

Evaluation of the Cleveland Scholarship and Tutoring Program Technical Report 1998-2004

**Jonathan Plucker, Ph.D.
Director**

**Patricia Muller, Ph.D.
Associate Director**

**John Hansen, MS
Research Associate**

**Russ Ravert, Ph.D.
Research Associate**

**Matthew Makel, MA
Graduate Research Assistant**

February 9, 2006



CENTER FOR EVALUATION & EDUCATION POLICY

509 East Third Street
Bloomington, Indiana 47401
<http://www.ceep.indiana.edu>

Jonathan A. Plucker, Ph.D.
Director

812-855-4438
800-511-6575
Fax: 812-856-5890
ceep@indiana.edu

Table of Contents

1	Introduction	1
1.1	Background of the Cleveland Scholarship and Tutoring Program (CSTP)	3
1.2	CSTP Evaluation	6
2	Evaluation Methods and Approaches	9
2.1	Data Sources and Collection	10
2.1.1	Achievement Test Scores	11
2.1.2	Non-Achievement Data and Sources: CSTP and CMSD Records	12
2.2	Sample and Sample Selection	15
2.2.1	Emergent Subgroups	17
2.2.2	Sample Selected for Analyses	19
2.2.3	The Imputed Sample	20
2.2.4	Demographic Comparisons between Imputed and Non-Imputed Cases	22
2.3	Data Analysis Techniques	24
3	Analyses and Results	29
3.1	Question One	29
3.1.1	Student Demographic Characteristics: Sixth Grade (Spring 2004)	30
3.1.2	Demographic Characteristics: Differential Entry and Exit of Scholarship Students	34
3.1.3	Academic Achievement and Student Demographic Characteristics	39
3.1.4	Students' Status Prior to Becoming Scholarship Recipient-users	40
3.1.5	Question One Summary: Student Demographic Characteristics	45
3.2	Question Two	48

3.2.1	Classroom Characteristics of Public vs. Private Schools: Sixth Grade (2003-2004)	48
3.2.2	Classroom Characteristics and Academic Achievement	52
3.2.3	Question Two Summary: Classroom and Teacher Characteristics	55
3.3	Question Three.....	56
3.3.1	ANCOVA with Minority Status.....	59
3.3.2	ANCOVA with Minority Status and Student Mobility	76
3.3.3	ANCOVA adjusting for differences in Prior Achievement	98
3.3.4	Analysis including poverty status	117
3.3.5	Differential Exit from the CSTP: Former Scholarship Recipients and Academic Achievement	145
3.3.6	Summary of Question Three	161
4	Summary and Conclusions	165

List of Figures

FIGURE 1. Sixth Grade 2003-2004 Minority Status by Student Group	32
FIGURE 2. Education Level of Public and Private School Teachers in Sixth Grade (2003-2004)	50
FIGURE 3. Overall Achievement from First Grade 1998 to Sixth Grade 2004.....	61
FIGURE 4. Reading Achievement from First Grade 1998 to Sixth Grade 2004	64
FIGURE 5. Language Arts Achievement from First Grade 1998 to Sixth Grade 2004.....	66
FIGURE 6. Mathematics Achievement from First Grade 1998 to Sixth Grade 2004.....	69
FIGURE 7. Science Achievement from Third Grade 2001 to Sixth Grade 2004.....	71
FIGURE 8. Social Studies Achievement from Third Grade 2001 to Sixth Grade 2004	73
FIGURE 9. Overall Achievement from First Grade 1998 to Sixth Grade 2004.....	80
FIGURE 10. Reading Achievement from First Grade 1998 to Sixth Grade 2004	83
FIGURE 11. Language Arts Achievement from First Grade 1998 to Sixth Grade 2004.....	86
FIGURE 12. Mathematics Achievement from First Grade 1998 to Sixth Grade 2004.....	89
FIGURE 13. Science Achievement from Third Grade 2001 to Sixth Grade 2004.....	91
FIGURE 14. Social studies Achievement from Third Grade 2001 to Sixth Grade 2004.....	94
FIGURE 15. Overall Achievement from First Grade 1999 to Sixth Grade 2004.....	102
FIGURE 16. Reading Achievement from First Grade 1999 to Sixth Grade 2004	104
FIGURE 17. Language Achievement from First Grade 1999 to Sixth Grade 2004.....	106
FIGURE 18. Mathematics Achievement from First Grade 1999 to Sixth Grade 2004.....	109
FIGURE 19. Science Achievement from Fourth Grade 2002 to Sixth Grade 2004.....	112
FIGURE 20. Social studies Achievement from Fourth Grade 2002 to Sixth Grade 2004	115
FIGURE 21. Overall Achievement from First Grade 1999 to Sixth Grade 2004.....	125
FIGURE 22. Reading Achievement from First Grade 1999 to Sixth Grade 2004	128
FIGURE 23. Language Achievement from First Grade 1999 to Sixth Grade 2004.....	132
FIGURE 24. Mathematics Achievement from First Grade 1999 to Sixth Grade 2004.....	135
FIGURE 25. Science Achievement from Fourth Grade 2002 to Sixth Grade 2004.....	139
FIGURE 26. Social studies Achievement from Fourth Grade 2002 to Sixth Grade 2004	142
FIGURE 27. Overall Achievement by Differential Exit: Former Recipient-users and Seven-year Recipient-users 1998-2004.....	149
FIGURE 28. Reading Achievement by Differential Exit: Former Recipient-users and Seven-year Recipient-users 1998-2004.....	151

List of Figures

FIGURE 29. Language Arts Achievement by Differential Exit: Former Recipient-users and
Seven-year Recipient-users 1998-2004 153

FIGURE 30. Mathematics Achievement by Differential Exit: Former Recipient-users and
Seven-year Recipient-users 1998-2004 155

FIGURE 31. Science Achievement by Differential Exit: Former Recipient-users and
Seven-year Recipient-users 1998-2004 157

FIGURE 32. Social Studies Achievement by Differential Exit: Former Recipient-users and
Seven-Year Recipient-users 1998-2004..... 159

List of Tables

TABLE 1.	Data Types and Sources.....	15
TABLE 2.	Multiple Comparison Groups	16
TABLE 3.	Maximum Sample Sizes by Student Group and Testing Episode1	17
TABLE 4.	Sample Selected for Imputation: Missing Data Estimated and Replaced	21
TABLE 5.	Demographic Comparisons between Students Selected for and Students Excluded from the Final Imputed Sample.....	23
TABLE 6.	Student Demographic Characteristics: Sixth Grade (Spring 2004).....	31
TABLE 7.	Expanded Minority Status: Sixth Grade (Spring 2004)	32
TABLE 8.	Student Demographic Characteristics of the Imputed Sample.....	33
TABLE 9.	Student Demographic Characteristics as of Sixth Grade: Differential Entry	35
TABLE 10.	Student Demographic Characteristics of First Year Recipients, 1997 - 2004	36
TABLE 11.	Student Demographic Characteristics as of Sixth Grade (2003-2004): Differential Exit	38
TABLE 12.	Results: Regression of Classroom and Teacher Features and Overall Achievement Scores (2003-2004)	39
TABLE 13.	Prior Year School Type for First-year Scholarship Recipients, 1999 - 2004	42
TABLE 14.	Proportion of First Year Scholarship Recipient-users by Prior School of Enrollment and Minority Status (2003-2004)	43
TABLE 15.	Expanded Student Demographic Data by Prior School of Enrollment for Scholarship Recipient-users as of Sixth Grade (2003-2004)	45
TABLE 16.	Descriptive Statistics for Total Years of Teacher Experience, Years at Current School, and Class Size in Sixth Grade (2003 - 2004)	49
TABLE 17.	Percentage of Public and Private School Teachers across Education Level Categories in Sixth Grade (2003-2004).....	50
TABLE 18.	Percentage of Public and Private School Teachers across Certification Categories in Sixth Grade (2003-2004).....	51
TABLE 19.	Correlations between Significant Classroom and Teacher Features and Sixth Grade Achievement (2003-2004)	53
TABLE 20.	Results: Regression of Classroom and Teacher Features and Overall Achievement Scores (2003-2004)	55
TABLE 21.	Overall Achievement: Early First Grade (Fall 1998) to Late Sixth Grade	

List of Tables

	(Spring 2004).....	60
TABLE 22.	ANCOVA Summary: Overall Achievement Analysis from First Grade 1998 to Sixth Grade 2004.....	60
TABLE 23.	Reading Achievement: Early First Grade (Fall 1998) to Late Sixth Grade (Spring 2004).....	62
TABLE 24.	ANCOVA Summary: Reading Achievement Analysis from First Grade 1998 to Sixth Grade 2004.....	63
TABLE 25.	Language Arts Achievement: Early First Grade (Fall 1998) to Late Sixth Grade (Spring 2004).....	65
TABLE 26.	ANCOVA Summary: Language Arts Achievement Analysis from First Grade 1998 to Sixth Grade 2004.....	66
TABLE 27.	Mathematics Achievement: Early First Grade (Fall 1998) to Late Sixth Grade (Spring 2004).....	67
TABLE 28.	ANCOVA Summary: Mathematics Achievement Analysis from First Grade 1998 to Sixth Grade 2004.....	68
TABLE 29.	Science Achievement: Late Third Grade (Spring 2001) to Late Sixth Grade (Spring 2004).....	70
TABLE 30.	NCOVA Summary: Science Achievement Analysis from First Grade 1998 to Sixth Grade 2004.....	70
TABLE 31.	Social Studies Achievement: Late Third Grade (Spring 2001) to Late Sixth Grade (Spring 2004).....	72
TABLE 32.	ANCOVA Summary: Social Studies Achievement Analysis from First Grade 1998 to Sixth Grade 2004.....	72
TABLE 33.	Subjects of Significant Pairwise Differences Favoring Scholarship Students Over: (a) Applicant Non-recipients (ANR) and (b) Non-applicants (NA) by Testing Episode.....	74
TABLE 34.	Relative Proportion of Sample Size between Comparison Groups.....	78
TABLE 35.	Overall Achievement: Early First Grade (Fall 1998) to Late Sixth Grade (Spring 2004).....	78
TABLE 36.	ANCOVA Summary: Overall Achievement Analysis from First Grade 1998 to Sixth Grade 2004.....	79
TABLE 37.	Reading Achievement: Early First Grade (Fall 1998) to Late Sixth Grade (Spring 2004).....	81

List of Tables

TABLE 38. ANCOVA Summary: Reading Achievement Analysis from First Grade 1998 to Sixth Grade 2004.....	81
TABLE 39. Language Arts Achievement: Early First Grade (Fall 1998) to Late Sixth Grade (Spring 2004).....	84
TABLE 40. ANCOVA Summary: Language Arts Achievement Analysis from First Grade 1998 to Sixth Grade 2004.....	84
TABLE 41. Mathematics Achievement: Early First Grade (Fall 1998) to Late Sixth Grade (Spring 2004).....	87
TABLE 42. ANCOVA Summary: Mathematics Achievement Analysis from First Grade 1998 to Sixth Grade 2004.....	87
TABLE 43. Science Achievement: Late Third Grade (Spring 2001) to Late Sixth Grade (Spring 2004).....	90
TABLE 44. ANCOVA Summary: Science Achievement Analysis from Third Grade 2001 to Sixth Grade 2004.....	90
TABLE 45. Social Studies Achievement: Late Third Grade (Spring 2001) to Late Sixth Grade (Spring 2004).....	92
TABLE 46. ANCOVA Summary: Social Studies Achievement Analysis from Third Grade 2001 to Sixth Grade 2004.....	93
TABLE 47. Subjects of Significant Pairwise Differences Favoring Scholarship Students Over: (a) Applicant Non-recipients (ANR) and (b) Non-applicants (NA) by Testing Episode	95
TABLE 48. Relative Proportion of Sample Size between Comparison Groups.....	99
TABLE 49. Overall Achievement: First Grade (Spring 1999) to Late Sixth Grade (Spring 2004).....	100
TABLE 50. ANCOVA Summary: Overall Achievement Analysis from First Grade 1999 to Sixth Grade 2004.....	101
TABLE 51. Reading Achievement: First Grade (Spring 1999) to Late Sixth Grade (Spring 2004).....	103
TABLE 52. ANCOVA Summary: Reading Achievement Analysis from First Grade 1999 to Sixth Grade 2004.....	103
TABLE 53. Language Arts Achievement: First Grade (Spring 1999) to Late Sixth Grade (Spring 2004).....	105
TABLE 54. ANCOVA Summary: Language Arts Achievement Analysis from First Grade	

List of Tables

1999 to Sixth Grade 2004	105
TABLE 55. Mathematics Achievement: First Grade (Spring 1999) to Late Sixth Grade (Spring 2004)	107
TABLE 56. ANCOVA Summary: Mathematics Achievement Analysis from First Grade 1999 to Sixth Grade 2004	107
TABLE 57. Science Achievement: Fourth Grade (Spring 2002) to Late Sixth Grade (Spring 2004)	110
TABLE 58. ANCOVA Summary: Science Achievement Analysis from Fourth Grade 2002 to Sixth Grade 2004	111
TABLE 59. Social Studies Achievement: Fourth Grade (Spring 2002) to Late Sixth Grade (Spring 2004)	113
TABLE 60. ANCOVA Summary: Social Studies Achievement Analysis from Fourth Grade 2002 to Sixth Grade 2004	114
TABLE 61. Subjects of Significant Pairwise Differences between Scholarship Students (7), Applicant Non-recipients (ANR) and Non-applicants (NA) by Testing Episode	116
TABLE 62. Relative Proportion of Sample Size between Comparison Groups	118
TABLE 63. ANCOVA Summary: Reading Achievement Analysis from First Grade 1999 to Sixth Grade 2004	119
TABLE 64. ANCOVA Summary: Language Arts Achievement Analysis from First Grade 1999 to Sixth Grade 2004	119
TABLE 65. ANCOVA Summary: Mathematics Achievement Analysis from First Grade 1999 to Sixth Grade 2004	120
TABLE 66. ANCOVA Summary: Overall Achievement Analysis from First Grade 1999 to Sixth Grade 2004	120
TABLE 67. ANCOVA Summary: Science Achievement Analysis from First Grade 1999 to Sixth Grade 2004	121
TABLE 68. ANCOVA Summary: Social Studies Achievement Analysis from First Grade 1999 to Sixth Grade 2004	121
TABLE 69. Overall Achievement for Students in Poverty: Late First Grade (Spring 1999) to Late Sixth Grade (Spring 2004)	123
TABLE 70. ANCOVA Summary: Overall Achievement Analysis from First Grade 1999 to Sixth Grade 2004 for Students in Poverty	123
TABLE 71. Overall Achievement for Students Not in Poverty: Late First Grade	

List of Tables

	(Spring 1999) to Late Sixth Grade (Spring 2004).....	124
TABLE 72.	ANCOVA Summary: Overall Achievement Analysis from First Grade 1999 to Sixth Grade 2004 for Students Not in Poverty.....	124
TABLE 73.	Reading Achievement for Students in Poverty: Late First Grade (Spring 1999) to Late Sixth Grade (Spring 2004).....	126
TABLE 74.	ANCOVA Summary: Reading Achievement Analysis from First Grade 1999 to Sixth Grade 2004 for Students in Poverty.....	126
TABLE 75.	Reading Achievement for Students Not in Poverty: Late First Grade (Spring 1999) to Late Sixth Grade (Spring 2004).....	127
TABLE 76.	ANCOVA Summary: Reading Achievement Analysis from First Grade 1999 to Sixth Grade 2004 for Students Not in Poverty.....	127
TABLE 77.	Language Arts Achievement for Students in Poverty: Late First Grade (Spring 1999) to Late Sixth Grade (Spring 2004).....	129
TABLE 78.	ANCOVA Summary: Language Arts Achievement Analysis from First Grade 1999 to Sixth Grade 2004 for Students in Poverty.....	129
TABLE 79.	Language Arts Achievement for Students Not in Poverty: Late First Grade (Spring 1999) to Late Sixth Grade (Spring 2004).....	130
TABLE 80.	ANCOVA Summary: Language Arts Achievement Analysis from First Grade 1999 to Sixth Grade 2004 for Students Not in Poverty.....	130
TABLE 81.	Mathematics Achievement for Students in Poverty: Late First Grade (Spring 1999) to Late Sixth Grade (Spring 2004).....	133
TABLE 82.	ANCOVA Summary: Mathematics Achievement Analysis from First Grade 1999 to Sixth Grade 2004 for Students in Poverty.....	133
TABLE 83.	Mathematics Achievement for Students Not in Poverty: Late First Grade (Spring 1999) to Late Sixth Grade (Spring 2004).....	134
TABLE 84.	ANCOVA Summary: Mathematics Achievement Analysis from First Grade 1999 to Sixth Grade 2004 for Students Not in Poverty.....	134
TABLE 85.	Science Achievement for Students in Poverty: Late Fourth Grade (Spring 2002) to Late Sixth Grade (Spring 2004).....	136
TABLE 86.	ANCOVA Summary: Science Achievement Analysis from Fourth Grade 2002 to Sixth Grade 2004 for Students in Poverty.....	136
TABLE 87.	Science Achievement for Students Not in Poverty: Late Fourth Grade (Spring 2002) to Late Sixth Grade (Spring 2004).....	137

