English ability	0.5564	3.4790	0.1600	0.8730
Student orientation	-0.9701	1.7039	-0.5690	0.5690
College reentrance counseling	-3.6612	1.6849	-2.1730	0.0300
Classroom instr.--basic skills	-5.0852	2.0723	-2.4540	0.0140
Classroom instr.--dvlpmntl. English	1.3197	2.3592	0.5590	0.5750
Classroom instr.--dvlpmntl. math	-2.2437	2.0880	-1.0750	0.2830
Cultural enrichment activities	0.7130	0.2992	2.3830	0.0170
Referrals to agencies/resources	-2.0481	1.6587	-1.2350	0.2170
# of counseling sessions in 1991–92	-0.1042	0.1588	-0.6560	0.5110
# of counseling sessions in 1992–93	0.0058	0.1559	0.0370	0.9710
# of counseling sessions in 1993–94	0.5198	0.1565	3.3210	0.0010
# of tutoring sessions in 1991–92	-0.1417	0.0924	-1.5330	0.1250
# of tutoring sessions in 1992–93	0.5115	0.0976	5.2380	0.0000
# of tutoring sessions in 1993–94	0.2977	0.1107	2.6890	0.0080
Some tutoring in years 4–6	0.0301	0.1982	0.1520	0.8800
Some counseling in years 4–6	1.4482	0.2171	6.6710	0.0000
Some services for disabled in years 4–6	-11.6425	3.1724	-3.6700	0.0000
Field trip in years 4–6	13.0440	1.5407	8.4660	0.0000
Contact with support services in years 4–6	2.1016	0.1777	11.8280	0.0000
Missing data on student race	-0.7630	5.8918	-0.1300	0.8970
Missing data on full-time status	19.4546	7.5037	2.5930	0.0100
Missing data on high school GPA	27.2416	4.9852	5.4650	0.0000
Missing data on SAT/ACT	-0.0586	1.9861	-0.0290	0.9770
Missing data on developmental courses	-1.3646	4.6997	-0.2900	0.7710
Missing data for hours on school activities	5.4407	3.5825	1.5190	0.1290
Missing data on first generation	-2.5116	3.1752	-0.7910	0.4290
Missing data on income	-0.3377	2.2521	-0.1500	0.8810
Missing data on perceived ability	0.6781	6.2966	0.1080	0.9150
Missing data on financial concerns	-9.5040	5.7126	-1.6640	0.0960
Missing data on finishing tasks	10.2830	6.1636	1.6680	0.0950
Missing data on comfort on campus	-5.1408	7.6061	-0.6760	0.4990
Missing data on services in later years	-1.6456	3.9744	-0.4140	0.6780
Missing data on services for limited-English	-17.7201	28.3003	-0.6260	0.5310
Missing data on student orientation	0.5878	7.1507	0.0820	0.9350
Missing data on reentrance counseling	0.5508	4.1750	0.1320	0.8950
Missing data on classroom instr.--basic skills	6.2460	5.8836	1.0620	0.2890
Missing data on cultural enrichment activities	-30.0858	13.6867	-2.1980	0.0280
Missing data on referrals to agencies/resources	42.7787	31.3177	1.3660	0.1720
Missing data on tutoring in 1991–92	-4.6920	4.3594	-1.0760	0.2820
Missing data on tutoring in years 4–6	0.1428	7.6608	0.0190	0.9850
Missing data on counseling in years 4–6	-5.5397	5.1007	-1.0860	0.2780
Missing data on services for disabled in years 4–6	-8.8703	7.5542	-1.1740	0.2410
Missing data on field trip in years 4–6	7.4848	10.6760	0.7010	0.4830
Missing data on contact with support services in yrs. 4–6	6.0580	10.3757	0.5840	0.5590

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit A-17. HLM analysis to predict retention or baccalaureate degree completion at the same institution six years after freshman entry in 1991–92 using continuous measures of participation and adding propensity scores

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	0.3182	0.0111	28.6840	0.0000
SSS services are home-based	0.0632	0.0298	2.1220	0.0400
Two-year institution	-0.2221	0.0288	-7.7180	0.0000
Doctorate-granting institution	0.1084	0.0466	2.3240	0.0250
No SSS programs at institution	0.0590	0.0308	1.9140	0.0620
SSS services are blended	0.0603	0.0300	2.0070	0.0510
Female student	0.0368	0.0130	2.8400	0.0050
High school GPA	0.0623	0.0112	5.5550	0.0000
Percentile on SAT/ACT	0.1144	0.0319	3.5890	0.0010
Took any developmental course	-0.0506	0.0139	-3.6500	0.0000
Attended college after first year	0.1640	0.0198	8.2930	0.0000
No parental education beyond high school	0.0048	0.0140	0.3440	0.7310
Family income greater than $20,000	-0.0124	0.0154	-0.8050	0.4210
Feel comfortable on this campus	0.0683	0.0160	4.2610	0.0000
Number of hours: instr. courses	0.0001	0.0004	0.1730	0.8630
Number of hours: profl. tutoring	0.0146	0.0275	0.5330	0.5940
Number of hours: peer tutoring	0.0019	0.0016	1.1990	0.2310
Number of hours: profl. counseling	0.0009	0.0072	0.1230	0.9030
Number of hours: peer counseling	0.0004	0.0176	0.0210	0.9830
Number of hours: labs	0.0010	0.0023	0.4470	0.6540
Number of hours: workshops	-0.0110	0.0065	-1.6910	0.0900
Number of hours: cultural events	-0.0020	0.0269	-0.0750	0.9410
Number of hours: handicapped srvc	0.0067	0.0057	1.1690	0.2430
Propensity to receive instr. courses	0.0008	0.0004	1.8690	0.0610
Propensity to receive profl. tutoring	0.0122	0.0153	0.8000	0.4240
Propensity to receive peer tutoring	-0.0009	0.0014	-0.6850	0.4930
Propensity to receive profl. counseling	0.0128	0.0117	1.0990	0.2720
Propensity to receive peer counseling	-0.0119	0.0106	-1.1140	0.2660
Propensity to receive labs	-0.0009	0.0016	-0.5600	0.5750
Propensity to receive workshops	0.0029	0.0038	0.7770	0.4370
Propensity to receive cultural events	0.0072	0.0096	0.7430	0.4570
Propensity to receive handicapped srvc.	0.0002	0.0016	0.1380	0.8910
Services for physically disabled	0.0279	0.0205	1.3630	0.1730
Services for limited-English ability	0.0270	0.0356	0.7600	0.4470
Student orientation	0.0068	0.0174	0.3910	0.6960
College reentrance counseling	-0.0100	0.0173	-0.5810	0.5610
Classroom instr.--basic skills	-0.0162	0.0213	-0.7600	0.4470
Classroom instr.--dvlpmntl. English	0.0053	0.0242	0.2210	0.8250
Classroom instr.--dvlpmntl. math	-0.0063	0.0214	-0.2930	0.7700
Cultural enrichment activities	-0.0008	0.0031	-0.2450	0.8070
Referrals to agencies/resources	-0.0225	0.0169	-1.3290	0.1840

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# of counseling sessions in 1991–92	-0.0021	0.0016	-1.2870	0.1980
# of counseling sessions in 1992–93	-0.0009	0.0016	-0.5480	0.5830
# of counseling sessions in 1993–94	0.0038	0.0016	2.3700	0.0180
# of tutoring sessions in 1991–92	-0.0014	0.0009	-1.5020	0.1330
# of tutoring sessions in 1992–93	0.0020	0.0010	1.9940	0.0460
# of tutoring sessions in 1993–94	0.0024	0.0011	2.1430	0.0320
Some tutoring in years 4–6	0.0016	0.0020	0.7870	0.4310
Some counseling in years 4–6	0.0110	0.0022	4.9310	0.0000
Some services for disabled in years 4–6	-0.0597	0.0321	-1.8600	0.0620
Field trip in years 4–6	0.0737	0.0158	4.6660	0.0000
Contact with support services in years 4–6	0.0176	0.0018	9.6740	0.0000
Missing data on high school GPA	0.2100	0.0482	4.3550	0.0000
Missing data on SAT/ACT	0.0343	0.0200	1.7160	0.0860
Missing data on developmental courses	-0.1286	0.0481	-2.6750	0.0080
Missing data for hours on school activities	-0.0081	0.0320	-0.2520	0.8010
Missing data on first generation	0.0302	0.0308	0.9800	0.3270
Missing data on income	-0.0038	0.0216	-0.1760	0.8610
Missing data on comfort on campus	-0.0010	0.0520	-0.0190	0.9850
Missing data on services in later years	0.0610	0.0407	1.4990	0.1340
Missing data on services for limited-English	-0.4886	0.2921	-1.6730	0.0940
Missing data on student orientation	0.0232	0.0718	0.3230	0.7460
Missing data on reentrance counseling	0.0197	0.0423	0.4660	0.6410
Missing data on classroom instr.--basic skills	0.0296	0.0601	0.4930	0.6220
Missing data on cultural enrichment activities	0.2612	0.1408	1.8560	0.0630
Missing data on referrals to agencies/resources	0.1782	0.3231	0.5520	0.5810
Missing data on tutoring in 1991–92	0.0069	0.0447	0.1550	0.8770
Missing data on tutoring in years 4–6	-0.0046	0.0768	-0.0600	0.9530
Missing data on counseling in years 4–6	-0.0517	0.0524	-0.9870	0.3240
Missing data on services for disabled in years 4–6	-0.0082	0.0774	-0.1060	0.9160
Missing data on field trip in years 4–6	0.0505	0.1072	0.4710	0.6370
Missing data on contact with support services in yrs. 4–6	0.0119	0.1048	0.1130	0.9100

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit A-18. HLM analysis to predict retention or baccalaureate degree completion at any institution six years after freshman entry in 1991–92 using continuous measures of participation and adding propensity scores

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	0.6196	0.0099	62.6400	0.0000
SSS services are home-based	0.0766	0.0266	2.8760	0.0070
Two-year institution	-0.1315	0.0262	-5.0220	0.0000
Doctorate-granting institution	0.1365	0.0437	3.1240	0.0040
No SSS programs at institution	0.0675	0.0278	2.4250	0.0200
SSS services are blended	0.0437	0.0264	1.6580	0.1050
Female student	0.0540	0.0132	4.0980	0.0000
High school GPA	0.0426	0.0115	3.6920	0.0000
Percentile on SAT/ACT	0.0939	0.0319	2.9410	0.0040
Took any developmental course	-0.0525	0.0138	-3.8140	0.0000
Hours on school activities	0.0005	0.0004	1.1720	0.2420
Attended college after first year	0.3501	0.0234	14.9680	0.0000
No parental education beyond high school	-0.0508	0.0141	-3.5960	0.0010
Family income greater than $20,000	0.0114	0.0155	0.7340	0.4630
Above average academic ability	0.0211	0.0139	1.5180	0.1290
Number of hours: instr. courses	-0.0006	0.0004	-1.5740	0.1150
Number of hours: profl. tutoring	0.0079	0.0284	0.2780	0.7810
Number of hours: peer tutoring	0.0010	0.0016	0.6170	0.5370
Number of hours: profl. counseling	0.0089	0.0071	1.2500	0.2120
Number of hours: peer counseling	-0.0008	0.0173	-0.0440	0.9650
Number of hours: labs	0.0009	0.0024	0.3630	0.7160
Number of hours: workshops	-0.0070	0.0064	-1.0960	0.2740
Number of hours: cultural events	-0.0219	0.0267	-0.8200	0.4120
Number of hours: handicapped srvc.	-0.0007	0.0059	-0.1170	0.9070
Propensity to receive instr. courses	0.0015	0.0004	3.4700	0.0010
Propensity to receive profl. tutoring	0.0224	0.0166	1.3480	0.1780
Propensity to receive peer tutoring	-0.0005	0.0014	-0.3500	0.7260
Propensity to receive profl. counseling	-0.0121	0.0125	-0.9750	0.3300
Propensity to receive peer counseling	0.0070	0.0106	0.6670	0.5050
Propensity to receive labs	-0.0016	0.0017	-0.9350	0.3500
Propensity to receive workshops	-0.0018	0.0037	-0.4750	0.6340
Propensity to receive cultural events	-0.0074	0.0095	-0.7810	0.4350
Propensity to receive handicapped srvc.	0.0002	0.0016	0.1140	0.9100
Services for physically disabled	-0.0090	0.0231	-0.3910	0.6960
Services for limited-English ability	0.0490	0.0374	1.3110	0.1900
Student orientation	0.0143	0.0177	0.8100	0.4180
College reentrance counseling	0.0123	0.0191	0.6440	0.5190
Classroom instr.--basic skills	-0.0059	0.0216	-0.2740	0.7840
Classroom instr.--dvlpmntl. English	-0.0221	0.0243	-0.9080	0.3640
Classroom instr.--dvlpmntl. math	-0.0166	0.0217	-0.7660	0.4440
Cultural enrichment activities	0.0029	0.0035	0.8380	0.4020

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Referrals to agencies/resources	-0.0340	0.0171	-1.9940	0.0460
# of counseling sessions in 1991–92	-0.0027	0.0016	-1.6500	0.0990
# of counseling sessions in 1992–93	-0.0020	0.0015	-1.3150	0.1890
# of counseling sessions in 1993–94	0.0034	0.0015	2.1990	0.0280
# of tutoring sessions in 1991–92	-0.0016	0.0009	-1.6800	0.0930
# of tutoring sessions in 1992–93	0.0008	0.0010	0.8440	0.3990
# of tutoring sessions in 1993–94	0.0048	0.0011	4.3290	0.0000
Some tutoring in years 4–6	-0.0016	0.0019	-0.8320	0.4060
Some counseling in years 4–6	0.0208	0.0021	9.9940	0.0000
Some services for disabled in years 4–6	-0.0191	0.0299	-0.6390	0.5230
Field trip in years 4–6	0.1320	0.0147	8.9590	0.0000
Contact with support services in years 4–6	0.0194	0.0017	11.4010	0.0000
Missing data on fulltime status	-0.0055	0.0673	-0.0820	0.9350
Missing data on high school GPA	0.1319	0.0486	2.7170	0.0070
Missing data on SAT/ACT	-0.0172	0.0202	-0.8500	0.3950
Missing data on developmental courses	0.0418	0.0541	0.7730	0.4390
Missing data for hours on school activities	0.0023	0.0385	0.0590	0.9530
Missing data on first generation	-0.0442	0.0343	-1.2890	0.1980
Missing data on income	-0.0028	0.0222	-0.1250	0.9010
Missing data on perceived ability	0.0566	0.0569	0.9940	0.3210
Missing data on services in later years	-0.0473	0.0468	-1.0110	0.3120
Missing data on services for limited-English	-0.1851	0.2720	-0.6800	0.4960
Missing data on student orientation	0.0319	0.0744	0.4290	0.6670
Missing data on reentrance counseling	0.0089	0.0413	0.2150	0.8300
Missing data on classroom instr.--basic skills	-0.0155	0.0602	-0.2580	0.7970
Missing data on cultural enrichment activities	-0.2483	0.1314	-1.8900	0.0580
Missing data on referrals to agencies/resources	0.3955	0.3010	1.3140	0.1890
Missing data on tutoring in 1991–92	-0.1117	0.0572	-1.9550	0.0500
Missing data on tutoring in years 4–6	0.2011	0.0720	2.7940	0.0060
Missing data on counseling in years 4–6	-0.0378	0.0488	-0.7750	0.4380
Missing data on services for disabled in years 4–6	-0.1129	0.0720	-1.5690	0.1160
Missing data on field trip in years 4–6	0.2226	0.0997	2.2330	0.0250
Missing data on contact with support services in yrs. 4–6	0.1243	0.0975	1.2740	0.2030

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit A-19. HLM analysis to predict baccalaureate degree completion (or higher) at any institution six years after freshman entry in 1991–92 using continuous measures of participation and adding propensity scores

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	0.3985	0.0143	27.9370	0.0000
SSS services are home-based	0.0452	0.0386	1.1710	0.2490
Two-year institution	-0.1713	0.0365	-4.6890	0.0000
Doctorate-granting institution	0.1128	0.0542	2.0810	0.0430
No SSS programs at institution	0.0415	0.0390	1.0630	0.2940
SSS services are blended	0.0228	0.0394	0.5790	0.5650
Black student	-0.0311	0.0231	-1.3470	0.1780
Hispanic student	0.0275	0.0393	0.6980	0.4850
American Indian student	-0.1825	0.0559	-3.2670	0.0010
Asian student	0.1006	0.0417	2.4150	0.0160
Female student	0.0344	0.0138	2.4920	0.0130
Live in college housing or frat./sorority	0.0466	0.0222	2.1000	0.0350
High school GPA	0.0980	0.0121	8.0870	0.0000
Percentile on SAT/ACT	0.1359	0.0335	4.0630	0.0000
Took any developmental course	-0.0889	0.0143	-6.2070	0.0000
Hours on school activities	0.0009	0.0004	2.1000	0.0350
Attended college after first year	0.1436	0.0242	5.9330	0.0000
No parental education beyond high school	-0.0253	0.0150	-1.6840	0.0920
Family income greater than $20,000	0.0305	0.0163	1.8750	0.0600
Have major concerns about ed. finances	-0.0418	0.0136	-3.0770	0.0030
Once I start something, I finish it	0.0434	0.0153	2.8480	0.0050
Number of hours: instr. courses	0.0000	0.0004	0.0590	0.9540
Number of hours: profl. tutoring	-0.0236	0.0297	-0.7940	0.4270
Number of hours: peer tutoring	0.0019	0.0017	1.0980	0.2720
Number of hours: profl. counseling	0.0025	0.0077	0.3210	0.7480
Number of hours: peer counseling	-0.0099	0.0188	-0.5270	0.5980
Number of hours: labs	0.0031	0.0026	1.2090	0.2270
Number of hours: workshops	-0.0064	0.0068	-0.9470	0.3440
Number of hours: cultural events	-0.0426	0.0281	-1.5200	0.1280
Number of hours: handicapped srvc.	0.0065	0.0062	1.0510	0.2940
Propensity to receive instr. courses	0.0008	0.0005	1.4430	0.1490
Propensity to receive profl. tutoring	0.0270	0.0183	1.4780	0.1390
Propensity to receive peer tutoring	-0.0024	0.0015	-1.5940	0.1110
Propensity to receive profl. counseling	0.0392	0.0156	2.5200	0.0120
Propensity to receive peer counseling	0.0100	0.0121	0.8250	0.4090
Propensity to receive labs	-0.0018	0.0018	-0.9690	0.3330
Propensity to receive workshops	-0.0019	0.0045	-0.4280	0.6680
Propensity to receive cultural events	0.0165	0.0102	1.6130	0.1060
Propensity to receive handicapped srvc	-0.0028	0.0017	-1.6050	0.1080
Services for physically disabled	0.0161	0.0239	0.6730	0.5010
Services for limited-English ability	0.0055	0.0392	0.1400	0.8890

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Student orientation	0.0007	0.0186	0.0380	0.9700
College reentrance counseling	-0.0130	0.0198	-0.6580	0.5100
Classroom instr.--basic skills	0.0000	0.0225	-0.0010	0.9990
Classroom instr.--dvlpmntl. English	-0.0014	0.0255	-0.0550	0.9560
Classroom instr.--dvlpmntl. math	-0.0146	0.0227	-0.6410	0.5220
Cultural enrichment activities	-0.0023	0.0036	-0.6470	0.5180
Referrals to agencies/resources	-0.0066	0.0178	-0.3700	0.7110
# of counseling sessions in 1991–92	-0.0029	0.0017	-1.7140	0.0860
# of counseling sessions in 1992–93	0.0017	0.0016	1.0540	0.2920
# of counseling sessions in 1993–94	0.0041	0.0016	2.6240	0.0090
# of tutoring sessions in 1991–92	0.0000	0.0010	0.0470	0.9630
# of tutoring sessions in 1992–93	0.0013	0.0010	1.2830	0.2000
# of tutoring sessions in 1993–94	0.0005	0.0012	0.4490	0.6530
Some tutoring in years 4–6	-0.0040	0.0020	-2.0250	0.0430
Some counseling in years 4–6	0.0117	0.0022	5.4390	0.0000
Some services for disabled in years 4–6	-0.1063	0.0309	-3.4350	0.0010
Field trip in years 4–6	0.1334	0.0152	8.7810	0.0000
Contact with support services in years 4–6	0.0162	0.0018	9.2270	0.0000
Missing data on student age	0.0582	0.0568	1.0240	0.3060
Missing data on student race	0.1168	0.0790	1.4790	0.1390
Missing data on high school GPA	0.3029	0.0521	5.8140	0.0000
Missing data on SAT/ACT	-0.0046	0.0213	-0.2170	0.8280
Missing data on developmental courses	-0.0250	0.0576	-0.4340	0.6640
Missing data for hours on school activities	0.0389	0.0402	0.9680	0.3340
Missing data on first generation	-0.0496	0.0360	-1.3780	0.1680
Missing data on income	0.0444	0.0234	1.8990	0.0570
Missing data on financial concerns	-0.0480	0.0648	-0.7410	0.4590
Missing data on finishing tasks	-0.0245	0.0567	-0.4330	0.6640
Missing data on B32	0.0099	0.0504	0.1970	0.8440
Missing data on services for limited-English	0.4974	0.2802	1.7750	0.0750
Missing data on student orientation	0.0115	0.0771	0.1490	0.8820
Missing data on reentrance counseling	0.0258	0.0429	0.6020	0.5470
Missing data on classroom instr.--basic skills	0.0037	0.0621	0.0600	0.9530
Missing data on cultural enrichment activities	-0.1003	0.1359	-0.7380	0.4600
Missing data on referrals to agencies/resources	-0.4757	0.3101	-1.5340	0.1250
Missing data on tutoring in 1991–92	-0.0910	0.0617	-1.4760	0.1400
Missing data on tutoring in years 4–6	0.1561	0.0747	2.0890	0.0360
Missing data on counseling in years 4–6	0.0357	0.0503	0.7090	0.4780
Missing data on services for disabled in years 4–6	-0.1335	0.0742	-1.7990	0.0720
Missing data on field trip in years 4–6	0.3262	0.1032	3.1600	0.0020
Missing data on contact with support services in yrs. 4–6	0.0886	0.1007	0.8800	0.3790

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit A-20. HLM analysis to predict associate's degree completion (or higher) at any institution six years after freshman entry in 1991–92 using continuous measures of participation and adding propensity scores