List of Tables

TABLE 88. ANCOVA Summary: Science Achievement Analysis from Fourth Grade 2002 to Sixth Grade 2004 for Students Not in Poverty	137
TABLE 89. Social Studies Achievement for Students in Poverty: Late Fourth Grade (Spring 2002) to Late Sixth Grade (Spring 2004)	140
TABLE 90. ANCOVA Summary: Social Studies Achievement Analysis from Fourth Grade 2002 to Sixth Grade 2004 for Students in Poverty	140
TABLE 91. Social Studies Achievement for Students Not in Poverty: Late Fourth Grade (Spring 2002) to Late Sixth Grade (Spring 2004)	141
TABLE 92. ANCOVA Summary: Science Achievement Analysis from Fourth Grade 2002 to Sixth Grade 2004 for Students Not in Poverty	141
TABLE 93. Significant Pairwise Differences Between Seven-Year Scholarship Students (7) and Applicant Non-recipients (ANR) by Testing Episode for Students in Poverty and Students Not in Poverty	143
TABLE 94. Correlations between Duration of Participation in the CSTP and Sixth-Grade Achievement among Current and Former Scholarship Recipient-users.....	146
TABLE 95. Overall Achievement: Differential Exit from the CSTP Fall 1998 to Spring 2004 - Former Recipient-users vs. Seven-year Recipient-users	147
TABLE 96. ANOVA Summary: Overall Achievement Analysis from First Grade 1998 to Sixth Grade 2004	148
TABLE 97. Reading Achievement: Differential Exit from the CSTP Fall 1998 to Spring 2004 - Former Recipient-users vs. Seven-year Recipient-users	149
TABLE 98. ANOVA Summary: Reading Achievement Analysis from First Grade 1998 to Sixth Grade 2004	150
TABLE 99. Language Arts Achievement: Differential Exit from the CSTP Fall 1998 to Spring 2004 - Former recipient-users vs. Seven-year Recipient-users.....	151
TABLE 100. ANOVA Summary: Language Arts Achievement Analysis from First Grade 1998 to Sixth Grade 2004	152
TABLE 101. Mathematics Achievement: Differential Exit from the CSTP Fall 1998 to Spring 2004 - Former recipient-users vs. Seven-year Recipient-users	153
TABLE 102. ANOVA Summary: Mathematics Achievement Analysis from First Grade 1998 to Sixth Grade 2004	154
TABLE 103. Science Achievement: Differential Exit from the CSTP Fall 1998 to Spring 2004 - Former recipient-users vs. Seven-year Recipient-users.....	155

List of Tables

TABLE 104. ANOVA Summary: Science Achievement Analysis from First Grade 1998 to Sixth Grade 2004..... 156

TABLE 105. Social Studies Achievement: Differential Exit from the CSTP Fall 1998 to Spring 2004 - Former recipient-users vs. Seven-year Recipient-users 157

TABLE 106. ANOVA Summary: Social Studies Achievement Analysis from First Grade 1998 to Sixth Grade 2004..... 158

TABLE 107. Statistically Significant Marginal Mean Pairwise Differences by Number of Years in Scholarship Program 160

TABLE 108. Effect Sizes for Statistically Significant Sixth Grade Achievement Scores..... 168

TABLE 109. Sixth Grade (Spring 2004) Test Scores by Student Group in Achievement Areas Demonstrating Significant Differences: Grade Mean Equivalent (GME) and National Percentile Rank (NP) 169



1 Introduction

The history of school voucher programs in the United States is relatively short, with Milwaukee becoming the first city in the country to launch a voucher program in 1990. In the fifteen years since the Milwaukee voucher program's inception, the Wisconsin Supreme Court declared the use of vouchers in religious schools legal, and the Milwaukee voucher program has grown to become the oldest and largest voucher program in the country. Additional voucher programs have been implemented since Milwaukee as well, each having unique histories regarding their implementation and success.

According to the Education Commission of the States, ten states and the District of Columbia have voucher programs (or tax-credit or refund programs) to pay for private education. Although the majority of these programs are not statewide in nature, several states have recently engaged in efforts to implement statewide voucher programs. In 2003, Colorado adopted a statewide voucher program that was quickly ruled unconstitutional and in violation of the state's local control clause by the Colorado Supreme Court. Currently in Florida, while the Governor is attempting to expand the nation's first statewide school voucher program, the Florida State Supreme court is taking up the legality of one state program (Opportunity Scholarships) which allows students in failing public schools to attend private schools at the state's expense. Ohio also recently joined the ranks of states working to implement statewide programs. In June 2005, Governor Taft signed the state's budget bill opening scholarships (vouchers) to students statewide. As in

each state funded voucher program before it, both advocates and opponents vow to continue fighting until the issue is resolved.

During his first term, President George W. Bush proposed a plan to provide federally-financed vouchers allowing low-income parents across the nation the option of sending their children to private schools. The President settled for a \$13 million pilot program limited to families in Washington, D.C. This federally-funded voucher pilot program gives priority to students from low-income families who attend public schools identified for improvement, corrective action, or restructuring under the No Child Left Behind Act (NCLB) during the previous school year, to receive vouchers to pay for tuition at private or parochial schools in the D.C. area. According to recent reports, the Senate is considering changes to the program including an increase in the annual limit on scholarships and allowing students to use vouchers at private schools outside the District of Columbia. These recommended changes may possibly have been prompted in part by the large number of students being offered scholarships for the fall who may not be able to use them due to a lack of open slots in the upper grades in the District of Columbia. As with other programs, legal battles are likely to ensue over the DC program. The President's budget proposal for 2006 requests \$50 million for a nationwide Choice Incentive Fund, which gives groups across the U.S. the chance to compete for federal money to support school voucher programs. Passing the proposed budget may depend on the success of the District of Columbia's pilot effort.

As evidenced thus far, educational choice is increasingly becoming a visible and controversial issue facing the future of education in the U.S. Many states have considered and initiated legislation to increase educational choices available to families through a variety of programs, including charter schools (community schools in Ohio), magnet schools, and voucher programs. Proponents argue several benefits can result from the introduction of a market-based model to public education, including wider arrays of educational choice for students, enhanced student achievement, greater parental involvement, and

increased accountability among school personnel for school-wide student outcomes.

While these direct outcomes are expected to occur for students and their families, school choice advocates believe that existing schools may also benefit from improvements, advocating that the competitive edge prompted by the market-based model can serve to increase education and employment choice among students, teachers, and administrators.

1.1 Background of the Cleveland Scholarship and Tutoring Program (CSTP)

Ohio has been at the forefront of these issues, with Ohio Revised Code 3313.974-3313.979 authorizing the Ohio Superintendent of Public Instruction to create a pilot publicly-funded voucher program in one school district of the state. October 1995 saw the inception of the Cleveland Scholarship and Tutoring Program (CSTP) within the boundaries of the Cleveland Municipal School District (CMSD). Despite some uncertain times regarding the future of the program, the debate regarding its legality was settled in June 2002 when the U.S. Supreme Court ruled Cleveland's publicly-funded voucher program constitutional. In addition to funding the CSTP, the Ohio Department of Education (ODE) devoted substantial resources to an evaluation of the publicly-funded voucher program. Starting in Spring 1996, ODE contracted with Indiana University (IU) to conduct a longitudinal evaluation of the Cleveland Scholarship and Tutoring Program. The evaluation conducted by IU, the longest-running evaluation of any publicly-funded voucher program, provides a valuable opportunity to examine the impact of vouchers on students over time. To date, the evaluation has collected data from a cohort of students beginning in the 1997-98 school year and continuing through the students' sixth-grade year in 2003-2004.

Several changes to the program have recently been instituted, and will be noted here due to the potential influence of the changing context on the descriptive and academic outcomes. The first change arose during the summer of 2003 when the Ohio Legislature

enacted a decision to expand the program into district high schools. Therefore, for the 2003-2004 school year, grade nine scholarships were made available for students who had used a scholarship to attend private school in eighth grade the previous school year. Likewise, in the subsequent 2004-2005 school year, grade ten scholarships were made available for students who had used a scholarship to attend private school in ninth grade the previous school year. Prior to this legislative change, scholarships were available only to students up to and through eighth grade. The second change came when the Ohio Legislature increased the funding amount for the private school scholarships. In the 2003-2004 school year, the maximum scholarship amount increased to \$3,000 from \$2,250 for students from grades kindergarten to eighth and to \$2,700 for students from ninth and tenth grades.

As mentioned previously, besides the two program modifications just discussed, the most monumental change in the program occurred in June 2005, when Governor Taft signed the state's budget bill opening the scholarships to students statewide. This change more than tripled the size of the program by adding an additional 14,000 vouchers, and bringing the total of available vouchers in the state to nearly 20,000. Although this change does not directly impact the Cleveland program per se, this change is important to understanding the broader context of vouchers in the state of Ohio. The change will allow an additional 14,000 students throughout the state, from schools that have been labeled in "academic emergency" for three years, to attend a private school. At the same time, the maximum scholarship amount was again increased and eligibility was expanded to all grades, thereby adding grades eleven and twelve. Scholarships were increased to \$4,250 (from \$3,000) for kindergarten through eighth grades, and \$5,000 (from \$2,700 for ninth and tenth grade) for ninth through twelfth grade. These changes will make the program in Ohio the nation's largest program of its kind.

More specifically in terms of CSTP, the number of vouchers available during any given year is based on the number of vouchers used during the previous school year, not the

number of scholarships available during the previous year. Each year, the CSTP program is allowed to submit a request to the State Superintendent of Education requesting an increase in the number of scholarships from those used during the previous year. Historically, the number of additional scholarships requested each new year is 1,000 more than the previous years' total number of scholarships available. In other words, the number of scholarships actually utilized in any given school year, rather than simply the number of scholarships available for that year, is the basis for increasing the number of scholarships available for the following school year. Thus the pattern follows that the greater the number of scholarships used in one year, the greater the number of available scholarships in the ensuing year.

Up until 2004, vouchers were awarded on a monthly basis (from February through July) and applicants were categorized into one of three groups according to income within the federal poverty index. The first group consisted of applicants whose families earned less than 100% the federal poverty index; the second group consisted of applicants whose families earned between 100% and 200% of the federal poverty index; the third group consisted of applicants whose families earned more than 200% the federal poverty index. When the number of applicants in the first two groups exceeded the number of available vouchers, the lottery occurred amongst applicants in the first two groups. If the number of vouchers outnumbered the applicants in the first two groups, the remaining vouchers were made available to the third group. This procedure tended to result in a greater number of relatively higher-income and previous private school students receiving new scholarships and the CSTP perceived a need to develop a new process for more effectively distributing scholarships.

Starting in 2004, available scholarships were first awarded to eligible kindergarten students, with priority given to families who were in the lowest income category. Remaining available scholarships were awarded to families of students in first through eighth grades using a random lottery, again with priority given to families falling within the lowest

income levels. Families were given 30 days, upon being offered a scholarship, to use the scholarship which was a new procedure with a shorter timeframe. After 30 days, the process was repeated with unused scholarships again made available and distributed by random selection to remaining eligible applicants. For a more complete discussion of how vouchers are awarded see previous Technical Reports.

1.2 CSTP Evaluation

Researchers from Indiana University have examined the academic and demographic outcomes of the Cleveland Scholarship and Tutoring Program (CSTP) since its inception in 1996. Across the multiple years of the longitudinal study, academic outcomes have included the impact of the CSTP program on student academic achievement; and descriptive outcomes have included characteristics of students and families, qualities of the teachers and classrooms experienced by students, parental opinions of the program, and, more generally, parental opinions of the education their children receive. Although the evaluation initially focused on students who entered the program from public schools in third grade, since 1997-98 the project has focused on a cohort of students who entered the program as kindergartners. This evaluation study includes several methodological characteristics lacking in previous research on vouchers. Specifically, it: 1) tracks a cohort of children from their entrance into private or public schools in kindergarten or first grade; 2) uses multiple comparison groups (e.g., scholarship users, public school non-applicants, applicant non-recipients, etc.); and (3) tracks the performance and academic growth of individual students over time. For detailed information on methodologies and focus from previous years, please refer to prior summary and technical reports.¹

Similar to previous years of the longitudinal study, the most recent evaluation uses multiple comparison groups and annual measurement of students' academic performance to

1. All prior reports, from both phases one and two, are available through the Ohio Department of Education or through Indiana University (<http://ceep.indiana.edu/projects/project.php?id=37&category=3>).

examine both the level of achievement and achievement growth from the beginning of first grade through the end of sixth grade. The current report provides findings from the analyses of the academic outcome data collected annually from 1998 through 2004 from approximately 4,000 students in 100 different CMSD schools. More specifically, the current report provides findings related to the characteristics of students who participate in the CSTP, the characteristics of the classrooms and teachers with whom scholarship students work in private schools, and the impact of participation in the CSTP on students' academic achievement. Specifically, this study utilizes a mixed-model, longitudinal research design to examine the following research questions related to participation in the CSTP:

1. What are the characteristics of students who participate in the CSTP, and how do they compare with the characteristics of students who do not participate?
2. What are the characteristics of the classrooms and teachers with whom scholarship students work in private schools, and how do they compare with the characteristics of classrooms and teachers in public schools?
3. What is the impact of participation in the CSTP on students' academic achievement?

This Technical Report is based upon data collected from 1998-2004 and is organized into three sections. The first section describes the evaluation approaches and methodologies that were used during students' sixth grade year (2003-2004). Section two presents detailed results of the data analyses and is structured around the three evaluation questions described above. The final section discusses current results in the context of earlier findings, and presents conclusions from the study to date.



2 Evaluation Methods and Approaches

As noted previously, a mixed-model, longitudinal research design was used to examine the following research questions related to participation in the CSTP:

1. What are the characteristics of students who participate in the CSTP, and how do they compare with the characteristics of students who do not participate?
2. What are the characteristics of the classrooms and teachers with whom scholarship students work in private schools, and how do they compare with the characteristics of classrooms and teachers in public schools?
3. What is the impact of participation in the CSTP on students' academic achievement?

For each question presented, analyses includes both descriptive and inferential statistical techniques. Inferential analyses primarily relied upon analysis of variance and analysis of covariance (ANOVA and ANCOVA), and follow-up pairwise comparison techniques as appropriate. The primary achievement outcome data source is the Terra Nova, a standardized test produced by CTB/McGraw-Hill, and administered to students each year by representatives of the evaluation team. Two additional sources of data used in the study are classroom-level data collected in public and private schools by the evaluation staff and student demographic data drawn from records maintained by the CSTP office and Cleveland Municipal School District (CMSD) records.

The current report presents findings based on a replication of methodologies used in previous years of the longitudinal study. These analyses are necessary and warranted in that

they provide consistency across the years of the study. In addition, however, the research team also re-examined the previous methodologies and available extant data to determine if there were other approaches or additional variables that could be used to investigate the differences in student achievement over time. As a result, in addition to replicating previous analyses related to impact on student achievement (Research Question #3), the current report also includes analysis to control for pre-program academic differences between scholarship and non-scholarship students. As described in more detail in subsequent sections of the report, this analysis used students' test scores at the beginning of first grade as a covariate in the analysis to control for pre-program differences. In addition, analyses were conducted that incorporate the following extraneous variables: student mobility and poverty status. These additional analyses help provide a more comprehensive understanding of the impact of the CSTP program on student achievement.

This section of the Technical Report provides details related to these data sources and data collection. In addition, the section provides additional information on the sample and sample selection used for the study, as well as an overview of the data analysis techniques. Further details are also available in Technical Reports from previous years of the study.

2.1 Data Sources and Collection

The study used data from a variety of sources, including the collection of student achievement data by Indiana University researchers. In addition, data related to teacher and classroom characteristics were collected as part of the test administration process. Secondary (extant) data sources were also used, including CSTP and CMSD records. The following provides further information on the various independent and dependant variables.

2.1.1 Achievement Test Scores

Throughout the longitudinal evaluation, student academic achievement has been measured using the Terra Nova (CTB/McGraw-Hill). This nationally-normed test was selected for the following reasons: (a) none of the schools in which data are collected use the Terra Nova as their primary off-grade testing tool; (b) the test is among the most progressive in its use of contemporary testing principles and formats; and (c) scale scores allow comparisons across time. In the first and second grade, the selected versions of the test (Levels 10, 11, and 12) provided scores for each student in reading, language arts, mathematics, and a total or overall score – which is the average of the other three achievement measures. In the third through sixth grades, the versions of the test selected (Levels 13, 14, and 15) included science and social studies in addition to the other areas.²

Test Administration

For test administration, proctors administered the Terra Nova to target students in public and private schools over two testing sessions. The first testing session, which covers the reading and language arts portions of the test, is administered in the afternoon and the second testing session, which covers the mathematics, social studies, and science portions of the test, is administered on the following morning. A proctor to student ratio of 2:15 is used as a baseline, with additional proctors provided when large classrooms are used to test multiple groups of students and/or when special education students require accommodations that necessitate assistance of additional proctors (e.g., small group testing situations, scribes).

2. The total score on the Terra Nova is calculated by CTB/McGraw-Hill using the Language, Reading, and Mathematics scores (i.e., the average of the three scores). The total score on all Terra Nova tests is calculated in a similar manner, regardless of level.

Scale Scores

The longitudinal nature of the current project requires the use of linear scaled scores, rather than the more commonly used, but non-linear, normal curve equivalent (NCE) scores. In particular, the scale scores on the Terra Nova describe student achievement on a linear continuum from kindergarten through twelfth grade. While the entire scale ranges from approximately 100 to 900, each test level has a unique minimum and maximum attainable score. Scores on the overlapping test levels, which increase in difficulty, are linked to span the entire continuum. Thus, as the grade level of test difficulty increases, so does the range of attainable test scores.³

2.1.2 Non-Achievement Data and Sources: CSTP and CMSD Records

Cleveland Scholarship and Tutoring Program Data

The primary source of extant data for the evaluation was the office records of the Cleveland Scholarship and Tutoring Program. The records provided a means of identifying students as scholarship recipient-users, applicant non-recipients, and scholarship recipient non-users. These records also enabled the evaluation team to identify non-applicants who are tested in the public and private schools. Furthermore, by tracking this information across time, former scholarship recipient-users were also identified (i.e., students who applied for and used a scholarship in the past but, at some point in time, returned to public schools).

In addition to enabling project staff to classify students into research subgroups, CSTP records provide information pertaining to the following: school of enrollment for partici-

3. For example, scale scores on the Level 10 Reading section of the Terra Nova range from a minimum of 355 (zero items correct) to 626 (20 items correct), the Level 11 Reading scores range from a minimum of 407 to 701, the Level 12 Reading scores range from 423 to 722, the Level 13 Reading scores range from 427 to 750, the Level 14 Reading scores range from 433 to 780, and the Level 15 Reading scores range from 475 to 790. The test is designed so that a student who receives a score of 600 on the Level 10 Reading section will also score close to 600 on the progressively more difficult Levels 11 and 12 -- plus or minus a degree of measurement error. That is, a score of 600 represents the same level of achievement/mastery of the materials and concepts regardless of the level administered (within the limits of the floor and ceiling of a given test level).

pants (e.g., recipient-users); demographic information including student race/ethnicity, gender, family size, and family income; and information related to the date that families applied for a voucher and the date on which a voucher was awarded (in the case of applicants who receive a scholarship). These records are updated as scholarships are awarded and subsequently updated throughout the year if families change schools.

CSTP records also are used to obtain demographic information on students whose families applied for a scholarship at some point between the time their child entered kindergarten and fifth grade. The demographic data provide descriptive information and allow for comparisons to be made among participating, non-participating, and formerly participating students.

Cleveland Municipal School District Records

Cleveland Municipal School District records are used for purposes similar to CSTP records. That is, this data source provides demographic information on students as well as school of enrollment for students whose most current school is not available from CSTP records (e.g., former scholarship users, applicant non-recipients, and/or recipient non-users). Demographic information provided through the public school dataset includes student race/ethnicity and gender.

When possible, CMSD data are used in conjunction with the CSTP records. However, for public school non-applicants who have no information in CSTP records, only CMSD demographic information is used.

Meal Code as a Proxy for Family Income

Previous years of the evaluation used an estimated meal code status as a proxy for family income (see previous Technical Reports for details related to this variable). However, the 2004 Technical Report noted serious limitations of the meal code proxies being used for analyses. The research team estimated that since the most recent individual public school

meal code assignments were made in 2000-2001, the available data were likely to be inaccurate for more than 40% of public school students in the sample. Coupled with this serious limitation of the data and differential impact on data analyses for public school students and CSTP students, the high percentage of students with missing cases for meal codes made these data even more suspect. Therefore, due to the lack of reliability and validity of this important variable, a decision was made to not include measures of socioeconomic status for most of the analyses. However, as described later in the report, an indicator of poverty status was developed and used for one set of analyses related to academic impact.

Classroom Surveys

Guided questionnaires were implemented annually to obtain information regarding the teachers and classrooms in which students were primarily situated. Specifically, information was obtained on the teacher and classroom for each targeted student relating to the following: (a) class size, (b) teacher's total years of teaching experience, (c) teacher's years of teaching experience at current school, (d) teacher's level of education, and (e) whether or not the teacher was certified.

Table 1 presents each type of data collected and the source from which it was obtained. The data described above were used both independently and in combination for the data analyses, as described in subsequent sections of the report.

TABLE 1. Data Types and Sources

Type of Data	Public School Records	CSTP Office Records	Terra Nova	Evaluation Office Records	Classroom Interviews
Student gender	X	X	X		
Student race/ethnicity	X	X			
Academic achievement			X		
School(s) of enrollment	X	X		X	
Class size					X
Teacher experience-total					X
Teacher experience at present school					X
Teacher education					X
Teacher certification					X
Student mobility				X	

2.2 Sample and Sample Selection

Comparison of achievement outcomes in longitudinal and non-randomized interventions are especially challenging, with methodological and theoretical complexities making it difficult to identify a single appropriate comparison group. Therefore, these analyses use multiple comparison groups to best address the impact of the voucher program. To provide the most valid and meaningful evaluation design, the broadest possible sample of participating and non-participating students was selected during their first grade year in 1998-1999; and this longitudinal cohort was tracked as they progressed through first grade (1998-1999), second grade (1999-2000), third grade (2000-2001), fourth grade (2001-2002), fifth grade (2002-2003), and sixth grade (2003-2004). More specifically, the five groups of students used for the multiple comparison groups are noted in Table 2 below.

TABLE 2. Multiple Comparison Groups

Student Group / Population	Definition
Scholarship recipient-users	Students who received a scholarship and used it to attend private school
Scholarship applicant non-recipients (public)	Students who applied for but did not receive a scholarship through the lottery system and who attend public schools
Public recipient non-users	Students who applied for and received a scholarship but did not use the scholarship and attend public schools
Former scholarship users (public)	Students who received and used a scholarship for one or more years, subsequently withdrew from the CSTP, and now attend public schools
Public non-applicants	Public school students whose families never applied for a scholarship

For each of the five student groups, the sample sizes for the seven testing episodes are provided in Table 3. An ongoing and extensive process of monitoring and updating student status allowed the evaluation to maximize the retention of the various samples across the multiple years of the evaluation. Regardless, these sample sizes vary across the testing administrations due to student transience, double promotion of target students, retention of target students, absences during the testing episodes, inconsistent school records, and other uncontrollable and unintended factors. Given that students moved into and out of the various groups, sample sizes in the table below also vary and even increase in some instances (e.g., each year more students applied for the scholarship, increasing the population of applicants for each respective testing period). The sample sizes in Table 3 represent the maximum sample sizes available for the study, and actual sample sizes for analyses varied depending on the research question addressed. Given that actual sample sizes vary by analyses, the actual sample sizes are reported separately in each respective section for the research questions.

TABLE 3. Maximum Sample Sizes by Student Group and Testing Episode¹

Student Group	Time of Testing						
	Fall First Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004
Scholarship recipient-users	885	878	717	676	651	640	733
Scholarship applicant non-recipients (Public)	492	479	441	378	493	485	368
Public recipient non-users	83	82	90	100	223	278	193
Former scholarship users (Public)	30	50	98	129	207	318	188
Public non-applicants	1408	1402	1027	1170	1794	1587	1241

¹ These are maximum sample sizes available (i.e., total numbers of students tested). Actual sample sizes for individual analyses vary, and are reported separately throughout the report as relevant.

2.2.1 Emergent Subgroups

The longitudinal design of this evaluation also allows some of the groups discussed above to be further divided based on the students’ unique patterns of scholarship status across the six assessment episodes.

Scholarship Recipients: Six groups of scholarship recipients have been identified based on their entry into the CSTP (ignoring scholarship status prior to entering the program). These scholarship recipient groups are:

- 1. Seven-year scholarship recipients.** Students who entered the program in kindergarten (Fall 1997) and have participated in the program for seven school years, from kindergarten through sixth grade (2003-2004);
- 2. Six-year scholarship recipients.** Students who entered the program in first grade (Fall 1998) and have participated in the program for six school years, from first grade through sixth grade;
- 3. Five-year scholarship recipients.** Students who entered the program in second grade (Fall 1999) and have participated in the program for five school years, from second grade through sixth grade;
- 4. Four-year scholarship recipients.** Students who entered the program in third grade (Fall 2000) and have participated in the program for four school years, from third grade through sixth grade;

5. **Three-year scholarship recipients.** Students who entered the program in fourth grade (Fall 2001) and have participated in the program for three school years, from fourth grade through sixth grade;
6. **Two-year scholarship recipients.** Students who entered the program in fifth grade (Fall 2002) and have participated in the program for two school years, in fifth grade and sixth grade; and
7. **One-year scholarship recipients.** Students who entered the program in sixth grade (Fall 2003) and have participated in the program for one school year.

The groups of scholarship recipients who entered the program at various points from kindergarten (1997-1998) to sixth grade (2003-2004) have been identified to determine whether and how students who entered the CSTP later (e.g., in fifth or sixth grade) differ from students who entered the program earlier (e.g., in kindergarten or first grade). In general, the seven-year scholarship recipient-users constitute the primary group of interest in the present evaluation because they have continuously participated in the program since kindergarten and have never attended public schools.

Former Scholarship Recipients: Former scholarship recipients are comprised of subgroups of students who participated in the program for varying amounts of time and withdrew at different points after their enrollment in kindergarten. Five groups of former scholarship recipients have been identified and classified based on when they withdrew from the CSTP:

1. **Six-year former scholarship recipients.** Students who participated in the program for one school year, during kindergarten (1997-1998), withdrew from the program after kindergarten, and have attended public schools for *six years* (first grade through sixth grade);
2. **Five-year former scholarship recipients.** Students who participated in the program for two school years, during kindergarten and first grade (1997-1999), withdrew from the program after first grade, and have attended public schools for *five years* (second grade through sixth grade);
3. **Four-year former scholarship recipients.** Students who participated in the program for three years, from kindergarten through second grade (1997-2000), withdrew from the program after second grade, and have attended public schools for *four years* (third grade through sixth grade);

4. **Three-year former scholarship recipients.** Students who participated in the program for four years, from kindergarten through third grade (1997-2001), withdrew from the program after third grade, and have attended public schools for *three years* (fourth grade through sixth grade);
5. **Two-year former scholarship recipients.** Students who participated in the program for five years, from kindergarten through fourth grade (1997-2002), withdrew from the program after fourth grade, and have attended public schools for *two years* (fifth and sixth grades); and
6. **One-year former scholarship recipients.** Students who participated in the program for six years, from kindergarten through fifth grade (1997-2003), withdrew from the program after fifth grade, and have attended public schools for one year (sixth grade).

The former scholarship recipient subgroups, classified based on differential exit from the CSTP, were identified to investigate whether and how students who withdrew from the program differ as a function of their date of exit.

2.2.2 Sample Selected for Analyses

Following the Spring 2004 (late sixth grade) testing episode, achievement and demographic data were available from each of seven testing episodes (early first grade, late first grade, late second grade, late third grade, late fourth grade, late fifth grade, and late sixth grade). As mentioned previously, due to the inherent difficulties involved with tracking students across multiple years in a longitudinal study, the actual sample (as of Spring 2004) does not contain complete achievement and demographic data from every student targeted during testing. That is, as expected in a longitudinal study, students in the sample exhibit varying amounts of data across the seven testing episodes.

In order to replicate the evaluation conducted for the 1998-2003 report, the current study employed a multiple imputation technique to address the limitations associated with using datasets with missing student records for standard repeated measures or mixed-design analyses of variance (see 1998-2003 Technical Report). These multiple imputation techniques were utilized to replace the missing achievement scores with estimated (i.e., mathematically simulated) values randomly drawn from a predictive probability distribution of

missing scores and error terms. The predictive probability distributions used for imputing missing values were mathematically derived from the linear relationships between the observed scores on a given variable and the other variables in the data set (e.g., other achievement scores).

2.2.3 The Imputed Sample

For a given “target” variable comprised of missing and observed values, imputation replaces missing data based on the relationships between the observed data on the target variable and the observed data on all other variables selected as relevant predictors of the target variable. In longitudinal designs, multiple scores are obtained from each student over time, and the best predictors of missing achievement scores in one assessment period usually are observed achievement scores in other assessment periods. Therefore, the imputation model created for the present analyses included achievement scores on all measures (reading, language arts, mathematics, science, and social studies) across all assessment periods as predictors of missing scores. Student demographic, teacher, and classroom characteristics, however, were not imputed.

Imputation Criteria

Because imputation yields more accurate and precise predictions of missing scores when many, as opposed to few, observed scores are present in the data set for a particular student, a criteria was developed to mediate inclusion in the imputation sample. This criteria includes cases which have a complete set of scores from time periods in the beginning, middle and end of the longitudinal study.

For inclusion in the imputed sample, all cases must have a complete set of test scores from:

1. The current year, 6th grade, Spring 2004, or previous year, 5th grade, Spring 2003; and
2. Either of the first grade testing episodes, Fall 1998, or Spring 1999; and

3. At least three of the testing episodes.

Table 4 below presents the amount of missing achievement data replaced on each test by year.

TABLE 4. Sample Selected for Imputation: Missing Data Estimated and Replaced

Achievement Measure & Testing Episode	Complete Cases		Cases with Missing Data		Total Imputed Sample
	N	Percent	N	Percent	N
Reading					
1997-98	1802	89%	215	11%	2017
1998-99	1815	90%	202	10%	2017
1999-00	1570	78%	447	22%	2017
2000-01	1606	80%	411	20%	2017
2001-02	1728	86%	289	14%	2017
2002-03	1840	91%	177	9%	2017
2003-04	1585	79%	432	21%	2017
Language Arts					
1997-98	1799	89%	218	11%	2017
1998-99	1816	90%	201	10%	2017
1999-00	1571	78%	446	22%	2017
2000-01	1604	80%	413	20%	2017
2001-02	1726	86%	291	14%	2017
2002-03	1836	91%	181	9%	2017
2003-04	1585	79%	432	21%	2017
Mathematics					
1997-98	1817	90%	200	10%	2017
1998-99	1838	91%	179	9%	2017
1999-00	1582	78%	435	22%	2017
2000-01	1605	80%	412	20%	2017
2001-02	1738	86%	279	14%	2017
2002-03	1847	92%	170	8%	2017
2003-04	1561	77%	456	23%	2017

TABLE 4. Sample Selected for Imputation: Missing Data Estimated and Replaced

Achievement Measure & Testing Episode	Complete Cases		Cases with Missing Data		Total Imputed Sample
	N	Percent	N	Percent	N
Science					
2000-01	1601	79%	416	21%	2017
2001-02	1741	86%	276	14%	2017
2002-03	1838	91%	179	9%	2017
2003-04	1560	77%	457	23%	2017
Social Studies					
2000-01	1600	79%	417	21%	2017
2001-02	1737	86%	280	14%	2017
2002-03	1766	88%	251	12%	2017
2003-04	1544	77%	473	23%	2017
Average	1699	84%	355	18%	2017

2.2.4 Demographic Comparisons between Imputed and Non-Imputed Cases

Analyses were conducted to compare the demographic characteristics of students selected for the final sample, in which missing achievement data were imputed, with students who were not selected for each of the five student groups identified in the evaluation.⁴ The purpose of these analyses was to examine whether the imputation selection procedure systematically, and disproportionately, excluded certain demographic groups from the final sample. That is, we examined whether student groups in the final imputed sample were representative of all students from those groups in our database—both imputed and non-imputed. Findings are presented in Table 5.

4. Two separate one-way ANOVAs were performed for each student group in which imputation selection-status (selected vs. excluded from the final imputed sample) served as the categorical independent variable and the dichotomously coded demographic variables of gender (male=0, female=1) and race/ethnicity (0=non-minority, 1=minority) served as the dependent variables. Therefore, when group means are presented for gender or minority status, the numbers following the decimal indicate the percentage of students who are of minority status, female, or of lower income (e.g., a mean of .54 for minority students indicates that 54% of students in that group have been identified as minority students).

The students included in the imputed sample across these five groups appear to be very similar to the students excluded from the sample with respect to their race/ethnicity and gender such that the selected and excluded students within each group were descriptively and statistically similar in all cases other than applicant non-recipients (see Table 5).

Applicant non-recipients in the sample are found to have a statistically significant proportion of greater minority representation than those excluded from the sample, 88% of the imputed sample versus 81% of those students with incomplete data who were excluded from the sample. All other comparisons across minority status and gender did not have proportions that differed significantly within the five groups.

TABLE 5. Demographic Comparisons between Students Selected for and Students Excluded from the Final Imputed Sample

Student Group	% Minority			% Female		
	Selected	Excluded	p	Selected	Excluded	p
Scholarship Recipient-users	0.65 (n=197)	-- ^a	--	0.54 (n=197)	--	--
Scholarship Applicant Non-Recipients (Public)	0.88 (n=233)	0.81 (n=135)	0.044 ^b	0.55 (n=233)	0.47 (n=135)	0.148
Public Recipient Non-users	0.89 (n=73)	0.88 (n=120)	0.882	0.51 (n=73)	0.57 (n=118)	0.414
Former Scholarship Users (Public)	0.89 (n=145)	0.91 (n=43)	0.748	0.51 (n=144)	0.49 (n=43)	0.771
Public Non-applicants	0.82 (n=618)	0.82 (n=615)	0.857	0.53 (n=618)	0.50 (n=623)	0.441

a. Notes: Analyses were not conducted comparing seven-year scholarship recipient-users selected and seven-year scholarship recipient-users excluded in the imputation process for minority status and gender due to no cases being excluded.

b. Significant at $p < 0.05$.