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	0.5382	0.0153	35.2720	0.0000
SSS services are home-based	0.0238	0.0411	0.5780	0.5660
Two-year institution	-0.0041	0.0387	-0.1070	0.9160
Doctorate-granting institution	0.0596	0.0582	1.0240	0.3120
No SSS programs at institution	0.0073	0.0417	0.1750	0.8620
SSS services are blended	-0.0127	0.0422	-0.3000	0.7650
Black student	-0.1138	0.0286	-3.9750	0.0000
Hispanic student	-0.1422	0.0775	-1.8340	0.0660
American Indian student	-0.2444	0.0611	-3.9990	0.0000
Asian student	-0.0278	0.0566	-0.4910	0.6230
Female student	0.0573	0.0150	3.8240	0.0000
Student was full-time	0.1766	0.0790	2.2360	0.0250
High school GPA	0.1005	0.0141	7.1390	0.0000
Took any developmental course	-0.0891	0.0153	-5.8200	0.0000
Attended college after first year	0.2774	0.0263	10.5680	0.0000
No parental education beyond high school	-0.0183	0.0162	-1.1270	0.2600
Family income greater than $20,000	-0.0030	0.0217	-0.1360	0.8920
Above average academic ability	0.0468	0.0238	1.9690	0.0490
Have major concerns about ed. finances	-0.0371	0.0147	-2.5150	0.0120
Number of hours: instr. courses	-0.0002	0.0005	-0.3400	0.7340
Number of hours: profl. tutoring	-0.0324	0.0322	-1.0050	0.3150
Number of hours: peer tutoring	0.0012	0.0018	0.6530	0.5130
Number of hours: profl. counseling	-0.0008	0.0083	-0.1020	0.9190
Number of hours: peer counseling	0.0050	0.0205	0.2450	0.8070
Number of hours: labs	-0.0031	0.0028	-1.1110	0.2670
Number of hours: workshops	-0.0074	0.0073	-1.0120	0.3120
Number of hours: cultural events	0.0067	0.0302	0.2210	0.8250
Number of hours: handicapped srvc.	0.0084	0.0067	1.2500	0.2120
Propensity to receive instr. courses	0.0001	0.0006	0.1890	0.8500
Propensity to receive profl. tutoring	0.0238	0.0197	1.2120	0.2260
Propensity to receive peer tutoring	-0.0028	0.0016	-1.7080	0.0870
Propensity to receive profl. counseling	-0.0555	0.0500	-1.1090	0.2680
Propensity to receive peer counseling	0.0141	0.0130	1.0860	0.2780
Propensity to receive labs	-0.0003	0.0020	-0.1580	0.8750
Propensity to receive workshops	0.0032	0.0044	0.7290	0.4660
Propensity to receive cultural events	0.0099	0.0113	0.8780	0.3800
Propensity to receive handicapped srvc.	-0.0013	0.0018	-0.7300	0.4660
Services for physically disabled	0.0032	0.0253	0.1270	0.8990
Services for limited-English ability	0.0098	0.0423	0.2310	0.8170
Student orientation	0.0158	0.0201	0.7840	0.4330
College reentrance counseling	-0.0063	0.0215	-0.2920	0.7700

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Classroom instr.--basic skills	-0.0139	0.0244	-0.5710	0.5680
Classroom instr.--dvlpmntl. English	-0.0093	0.0276	-0.3370	0.7360
Classroom instr.--dvlpmntl. math	-0.0222	0.0247	-0.9000	0.3680
Cultural enrichment activities	-0.0015	0.0038	-0.4040	0.6860
Referrals to agencies/resources	0.0118	0.0194	0.6080	0.5430
# of counseling sessions in 1991–92	-0.0018	0.0019	-0.9760	0.3300
# of counseling sessions in 1992–93	0.0005	0.0017	0.2580	0.7960
# of counseling sessions in 1993–94	0.0053	0.0017	3.0440	0.0030
# of tutoring sessions in 1991–92	0.0000	0.0011	0.0020	0.9990
# of tutoring sessions in 1992–93	0.0016	0.0011	1.4080	0.1590
# of tutoring sessions in 1993–94	0.0003	0.0013	0.2320	0.8170
Some tutoring in years 4–6	-0.0048	0.0021	-2.2590	0.0240
Some counseling in years 4–6	0.0087	0.0023	3.7000	0.0000
Some services for disabled in years 4–6	-0.1038	0.0338	-3.0750	0.0030
Field trip in years 4–6	0.1184	0.0166	7.1450	0.0000
Contact with support services in years 4–6	0.0178	0.0019	9.2790	0.0000
Missing data on student race	-0.1322	0.0795	-1.6630	0.0960
Missing data on fulltime status	0.1719	0.0883	1.9470	0.0510
Missing data on high school GPA	0.2664	0.0602	4.4270	0.0000
Missing data on developmental courses	-0.0948	0.0627	-1.5120	0.1300
Missing data on first generation	-0.0832	0.0399	-2.0880	0.0360
Missing data on income	0.0027	0.0289	0.0940	0.9250
Missing data on perceived ability	0.0888	0.0729	1.2170	0.2240
Missing data on financial concerns	0.0077	0.0703	0.1090	0.9140
Missing data on services in later years	0.0210	0.0539	0.3890	0.6970
Missing data on services for limited-English	0.1387	0.3061	0.4530	0.6500
Missing data on student orientation	0.0084	0.0836	0.1000	0.9210
Missing data on reentrance counseling	0.0045	0.0466	0.0970	0.9230
Missing data on classroom instr.--basic skills	0.0210	0.0677	0.3100	0.7560
Missing data on cultural enrichment activities	-0.1688	0.1482	-1.1380	0.2550
Missing data on referrals to agencies/resources	-0.0264	0.3387	-0.0780	0.9380
Missing data on tutoring in 1991–92	-0.0254	0.0672	-0.3780	0.7050
Missing data on tutoring in years 4–6	0.1311	0.0820	1.5990	0.1100
Missing data on counseling in years 4–6	0.0627	0.0549	1.1410	0.2540
Missing data on services for disabled in years 4–6	0.0034	0.0811	0.0420	0.9670
Missing data on field trip in years 4–6	0.1918	0.1125	1.7050	0.0880
Missing data on contact with support services in yrs. 4–6	0.0721	0.1099	0.6570	0.5110

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Exhibit A-21. HLM analysis to predict transfers from two-year to four-year institutions six years after freshman entry in 1991–92 using continuous measures of participation and adding propensity scores

Variable	Coefficient	Standard Error	T-ratio	P-value
Intercept	0.2186	0.0122	17.9280	0.0000
SSS services are home-based	0.0375	0.0447	0.8410	0.4170
No SSS programs at institution	0.1060	0.0336	3.1530	0.0090
SSS services are blended	0.0285	0.0354	0.8050	0.4370
Female student	-0.0704	0.0251	-2.8050	0.0050
High school GPA	0.0629	0.0178	3.5340	0.0010
Took any developmental course	-0.0609	0.0252	-2.4150	0.0160
Attended college after first year	0.0930	0.0295	3.1510	0.0020
No parental education beyond high school	-0.1195	0.0271	-4.4080	0.0000
Family income greater than $20,000	0.0025	0.0281	0.0880	0.9300
Once I start something, I finish it	-0.0320	0.0262	-1.2190	0.2230
Number of hours: instr. courses	-0.0012	0.0006	-1.9150	0.0550
Number of hours: profl. tutoring	-0.0167	0.0589	-0.2840	0.7770
Number of hours: peer tutoring	0.0039	0.0037	1.0410	0.2980
Number of hours: profl. counseling	0.0169	0.0120	1.4060	0.1600
Number of hours: peer counseling	-0.0917	0.1648	-0.5560	0.5780
Number of hours: labs	0.0040	0.0027	1.4680	0.1420
Number of hours: workshops	0.0344	0.0321	1.0720	0.2840
Number of hours: cultural events	0.1990	0.1162	1.7130	0.0860
Propensity to receive instr. courses	0.0021	0.0007	3.1170	0.0020
Propensity to receive profl. tutoring	0.0421	0.0342	1.2300	0.2190
Propensity to receive peer tutoring	-0.0049	0.0033	-1.4830	0.1380
Propensity to receive profl. counseling	0.0159	0.0187	0.8500	0.3950
Propensity to receive peer counseling	-0.0461	0.0642	-0.7190	0.4720
Propensity to receive labs	0.0000	0.0021	0.0130	0.9890
Propensity to receive workshops	0.0355	0.0139	2.5540	0.0110
Propensity to receive cultural events	-0.1200	0.0584	-2.0540	0.0400
Propensity to receive handicapped srvc.	0.0027	0.0068	0.3940	0.6940
Services for physically disabled	0.0465	0.0312	1.4910	0.1360
Services for limited-English ability	-0.0761	0.0570	-1.3340	0.1820
Student orientation	0.0055	0.0254	0.2160	0.8290
College reentrance counseling	0.0486	0.0257	1.8890	0.0590
Classroom instr.--basic skills	-0.0604	0.0392	-1.5410	0.1230
Classroom instr.--dvlpmntl. English	0.0152	0.0418	0.3640	0.7150
Classroom instr.--dvlpmntl. math	-0.0750	0.0384	-1.9540	0.0500
Cultural enrichment activities	-0.0258	0.0146	-1.7640	0.0770
Referrals to agencies/resources	-0.0028	0.0329	-0.0870	0.9310
# of counseling sessions in 1991–92	-0.0033	0.0032	-1.0310	0.3030
# of counseling sessions in 1992–93	-0.0072	0.0030	-2.3530	0.0190
# of counseling sessions in 1993–94	0.0159	0.0035	4.5450	0.0000
# of tutoring sessions in 1991–92	0.0034	0.0021	1.6050	0.1080

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# of tutoring sessions in 1992–93	-0.0051	0.0023	-2.2700	0.0230
# of tutoring sessions in 1993–94	0.0082	0.0024	3.3640	0.0010
Some tutoring in years 4–6	-0.0030	0.0044	-0.6710	0.5020
Some counseling in years 4–6	0.0289	0.0051	5.6540	0.0000
Some services for disabled in years 4–6	-0.0181	0.0618	-0.2940	0.7690
Field trip in years 4–6	0.1334	0.0366	3.6420	0.0000
Contact with support services in years 4–6	0.0067	0.0042	1.5800	0.1140
Missing data on high school GPA	0.1558	0.0753	2.0690	0.0380
Missing data on developmental courses	0.0056	0.0797	0.0710	0.9440
Missing data on first generation	-0.0854	0.0505	-1.6900	0.0910
Missing data on income	0.0341	0.0357	0.9540	0.3400
Missing data on finishing tasks	-0.0764	0.0682	-1.1200	0.2630
Missing data on B32	-0.0618	0.0679	-0.9110	0.3630
Missing data on services for limited-English	-0.2639	0.1734	-1.5220	0.1280
Missing data on student orientation	0.1009	0.1358	0.7430	0.4570
Missing data on reentrance counseling	0.0212	0.0684	0.3100	0.7570
Missing data on classroom instr.--basic skills	0.1128	0.1686	0.6690	0.5030
Missing data on tutoring in 1991–92	-0.0747	0.0695	-1.0760	0.2820
Missing data on tutoring in years 4–6	0.1830	0.1451	1.2610	0.2080
Missing data on counseling in years 4–6	-0.1256	0.0818	-1.5370	0.1240
Missing data on services for disabled in years 4–6	-0.2264	0.1616	-1.4010	0.1610
Missing data on field trip in years 4–6	0.3364	0.2092	1.6080	0.1080
Missing data on contact with support services in yrs. 4–6	-0.2524	0.2092	-1.2060	0.2280

SOURCE: U.S. Department of Education, Policy and Program Studies Service, National Evaluation of Student Support Services (SSS): Examination of Student Outcomes After Six Years, 2010.