In response to the three research questions outlined in this report, analysis of both the full data set and the imputed sample are used. Responding to questions 1 and 2, the full data set is used. As this full data set has no deleted cases, it most accurately represents

both the characteristics of the student population and classroom configurations. Question three requires a longitudinal analysis of student scores, which if missing data were not addressed through imputation would be prohibitive given the number of cases deleted. The findings in Table 5 support the use of both the full data set and the subset imputed data set for the unbiased analysis of the three research questions.

2.3 Data Analysis Techniques

Data analyses were conducted to focus on each of the three questions guiding this phase of the evaluation and on relevant emerging sub-questions. For each question, analyses included both descriptive and inferential statistical techniques. This section provides an overview of analytic approach by evaluation question.

Question One examines the demographic characteristics of scholarship recipient-users and compares them to those of students in the various comparison groups. This question has been investigated using descriptive approaches as well as univariate analyses of variance to examine the data collected during the sixth grade testing episode (Spring of the 2003-2004 school year). When appropriate, the Holm's Sequentially Rejective Dunn-Sidak procedure has been used to conduct post hoc (i.e., follow-up) comparisons to further examine indicated differences.⁵ In each set of analyses, students serve as the unit of analysis and, because missing demographic data were not imputed, the largest possible sample sizes have been used for each analysis, unless otherwise noted.

An additional component of Question One involves the comparison of students who entered the CSTP as kindergartners, first-graders, second-graders, third-graders, fourth-

5. Holm's multiple comparison method has been selected because it offers greater statistical power (i.e., the ability to detect effects based on sample data if effects are truly present in the population of interest) than do other follow-up comparison procedures, while still controlling the Type I error rate across multiple comparisons at less than 0.05 (family-wise alpha). The Type I error rate is the probability of finding sufficient evidence to conclude that an effect (e.g., a mean difference between two groups) is present based on sample data when, in fact, *no effect* is present in the population of interest (under the statistical assumption that no effect/mean difference exists and sufficient evidence must be found to reject this a priori assumption).

graders, fifth-graders and sixth-graders (i.e., the question of whether and how the demographic characteristics of students differ as a function of when students entered the CSTP). Descriptive and inferential analyses have been conducted on student demographic and achievement data to address this question. In addition, for students who entered the program after kindergarten and first grade,⁶ descriptive analyses identify both the schools in which these students were enrolled prior to receiving and using a scholarship (public or private) and the students' past involvement in the program as applicant non-recipients, recipient non-users, or non-applicants. Furthermore, the demographic characteristics of recent scholarship recipients who previously attended public schools have been contrasted with the characteristics of recent recipients who attended private schools when these students were awarded scholarships, and the demographic characteristics of late entrants into the program (i.e., those whose vouchers were awarded after the start of the school year, hence on the first-come, first-served basis) are compared to those who were awarded their vouchers during the February through July selection process. Analyses also have been conducted to investigate differences in demographic characteristics between students who remained in the program continuously and those who chose to withdraw from the CSTP and return to public school (i.e., examining the effect of differential exit from the program).

Question Two, regarding the classroom and teacher characteristics of private versus public schools (i.e., those experienced by scholarship students and students in public schools), utilizes the largest possible sample for each of three independent sets of analyses. In addressing this question, separate analytic techniques were applied to examine the basic characteristics of classrooms and teachers and to examine the relationship between these characteristics and students' sixth-grade achievement. In the former analyses, classrooms served as the unit of analysis; whereas, in the latter, students served as the unit of analysis. Moreover, because the primary comparison for this question is between public and pri-

6. Five, six and seven-year recipient-users were not included in these analyses as their prior schools of enrollment (e.g., preschool and kindergarten) were unknown.

vate schools, rather than between or among the groups of students, this analysis investigates differences in classroom and teacher characteristics by classroom and between public and private schools. Descriptive, multivariate, and univariate analyses of variance have been conducted to address this question and related sub-questions regarding the characteristics of the classrooms that students attended during the 2003-2004 school year.

Question Three, addressing the academic achievement of students in the various comparison (scholarship-status) groups, was investigated in a somewhat different manner than either of the two questions discussed above. In an effort to determine whether differential patterns of achievement changed across time as a function of the students' scholarship status, it was believed important to examine not only overall differences in achievement between the student groups but also to focus attention on the pattern of achievement displayed by each group from the beginning of first grade through the end of sixth grade. Consequently, data analyses for Question Three employed mixed-design analyses of variance and covariance (i.e., ANOVA and ANCOVA).⁷ Using group membership as a between-subjects variable and time (testing episode) as a repeated-measure (within-subject) variable, these analyses provide the opportunity to investigate the impact of program participation across time and, when appropriate, while statistically controlling for initial differences among the comparison groups on key demographic characteristics (e.g., minority status). These principal analyses compare the achievement of seven-year recipient-users (students who have used a scholarship continuously from kindergarten through sixth grade) with that of applicant non-recipients and of non-applicants who were enrolled in public schools. In addition, analyses including indicators of student mobility and poverty status, and analysis including a measure of pre-program achievement as a covariate were also conducted.

7. For a discussion of the use and interpretation mixed-design analysis of variance, see J. Stevens, *Applied Multivariate Statistics for the Social Sciences*, 3rd. Edition, (Mahwah, NJ: Erlbaum Associates, 1996); J. J. Kennedy and A. J. Bush, *An Introduction to the Design and Analysis of Experiments in Behavioral Research*, (Lanham, MD: University Press of America, 1985).

In addition, analyses have been conducted to examine possible differences in achievement among scholarship students who continuously remained in the CSTP and those students who chose to withdraw from the program and return to public school (i.e., examining the effect of differential exit from the program on academic achievement).



3 Analyses and Results

3.1 Question One

What are the characteristics of students who participate in the Cleveland Scholarship and Tutoring Program and how do they compare with students who do not participate?

One important question regarding vouchers and school choice is, “Do these programs actually serve the families and students they intend to serve?” Thus, the first aspect of analysis was to examine the characteristics of students and families that decided to pursue and use scholarships through the CSTP. Specifically, this analysis focused on enhancing our understanding regarding how representative CSTP voucher recipient users are of the more general population of Cleveland students, particularly in terms of the following demographic variables: student gender, student race-ethnicity, and mobility. Analyses include descriptions and comparisons of the demographic characteristics of students from each group targeted in the evaluation: scholarship recipient-users, former recipient-users attending public schools, public applicant non-recipients, recipient non-users, and public non-applicants.

Primary analyses of student gender and minority status are presented together in the first section below (3.1.1). Section 3.1.2 examines student characteristics of recipient-users, in terms of gender and race, disaggregated by differential entry into the CSTP, as well as the characteristics of former recipient-users based on when they exited the program. Section

3.1.3 then presents the results of multiple regression analyses examining the association between academic achievement and student demographic characteristics. Finally, section 3.1.4 analyzes and compares the types of prior schools of enrollment (i.e., public or private) for CSTP students.

Unless otherwise noted, analyses presented in this section include data for students in each of the primary groups using the largest available sample for each. That is, the data represent results for all students, including those students with missing or incomplete achievement data. The imputation procedures were discussed in more detail in the previous section.

3.1.1 Student Demographic Characteristics: Sixth Grade (Spring 2004)

To examine whether scholarship recipient-users in the sixth grade (2003-2004) displayed different demographic characteristics than their counterparts in the public schools, the characteristics of all scholarship recipient-users, regardless of when they entered the CSTP, were compared to the four primary public school groups: former (but not current) scholarship users, applicant non-recipients, non-applicants, and scholarship recipient non-users. Table 6 presents descriptive statistics associated with the demographic characteristics of students in these five groups from whom data were obtained in the Spring of sixth grade, 2004.⁸

Separate univariate analyses of variance (ANOVAs) have been conducted on the demographic variables student gender and minority status. These analyses identified no statistically significant differences in gender among the groups, $F(4, 2630) = 1.42, p = .226$, but did reveal statistically significant differences in minority status, $F(4, 2687) = 38.51, p <$

8. *Minority status* is dichotomously coded as Non-minority = 0, Minority = 1. The Non-minority group is comprised entirely of Caucasian students, and the Minority group is comprised primarily of African American students but includes Hispanic and Multiracial students as well. *Student sex* is coded as Male = 0, Female = 1. Group means for *minority status* and *student sex* indicate the proportion of students in a group who are *minority* and *female* (e.g., a group mean of .54 for minority status indicates that 54% of those students are minority students).

.001. Table 7 presents expanded minority status data for the groups, and Figure 1 graphically presents these data.

Follow-up comparisons were conducted to identify which group differences were statistically significant⁹. Results indicate that students in the scholarship recipient-users group were less likely to hold minority status (62.8%) than former scholarship users (89.4%), applicant non-recipients (85.6% minority), recipient non-users (88.6% minority), and non-applicants (81.8% minority). In other words, the seven-year scholarship recipient-users were more likely to be white than were their counterparts who either left the CSTP program or never entered the CSTP program. Table 7 and Figure 1 present an expanded view of the minority status data. As reported in a prior evaluation report (1998-2003), the lower minority status in the scholarship recipient group appears to largely reflect the disproportionate representation of African Americans in the comparison groups (ranging from 74.7% to 81.5%) versus the recipient-user group (48.3%).

TABLE 6. Student Demographic Characteristics: Sixth Grade (Spring 2004)

Student Group	% Female ^a			% Minority ^b		
	Mean	SD	N	Mean	SD	N
Scholarship Recipient-users ^c	0.57	0.50	648	0.63	0.48	710
Former Scholarship Users (Public)	0.51	0.50	187	0.89	0.31	188
Scholarship Applicant Non-recipients (Public)	0.52	0.50	368	0.86	0.35	368
Public Recipient Non-users	0.54	0.50	191	0.89	0.32	193
Public Non-applicants	0.51	0.50	1241	0.82	0.39	1233

- a. Student gender is coded as Male=0, Female=1. Means represent the proportion of female students in each group.
- b. Minority status is coded as Non-minority=0, Minority=1. Means represent the proportion of minority students in each group.
- c. Scholarship recipient-users include all CSTP participants as of sixth grade, 2003-2004.

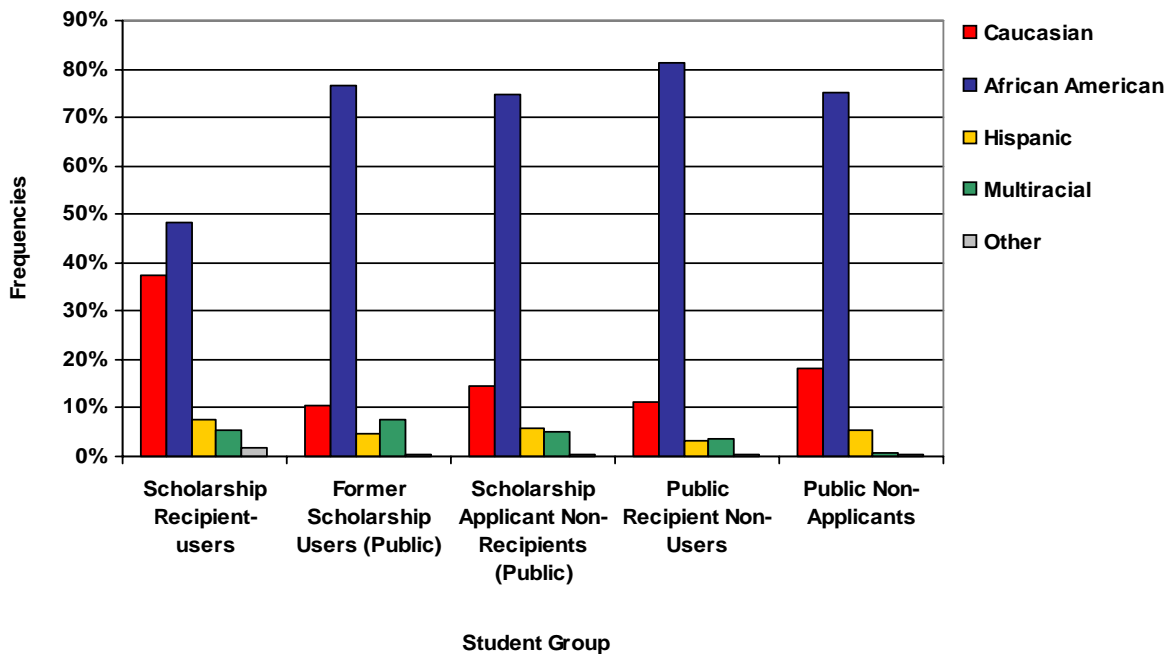
9. Comparisons have been conducted using Holm's sequentially rejective Dunn-Sidak procedure to control family-wise Type I error at $\alpha < .05$ across multiple comparisons. For more information on this multiple comparison procedure, see Kirk, R.E. (1998). *Experimental design: Procedures for the behavioral science* (3rd ed.). Pacific Grove, CA: Brooks/Cole.

TABLE 7. Expanded Minority Status: Sixth Grade (Spring 2004)^a

		Caucasian	African American	Hispanic	Multi-racial	Other	Total
Scholarship Recipient-users	%	37.2	48.3	7.5	5.3	1.7	100
	N	264	343	53	38	12	710
Scholarship Applicant Non-Recipients (Public)	%	14.4	74.7	5.7	4.9	0.3	100
	N	53	275	21	18	1	368
Public Recipient Non-users	%	11.4	81.5	3.1	3.6	0.5	100
	N	22	157	6	7	6	193
Former scholarship users (Public)	%	10.6	76.6	4.8	7.5	0.5	100
	N	20	144	9	14	1	188
Public Non-Applicants	%	18.3	75.1	5.4	0.7	0.5	100
	N	225	926	67	9	6	1233

a. Racial Composition of the Cleveland Municipal School District (average daily membership = 73,943): 19.7% Caucasian, 71.0% African American, 8.4% Hispanic, 0.7% Multiracial, and 1.2% Other. Data were obtained from the Cleveland Municipal School District 2000-2001 Annual Report, available for public download: <http://www.cmsdnet.net/administration/2000annualreport.htm>

FIGURE 1. Sixth Grade 2003-2004 Minority Status by Student Group



The results presented above address demographic characteristics of all students in the sample. However, since achievement data were not available for all students, the actual pool of students included in the achievement analyses differs slightly from this group. For most students with missing data, scores were imputed as described previously. But for some students no such imputation was possible. Therefore, a separate analysis of the imputed sample was generated in order to compare the results with those from the entire sample. Table 8 presents descriptive statistics for gender and minority status for the imputed sample.

TABLE 8. Student Demographic Characteristics of the Imputed Sample

Student Group	% Female ^a			% Minority ^b		
	Mean	SD	N	Mean	SD	N
Scholarship Recipient-users ^c	0.58	0.58	461	0.63	0.48	451
Scholarship Applicant Non-recipients (Public)	0.55	0.55	233	0.88	0.32	233
Public Recipient Non-users	0.51	0.51	73	0.89	0.31	73
Former Scholarship Users (Public)	0.51	0.51	144	0.89	0.31	145
Public Non-applicants	0.53	0.53	618	0.82	0.39	618

- a. Student gender is coded as Male=0, Female=1. Means represent the proportion of female students in each group.
- b. Minority status is coded as Non-minority=0, Minority=1. Means represent the proportion of minority students in each group.
- c. Scholarship recipient-users include all CSTP participants as of sixth grade, 2003-2004.

As found among the broader sample, slightly more than 50% of students in the imputed recipient-user group were female (58% vs. 57% among the entire sample). No significant gender differences were seen among groups within the imputed sample, $F(4, 1528) = 0.94, p = .441$.

As found among the entire sample, statistically significant differences in minority status were seen in the imputed sample, $F(4, 1519) = 25.09, p < .001$. Follow-up pairwise com-

parisons indicate that sixth grade scholarship users are significantly less likely to be of minority status (63.0%) than students in the former scholarship user group (89.0%), the applicant non-recipient group (88.4%), the recipient non-user group (89.0%), or the non-applicant group (81.6%). These results are all consistent with those from similar analyses completed on the entire sample. Therefore, we conclude that the imputed sample is representative of the larger group in terms of minority status and gender.

3.1.2 Demographic Characteristics: Differential Entry and Exit of Scholarship Students

Throughout the longitudinal study, an ongoing area of interest has been whether the demographic characteristics of scholarship recipient-users and comparison groups have remained relatively stable over the life of the program. In prior reports this question has been addressed by comparing demographic characteristics of current scholarship-users based on the year they had entered the program. A similar analysis was repeated this year, as well. An additional analysis is also presented which examines gender and minority status of first-year recipients across all seven years of the voucher program. Another question addressed in previous reports is whether the demographic characteristics of scholarship recipient-users who have withdrawn from the voucher program at various points since 1997 differ from characteristics of recipient-users who remain in the program or of their peers in public schools. This line of query, regarding differential exit from the CSTP is addressed by comparing the following three groups: grade six scholarship users, 2002-2003 former scholarship users, and the group of 1997-2002 former scholarship users. This allows comparison between students who dropped out of the program for the last year with the recipient-user group as well as the collective group of students who dropped out of the program prior to the last year. Results regarding analysis of differential entry and demographic analyses are presented first, followed by a section on differential exit demographics.

Demographic Characteristics and Differential Entry of Scholarship Recipient-users

To address the first sub-question regarding differential entry, univariate ANOVAs were conducted contrasting the sixth grade, 2003-2004 demographic characteristics of students who entered the program as:

- a. kindergartners in autumn, 1997 (seven-year recipients),
- b. first graders in autumn, 1998 (six-year recipients),
- c. second graders in autumn, 1999 (five-year recipients),
- d. third graders in autumn, 2000 (four-year recipients),
- e. fourth graders in autumn, 2001 (three-year recipients),
- f. fifth graders in autumn, 2002 (two-year recipients), and sixth graders in autumn, 2003 (one-year recipients).

These analyses were conducted using data for the entire sample, as opposed to the imputed sample used in the achievement analyses.

Table 9 presents descriptive statistics for the demographic characteristics of students based on differential entry into the CSTP.

TABLE 9. Student Demographic Characteristics as of Sixth Grade: Differential Entry

Student Group	% Female			% Minority		
	Mean	SD	N ^a	Mean	SD	N
1-year Scholarship Recipient-users	0.63	0.48	123	0.65	0.48	190
2-year Scholarship Recipient-users	0.56	0.50	98	0.50	0.50	92
3-year Scholarship Recipient-users	0.64	0.48	61	0.64	0.48	61
4-year Scholarship Recipient-users	0.42	0.50	53	0.53	0.50	53
5-year Scholarship Recipient-users	0.53	0.51	40	0.68	0.47	41
6-year Scholarship Recipient-users	0.61	0.49	76	0.68	0.47	76
7-year Scholarship Recipient-users	0.54	0.50	197	0.65	0.48	197
Total Scholarship Recipients			648			710

a. N refers to all cases with available data on this variable.

No statistically significant gender differences between scholarship recipient cohorts were found, $F(6, 641) = 1.63, p = .136$. Therefore, while female percentage ranged from 48% to 64% among scholarship recipient-users who entered the program at various points over the years, these differences are not statistically significant and can be attributed to chance. Similarly, no statistically significant differences in minority status were found, $F(6, 703) = .191, p = .077$. This indicates that although the percent of minority students entering the voucher program at any given year ranges from 50% to 68%, the seven groups are of statistically equivalent minority proportions, and variance can be accounted for by chance.

In addition to the results presented above, an alternate analysis was conducted to provide another perspective on how demographics may (or may not) have changed over the life of the program. In this analysis, data from first-year voucher recipients from each year of the program were generated from that year's dataset. Those findings are shown in Table 10 below. This varies from the method presented above in that rather than draw from the data for the current pool of program participants, this approach does not limit itself to those students currently receiving vouchers. Rather, it indicates the gender and minority status of new voucher recipients for each year of the program since 1997-1998.

TABLE 10. Student Demographic Characteristics of First Year Recipients, 1997 - 2004

Student Group	% Female		% Minority	
	Mean	N ^a	Mean	N
1997-1998	0.52	738	0.75	830
1998-1999	0.47	218	0.74	235
1999-2000	0.46	94	0.72	100
2000-2001	0.45	103	0.64	109
2001-2002	0.64	77	0.70	94
2002-2003	0.56	109	0.55	106
2003-2004	0.63	190	0.65	190

a. N refers to all cases with available data on this variable.

In contrast to the previous analyses, these results suggest a trend whereby the percentage of minority students in CSTP appears to have decreased since the inception of the program. That is, although comparing all current scholarship recipients based on their year of entry indicates no differences in minority status by entry year, comparing proportions of minority vs. non-minority students granted first-year scholarships each year suggests a decrease in percent minority first-year scholarships since 1997.

Demographic Characteristics and Differential Exit of Former Scholarship Recipient-users

A second demographic question of interest is related to differential exit from the CSTP. Specifically, the present section examines whether students who leave the CSTP after one or more years of participation (termed “former scholarship recipient-users”) differ, in terms of gender and minority status, from recipient-users who remain in the program or from their peers in public school. To address this question, three groups of students have been identified for the analyses. The first group includes those students who were scholarship recipients for at least one year since 1997, but dropped out of the program prior to 2003. The second group consists of those students who are previous scholarship users but dropped out of the program in 2003. The final comparison group consists of all sixth grade scholarship-users, 2003-2004. This analysis allows us to ascertain how/whether students who drop out of the program differ from scholarship recipient-users in terms of gender and minority status, and whether the group who dropped out last year was unique

in any respect. Table 11 presents descriptive information on demographic characteristics of these three groups.

TABLE 11. Student Demographic Characteristics as of Sixth Grade (2003-2004): Differential Exit

Student Group	% Female			% Minority		
	Mean	SD	N	Mean	SD	N
Former Scholarship Recipient-users 2002-2003	0.48	0.50	517	0.89	0.31	133
Former Scholarship Recipient-users 1998-2002	0.45	0.50	134	0.87	0.34	260
Scholarship Recipient-users 1998-2002	0.55	0.50	251	0.61	0.49	509

Univariate analyses were used to assess whether differences exist between the three groups. Significant gender differences between groups were found, $F(2, 885) = 3.43, p = .033$. Pairwise comparisons revealed no significant differences between the two groups of former scholarship recipient-users. But, current scholarship recipient-users were more likely to be female (54.8%) than the group of former recipient-users who dropped out of the CSTP in 2002-2003 (48.4% female). Thus, the students who dropped out of the scholarship program between 2002-2003 were more likely to be male.

Significant group differences were also found regarding minority status of recipient-users vs. former-users, $F(2, 899) = 41.59, p < .001$. Pairwise comparisons indicated no significant differences between the two groups of former recipient-users. But, sixth grade recipient-users were significantly less likely to be of minority status than both the 2003-2004 former recipient-users and the 1998-2002 former recipient-users (61%, 89%, 87% minority status, respectively). In other words, students who exit the CSTP program are more likely to be racial-ethnic minorities than those students who remained in the program through the sixth grade.

3.1.3 Academic Achievement and Student Demographic Characteristics

Regression analyses were performed to examine possible relationships between student demographic characteristics and academic achievement. Reading, language arts, mathematics, science, social studies, and overall achievement scores from the sixth grade (Spring 2004) were regressed on gender and minority status demographic variables.¹⁰

TABLE 12. Results: Regression of Classroom and Teacher Features and Overall Achievement Scores (2003-2004)

Scholarship Recipient-users						
Measure	Feature	Parameter ^a	SE	t	Sig.	N
Reading	Minority Status	-11.35	3.44	-3.30	<0.0001	404
	Gender	11.87	3.38	3.51	<0.0001	
Language Arts	Minority Status	-19.47	3.92	-4.96	<0.0001	404
	Gender	13.50	3.86	3.50	<0.0001	
Math	Minority Status	-20.33	3.85	-5.29	<0.0001	404
	Gender	1.46	3.78	0.39	0.70	
Overall	Minority Status	-17.08	3.25	-5.25	<0.0001	404
	Gender	8.99	3.20	2.81	0.01	
Science	Minority Status	-17.31	4.02	-4.31	<0.0001	404
	Gender	-2.49	3.95	-0.63	0.53	
Social Studies	Minority Status	-14.01	3.52	-3.98	<0.0001	404
	Gender	7.32	3.46	2.11	0.04	
Applicant Non-recipient and Non-applicants Public School Students in CSTP						
Measure	Feature	Parameter	SE	t	Sig.	N
Reading	Minority Status	-19.44	3.90	-4.99	<0.0001	723
	Gender	12.16	2.91	4.18	<0.0001	
Language Arts	Minority Status	-17.82	4.19	-4.25	<0.0001	723
	Gender	13.56	3.13	4.34	<0.0001	
Math	Minority Status	-22.73	4.82	-4.71	<0.0001	723
	Gender	12.83	3.60	3.57	<0.0001	
Overall	Minority Status	-19.97	3.72	-5.37	<0.0001	723
	Gender	12.82	2.78	4.62	<0.0001	

10. The overall/total scale score represents the average of each student's reading, language arts, and mathematics scale scores.

Scholarship Recipient-users						
Measure	Feature	Parameter ^a	SE	t	Sig.	N
Science	Minority Status	-27.67	4.80	-5.76	<0.0001	723
	Gender	7.37	3.59	2.06	0.04	
Social Studies	Minority Status	-20.90	4.31	-4.85	<0.0001	723
	Gender	13.93	3.22	4.33	<0.0001	

a. Note: Parameter estimates indicate the magnitude and direction of the linear relationship between each demographic characteristic and the corresponding achievement measure. Standard errors are presented to facilitate meaningful comparisons among the demographic variables.

These regression results indicate that for scholarship recipient users, minority status covaried significantly (beyond the $p = .001$ significance level) with reading, language arts, math, overall, science, and social studies scores. The negative direction of the parameter estimates indicates that minority status was associated with lower achievement scores on all of those measures. Gender also exhibited significant covariance with scholarship recipient scores in reading, language arts, overall, and social studies, with female status being associated with higher scores. No significant findings were seen with respect to math and science scholarship recipient users scores.

For public school students, minority status exhibited significant covariance (beyond $p = .05$ in all cases) and was associated with lower scores on all achievement measures. Gender was also significant in the model for all tests within the public student group (all lower than $p < .01$, except science, $p = .04$). Consistent with the scholarship recipient group, female and non-minority status were associated with higher test scores. Thus, student gender and minority status were generally significantly associated with academic achievement, and the nature of that association was consistent across the scholarship and public student groups.

3.1.4 Students' Status Prior to Becoming Scholarship Recipient-users

As mentioned in the introduction to this section, a primary issue of interest in the evaluation of vouchers and school choice is whether these programs serve the families and stu-

dents they intended to serve. This section presents findings related to three sub-questions within this field of interest that have been addressed in prior reports. The first is, “What type of schools (public or private) did recent recipient-users attend prior to entering the CSTP?” The second, related question is, “What type of educational choices did these students and their families make prior to receiving a scholarship and entering the CSTP (i.e., did they previously apply for but not receive a scholarship, or had they never applied before)?” Finally, we address the question, “If students who enter the CSTP in our sample come from both public and private schools, what are the demographic characteristics of these two groups of recipient-users, and do these characteristics differ between CSTP entrants who previously attended public versus private schools?”

Prior School Attended and Prior Scholarship Status of Scholarship Recipient-users

As in previous CSTP evaluations, data on school of prior enrollment (public or private) and prior scholarship status were examined to better understand defining characteristics of scholarship recipients. Previous reports have concluded that recipient-users tend to be students who have applied for a scholarship previously, and attended a private school prior to entering the CSTP (69.5% of recipients as reported in the 2003 report). A slightly revised analysis was conducted for the current report to provide an alternate perspective and include as thorough data as possible. Whereas the previous reports drew from the pool of students in the current cohort, and presented data regarding those students’ status prior to receiving the scholarship, the revised, current method was to examine data from each cohort from 1999 to 2004 separately. For each year of entry, first-year scholarship recipients were included in the analysis. Table 13 displays the proportional breakdown of the students who attended public vs. private school during the previous year, for first year scholarship recipients within each cohort.

TABLE 13. Prior Year School Type for First-year Scholarship Recipients, 1999 - 2004

Year of CSTP Entry	N	Type of School Attended in Prior Year			
		Public		Private	
		N	% of Total N	N	% of Total N
1999-00	58	18	31%	40	69%
2000-01	65	19	29%	46	70%
2001-02	41	16	39%	25	61%
2002-03	75	21	28%	54	72%
2003-04	107	41	38%	66	62%
Combined 1999-2003	346	115	33%	231	67%

As shown above, students who entered the CSTP after first grade (1999) were more likely to have attended private than public schools prior to being granted a scholarship. Across that period, 67% of first-year scholarship recipients had attended private school in the previous year. These results are consistent with those from last year’s CSTP analysis using the alternate methodology, which found that 68.3% of 2003 recipient-users had attended a private school prior to entering the CSTP.

Demographic Characteristics of Scholarship Recipient-users from Public versus Private Schools

Another question of interest addressed in prior CSTP evaluations is that of the similarity between the demographic characteristics of students who enter the CSTP from public schools and those of students already enrolled in private schools when they receive a scholarship. Those previous reports have suggested that the CSTP tends to either attract or inadvertently select proportionally fewer minority students than are represented in the public school group.

Those prior evaluations examined whether this finding holds across all recipient-users by separately examining recipient-users from public and private schools. The current year of

scholarship-recipients was the student group whose demographics and prior school status were compared. As in the previous section, this year’s report uses an alternate method, utilizing first-year scholarship-recipient data from each year from 1999 to 2004. This alternate method was chosen to allow for the largest N possible and because it conceptually seemed the most appropriate analysis for the question.

Minority Status. Among scholarship recipient-users with known schools of prior enrollment, a greater proportion of entrants from public schools were minority status (75.6%) as opposed to non-minority students (24.4%). However, among students entering the scholarship program from private schools, a majority of students were non-minority status (54.6%) as opposed to minority status (45.4%). These findings are consistent with those reported in 2003, which found that school of prior enrollment (public versus private) was related to minority status (minority versus non-minority) in the same direction, with a higher proportion of minority students entering the program from public than private schools.

TABLE 14. Proportion of First Year Scholarship Recipient-users by Prior School of Enrollment and Minority Status (2003-2004)

School or Prior Enrollment		Minority Status		Row Totals ^a
		Minority	Non-minority	
Public	% of all Public	75.6%	24.4%	100%
	N	31	10	41
Private	% of all Private	45.4%	54.6%	100%
	N	25	30	55

a. Total N=96, missing=109

Of particular interest is whether scholarship recipient-users who entered the program after attending public schools in previous years possessed demographic characteristics similar to their former classmates in public schools. In other words, are students from public schools who use a scholarship to attend private schools similar to or different from their peers who remain in public schools? In the present sample of sixth-grade students,

81.1% of 1091 public school non-applicants are minority students, and 17.9% are non-minority students (i.e., Caucasians). An ANOVA analysis was conducted to compare the proportion of minority status among three groups: 2003-2004 first-year recipient-users who entered the program from public schools, 2003-2004 first-year recipient-users who entered the program from private schools, and 2003-2004 public non-applicants. Results indicate that minority status differs significantly between the groups ($F(1,2) = 21.01$, $p < .001$). Pairwise comparisons indicate significantly fewer minority students within the first year scholarship-recipient group who had attended private school than public school ($p < .001$). That group also had significantly fewer minority students than the public non-applicant group ($p < .01$). However, no statistically significant difference was seen between the first-year recipient-user group and public non-applicant group. In summary, as found in the previous CSTP report, first-year recipients in 2003-2004 who attended public schools before receiving and using a scholarship to attend private schools were comparable to public school non-applicants, in terms of minority status, whereas scholarship recipients from private schools were significantly more likely to be non-minority (Caucasian) students.

Table 15 displays the expanded demographic characteristics of 2003-2004 first year scholarship recipient-users who entered the program from public and private schools. In support of the findings reported above, the proportional distribution across the expanded minority categories (Caucasian, African American, Hispanic, and Multiracial/Other) demonstrates the differing distribution of Caucasian and African American.

TABLE 15. Expanded Student Demographic Data by Prior School of Enrollment for Scholarship Recipient-users as of Sixth Grade (2003-2004)

Prior School of Enrollment	Minority Status ^a				
	Caucasian	African American	Hispanic	Other	N
Public	24.4%	65.9%	2.4%	7.3%	41
Private	54.5%	25.5%	9.1%	10.9%	55

a. Racial composition of the Cleveland Municipal School District (average daily membership = 73,943): 19.7% Caucasian, 71.0% African American, 8.4% Hispanic, 1.9% Other (Asian, Native American, Multi-ethnic). These data were obtained from the Cleveland Municipal School District’s 2000-2001 Annual Report available for public download at <http://www.cmsdnet.net/administration/2000annualreport.htm>.

3.1.5 Question One Summary: Student Demographic Characteristics

The characteristics of students and families participating in the CSTP have been examined in this section, in terms of gender and race or ethnicity. Comparisons have been made among (1) scholarship recipient-users, (2) former scholarship users, (3) recipient non-users, (4) scholarship applicant non-recipients, and (5) non-applicants. The imputed sample to be used in achievement analyses was also compared with larger sample. Demographic characteristics were compared based on when current scholarship recipients entered the CSTP, using two different methods. The relationship between demographic characteristics and academic achievement was examined. Finally, demographic comparisons were made with regard to the type of school (public or private) attended prior to receiving and using a CSTP scholarship. Those findings can be summarized as follows:

Student Demographic Characteristics

With respect to gender, students in the scholarship and public school group are generally comparable. However, differences in minority status were found across groups. Sixth grade students in the scholarship recipient-user group were less likely to be racial-ethnic minorities than all other groups. Notably, 62.8% of current recipient users are non-white,

compared with 85.6% of applicant non-recipients and 81.8% of non-applicants. These findings are consistent within the imputed sample, which supports use of the imputed sample in achievement analyses, particularly with respect to gender and race/ethnicity.

Differential Entry and Exit

Demographic characteristics vary across CSTP program years since its initiation in 1997. In a series of analyses, we sought to examine whether systematic or significant trends are evident. Two methods of analyses were utilized. When looking at the current group of recipient-users, no significant differences were seen between cohorts in terms of gender or minority status. However, looking solely at data from first year recipients each year does give cause to consider whether minority status of first-year scholarship recipients has decreased systematically since 1997. While the issue is not central to the scope of this report, future analyses using appropriate methods of trend analysis might be used to address this question further.