Appendix B: Methodology

Highlights

- This study examined two types of outcomes to evaluate the effects of SSS. These were students' academic performance (i.e., college grade point averages and total number of credits earned), and retention in higher education and degree attainment (including transfers from two-year to four-year institutions).
- The study used transcript data to track the academic performance of about 2,900 freshman SSS participants over six years. Propensity scoring was used to select a comparison group of about 2,900 students with similar demographic characteristics who also were tracked over six years.
- Researchers collected detailed information about students' participation in SSS, including the number of hours of services received in each of nine categories: instructional courses, professional tutoring, peer tutoring, professional counseling, peer counseling, labs, workshops, cultural events, and services for the disabled. Both SSS participants and the comparison group also provided self-reports about services they received.
- Because students in the comparison group were still relatively advantaged compared with the SSS participants, additional statistical adjustments were used to correct for these differences. The variables chosen for these adjustments include students' demographic characteristics, academic background, and attitudes, and institutional characteristics of the schools they attended.
- Using regression analysis, the study developed statistical models to examine the relationship between the SSS services received and the measures of effect.
- Regression coefficients were used to calculate the effects of SSS for each student based on the number of hours of services that each received. Summary statistics then were developed to describe the average effect of individual SSS services and of SSS overall.

Introduction

This section provides a description of the study design and of the issues that were involved in the data analysis. Although there is some overlap in topics, it does not attempt to repeat all of the discussion provided in chapter 2 on the study design. Chapter 2 is intended to provide the general background that is needed to understand the structure of the report, while this section provides additional historical information about the development of the study and of the statistical models, along with some additional details on the topics discussed in chapter 2. (There necessarily also is some discussion of the research methodology when interpreting the statistical models used for the evaluation, especially in chapter 5, which weighs the various statistical models and attempts to determine whether some analytic approaches are more effective or trustworthy than others. Again, this section does not attempt the repeat that analysis but focuses on more general issues concerning the study design.)

While this report adds new methodological approaches that have not been used in earlier reports (i.e., the use of propensity scores within the statistical models, and the use of hierarchical linear modeling), in many ways the form of the statistical models still builds upon research that was conducted in earlier phases of the study. We did not attempt to reinvestigate every methodological choice that had been examined in the past. Thus, some parts of this appendix refer to earlier investigations (e.g., comparing the value of various approaches when investigating the effects of SSS on first-year GPAs) and do not attempt to update the analysis using the final data set (e.g., looking at six-year cumulative GPAs).

Response Rates

Following is a list of the different data sources used in preparing this analysis, together with the dates the data were collected and the response rates.

Data source	Dates of data collection	Response rate
Lists of all SSS participants	1991–92	28 of 30 sites
Freshman files for all freshmen in each SSS and non-SSS study site	1991–92	28 of 30 SSS sites; 19 of 20 non-SSS sites
First-year baseline student survey	1991–92	86 percent
Service records of SSS participants	1991–92	86 percent
Follow-up student survey	1994–95	86 percent
Student transcripts	1994	97 percent from initial 47 institutions; 92 percent from additional institutions
Follow-up student survey	1997–98	77 percent
Student transcripts	1997–98	92 percent of schools; 97 percent of transcripts

Longitudinal Analysis

This study was designed as a longitudinal analysis of 2,900 SSS participants chosen when they first entered college and then tracked over time. Students were regularly contacted to obtain information about their attitudes, characteristics, academic progress, and employment, and their academic transcripts were collected and summarized in order to measure their academic

performance. At the time of this report, six years of data about the students were available. For this report, students' performance is measured in the following ways:

- Academic performance
  - GPAs earned in college each year and over all six years combined
  - Number of credits earned each year and over all six years
- Retention and degree attainment
  - Retention at the same institution to the second, third, and sixth years
  - Retention at any institution of higher education in the third year and sixth year
  - Transfer from two-year to four-year institutions

For several reasons, it was determined that a longitudinal analysis of college freshmen would be the most effective means of measuring the short-term and long-term effects of SSS participation. If students were sampled at a later point in their college enrollment, then little information would be available about their first years in college, except for information recorded on academic transcripts or that students are able to remember and report. Also, because many students drop out of college before their second and third years, and because promoting retention in college is one of the major goals of SSS, a sample of non-freshmen potentially would be statistically biased by excluding those students who were not retained. Finally, an examination of SSS programs revealed that SSS services are primarily provided in the freshman year, and that there is little difference in the receipt of services after the freshman year; by selecting students as freshmen, detailed information could be collected about their participation in SSS services, which forms the primary basis for the analysis that follows.

Depending on the effect measure used, the effects are examined in individual years and cumulatively across all six years. Generally, given that SSS participation is typically greatest during the freshman year, one might expect that the greatest effect of SSS would also be found at that time, though it is also possible that some effects (perhaps especially for retention) may take more time to accumulate. On the other hand, since SSS has specific long-term goals such as increasing degree completion and transfers to four-year institutions, it is appropriate to evaluate SSS in terms of such goals. By looking at each year individually as well as at all years in combination, both possibilities can be examined. Moreover, this approach also allows the examination of the persistence of benefits of SSS participation: if SSS does improve students' academic performance, is that effect limited to the specific courses and time period when those services are received, or are the students learning knowledge and study skills that will help their performance in later years as well?

Quasi-Experimental Design

Many studies are handicapped by the lack of adequate statistical controls, so that when program effects appear to be identified, there may be a strong possibility of other confounding explanations for any differences that were found. For example, some possible confounding factors are maturation, high motivation to succeed, and differing levels of academic skills and knowledge. To limit the danger of such confounding factors, it is best to study two roughly equivalent groups, one subjected to the program treatment and the other which is not. By comparing the outcomes of the two groups, one can estimate whether the program treatment was

associated with improved performance. For this approach to work, it is especially important that the two groups be equivalent, and the process for choosing the groups can be critical to the success of the study. If people are assigned to the groups on a random basis, then the design is considered a true experiment. If exposures to the treatment are not randomized, then the design is quasi-experimental.

Selection of an appropriate comparison group is especially important for an evaluation of programs for disadvantaged students. Disadvantaged students are less likely both to attend college and to graduate from college. A study that compared SSS students to a typical mixture of students would be likely to show negative correlations between participation in SSS and student outcomes, not because SSS participation was counterproductive, but because SSS students could be expected to have worse outcomes than other students on average.

Random assignment is often considered the "gold standard" for evaluation studies. The random assignment of people to both groups is helpful because there is always the possibility that some factor might make one group systematically different from another, and thus explain in part any differences that are found. Researchers can consciously try to make the two groups equivalent by using some type of matching process, but there is the possibility that the matching may not work well (e.g., because data are not available, the data are of poor quality, or researchers failed to anticipate all of the characteristics that might be important). The use of randomization helps to helps to prevent any systematic differences from appearing between the two groups.

Despite the strong advantages of random assignment, there are times where it is impractical or ineffective. These situations are particularly relevant with regard to the SSS evaluation.

- **Failure of randomization to control for critical characteristics.** It is necessary that the random assignment process be designed to span across all important dimensions. Though simple in concept, however, it not always easy in practice, and especially if one does not know which dimensions might be important. One way that this issue is relevant for the SSS evaluation is that the assignment of SSS grants to institutions is itself not random. Institutions must choose to apply for the SSS grants, and the grants are awarded in a competitive fashion after evaluating the quality of the proposals. It is possible that characteristics that affect an institution's interest and ability to prepare a strong proposal might also be important in shaping the institution's program design and implementation. In this particular case, the potential for bias is not necessarily critical as long as the way in which grants are distributed does not change, but it may affect the generalizability of the results to new institutions if the program is expanded or the selection criteria are altered.

- **Ethical issues with the use of randomization.** Sometimes there are ethical reasons why it is difficult to impose randomization. For example, there are ethical difficulties with telling a student in the comparison group that he or she cannot receive tutoring or some other service from any source while in the study. Further, institutions would be likely to consider such a policy as being counter to their mission and potentially risky with regard to maintaining support and interest from prospective students, parents, alumni, and financial supporters. Thus, institutions do often offer supplementary services outside of

SSS, and needy students often participate in them, making it difficult or impossible to select students who have equivalent experiences except for the participation in SSS.

- **Problems in implementation.** Sometimes it is difficult to implement a study in a way that will make the desired distinction between the treatment and control groups. One difficulty with regard to SSS has already been noted: the distinction between SSS students and the comparison group is not ideal because the comparison students also often received supplemental services. Further, even among those students receiving SSS services, SSS is structured to allow students freedom in determining which services they receive and how much they receive; thus, one cannot force them all to receive equivalent amounts of services, and there is a potential that students who choose a particular type of service or who choose high levels of services may be systematically different from other study participants. SSS students also may receive supplemental services from other sources than SSS, and it would be both impractical and potentially unethical to prevent the receipt of such services (especially since some SSS programs are designed with the expectation that the students will also receive supplemental services from other sources).

- **Placebo effects.** In medical and other research, it has been well documented that the process of being monitored or treated can itself have an effect. Researchers try to compensate for this issue in a variety of ways; for example, the act of observing a comparison group helps to ensure that all groups have the feeling of being monitored, and the distribution of sugar pills (or other substitutes) helps to make people feel they are being treated. However, depending on the nature and invasiveness of the procedure, it is not always possible to hide that one group is being treated differently than another. The nature of participation in SSS is such that one cannot disguise whether a student is receiving a service, and one could easily hypothesize that the process of participating may change a student's attachment to the institution or motivation to study.[26]

Because of the difficulties with implementing a random assignment approach, this study instead used a quasi-experimental approach. The study did not attempt to influence either students' inclusion within SSS or their level of participation in supplemental services. It used a comparison group of students who were not participants in SSS but were chosen because they had similar characteristics to the participants.[27] The method and effectiveness of the selecting the comparison students is discussed in greater detail in a following section. The use of such a quasi-experimental design had both advantages and disadvantages:

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[26] Students often are unaware of the source of the service (e.g., whether it was provided through SSS or some other source), but the critical point is that such students are aware that the institution provided special supplemental services to them.

[27] A few schools did accept some marginal students for enrollment into the institution only if those students agreed to participate in SSS as a condition of their enrollment. The study did not attempt to change institutions' policies in either direction, neither forbidding conditional enrollments nor requiring them.

- The study was able to evaluate SSS in the same form as it was actually being implemented. If the conditions of SSS had been changed (e.g., by requiring a certain level of participation), the nature of the SSS program might be have been so radically changed that the study results might no longer be applicable toward estimating the effects of SSS. For example, it is possible that students select the type and amount of services they receive based on their perceptions of the effectiveness of the services (e.g., by discontinuing contacts if a service does not seem to be helpful), and that students vary in terms of which service is most effective (e.g., based on differences in learning style or academic skills and background). Forcing all students to receive uniform experiences might not only be difficult to implement (because of student resistance) but might obscure the effects of SSS. One difficulty is that students may not be as likely to benefit from a service if their attendance is forced, and another is that if students do differ in terms of which services will be most helpful, denying the possibility of self-selection may water down the estimated effect of each service by including students who are less able to benefit. Whatever the findings, it would be difficult to extrapolate those findings to SSS programs as they are actually implemented, when students can determine for themselves the amounts and types of services that they receive. The actual effect might be either higher (because of students' self-selection into those services that are most helpful) or lower (because of lower participation levels) than those observed under controlled conditions.

- The fact that students' receipt of services was not controlled or randomized does create a potential for bias, if the factors that are associated with participation are also related to student outcomes. For example, if those students who participate most are highly motivated to succeed, that motivation might help the students to be successful regardless of what supplemental services they receive. Conversely, if the students who participate the most are the neediest students (who seek more help because they need more help), then their outcomes may tend to be worse because of their greater need. Note that this issue is very different from the one raised in the first bullet. If students' self-selection is associated with whether the services are helpful, then it is critical to allow such self-selection to properly estimate program effects. On the other hand, if students' self-selection is associated with other factors that may affect student outcomes, then it may be difficult or even impossible to separate the effect of the service from the "effect" of the student characteristics. This issue is discussed in greater detail later within this chapter.

The Comparison Group of Non-SSS Students

In order to measure the effects of SSS on students' academic performance, one needs some basis for knowing how the students would have performed if they had not been in SSS. It is not appropriate to compare SSS students to typical college students because the academic or economic disadvantages that are required for SSS eligibility are known to be negatively associated with students' academic performance. Depending on the degree to which SSS helps participants

to overcome their disadvantages, they might be helped through their SSS participation without necessarily performing as well as “typical” students.

Method of Creation of Comparison Group

The study design included the selection of a comparison group of freshman students who were chosen to be as similar as possible to the SSS participants. The comparison group was chosen by using regression analysis to calculate propensity scores of students' likelihood of participation in SSS based on demographic data that were available from the colleges.[28] The derived formulas were then used to choose at each institution a comparison group of students whose propensity scores showed similar distributions. To lessen the risk that an institution might not have non-SSS students who were comparable to the SSS participants, the study also used propensity scores to select a comparison group of students from a similar institution that had no SSS programs. In this way, even if the SSS programs "skimmed" the most disadvantaged students, the study would include some comparison students for whom no such skimming was possible.[29]

No constraints were placed on the comparison group in terms of whether they participated in other non-SSS services, because if the SSS students had not participated in SSS, one might expect that they would have received many of the same non-SSS services. However, both the SSS participants and the comparison group were asked in the student questionnaires to describe all of the services that they received so that the effects of these services could be measured.

Comparison With SSS Students

As the 1997 report documented, while the propensity scoring was effective in selecting students who were more like the SSS participants than typical students, the differences were only partially overcome. In particular, SSS students tended to be more disadvantaged than the students in the comparison group. The primary reason the SSS students and the comparison group were not more similar appears to be the lack of adequate data for fully comparing the two groups of students. For example, some institutions did not have information about the race or ethnicity of their students or did not have information about the students’ finances, especially for those who were not receiving assistance. The fewer the items that were available, the less powerful were the propensity models that were developed; most institutions were able to supply only a limited amount of data. Another reason that it was sometimes difficult to select comparable non-SSS students is that at a few institutions, case studies revealed that the SSS programs were so highly targeted that there were no comparable non-SSS students with similar characteristics. The number of SSS students at such institutions, however, was sufficiently small as to have only a

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[28]The formulas that were used for calculating propensity scores varied from one institution to another because institutions differed in the amount of information that they were able to provide for use in the statistical model.

[29]However, some institutions only admitted certain types of students if they participated in SSS. These institutions by definition did not have comparable students outside of SSS. To the degree that the matching non-SSS institutions had similar admissions criteria, even those institutions might not have students with comparable disadvantages because without an SSS program to compensate for the students' deficiencies, those institutions might not accept such students on even a conditional basis.

minor effect on the overall averages. Also, the students in the highly targeted programs were actually less likely to be disadvantaged than the other SSS students (e.g., 77 percent were white, compared with 35 percent of other SSS students) so that targeting was not the major source of the differences between the SSS and comparison groups. Whatever the cause, there were systematic differences between the SSS participants and the comparison group, with the SSS participants being more disadvantaged. The analysis therefore required the use of statistical adjustments to correct for these differences (discussed below).

The 1997 report also shows that there generally were only small differences between the comparison students based on whether they were at SSS or non-SSS institutions. Because statistical adjustments for the differences between SSS and non-SSS students are required in any case, and these adjustments can also compensate for small differences between the two types of institutions, the distinction between the two comparison groups is unnecessary. Accordingly, this report combines both groups of comparison students into a single group for most analyses.

Use of Statistical Adjustments

Because the comparison group still might be anticipated to outperform the SSS students on academic measures, additional statistical adjustments were necessary. The use of statistical adjustments also was necessary for another reason: even among the pool of SSS participants, there was substantial variation in student characteristics that might reasonably be expected to affect the level of services that students use. For example, a student's high use of tutoring or counseling might reflect a high level of academic need so that the use of SSS services could be negatively correlated with measures of academic performance.

In order to adjust for these differences in student characteristics, two steps were taken. First, the analysis pooled the student data across all of the participating institutions; in this way, even if comparable non-SSS students could not always be found at the same institution as a particular group of SSS students, students with similar characteristics could often be found at one or more of the other institutions. Second, multivariate regression models were used to statistically adjust for differences in student characteristics. Because the purpose was not to measure the effect of a specific student characteristic, but rather to adjust for the cumulative effect of many characteristics, a relatively large number of variables were used in the regression models. Specifically, a variable was included in the model if it was of theoretical interest (e.g., measures of SSS participation and eligibility) or it proved statistically significant at the 0.05 level.

Because the intention of the model was to statistically adjust for factors that might be related both to SSS participation and to students' GPAs or retention, a relatively comprehensive list of variables was included in the model. If the intention was to measure the specific effects of one of these factors, such a procedure might result in biased estimates. For this particular study, however, the goal of providing a complete adjustment was deemed more important.

Measurement Issues

Variability of SSS Services

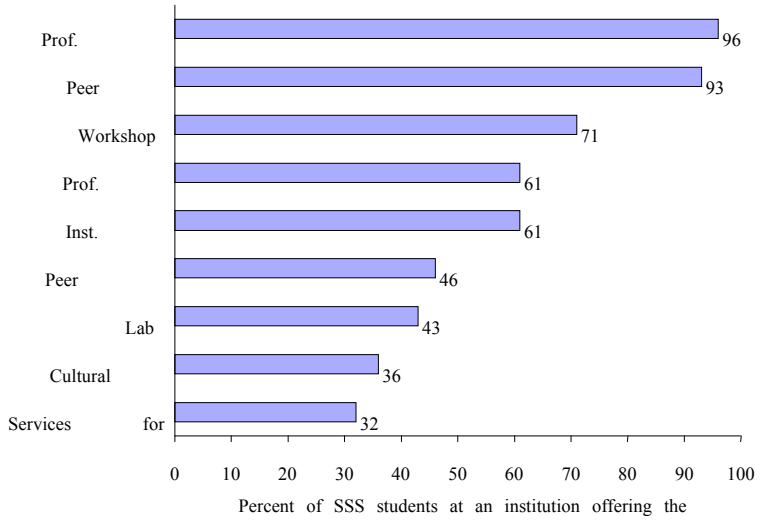
One theoretical decision that has important implications for evaluating SSS is whether to treat SSS as a relatively uniform intervention into students' lives or as a set of services that varies tremendously from one institution to another, and from one student to another even within an institution. From the standpoint of policy evaluation, there is considerable value in stating an overall effect of the SSS program and, thus, treating SSS as being relatively uniform. However, both our qualitative case studies and our quantitative data indicate that SSS services are not received in a uniform manner.

- SSS programs differed in the way they were organized. Some primarily focused on providing a single service, some were the only (or at least primary) provider of all support services at the institution, and some provided a home base on campus that served the "whole student" by providing a broader range of services to facilitate the students' integration on campus and by seeing that any needed supplemental services were provided. Because only three programs fit the "all service" category, and because the case studies suggested that the home-based programs deserved the closest analysis, the analysis in this study contrasts home-based programs with all other programs.
- SSS programs also differed in the extent to which the SSS services were blended with other services on campus. The analysis in the report uses the degree of blending as another way of differentiating between programs.
- SSS programs differed greatly in the types and amount of services they provided. For example, some programs provided separate instructional courses (e.g., developmental courses) that were offered exclusively to SSS students, while others offered similar courses that made no distinction between SSS and non-SSS students. Exhibit B-1 shows the percentage of SSS programs that provided each of nine SSS services to at least one freshman student in the sample.[30] While some services, such as professional counseling and peer tutoring, were almost universally available to students (with over 90 percent of the students at programs that provided the service), four of the nine services were offered by less than half of the programs.
- SSS students differed greatly in their use of services even at a single institution. This is most obviously true of services offered to the handicapped, because relatively few students were eligible for such services, but it was also true of more general services such as peer tutoring: some SSS students received no services, others received only small amounts, and still others received large amounts. No service was used by all students for whom the service theoretically was available. For example, while 96 percent of all programs offered

[30]In some programs, a service may have been available, even though no sampled freshman had received the service. For example, the service might be offered only to nonfreshmen, or it might be such a specialized service (e.g., for handicapped students) that no sampled students used it during the study. The definition used here requires specifically that the service be available to the SSS freshmen in the sample, as measured by the fact that at least one such freshman received the service. Additional information about the nine services is provided in exhibit 1-1 in chapter 1.

professional counseling to freshmen, only 82 percent of all the sampled freshmen in those programs received professional counseling.[31] In fact, only two services—professional counseling (82 percent) and workshops (62 percent)—were received by a majority of the students to whom they were available, while five of the nine services were received by less than a third of the students that might have received them. And only one service (professional counseling at 80 percent) was received by a majority of all SSS students.

Exhibit B-1. Percent of students in SSS programs in 1991–92 that provided each of nine SSS services



SOURCE: U.S. Department of Education, Planning and Evaluation Service (now known as the Policy and Program Studies Service), National Study of Student Support Services (SSS), *Service Record Analysis, 1991–92.*

Because of this great variation in the availability and use of the SSS services, a measure of the effects of SSS can be misleading unless the variation is taken into account. The group of SSS students includes many who received very few services through SSS and thus who were not very different from the comparison group in their educational experiences. Also, if some SSS services are more effective than others (as suggested later in this report), then even students who appeared to receive many SSS services may not have received the services that were most valuable, so that their educational experiences again may not be meaningfully different from those of the comparison group.

An implication of these differences is that it is difficult to describe SSS in terms of the "average" effects. Because there are many students who participate in SSS in only a minimal way (9 percent had only one service contact over the entire freshman year, 7 percent received less than one hour of total services in the first year, and 22 percent received between one and five hours), the average tends to understate the effect of SSS on those with whom it is most involved.

[31] A slightly lower number—80 percent—received professional counseling if one also includes SSS students who attended colleges that did not offer professional counseling. Typically, for services that were less widely offered than professional counseling, the gap between the two percentages is much greater.