With regard to differential exit, gender differences were seen whereby students who have dropped out of the scholarship program were found to be male in higher proportion than the group of current recipient users. Significant group differences were seen on minority status as well, with current scholarship recipient-users more likely to be white than students who had dropped out of the program since 1998.

Student Demographic Characteristics and Academic Achievement

Demographic characteristics were found to significant, albeit slight, predictors of achievement scores. For both scholarship recipients and the pooled group of non-recipient and non-applicant public students, minority status and male gender were associated with lower achievement scores. Results, while statistically significant, represent limited predictive value beyond their usefulness in demonstrating similarities between the public and private groups in the relationship between gender, minority status, and achievement.

Student Status Prior to Entering the CSTP

A series of analyses assessed a student's school type prior to becoming a scholarship recipient-user and explored the possibility of differential demographic characteristics within those subgroups. In summary, a majority (67%) of first-year scholarship users since 1999 have entered the program from private school, compared with 33% who entered from public school. Those students entering from private school were significantly more likely to be white than both those who entered from public school and those who were public school non-applicants.

3.2 Question Two

What are the characteristics of the classrooms and teachers to which the scholarship students are exposed in private schools, and how do they compare with the characteristics of classrooms and teachers in public schools?

Question Two has been examined using data collected from classroom teachers in conjunction with administration of the Terra Nova in Spring 2004. Analyses comparing classroom and teacher characteristics between public and private schools were conducted by aggregating data such that each individual teacher's classroom served as the unit of analysis. The primary focus of analyses was comparison between public and private schools on six teacher and classroom characteristics: teacher certification status, total years of teaching experience, consecutive years of teaching experience at the current school, highest degree earned by the teacher, class size, and completion of post Baccalaureate coursework.

Data were analyzed using univariate analyses of variance (ANOVA) to examine differences between public and private schools. Teacher certification (coded yes or no) and highest degree earned (less than a bachelor's, bachelor's only, bachelor's plus, master's degree, master's plus, and doctorate) were considered continuous variables for purposes of these analyses.

3.2.1 Classroom Characteristics of Public vs. Private Schools: Sixth Grade (2003-2004)

Table 16 presents descriptive statistics for four of the continuous classroom and teacher variables. Those findings indicate that the private school class size averaged around 3 students higher than in public schools (22.9 students in private schools vs. 19.8 students in public schools). This difference was found to be statistically significant, $F(1, 685) = 23.3$, $p < .001$. This finding may be explained, in part, by the number of very small (<10) class-

rooms reported in the group of public schools. While the smallest class size reported in the private school group was ten, 30 public schools reported class sizes smaller than that, with the smallest being 2 students. Still, considering that 592 classes were represented in the public sample, this set of especially small classes is unlikely to account entirely for the differences in average class size between the groups.

Teacher experience was found to be very similar between public and private schools, with both public and private school teachers averaging just over 11 years of teaching experience. The univariate analysis supports that the two groups do not differ significantly, $F(1, 677) = .03, p = .851$. Teachers in both types of schools had spent an average of around 6 years (or slightly over half of the average career teaching experience) in their current school, $F(1, 673) = .5, p = .479$.

Differences were seen between school types in the highest degree earned by teachers, $F(1, 683) = 48.71, p < .001$. On average, teachers in public schools held a higher degree than teachers in private schools. On the continuous scale used in the analysis, the 3.72 mean for public school teachers would represent roughly an MS/MA degree, while the 2.91 mean for private school teachers would correspond to a BA/BS plus degree level

TABLE 16. Descriptive Statistics for Total Years of Teacher Experience, Years at Current School, and Class Size in Sixth Grade (2003 - 2004)

Classroom & Teacher Characteristics	Public Schools (N=596)			Private Schools (N=95)		
	Mean	SD	N	Mean	SD	N
Class size (number of students)*	19.8	5.83	592	22.87	4.74	95
Years of teaching experience overall	11.1	8.13	585	11.29	9.87	94
Years of teaching experience at present school	5.96	4.65	582	6.38	7.68	93
Highest degree earned ^{a,*}	3.72	1.08	590	2.91	0.89	95

a. 1=none, 2=BA/BS, 3=BA/BS+, 4=MA/MS, 5=MA/MS+, 6=EdS, 7=ABD, 8=PhD

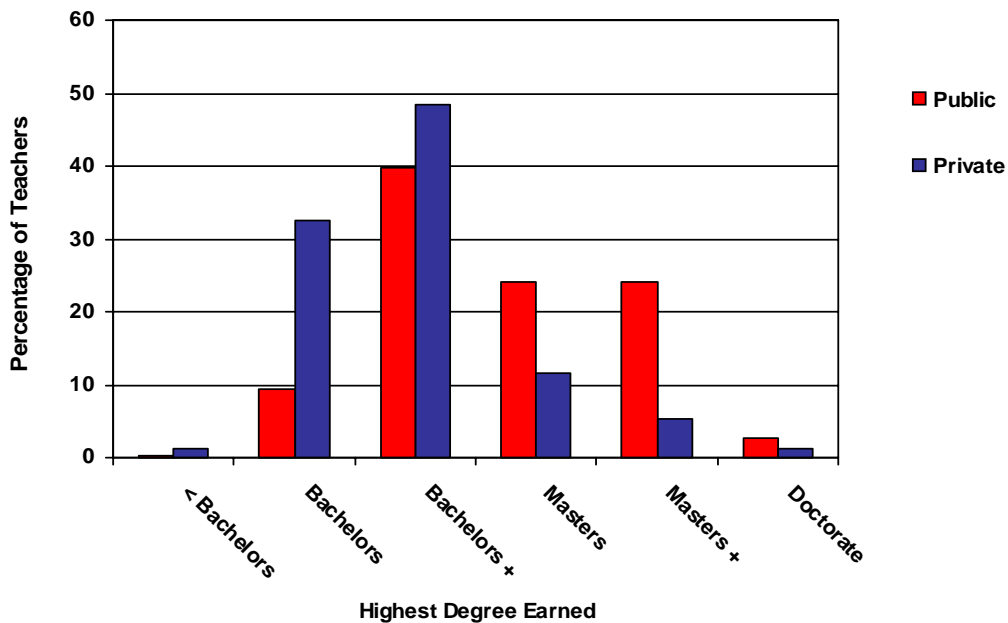
* Statistically significant differences $p < .001$

Table 17 below presents more detailed descriptive statistics for the measure of teacher level of education. In addition, Figure 2 depicts these data in chart format.

TABLE 17. Percentage of Public and Private School Teachers across Education Level Categories in Sixth Grade (2003-2004)

School Type	Education Level						
	N	Less than Bachelors	Bachelors	Bachelors Plus	Masters	Masters Plus	Doctorate
Public	590	0.3%	9.3%	39.7%	24.0%	24.1%	2.7%
Private	95	1.1%	32.6%	48.4%	11.6%	5.3%	1.1%

FIGURE 2. Education Level of Public and Private School Teachers in Sixth Grade (2003-2004)



In a follow-up analysis, the variable was recoded into a dichotomous measure of “M.A. or higher” and “less than M.A.” Those findings indicate that 50.8% of public school teachers hold an M.A. or higher, compared with 18.0% of private school teachers. Likewise, when the variable was recoded into a dichotomous measure related to having or not

having post baccalaureate coursework, 90.5% of public teachers were found to have some post baccalaureate coursework, compared with 66.4% of private teachers. These findings support previous findings, including last year’s 2003 CSTP report indicating that students attending public schools have teachers who are more likely to have completed graduate coursework than the teachers of scholarship recipients attending private schools.

Although differences exist between public and private schools in terms of teachers’ education level, those differences are not evident in terms of differences in certification. The vast majority of both public and private school teachers are certified. Table 18 presents descriptive statistics regarding teacher certification in the sixth grade public and private student groups. Of public school teachers, 93.2% reported holding teacher certification, compared with 90.4% of private school teachers. This does not represent a statistically significant difference, $F(1, 674) = 1.01, p = .315$.

TABLE 18. Percentage of Public and Private School Teachers across Certification Categories in Sixth Grade (2003-2004)

School Type	N	Teacher Certification	
		Certified	SD
Public	582	93.2%	0.25
Private	94	90.4%	0.30

Taken together, these results indicate that public and private school students are exposed to similar teacher characteristics in some respects, but may have different experiences in terms of class size and teacher’s education level. Students in both types of school are likely to work with teachers who are well experienced in the profession (an average of approximately 11 years) and have worked much of that time in their current school (approximately six years on average). Students in both types of schools are also likely to experience a teacher who holds teacher certification. However, on average, public school students are more likely to experience a slightly smaller classroom (approximately 3 students fewer on average) than private school students. In addition, public school students are more likely

than private school scholarship recipients to work with teachers who have completed graduate coursework beyond the master's degree.

3.2.2 Classroom Characteristics and Academic Achievement

A second set of analyses was conducted to examine the relationship between these classroom or teacher characteristics and student academic achievement, with students as the unit of analysis. For each student, a mean *exposure* measure was computed to aggregate each teacher and classroom measure across grades three through six (2000-2004). The resulting measures capture the average *exposure* students have had to each classroom and teacher characteristic (total years of teacher experience, years of teacher experience in current school, certification level, and class size) from the time they entered third grade in 2000 through sixth grade in 2004. Bivariate correlation coefficients were generated separately for public and private schools to identify what relationships existed between each individual teacher/class characteristic and various sixth grade achievement measures within the public and private school groups. Multiple regression techniques were then employed to identify the *unique* contribution each of these aggregated measures of students' exposure to classroom and teacher factors made to explaining sixth grade achievement while also accounting for the other characteristics. To account for the potential impact of the type of school students attended (i.e., public or private), separate regression analyses have been performed for public and private school students. Table 19 presents the results of the bivariate correlation matrix within public and private schools.

In those results, years of teacher experience consistently showed a relationship with the various achievement measures, within both public and private schools, accounting for between 4% and 6% of the variance in achievement scores in public schools (indicated by R^2), depending on the measure. Within private schools, years of teacher experience accounted for between 3% and 7% of variance in achievement scores. Having a teacher with more years of experience was related to higher achievement scores in all cases, as

indicated by the positive coefficient value. Years of teacher experience at that school was also found to be positively associated with higher achievement scores in most cases. Certification had a negligible relationship with any of the achievement measures. Class size was also found to be meaningfully associated with achievement in one case, accounting for 5% of variance in math achievement scores in private schools. This finding is somewhat counter-intuitive, in that higher class size was associated with higher math achievement scores. But this is consistent with findings reported in previous CSTP reports.

TABLE 19. Correlations between Significant Classroom and Teacher Features and Sixth Grade Achievement (2003-2004)

Measure	Public Schools				Private Schools			
	Coefficient variables	r	R ²	N	Coefficient variables	r	R ²	N
Reading								
	Years of Experience	0.21	0.04	201	Years of Experience	0.19	0.04	155
	Years at School	0.21	0.04		Years at School	0.18	0.03	
	Certification	0.03	0.00		Certification	-0.05	0.00	
	Class Size	0.07	0.00		Class Size	-0.02	0.00	
Language Arts								
	Years of Experience	0.25	0.06	201	Years of Experience	0.18	0.03	155
	Years at School	0.02	0.04		Years at School	0.13	0.02	
	Certification	-0.02	0.00		Certification	0.00	0.00	
	Class Size	0.03	0.00		Class Size	0.07	0.01	
Math								
	Years of Experience	0.22	0.05	193	Years of Experience	0.26	0.07	153
	Years at School	0.21	0.04		Years at School	0.28	0.08	
	Certification	0.03	0.00		Certification	-0.11	0.01	
	Class Size	0.01	0.00		Class Size	0.22	0.05	
Overall								
	Years of Experience	0.25	0.06	185	Years of Experience	0.26	0.07	149
	Years at School	0.23	0.05		Years at School	0.24	0.06	
	Certification	0.04	0.00		Certification	-0.08	0.01	
	Class Size	0.03	0.00		Class Size	0.12	0.01	
Science								

Measure	Public Schools				Private Schools			
	Coefficient variables	r	R ²	N	Coefficient variables	r	R ²	N
	Years of Experience	0.21	0.04	193	Years of Experience	0.19	0.04	153
	Years at School	0.22	0.05		Years at School	0.12	0.01	
	Certification	0.09	0.01		Certification	-0.06	0.00	
	Class Size	-0.03	0.00		Class Size	0.06	0.00	

Social Studies								
Measure	Public Schools				Private Schools			
	Coefficient variables	r	R ²	N	Coefficient variables	r	R ²	N
	Years of Experience	0.22	0.05	190	Years of Experience	0.24	0.06	153
	Years at School	0.26	0.07		Years at School	0.16	0.03	
	Certification	0.01	0.00		Certification	-0.13	0.02	
	Class Size	-0.03	0.00		Class Size	0.06	0.00	

Two separate regression analyses were conducted as well to examine the relationship between overall achievement scores and variance of teacher/classroom characteristics. Table 20 presents results of the multiple regression analyses, conducted separately on private and public school groups in order to allow comparison of the results across groups.

In these analyses, overall achievement scores were regressed on years of experience, years at current school, certification level, and class size. The model consisting of the four variables found significant covariance with achievement scores in both public schools, $F(4, 177) = 3.94, p = .004$, and private schools, $F(4, 144) = 3.10, p = .018$. Significance levels for the two analyses are shown in Table 20 below. While the overall model was statistically significant, no individual factors were significant beyond the .05 alpha level. Still, those results support findings from the correlation analysis in that years of experience accounted for the greatest amount of unique variance in achievement scores within both public and private schools. The findings also confirm that this set of classroom characteristics may represent limited meaningful or practical significance when evaluated individually.

TABLE 20. Results: Regression of Classroom and Teacher Features and Overall Achievement Scores (2003-2004)

Public Schools						
Measure	Feature	Parameter	SE	t	Sig.	N
Overall Score	Years of Experience	1.47	0.75	1.96	0.05	182
	Years at School	1.48	1.34	1.07	0.29	
	Certification	52.12	39.13	1.33	0.18	
	Class Size	0.19	0.97	0.20	0.84	
Private Schools						
Measure	Feature	Parameter	SE	t	Sig.	N
Overall Score	Years of Experience	1.32	0.73	1.81	0.07	149
	Years at School	1.21	1.11	1.09	0.28	
	Certification	-10.05	23.94	-0.42	0.68	
	Class Size	0.23	1.03	0.22	0.82	

3.2.3 Question Two Summary: Classroom and Teacher Characteristics

Analyses related to question two focused on comparing classrooms and teachers experienced by scholarship recipient-users in private school with those of students enrolled in public schools. Characteristics of interest included class size, years of teaching experience, years of teaching experience at present school, highest degree earned, and teacher certification status.

As found in previous years, private school teachers and public school teachers were comparable in terms of years of teaching experience, with an average of just over 11 years in each group. Teachers had also been teaching at their current school for approximately the same numbers of years (approximately six years). The two groups of teachers differed with respect to their academic background. Teachers in public schools, on average, held higher degrees than those in private school, with 50.8% of public school teachers holding an M.A. or higher, compared with 18.0% of private school teachers. The vast majority of teachers in both types of schools held teacher certification (93.2% of public teachers,

90.4% of private teachers). Finally, class size in public schools was found to be smaller than in private schools. Some evidence suggests this is influenced by a number of especially small classrooms (< 10 students) reported by some public schools but not reported in private schools.

In analyses examining the relationship between classroom and teacher characteristics and achievement, a small but significant relationship between achievement scores and teacher experience was seen. This was true among public and private students and across six indicators of achievement including reading, language arts, math, overall, science, and social studies scores. Years at current school was also found to be predictive of achievement scores. Class size was only found to have a statistically significant relationship to achievement scores in the case of private school math, with larger class size being related to higher scores. No relationship was seen between teacher certification and achievement, possibly due to the dichotomous nature of the variable and high proportion of certified teachers within both school types.

3.3 Question Three

What is the impact of participation in the Cleveland Scholarship and Tutoring Program on student academic achievement?

Student academic achievement data have been collected on the same cohort of students across seven assessment periods: Fall and Spring of first grade (1998-1999), Spring of second grade (1999-2000), Spring of third grade (2000-2001), Spring of fourth grade (2001-2002), Spring of fifth grade (2002-2003), and Spring of sixth grade (2003-2004). Analyses of the longitudinal achievement data has been conducted to examine whether, and to what extent, participation in the Cleveland Scholarship and Tutoring Program (CSTP) has affected the academic achievement of children in this study. More specifically, four sepa-

rate sets of analyses were conducted to provide a comprehensive examination of the academic impact of the program with the available extant data. These analyses include the following:

(1) **ANCOVA with Minority Status**. First, as mentioned previously in the report, analyses were conducted to provide a replication of methodologies used in previous years of the longitudinal study. Specifically, analysis of covariance (ANCOVA) using minority status as a covariate was employed to look for achievement differences not only among the targeted groups of students at each assessment period, but also in the pattern of group performance over time.

(2) **ANCOVA with Minority Status and Student Mobility**. Analysis of covariance (ANCOVA) using minority status *and* student mobility as covariates was also employed to look for achievement differences. Although the following model (#3) also includes both of these covariates, this analysis is presented separately in the full Technical Report because the model including prior achievement makes it more difficult to discern the relationships between minority status, student mobility, and student achievement.