The financial costs connected with SSS are most associated with students who are heavy users of the services, while the average effect would instead give a substantial weight to students who neither required many resources nor would be expected to feel much benefit. On the other hand, excluding those students who barely participated in SSS could also lead to misinterpretations of the data. If the reason that those students showed minimal participation is because they perceived that SSS was not helping them, then excluding them would be biasing the study results by excluding the "failures" (i.e., those who the program failed to help, regardless of how they did on the various outcome measures).

This analysis therefore uses multiple approaches. Some statistical models differentiate between SSS students based on the types of programs in which they were involved (home-based versus other, and blended versus separate), the types of services they received, and the number of hours of services they received. As an alternative, we also examined SSS participation through a single dichotomous measure that was based only on whether students participated in SSS during their freshman year, and that did not take account of either the type or amount of services they received. We also considered alternative means of measuring SSS participation, such as summing each student's participation across all nine services to create a single total for each student. This approach has the advantage of simplifying the measurement of SSS participation while still allowing for variations in the use of services. However, such an approach assumes that an hour of one type of service is equivalent to an hour of another, and tends to especially place a high weight on those services that consumed the most time (especially on development courses that were set aside only for SSS students). Both assumptions might be considered questionable.

One might speculate that the presence of certain types of SSS services provides important information about the general characteristics of the SSS programs. For example, only some SSS programs offered participation in cultural events as part of their SSS program, which might be an indicator that the program was sensitive to students' integration on the campus as well as to academic issues. Thus, it is possible that the effect measures used here might sometimes measure more general program characteristics than the specific services noted here. For example, it is possible that participation in cultural events by itself has no effect on student outcomes, but that rather it is the orientation of the program (which is measured through the offering of cultural events) that is the key factor. Possibly the "service" presenting the greatest such risk is the measure of home-based programs, because the presence of such a home base on campus helps to assure that students receive a coordinated package of benefits; thus, this measure is not really a measure of a particular service but of a set of services. The measure of blended services could present similar risks. Except for these two measures, however, the wide variation in the receipt of SSS services even within individual institutions lessens the likelihood that the measures are only serving as surrogates for more general program characteristics. It is certainly possible that other services might provide some of the same effects (or even increased effects) as the services examined here. In fact, this would be true regardless of whether the measures are surrogates for more general program characteristics. Nevertheless, it seems reasonable to conclude that the effects are still the result of participation in particular services rather than being more general indicators of program effects.

Measurement of SSS and Other Student Services

The measures of first-year SSS services were based on service records provided by the cooperating institutions that indicated the number of minutes (here converted to hours) of students' participation in each service. Data were collected for nine different categories of services: instructional courses, professional tutoring, peer tutoring, professional counseling, peer counseling, labs, workshops, cultural events, and services to the disabled. Additionally, data were collected using a number of subcategories of these services; for example, the category of peer tutoring was subdivided into general peer tutoring and tutoring in each of five different specific subject areas (English, mathematics, science, social science, and general). These subcategories and the percentage of SSS students using each type of service are presented in exhibit 1-1 in chapter 1. Some analyses were conducted using selected subcategories to determine whether the general categories or subcategories were more useful. The general categories are used in this report for simplicity and because the subcategories provided no useful additional information; generally the main effect of using the subcategories was to reduce the statistical significance of the findings, probably because of the reduced number of students getting a service when such detailed subcategories were used.

In order to reduce the burden the participating institutions, and because the freshman year was viewed as the primary year in which students participate in SSS, the study only obtained service records for the first year (1991–92). For services received in later years, only students' self-reports were used. Students were not asked to indicate the source of the services (they would not necessarily know the source, especially since many SSS projects adopt unique names at individual schools rather than using the SSS name), so these data do not distinguish between SSS and non-SSS services.

In order to properly measure the effects of the SSS services, it was judged necessary to also measure students' use of non-SSS services because SSS programs often referred students to non-SSS services, and because students often could receive equivalent services without participating in SSS. For example, if two students had equivalent abilities and backgrounds and one student benefited from SSS services while the other benefited from equivalent non-SSS services, an analysis that excluded the non-SSS services might falsely conclude that SSS had no effect because there was no measurable difference in outcomes between the two students. In fact, they each may have benefited compared with how they would have performed with no services. Similarly, because SSS students may receive non-SSS services, even an analysis that was limited to SSS participants would require the measurement of non-SSS services. Otherwise, one SSS student could benefit from an SSS service while another SSS student benefited from an equivalent non-SSS service, and the SSS service would falsely appear to show no effect because there would be no difference in the effect on outcomes.

Unfortunately, it was not possible to collect data about non-SSS services with the same precision as for SSS services, partly because of the wide range of sources of services. Instead, this study used students' self-reports of the services they had received, which was typically a dichotomous (yes or no) measure. (An exception is for tutoring and counseling, in which the students gave more detailed categorical responses—e.g., weekly, monthly—that were converted to numeric estimates.) The dichotomous measures were not expected to perform as well as the more precise measures of the SSS services (because they lumped together students receiving high and low amounts of the services), and an analysis confirmed that they did not. For example, the

measure of non-SSS tutoring showed statistically significant effects on first-year GPA when used as a continuous measure but not when it was recoded as a dichotomous variable. Thus, this analysis may understate the value of non-SSS services. Nevertheless, the statistical results for the non-SSS services were consistent with those for the SSS services, with the same types of services often being statistically significant for both SSS and non-SSS students.

The primary difference between the two groups of measures is that in a few cases the non-SSS measures were positive and statistically significant when the comparable SSS measures were not: for example, for two outcomes cultural enrichment activities were statistically significant when the comparable SSS measure was not, and measures of counseling often performed better than the measure of first-year SSS counseling. These small and occasional differences might be attributed to extraneous factors, such as differences in the number of students receiving services, or the use of targeted SSS counseling to help students facing academic difficulties. Given the consistency of the findings for SSS and non-SSS services, it does not seem that the differences in metrics had a harmful effect. Further, the primary goal of including the measures of non-SSS services was not to precisely measure their effects but to obtain an overall measure of the mean effect of each service so that the regression intercept (in combination with the other demographic variables) reflected the estimated result if a student received no services; this approach allowed a better estimate of whether SSS students were helped.

The measurement issue is further complicated by the fact that students' self-reports did not indicate whether the services they received were provided through SSS or through some other mechanism. One alternative was to leave the students' self-reports unadjusted, which would risk double-counting an SSS service as being provided both through SSS and also outside of SSS, while another alternative was to assume that whenever a student received an SSS service, the student's self-report must be referring to that SSS service and not to some alternative source. The case studies suggested that it is rare for a student to receive the same service through both SSS and outside of SSS; rather, when students receive both SSS and non-SSS services, the non-SSS services are typically in areas in which no comparable SSS services are provided at the institution. Thus, the second alternative was judged the most reasonable, and student self-reports were adjusted to eliminate any double-counting of services.[32]

The Use of Multiple Measures of SSS Services

By using multiple measures of SSS services, there is a risk that if two services were highly correlated, their joint inclusion might result in increased standard errors or a mismeasurement of the relative effects of the services. To check whether the use of multiple measures simultaneously had an effect on the results, each of the nine measures of SSS services was also run separately in regressions to estimate the effects of SSS on students' first-year GPAs. This procedure had no effect on which variables showed positive and statistically significant results; the only important difference was that one variable (professional counseling) that

[32]One reviewer had the concern that the combination of using a highly precise measure of SSS services with a dichotomous measure of non-SSS services would result in the effects of non-SSS services being absorbed by the more precise SSS measures. However, the strategy that was used to avoid double-counting helps to prevent this problem from occurring, because only one measure of a particular type of service can be nonzero for any given student. There is a risk that the measurement of the SSS effects will be overstated if a student received both an SSS service and an equivalent non-SSS service, but the likelihood of such an occurrence is so low that this is not a serious issue.

otherwise showed negative and statistically significant results was still negative but no longer statistically significant.

There are probably two explanations for this. First, because SSS overall had a positive effect and no other variable was included in the equation to measure that effect, the variable for SSS professional counseling picked up some of that positive effect, canceling out some of the negative association between the need for counseling and students' GPAs. Second, when professional counseling alone was in the model, the remaining variables in the regression equation were better able to adjust for the differences between students who received counseling and those who did not, while when all nine SSS services were included together, the coefficients that were appropriate for most SSS services were not as appropriate for professional counseling. The primary change was in the intercept, suggesting that students who received professional counseling started with some type of disadvantage relative to other SSS students that could not be captured through the other measures of student characteristics. Though the negative coefficient for professional counseling is undesirable (in the sense that some aspect of students' performance is not being properly explained), this finding best supports the conclusion that a more complex model is needed that more fully captures the differences between students who received counseling and those who did not, not that there is a problem with including individual measures of each SSS service.

Measures of Student Outcomes

Several measures of student outcomes were developed for this report: students' GPAs, the total number of credits earned, students' retention at the same college or within any college, students' retention or completion of a baccalaureate degree, and students' transfer from two-year to four-year institutions. Following is a more detailed description of the derivation of these measures.

Students' GPAs were calculated for each year individually and for all six years combined using the transcript data. In order to standardize the grading system, all grades were converted to a standard four-point scale, with an increment of 0.3 used for pluses and minuses.[33] The converted numeric score was multiplied by the number of credits attempted in order to compute a weighted GPA.

The number of credits earned was based only on courses taken for regular credit. Institutions sometimes differed in the way that credits were assigned, with developmental courses counting for regular credit at some institutions and not at others. Each institution's definition was accepted, without attempting to convert all credits to a similar coding scheme. For those colleges that divided the academic year into three terms (rather than two semesters), the credits earned were multiplied by two-thirds in order to create a standardized semester-based measure.

Retention at the same institution was measured by the presence of a GPA for that year at the sampled institution, without setting a minimum number of courses. Thus, part-time students were counted as retained, as were students who enrolled only for a single term in the academic year. Retention was measured through students' self-reports, except that students were

[33] E.g., "A"=4.0 and "C+"=2.3.

counted as retained if their transcript data indicated they were enrolled, even if the students reported they were not enrolled or the students did not complete the student questionnaire.[34]

Retention by itself could be a misleading outcome measure since a student who had graduated with a baccalaureate degree would typically no longer be in college (unless he or she was obtaining additional schooling for a teaching certificate or for graduate education). At the same time, many students had not had sufficient time to complete a baccalaureate degree. Thus, a combined measure was created that indicated those students who either were still in college or who had completed a baccalaureate degree or higher. The study also included separate outcome measures based only on what degrees the students had earned (without looking at retention); these measures sometimes might be premature (in the sense that some students may not have had sufficient time to complete their degrees), but they do not present the same difficulty that a retention-only measure would present (i.e., that a success—completing a degree—might be interpreted as a failure—no longer being enrolled in higher education).

The measure of students' transfers was limited to those students who started out at two-year institutions and whose transcripts showed that they had at some time attended a four-year institution. The level of the institution was obtained from the Integrated Postsecondary Education Data System (IPEDS).

Missing Data

In general, if a questionnaire item had substantial missing data, then a two-step procedure was followed: the missing values were set to 0, and a new dummy variable was set to 1 if there had been missing values, and 0 otherwise. In this way, the cases could be retained in the analysis, while the dummy variable summarizes the degree to which the cases with missing data differed from the overall mean.

A special situation occurred when structural equations models were used to estimate the effect of SSS on retention to the third year. Second-year GPAs were missing for roughly 30 percent of the students (i.e., because the student at least temporarily left higher education or transferred, and the student either did not provide any information or did not provide sufficient information for the transfer grades to be obtained), but the previous solution could not be used because the second-year GPA was used as a dependent variable in one of the equations. Rather than remove these students from the analysis, second-year GPAs were instead imputed by first introducing the first-year GPAs, and then iteratively using regression equations to calculate an estimated second-year GPA. Without the use of these additional data, the structural equations

[34]There would be some risk of bias if retention *rates* were calculated through this mechanism, because students who remained at the same institution would be counted as enrolled, but students who transferred to another institution might not be detected (without the student's report that he or she had attended another college, the transcript would not have been collected). Also, the imputation was only in one direction; no students were coded as not enrolled if we lacked transcript records to confirm the enrollment. However, the focus of the regression analysis was not to calculate retention rates but to calculate the incremental effect of SSS on retention. Assuming that the effects of SSS did not vary greatly from one student to another (except based on the differing amounts of services that each received, which was included in the model), this recoding of data was helpful by increasing the accuracy of the data and increasing the number of cases available for analysis.

model could not be estimated.[35] The results from the structural equations models were not greatly different from logistic regression models that used high school GPAs in place of college GPAs as a measure of academic strength, so unlike the third-year report, this report uses the logistic regression models without any imputation of data both for the third-year and sixth-year measures of retention.

Development of the Statistical Models

In this section, we describe the four types of statistical models that were used in the outcomes analysis. Additional discussion of the modeling process, including some alternative models that were considered, is provided in the 1997 report. A later section discusses how the models were interpreted.

Choice of Statistical Techniques

At times, relatively complex statistical techniques were required to solve some of the methodological issues that appeared in this study. Because of the possibility that the choice of a particular methodological approach might be responsible for the research findings, the 1997 report examined each student outcome from multiple statistical perspectives—at the least, by using multiple regression to look both for overall effects and for effects associated with particular SSS services, but also through using several methods to analyze retention: (1) logistic regression, (2) allowing for indirect effects of SSS through its effects on college GPAs, and (3) structural equations. In general, the comparison of the different statistical approaches showed that with only a few exceptions, the different approaches produced highly similar results, and the techniques that appeared the best from theoretical grounds were also the most powerful with regard to their predictive power. Thus, rather than repeating the use of multiple perspectives, this analysis builds upon the techniques that were identified as best in the 1997 report. This section briefly summarizes the findings of the 1997 report, while a more complete discussion of the approach, including the results of using the various alternative approaches, is provided in that report.

One of the key findings from the comparison of multiple approaches was that the statistical models were more powerful when each SSS service was treated as a separate variable in the overall model than when SSS participation was measured though a simple dichotomous measure (i.e., either the student was an SSS participant, or he or she was not). This finding was expected because the dichotomous measure mixes together students who were highly involved in SSS with students who were barely different in their participation from the non-SSS comparison group, and it is not realistic to expect both students to experience the same effects. Further, the use of a dichotomous measure ignores how the resources within SSS are distributed; the heavy users of SSS are also the ones requiring the greatest resources, so the costs of SSS are largely associated with one group, while the effects would be measured by a much larger and very different group. This report continues the practice of examining both a dichotomous measure of

[35]However, the results of logistic regression models that omitted second-year GPAs (as an alternative way of handling indirect effects of SSS through GPAs) were consistent with the structural equations models, so the results presented here do not appear to be an artifact of the imputation process.

participation and multiple, continuous measures of participation, so that readers may see the importance of the methodological choices involved.

Second, this analysis repeats the use of logistic regression analysis when the dependent variable is dichotomous, because the statistical assumptions for ordinary least squares regression analysis are violated when the dependent variable is limited to only two values. (However, the HLM models did not use logistic regression because HLM generally was unable to converge to a stable estimate. Fortunately, some studies have indicated that OLS regression is fairly robust, and tends to produce similar results to logistic regression. The same appeared to be true in this study, with the various methodological approaches often producing highly similar estimates of effect.)

In the 1997 report, only the measures of retention required logistic regression analysis, but the new measure of transfers to four-year institutions also is dichotomous, so that logistic regression analysis is used. In logistic regression analysis, coefficients have a somewhat different interpretation than do regression coefficients; they are not as directly interpretable, but rather can be transformed to reflect the odds ratio of a student's probability of retention or transfer. For example, suppose that a student would normally have a probability of 60 percent of being retained until the next year. This probability might be expressed as an odds (60 percent versus 40 percent, or 60/40 = 1.5). If the logistic regression indicates that the receipt of an SSS service might double the odds (i.e., if the odds ratio is 2), then the student's estimated new probability of retention (given the receipt of the service) would be 75 percent (i.e., the odds would be doubled from 1.5 to 3, and the probability distribution that would produce odds equal to 3 is 75 percent versus 25 percent). Thus, the amount by which students' probability of retention is increased will depend upon the original predicted retention rates; if the students are very unlikely to be retained, then even a doubling of the (low) probability will still result in a low number, while if the students are equally likely to be retained or not retained, the same odds ratio would be associated with a much larger change in the probability of retention.

To estimate the effects of SSS, one therefore needs to know not only the odds ratio, but also at least a rough approximation of the students' probability of retention. To simplify the discussion, this analysis often inserts a base rate into the calculation, so that it will easier to judge the magnitude of the change in probability. The base rates that were used are 14 percent for retention to the sixth year at the same institution, 42 percent for retention to the sixth year at any institutions, 34 percent for retention to the sixth year or the earning of a baccalaureate degree or higher at the same institution, 60 percent for retention to the sixth year or the earning of a baccalaureate degree or higher at any institutions, 6 percent for retention to the sixth year at the same institution at two-year institutions, 30 percent for retention to the sixth year at any institutions at two-year institutions, 6 percent for retention to the sixth year or the earning of a baccalaureate degree or higher at the same institution at two-year institutions, 34 percent for retention to the sixth year or the earning of a baccalaureate degree or higher at any institutions, and 15 percent for transfers from two-year to four-year institutions.[36]

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[36]The choice of the base retention rate has no effect on the statistical significance of the findings; it only affects how the coefficients are interpreted in terms of the size of the SSS effects. Further, even when interpreting the size of the SSS effects, the choice of the base retention rate does not have much effect as long as the alternatives are all relatively close to each other, as was the case here. Only a rough approximation is needed, especially given the low odds ratios that appeared in this analysis (no higher than 1.5 for the SSS variables). For example, if the odds ratio was 1.5, any base retention rate from 0.34 to 0.57 would produce an estimate of a 10 percent increase in retention, and any base retention

A third finding was that unless great care was used, introducing students' college GPAs as explanatory variables in the regression analysis had the effect of understating estimates of SSS on retention. Because students' college GPAs were affected by participation in SSS, the variables that were intended to measure the effect of SSS actually only measured the residual effect after the influence of SSS through students' GPAs was removed, not the total impact of SSS. Two different approaches produced similar results: leaving college GPAs out of the regression (instead using high school GPAs as a measure of academic strength) and using structural equations to calculate a base GPA (i.e., the predicted GPA if students had not participated in SSS) that could be used rather than the actual GPA (which included the added impact of SSS) to predict retention. Because the results were quite similar and the structural equations approaches added several complexities (i.e., the software for structural equations models was not designed for logistic regression analysis to compensate for the use of a dichotomous dependent variable, and it was necessary to impute college GPAs for many students in order to provide enough cases for stable estimates), this report uses logistic regression analysis without the use of college GPAs rather than using structural equations models.

Interpretation of Models

This section discusses how the summary measures of the effects of SSS were derived, and how the occasional appearance of negative but statistically significant regression coefficients should be interpreted.

rate from 0.66 to 0.71 would produce an estimated increase of 8 percent. If the odds ratio was 1.2, any base retention rate from 0.43 to 0.53 would produce an estimated increase of 5 percent, and any base retention rate from 0.54 to 0.72 would produce an estimated increase of 4 percent. The base retention rates were chosen based on the observed retention rates of the SSS students and the comparison group.

Translation of Coefficients into Estimated Effects

The regression coefficients for SSS services that appear in Appendix A may be interpreted as the average change in the student outcome that is associated with each hour of service received.[37] However, because SSS students varied greatly in the amount of services received, the actual impact of the SSS programs cannot be determined from those statistics alone. To provide a better summary measure of the impact of SSS, those coefficients that were positive and statistically significant were multiplied by the actual hours of services that each student received, and the mean among all students was then calculated.[38] This procedure was conducted both for each individual service that was statistically significant and for the sum of all statistically significant services that each student received. The latter statistic, labeled "total program effect" in this report, can be viewed as a single summary statistic that describes the total impact of the SSS program when all services are combined together.

In previous reports, the above calculation typically was performed for two groups of students. First, in order to provide an overall measure of the impact of SSS, the calculation was performed over all SSS students in the sample, even if a particular student did not participate in any services that showed statistically significant effects. This is the most useful statistic if one wishes to describe the total impact of SSS as a national program; however, because many SSS students participate in only a minimal way, this statistic does not necessarily describe the impact on those students most responsible for using SSS resources. Further, especially since some of the statistically significant services were not even available to many SSS students, the overall statistic fails to indicate the impact that might be produced if SSS were restructured to make greater use of services that are shown to be effective. For these reasons, in previous reports the calculation was also performed only for students who received statistically significant services (e.g., only for students receiving peer tutoring or, for the measurement of the "overall program effect," only for students receiving at least one statistically significant service). This latter statistic is a better measure of the value of a specific service, though it does not show the national impact of the service. For example, typically each of the nine SSS services was only offered at some of the SSS projects and not at others. If a service is offered, say, at half of the SSS projects, it might be accurate to say that the nationwide impact of that service was *x* percent, but it is also misleading in the sense that many SSS students never had the option of receiving that service through SSS. In this report, the primary focus is on the overall impact of SSS after summing across all SSS services rather than on individual services. Also, in order to be conservative with regard to the "intent to treat" issue (i.e., that omitting people who did not participate might bias the results by omitting failures of the project to help students), it seemed best to include all students.[39]

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[37]The coefficients for the logistic regressions are interpreted somewhat differently and reflect changes in the odds ratio that are associated with each hour of service. Odds ratios are discussed in greater detail earlier in this appendix.

[38]In the case of home-based and blended programs, the coefficient was multiplied by 1 if a student was in that type of program, and by 0 if the student was in a different type of program.

[39] However, one could differentiate between institutions that do not offer a particular service and students who do not participate when it is offered. A student's choice not to participate might be considered a failure of the service (e.g., if the reason is that the student has heard negative reports from other SSS participants), but the lack of availability of the service might simply indicate that the institution has chosen to offer the service though some means other than SSS.