(3) **ANCOVA adjusting for differences in Prior Achievement**. Analysis of covariance (ANCOVA) using minority status, student mobility and prior achievement (i.e., Spring first grade test scores) as covariates was also employed to look for achievement differences not only among the targeted groups of students at each assessment period, but also in the pattern of group performance over time.

(3) **Analyses including Poverty Status**. Given that valid and reliable measures of socioeconomic status were not available for all three comparison groups, a separate analysis of impact on student achievement was also conducted to take into account the economic status of students for those groups where some indicator of poverty status was available (i.e. scholarship recipients and scholarship applicant non-recipients). Three comparisons were conducted. First, a comparison of students in poverty and students not in poverty

(regardless of scholarship status) was used to test whether poverty status had a significant effect on achievement scores. Then the sample was divided into two groups based on poverty status, and separate analyses were conducted on each sub-sample to examine differences between scholarship recipients and public school applicant non-recipients. These analyses included minority status, student mobility and prior achievement as covariates.

These four different analyses are included in the full Technical Report as they reflect both a replication of the analysis procedures used in prior reports and additional modeling considerations identified by the evaluation team in 2005. Providing these four sets of analyses allows the most comprehensive consideration of the impact of the CSTP on student achievement. Given that repeated hypothesis testing of the same sample will inflate the type I error rate, the evaluation team has adjusted the hypothesis rejection criteria to offset this sampling condition. Each of these analyses is presented in the following pages of this section.

As noted previously, the first three sets of analyses (ANCOVA with minority status; ANCOVA with minority status and student mobility; and ANCOVA accounting for differences in prior achievement) compare the academic performance of students who have used a scholarship to attend private schools consistently throughout the period from kindergarten through the end of sixth grade with that of two groups of students who attended public schools during this same period. The first public school comparison group consists of students whose families applied for but did not receive a scholarship at some point between first and sixth grade and who were in public schools during 6th grade (applicant non-recipients). The second public school comparison group is made up of students whose families have never applied for a scholarship and who were in public schools in 6th grade (non-applicants). For the final analysis that includes poverty status, there is only one public school comparison group (applicant non-recipients) due to a lack of valid and consistent income data for non-applicants.

All analyses were conducted using achievement measures adjusted for relevant covariates, as well as for unadjusted achievement score means. However, for purposes of simplicity and to minimize complexity, the discussion of results in this report focuses on the adjusted measures. The results of both adjusted and unadjusted analyses were highly consistent, particularly those associated with main effects of time and group membership. Thus, we believe these adjusted analyses provide reasonable, though conservative, indications of the impact of using a scholarship to attend private schools during the period of the study. To allow the reader some sense of the influence of covariance in adjusting mean performance, tables of descriptive statistics include both adjusted and unadjusted means and measures of variance.

3.3.1 ANCOVA with Minority Status

Analysis of covariance (ANCOVA) was employed to look for achievement differences not only among the targeted groups of students at each assessment period, but also in the pattern of group performance over time. The factorial ANCOVAs include fixed factors of student group or scholarship status, time period, time by group interaction and the covariate, minority status.¹¹ These analyses allow examination of achievement differences associated with the assessment period (i.e., time), student group (i.e., participation in the CSTP), and the interaction of assessment period and student group. In the present study, the interaction is of particular interest because it indicates whether the pattern of change in academic achievement over time differs as a function of participation in the CSTP. ANCOVAs were conducted separately on each of the six academic measures of the Terra Nova instrument: overall achievement, reading, language arts, mathematics, science, and social studies.

11. Factorial ANCOVA are presented for ease of interpretation. Split-plot factorial design (mixed-design factorial ANCOVA) were also employed to model time as a random effect. These analyses resulted in outcomes with no substantively different results.

Overall Achievement

Descriptive statistics (unadjusted and adjusted) on overall student achievement across the six assessment periods are presented in Table 21. ANCOVA results are displayed in Table 22, with the graphical representation of adjusted means presented in Figure 3.

TABLE 21. Overall Achievement: Early First Grade (Fall 1998) to Late Sixth Grade (Spring 2004)

Student Group		Mean Overall Achievement by Assessment Period							
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	Marginal means (group)
Seven-year scholarship recipient-users (n=197)	Unadjusted mean	537	555	587	615	632	643	654	603
	SD	28	30	32	33	33	32	33	--
	Adjusted Mean	534	551	584	612	628	640	651	600
Public applicant non-recipients (n=259)	Unadjusted mean	522	546	577	605	620	636	639	592
	SD	31	34	32	33	38	33	40	--
	Adjusted Mean	524	548	579	606	622	638	641	594
Public non-applicants (n=343)	Unadjusted Mean	521	548	580	607	624	636	638	593
	SD	30	33	30	34	38	38	41	--
	Adjusted Mean	522	549	580	607	625	636	638	594

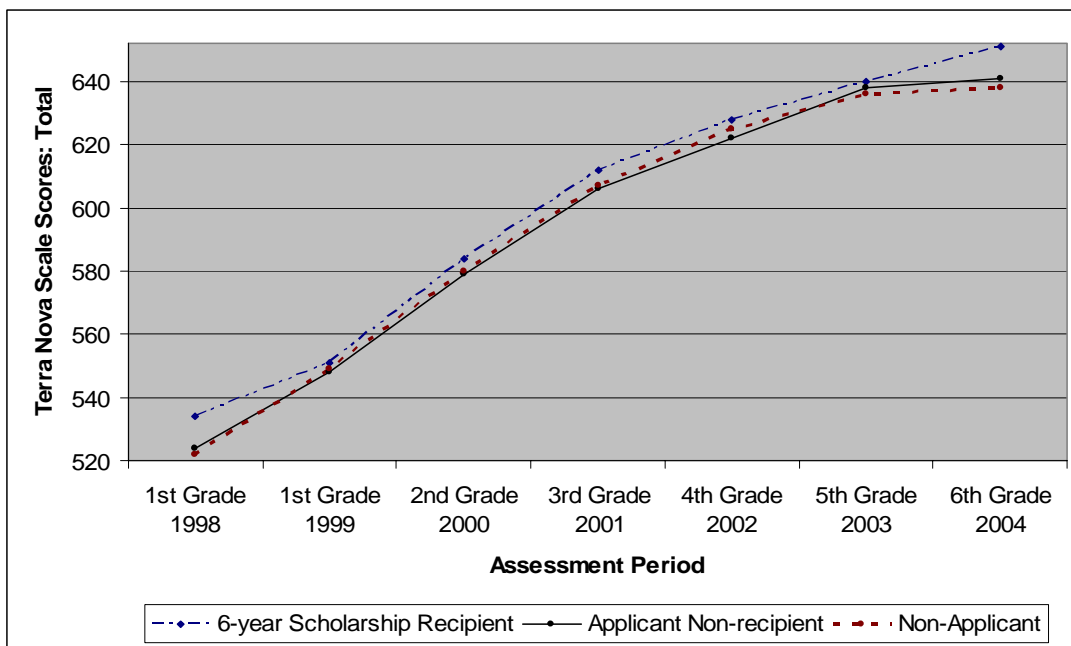
TABLE 22. ANCOVA Summary: Overall Achievement Analysis from First Grade 1998 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	40759	2	20379	18.55	0.0001
Time	9277963	6	1546327	1407.43	0.0001
Minority Status	358842	1	358842	326.61	0.0001
Time x Group	17035	12	1420	1.29	0.2154
Corrected Error	6120813	5571	1098		

As shown in Table 22, significant results were obtained for the main effect of time and minority status; and the interaction of time and group was found to be not significant.

Examination of the main effect of group also revealed a statistically significant difference in overall achievement across the three groups $p < 0.001$. Follow-up Sidak multiple comparison procedures found significant differences between the three comparison groups (Scholarship recipients - Applicant non-recipients, $p < 0.001$; Scholarship recipients - Non-applicants, $p < 0.001$).

FIGURE 3. Overall Achievement from First Grade 1998 to Sixth Grade 2004



At the beginning of the study (Fall of first grade), overall achievement differed significantly between scholarship recipients and those groups that did not receive scholarships. Students who used a scholarship had significantly higher overall achievement ($M = 534$) than did either of the public school groups (524 and 522 for applicant non-recipients and non-applicants, respectively). No significant differences across groups appeared in these data from the Spring of 1999 through the Spring of 2003. By the Spring of 2004, however, significant differences again appeared between scholarship recipients and those groups that did not receive scholarships. Students who used a scholarship had significantly higher overall achievement ($M = 651$) than did either of the public school groups (641 and 638

for applicant non-recipients and non-applicants, respectively). Over the seven waves of data collection, the marginal means for overall academic achievement were 600, 594, and 594 for scholarship recipients, public applicant non-recipients and public non-applicants respectively. A summary of these group differences across time and subject areas can be found in Table 33.

Reading Achievement

Adjusted and unadjusted descriptive statistics on student reading achievement across the six assessment periods are presented in Table 23, and ANCOVA results are displayed in Table 24. Figure 4 presents these data graphically.

TABLE 23. Reading Achievement: Early First Grade (Fall 1998) to Late Sixth Grade (Spring 2004)

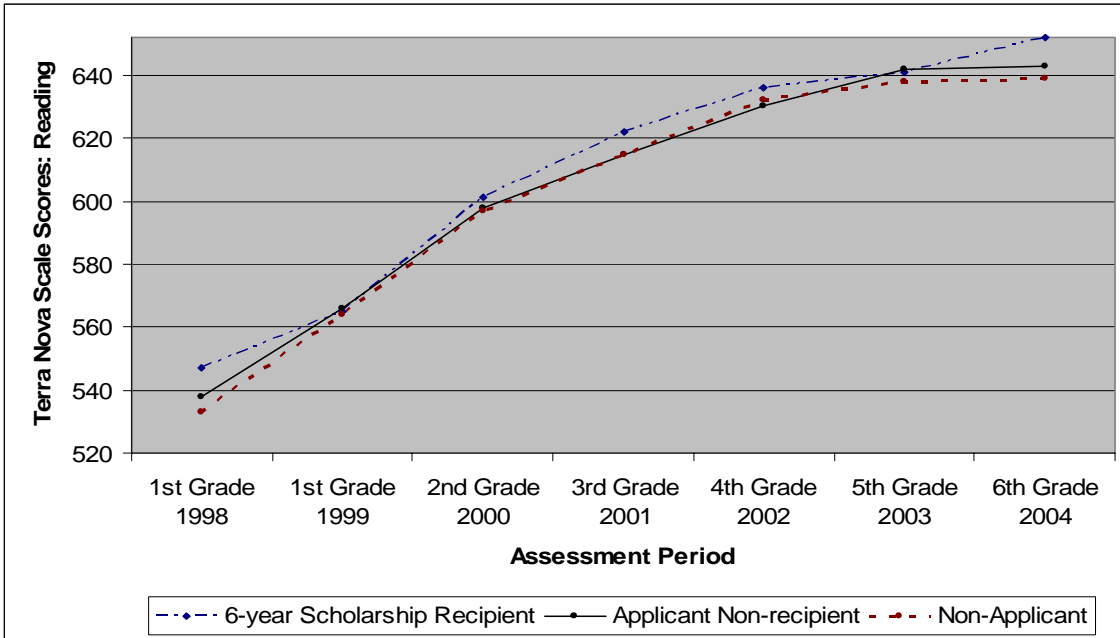
Student Group		Mean Reading Achievement by Assessment Period							
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	Marginal means (group)
Seven-year scholarship recipient-users (n=197)	Unadjusted mean	550	568	603	624	639	644	655	612
	SD	34	38	34	39	35	39	33	--
	Adjusted Mean	547	565	601	622	636	641	652	609
Public applicant non-recipients (n=259)	Unadjusted mean	536	564	596	614	628	640	641	603
	SD	37	37	35	37	42	37	41	--
	Adjusted Mean	538	566	598	615	630	642	643	605
Public non-applicants (n=343)	Unadjusted Mean	533	563	597	615	631	637	632	601
	SD	38	38	34	41	43	45	43	--
	Adjusted Mean	533	564	597	615	632	638	639	603

TABLE 24. ANCOVA Summary: Reading Achievement Analysis from First Grade 1998 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	38291	2	19146	13.36	0.0001
Time	7358505	6	1226417	855.71	0.0001
Minority Status	291881	1	291881	203.65	0.0001
Time x Group	23461	12	23460	1.36	0.1753
Corrected Error	7984473	5571	1433		

As shown in Table 24, significant results were obtained for the main effect of time and minority status; and the interaction of time and group was found to be not significant. Examination of the main effect of group also revealed a statistically significant difference in reading achievement across the three groups $p < 0.001$. Follow-up Sidak multiple comparison procedures found significant differences between the three comparison groups (Scholarship recipients - Applicant non-recipients, $p < 0.001$; Scholarship recipients - Non-applicants, $p < 0.001$).

FIGURE 4. Reading Achievement from First Grade 1998 to Sixth Grade 2004



At the beginning of the study (Fall of first grade), reading achievement differed significantly between scholarship recipients and those groups that did not receive scholarships. Students who used a scholarship had significantly higher reading achievement ($M = 547$) than did either of the public school groups (538 and 533 for applicant non-recipients and non-applicants, respectively). No significant differences across groups appeared in these data from the Spring of 1999 through the Spring of 2003. By the Spring of 2004, however, significant differences again appeared between scholarship recipients and those groups that did not receive scholarships. Students who used a scholarship had significantly higher reading achievement ($M = 652$) than did either of the public school groups (643 and 639 for applicant non-recipients and non-applicants, respectively). Over the seven waves of data collection, the marginal means for reading achievement were 609, 605, and 603 for scholarship recipients, public applicant non-recipients and public non-applicants respec-

tively. A summary of these group differences across time and subject areas can be found in Table 33.

Language Arts Achievement

Adjusted and unadjusted descriptive statistics on student language arts achievement across the six assessment periods are presented in Table 25, and ANCOVA results are displayed in Table 26. Figure 5 presents these data graphically.

TABLE 25. Language Arts Achievement: Early First Grade (Fall 1998) to Late Sixth Grade (Spring 2004)

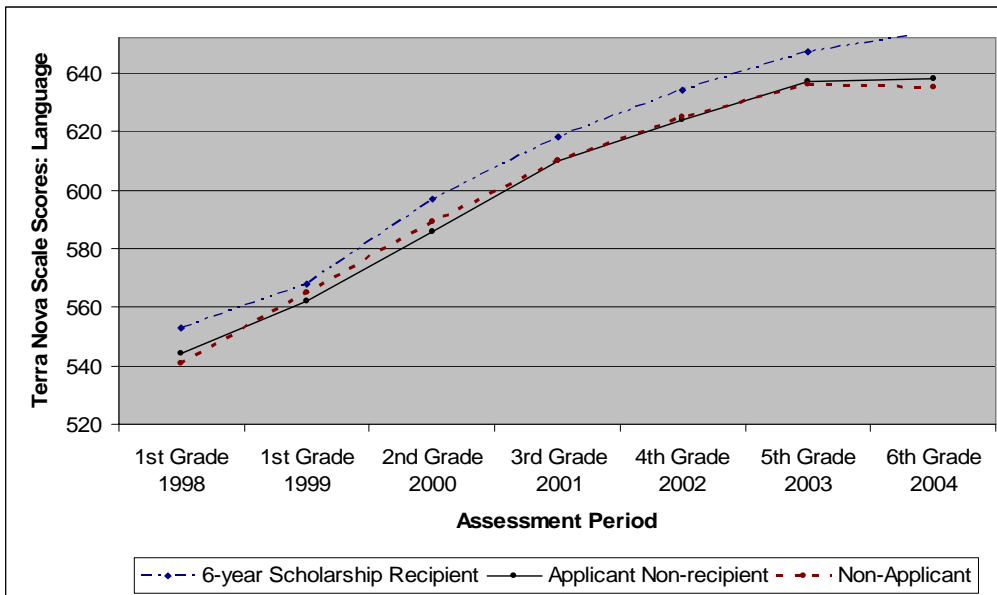
		Mean Language Arts Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-users (n=197)	Unadjusted mean	557	572	600	620	637	649	657	613
	SD	36	39	42	35	36	38	39	--
	Adjusted Mean	553	568	597	618	634	647	654	599
Public applicant non-recipients (n=259)	Unadjusted mean	542	560	585	609	622	636	636	599
	SD	38	43	37	33	42	36	43	--
	Adjusted Mean	544	562	586	610	624	637	638	600
Public non-applicants (n=343)	Unadjusted Mean	540	565	588	610	625	636	635	600
	SD	39	40	33	35	36	42	43	--
	Adjusted Mean	541	565	589	610	625	636	635	600

TABLE 26. ANCOVA Summary: Language Arts Achievement Analysis from First Grade 1998 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	101926	2	50963	35.72	0.0001
Time	6414135	6	1069023	749.30	0.0001
Minority Status	303397	1	303397	212.66	0.0001
Time x Group	18702	12	1559	1.09	0.3614
Corrected Error	7948136	5571	1426		

As shown in Table 26, As shown in Table 22, significant results were obtained for the main effect of time and minority status; and the interaction of time and group was found to be not significant. Examination of the main effect of group also revealed a statistically significant difference in language arts across the three groups $p < 0.001$. Follow-up Sidak multiple comparison procedures found significant differences between the three comparison groups (Scholarship recipients - Applicant non-recipients, $p < 0.001$; Scholarship recipients - Non-applicants, $p < 0.001$).