Negative Regression Coefficients

For some models, and particularly using the measure of the amount of SSS professional counseling received by each student, one or more regression coefficients for the SSS services were negative but statistically significant. While it seems reasonable that some SSS services might be ineffective and show no relationship to student outcomes, it seems much less reasonable that a service was actually detrimental to students (e.g., because of quality control procedures to win and maintain the program grants, and because students would not be likely to participate unless they perceived a benefit from their participation); a more likely explanation is that some unmeasured variable (e.g., some academic deficiency) was responsible for both students receiving relatively large amounts of a service and also performing poorly on a measure of student outcomes. This, in fact, is a common risk of studies of programs to help disadvantaged students, because the disadvantages that make a student eligible for special programs also are related to poor academic performance; unless appropriate statistical adjustments are made, a negative relationship between participation and achievement may simply mean that a program failed to fully compensate for students' disadvantages, even if the participation might have been helpful. It is because of this risk that considerable effort was given to selecting a comparison group that had similar characteristics to the SSS participants, and for using additional statistical adjustments in the regression models.

If negative regression coefficients appear only rarely and there is no systematic pattern to their appearance, they might appear by chance given the large number of outcome measures used in this report. (While this study uses seven categories of outcome measures, it uses 12 separate measures across those categories; for example, retention/degree completion is measured both overall and also separately for two-year and four-year institutions.) For example, if a significance level of 0.05 is used for hypothesis testing, then one out of 20 of the findings might be expected to be statistically significant simply by chance.[40] This report will interpret negative relationships within the larger context of the findings: to the extent that they appear idiosyncratic and contradicted by more frequent positive findings, they will be ignored and assumed to reflect either the disadvantaged status of the SSS students or random aberrations, while consistent patterns will be examined to determine the source of the negative relationships.

The SSS service variable that most regularly produced negative and statistically significant coefficients was professional counseling. Additional analysis of the data indicated that there were systematic differences between students who received counseling and those who did not. For example, students who received no professional counseling had the strongest prior academic backgrounds (i.e., based on their mean SAT and ACT percentiles of 0.43). More generally, the strength of the students' prior backgrounds was inversely related to the amount of counseling they received (with SAT and ACT percentiles of 0.34 for students receiving up to one hour of professional counseling, 0.27 for one to two hours, and 0.24 for two to four hours; an exception to this pattern is that the percentile was 0.36 for the 6 percent of students receiving more than four hours of professional counseling). Similar patterns appeared for other types of counseling besides professional counseling. Students who received no peer counseling had the

[40] Not all of the measures are completely distinct. For example, retention or degree completion at four-year institutions is likely to be similar to retention or degree completion overall, and perhaps even to retention or degree completion at two-year institutions. Thus, it is probably an overstatement to label these as 12 separate measures. Still, to the degree that a finding appears highly idiosyncratic rather than showing a consistent pattern across multiple measures, one should be wary of giving too much importance to that finding.

strongest prior backgrounds with mean SAT or ACT percentile scores of 0.40, while students who received up to one hour of peer counseling had mean percentiles of 0.28, and those who received over one hour had mean percentiles of 0.25. For non-SSS counseling, the results were mixed depending on the type of counseling received. College reentrance counseling showed a similar pattern to those above, with the students who received counseling having weaker backgrounds (0.35) than those who did not (0.39). For other non-SSS counseling, however, the pattern sometimes held and sometimes did not: students who received one to three sessions had stronger backgrounds (0.45) than students with more than three sessions (0.38), but also stronger backgrounds than those with no counseling (0.37).

In principle, it should be possible to statistically adjust for the systematic differences in student characteristics so that the effect of counseling can be measured. In practice, however, the statistical adjustments that were appropriate for the remaining SSS service variables did not completely compensate for the relative disadvantage of students receiving professional counseling. Even when the remaining SSS service variables were deleted from a regression to predict students' first-year GPAs (under the assumption that different statistical adjustments are required for professional counseling than for other services), the relationship remained negative (though statistically insignificant). The primary change among the rest of the variables in the regression model was a slightly lower intercept, suggesting that students who need professional counseling were somehow academically more disadvantaged, but this disadvantage was not well captured by the other explanatory variables. Thus, it appears that the proper modeling of characteristics associated with receiving counseling would require data that are not currently available. One reason for this finding may be that professional counseling was often administered in a manner that was distinct from other SSS services; students who appeared to be in academic trouble were often called in for professional counseling, so that the receipt of professional counseling was often an indicator of academic distress.

Given the above difficulties, it seems the best interpretation of negative regression coefficients is to group them together with other SSS services that failed to show positive and statistically significant results; they all are services for which no benefit to students can be statistically proven. This does not mean that services that fail to show positive effects are proven to have no effect; that is, a failure to prove that a coefficient is different from 0 does not mean that the coefficient is equal to 0. For the particular case of negative regression coefficients, we especially have reason to think that the model is not working properly, and thus not to give excessive attention to those statistics. In this report, the focus is primarily on those services that do show positive and statistically significant results, rather than discussing each SSS service individually.

Another question that was examined was the treatment of negative but statistically significant regression coefficients when calculating the total impact of SSS. As described in an earlier section, the total impact was estimated by multiplying the positive and statistically regression coefficients by the actual number of hours of services received for each student, and then calculating the total across all services. The negative but statistically significant coefficients should not be considered reliable estimates of the effects of SSS, and in that sense they should not be included in the calculations. On the other hand, it might be that the size of the positive and statistically significant coefficients is due in part to the presence of negative coefficients, and that they would be smaller (with a correspondingly smaller total effect of SSS) if the variables showing a negative relationship were not included. To investigate this possibility, the regressions in the

third-year report were recalculated with the negative but statistically significant variables excluded. Overall, the coefficients that previously were statistically significant continued to be statistically significant, with coefficients that were roughly the same as those that were found previously. For example, the estimated impact of SSS on students GPAs in the first year would generally be 0.01 lower than reported in chapter 2 if this procedure is followed. Thus, the presence of negative but statistically significant coefficients does not seem to have had an important effect on estimates of the effects of other SSS services or on the calculation of the total impact.

For this report, the sixth-year regressions also were examined through alternative models in which the negative but statistically significant variables were excluded. Overall, the exclusion of the variables typically had little effect on the regression estimates. The two major exceptions are that in one model (the impact of SSS on retaining or completing a baccalaureate degree), there was a service (SSS workshops) that stopped being statistically significant when negative but statistically significant variables were excluded, and in another model (the impact of SSS on whether participants at two-year institutions received an associate's degree or higher), there was a service (peer tutoring) that became statistically significant when negative but statistically significant variables were excluded. In general, deleting variables is riskier than including irrelevant variables because deleting a variable may result in biased estimates, while including irrelevant variables affects the standard errors but does not bias the estimates. The presence of negative but statistically significant coefficients suggests that there is wide variation in the impact or distribution of SSS that is not adequately being measured in the model. Most likely, the regression model is too small (e.g., it is not including important information about how the services are distributed, as noted with regard to professional counseling) rather than too large. The approach used in this report is to focus on the statistics resulting from the full model, while footnotes discuss the results of the alternative models in which negative but statistically significant variables were excluded.

Estimating Program Impacts

The method used to estimate program impact varies slightly depending on the particular methodology that is used. When dichotomous measures of SSS participation are used in multivariate regressions, the regression coefficient for the measure of SSS participation can be directly interpreted as the average change in student outcomes that is associated with participation in the program. For example, a coefficient of 0.03 in the analysis of GPAs could be interpreted as an average improvement (across all SSS students) of 0.03 using a four-point grading scale, and a coefficient of 3.1 in the analysis of total credits earned could be interpreted as an average improvement of 3.1 credits. When logistic regression is used, the coefficients are more difficult to interpret because they represent a change in the probability that the student will achieve the stated outcome.

More specifically, the statistics shown in the tables are not the actual coefficients but the log-odds ratio. The odds ratio expresses the improvement in the probability that is associated with participation in SSS. For example, if a student's probability of achieving the outcome is 60 percent, that probability could also be expressed as an odds of 1.5 (i.e., 60/(100-60)=60/40=1.5). An odds ratio of 2 would imply that participation in SSS is associated with doubling the student's odds (i.e., from 1.5 to 3), which would be equivalent to a probability of 75 percent (i.e., 75/(100-75)=75/25=3). For that student, then, the increase in probability of achieving the outcome is 15

percent (i.e., 75–60). Note that the amount of change in a student's probability depends on the student's base level of probability of achieving the outcome if he/she does not participate in SSS. If the base probability of achieving the outcome instead was 75 percent, the odds would be expressed as 3.0 (75/(100-75)=75/25=3.0), and a doubling of the odds to 6.0 would be equivalent to a probability of approximately 85.7 percent (85.7/(100-85.7)=85.7/14.3≈6.0), or an increase of about 12 percent. For this report, when a dichotomous measure of SSS participation is used, the base probability was calculated by determining what probability level, when combined with the estimated log-odds ratio that was obtained, would result in the actual outcome probability as observed among the SSS students.[41]

When nondichotomous measures of SSS participation are used, the regression coefficients cannot automatically be interpreted as the average impact across all students. Rather, the regression coefficient represents the level of improvement that is associated with receiving one hour of the specified service. Thus, one way of estimating the average impact is to multiply the regression coefficient by the average number of hours of that service that were received across all SSS students. If multiple services showed positive and statistically significant results, one also needs to sum all such estimates in order to estimate the total SSS impact (rather than just the impact of one particular service). When logistic regression is used, one would take a somewhat comparable approach, except that one must also conduct the appropriate transformations to switch from log-odds ratios to changes in the probability of achieving the specified outcome. However, when multiple SSS services show positive and statistically significant results, the log-odds ratios cannot simply be added. The estimates in this report were computed by multiplying the logistic regression coefficients by the actual number of hours for each student, summing the results across all SSS variables for each student, estimating the level of impact per student, and averaging those results to produce an overall estimate.

Data on Two-year Institutions

Several of the outcome measures used in this report were limited to students who were attending two-year institutions at the start of the study. The measure of transfers from two-year to four-year institutions was defined only for such students, while the measures of retention and degree completion were computed for two-year institutions only, as well as across all institutions and (sometimes) for four-year institutions only. However, because only 1,200 of the 5,055 students in the database started at two-year institutions, the models that were limited to such students were less likely to show statistically significant relationships. In fact, not only were the supplemental services less likely to be significantly related to student outcomes, but all variables in the models tended to perform poorly. The final statistical models generally contained only a relatively small number of variables, and several variables were retained in the final models only because the selection procedures required that at least one variable be retained in each major category of variables, regardless of statistical significance. Thus, statistics on two-year institutions are not highly accurate, and readers should be wary of overinterpreting the findings. In particular, a failure to find statistically significant relationships may only indicate that the number of cases

[41] This approach is a simplification because it ignores the fact that most SSS students also received non-SSS services in the first year, plus SSS or non-SSS services after the first year, and both types of services may be associated with improved student outcomes. The estimated change in probability that is associated with SSS participation depends on what base probability of achieving the outcome is assumed, and the presence of positive and statistically significant results for these other supplemental services would suggest that the base probability should be somewhat lower than if one assumes that SSS was the only factor producing improved student outcomes.

available was not adequate for identifying statistical relationships unless those relationships were quite strong. The small number of cases was especially an issue for examining retention or baccalaureate degree completion at the same institution. With only a few exceptions, students were not able to earn baccalaureate degrees at two-year institutions, and students at two-year institutions were not likely to remain enrolled for six years unless they also transferred to four-year institutions. Only a total of 84 students at two-year institutions had either remained enrolled at that institution or earned a baccalaureate degree at that institution. Thus, the statistical models for this student outcome consistently performed poorly, and few variables of any type were statistically significant.

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