FIGURE 5. Language Arts Achievement from First Grade 1998 to Sixth Grade 2004



At the beginning of the study (Fall of first grade), language arts achievement differed significantly between scholarship recipients and those groups that did not receive scholarships. Students who used a scholarship had significantly higher language arts achievement ($M = 553$) than did either of the public school groups (544 and 541 for applicant non-recipients and non-applicants, respectively). No significant differences across groups appeared that Spring, 1999. The following Spring, second grade 2000, the same group differences reemerged. Students who used a scholarship had significantly higher language arts achievement ($M = 597$) than did either of the public school groups (586 and 589 for applicant non-recipients and non-applicants, respectively). This trend of differences continued into third grade, Spring 2001 and remained through the last wave of data collection in sixth grade, Spring 2004. Over the seven waves of data collection, the marginal means for language arts achievement were 610, 600, and 600 for scholarship recipients, public applicant non-recipients and public non-applicants respectively. A summary of these group differences across time and subject areas can be found in Table 33.

Mathematics Achievement

Adjusted and unadjusted descriptive statistics on student mathematics achievement across the six assessment periods are presented in Table 27, and ANCOVA results are displayed in Table 28. Figure 6 presents these data graphically.

TABLE 27. Mathematics Achievement: Early First Grade (Fall 1998) to Late Sixth Grade (Spring 2004)

Student Group		Mean Mathematics Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-users (n=197)	Unadjusted mean	506	524	558	600	619	636	652	585
	SD	34	32	35	37	41	34	40	--
	Adjusted Mean	502	521	554	597	615	633	648	581

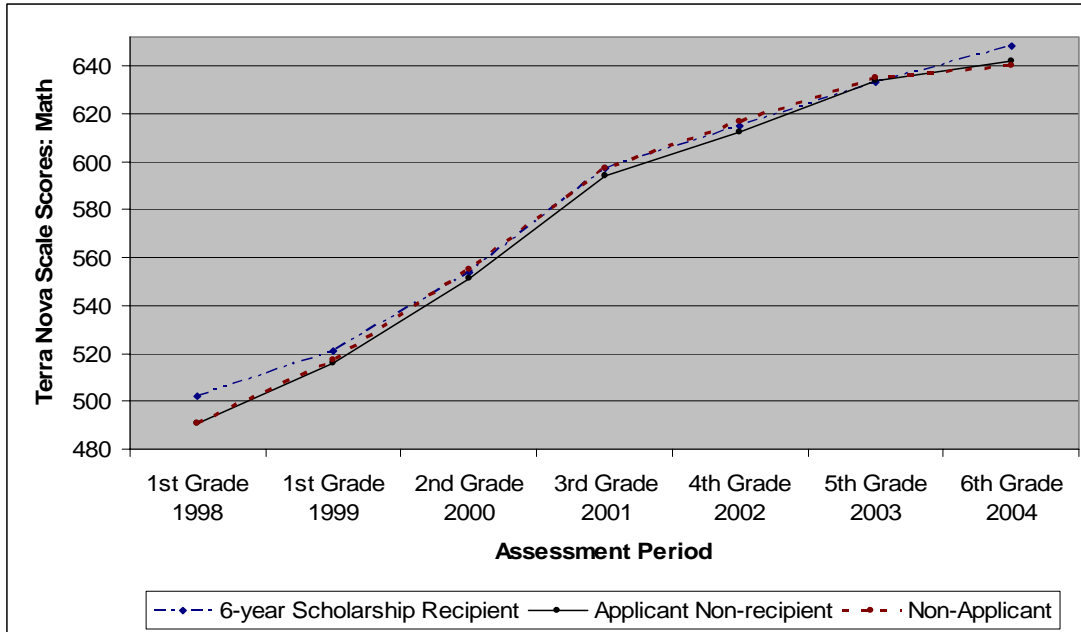
		Mean Mathematics Achievement by Assessment Period							
Student Group		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	Marginal means (group)
Public applicant non-recipients (n=259)	Unadjusted mean	489	504	550	592	610	632	639	575
	SD	33	39	37	40	47	42	52	--
	Adjusted Mean	491	516	551	594	612	634	642	577
Public non-applicants (n=343)	Unadjusted Mean	491	517	554	597	617	635	640	579
	SD	31	39	37	40	48	43	55	--
	Adjusted Mean	491	517	555	597	617	635	640	579

TABLE 28. ANCOVA Summary: Mathematics Achievement Analysis from First Grade 1998 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	12704	2	6352	4.06	0.0174
Time	15335475	6	2555973	1631.86	0.0001
Minority Status	497190	1	497190	317.44	0.0001
Time x Group	22677	12	1890	1.21	0.2716
Corrected Error	8725618	5571	1566		

As shown in Table 28, significant results were obtained for the main effect of time and minority status; and the interaction of time and group was found to be not significant. Examination of the main effect of group also revealed a statistically significant difference in mathematics achievement across the three groups $p < 0.05$. Follow-up Sidak multiple comparison procedures found significant differences between two comparison groups (Scholarship recipients - Applicant non-recipients, $p < 0.05$).

FIGURE 6. Mathematics Achievement from First Grade 1998 to Sixth Grade 2004



At the beginning of the study (Fall of first grade), mathematics achievement differed significantly between scholarship recipients and those groups that did not receive scholarships. Students who used a scholarship had significantly higher mathematics achievement ($M = 502$) than did either of the public school groups (491 and 491 for applicant non-recipients and non-applicants, respectively). No significant differences across groups appeared over the following six data collection waves. Over the seven waves of data collection, the marginal means for mathematics achievement were 581, 577, and 579 for scholarship recipients, public applicant non-recipients and public non-applicants respectively. A summary of these group differences across time and subject areas can be found in Table 33.

Science Achievement

Adjusted and unadjusted descriptive statistics on student science achievement across the four assessment periods are presented in Table 29, and ANCOVA results are displayed in Table 30. Figure 7 presents these data graphically.

TABLE 29. Science Achievement: Late Third Grade (Spring 2001) to Late Sixth Grade (Spring 2004)

Student Group		Mean Science Achievement by Assessment Period							
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	Marginal means (group)
Seven-year scholarship recipient-users (n=197)	Unadjusted mean	--	--	--	601	623	637	656	629
	SD	--	--	--	39	44	41	43	--
	Adjusted Mean	--	--	--	597	618	633	653	625
Public applicant non-recipients (n=259)	Unadjusted mean	--	--	--	591	611	628	640	618
	SD	--	--	--	48	50	37	49	--
	Adjusted Mean	--	--	--	593	613	630	643	620
Public non-applicants (n=343)	Unadjusted Mean	--	--	--	591	613	631	639	619
	SD	--	--	--	50	49	43	51	--
	Adjusted Mean	--	--	--	591	613	631	639	619

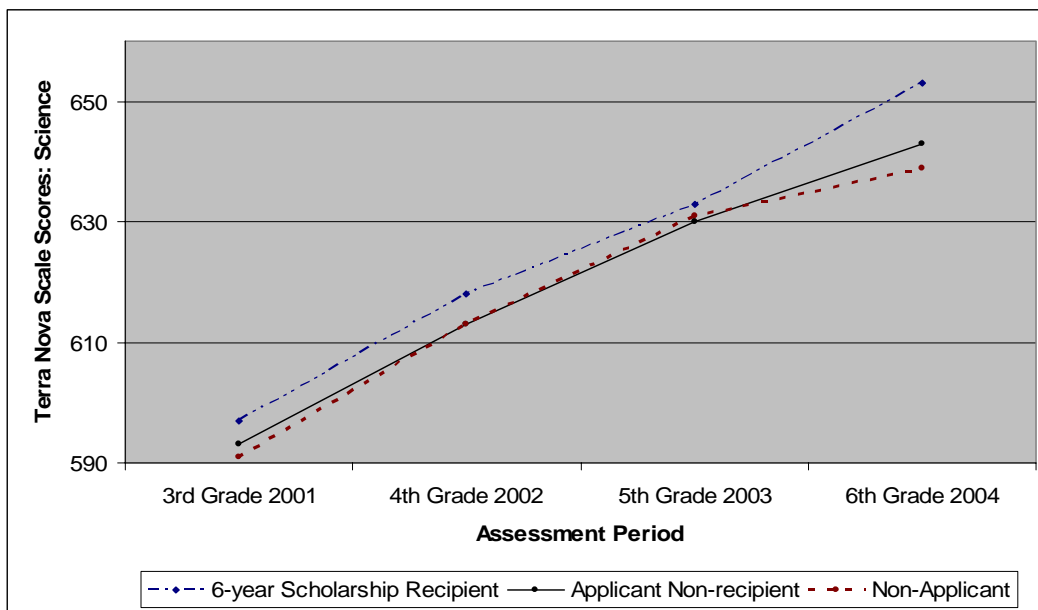
TABLE 30. NCOVA Summary: Science Achievement Analysis from First Grade 1998 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	23058	2	11529	5.70	0.0034
Time	1100325	3	366775	181.49	0.0001
Minority Status	347929	1	347929	172.16	0.0001
Time x Group	8378	6	13963	0.69	0.6570
Corrected Error	6432708	3183	2021		

As shown in Table 30, significant results were obtained for the main effect of time and minority status; and the interaction of time and group was found to be not significant.

Examination of the main effect of group also revealed a statistically significant difference in science achievement across the three groups $p < 0.01$. Follow-up Sidak multiple comparison procedures found significant differences between two pairs of comparison groups (Scholarship recipients - Applicant non-recipients, $p < 0.05$; Scholarship recipients - Non-applicants, $p < 0.01$).

FIGURE 7. Science Achievement from Third Grade 2001 to Sixth Grade 2004



For the first administration of the Terra Nova science exam, (third grade 2001), no statistically significant difference across the three groups was observed. Students who used a scholarship had a mean score of ($M = 597$) with scores from the other two groups reported as 593 and 591 for applicant non-recipients and non-applicants, respectively. No significant differences across groups appeared until the final wave of data collection during the sixth grade, 2004. During this final wave, a statistically significant difference existed between students that received scholarships and non-applicants, $M = 653$ and $M = 639$ respectively. Over the four waves of data collection, the marginal means for science achievement were 625, 620, and 619 for scholarship recipients, public applicant non-

recipients and public non-applicants respectively. A summary of these group differences across time and subject areas can be found in Table 33.

Social studies Achievement

Adjusted and unadjusted descriptive statistics on student social studies achievement across the four assessment periods are presented in Table 31, and ANCOVA results are displayed in Table 32. Figure 8 presents these data graphically.

TABLE 31. Social Studies Achievement: Late Third Grade (Spring 2001) to Late Sixth Grade (Spring 2004)

		Mean Social Studies Achievement by Assessment Period							
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	Marginal means (group)
Seven-year scholarship recipient-users (n=197)	Unadjusted mean	--	--	--	616	631	635	655	634
	SD	--	--	--	33	42	40	35	--
	Adjusted Mean	--	--	--	613	627	632	652	631
Public applicant non-recipients (n=259)	Unadjusted mean	--	--	--	608	620	623	636	622
	SD	--	--	--	30	42	41	43	--
	Adjusted Mean	--	--	--	610	622	625	638	624
Public non-applicants (n=343)	Unadjusted Mean	--	--	--	608	622	621	632	621
	SD	--	--	--	44	34	44	48	--
	Adjusted Mean	--	--	--	608	622	621	633	621

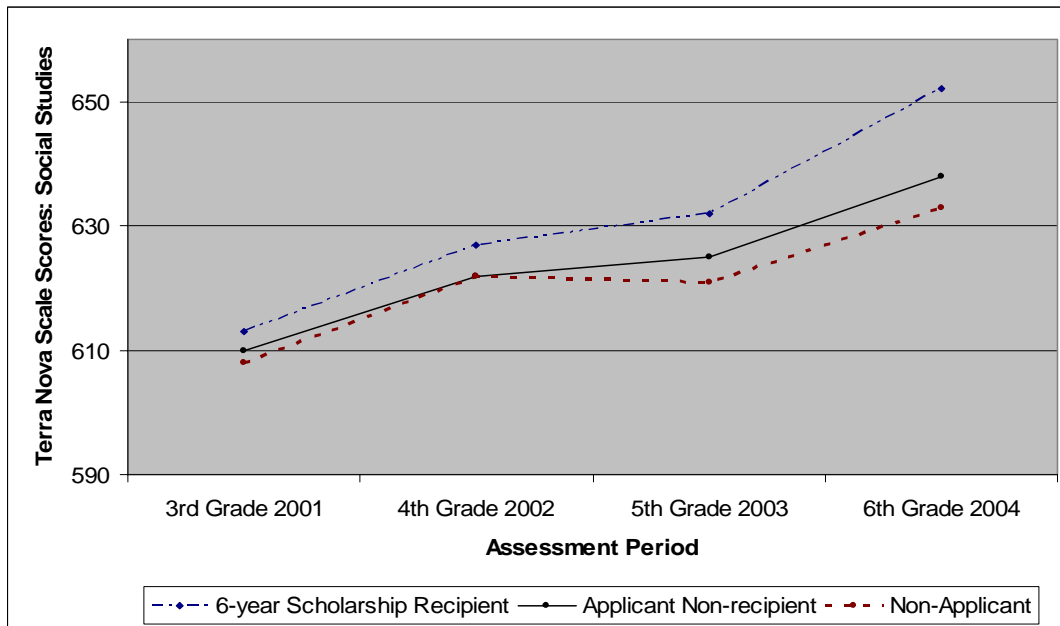
TABLE 32. ANCOVA Summary: Social Studies Achievement Analysis from First Grade 1998 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	47361	2	23681	14.14	0.0001
Time	361067	3	120356	71.88	0.0001
Minority Status	238873	1	238873	142.66	0.0001

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Time x Group	17744	6	120356	1.00	0.1020
Corrected Error	5329604	3183	1674		

As shown in Table 32, significant results were obtained for the main effect of time and minority status; and the interaction of time and group was found to be not significant. Examination of the main effect of group also revealed a statistically significant difference in social studies achievement across the three groups $p < 0.001$. Follow-up Sidak multiple comparison procedures found significant differences between two pairs of comparison groups, (Scholarship recipients - Applicant non-recipients, $p < 0.01$; Scholarship recipients – Non-applicants, $p < 0.01$).

FIGURE 8. Social Studies Achievement from Third Grade 2001 to Sixth Grade 2004



For the first administration of the Terra Nova social studies exam, (third grade 2001), no statistically significant difference across the three groups was observed. Students who used a scholarship had a mean score of ($M = 613$) with scores from the other two groups

reported as 610 and 608 for applicant non-recipients and non-applicants, respectively. No significant differences across groups appeared until the fifth grade, Spring 2003 data collection. During this administration, a statistically significant difference existed between students that received scholarships and non-applicants, $M = 632$ and $M = 621$, respectively. Additionally, significant differences appeared during the final wave of data collection during the sixth grade, 2004. During this final wave differences existed between students who received scholarships and applicant non-recipients, $M = 652$ and $M = 638$, respectively and between students that received scholarships and non-applicants, $M = 652$ and $M = 633$, respectively. Over the four waves of data collection, the marginal means for social studies achievement were 631, 624, and 621 for scholarship recipients, public applicant non-recipients, and public non-applicants, respectively. A summary of these group differences across time and subject areas can be found in Table 33.

TABLE 33. Subjects of Significant Pairwise Differences Favoring Scholarship Students Over: (a) Applicant Non-recipients (ANR) and (b) Non-applicants (NA) by Testing Episode

Subject	Testing Episode ^a						
	Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004
Overall	ANR NA	b					ANR NA
Reading	ANR NA						ANR NA
Language Arts	ANR NA		ANR NA	ANR NA	ANR NA	ANR NA	ANR NA
Math	ANR NA						
Science	Not Tested						NA
Social Studies	Not Tested					NA	ANR NA

- a. Indicated comparisons in which non-applicants were found to obtain significantly lower scores than applicant non-recipients.
- b. Empty cells indicate no significant difference between scholarship students and the particular comparison group.

Synopsis across Achievement Measures (1998-2004): Seven-Year Scholarship Recipient-users

The following summary describes patterns of achievement among three groups of students: those who used a scholarship for private school enrollment continuously from kindergarten through sixth grade (i.e., seven-year scholarship recipient-users), those whose families applied for but did not receive a scholarship and who were attending public schools in 6th grade (i.e., public applicant non-recipients), and those whose families never applied for a scholarship and who were attending public schools in 6th grade (i.e., non-applicants). Scores in the areas of reading, language arts, mathematics, and overall achievement, computed as the mean of performance in the prior three areas, were obtained at seven points in time, beginning in Fall of 1998 and continuing each subsequent Spring through 2004. Achievement in science and social studies was first available in the Spring of students' third grade year, 2001, and was obtained each subsequent Spring. While differences between the two public school comparison groups do appear, we focus our discussion on the performance of these public school groups with that of scholarship students. It should be noted that the following summary reflects examination of program impact after controlling for the minority status of students.

At the beginning of first grade, Fall 1998, and after adjusting for variance attributable to minority status, students who continued to use a scholarship to attend private schools had higher achievement scores than did students in both of the public school comparison groups ($p < 0.05$) in all of the four available achievement measures: overall, reading, language arts and mathematics. By the end of first grade (Spring 1999), there was no longer any statistically significant difference in students' achievement scores in these four areas.

By the end of second grade (Spring 2000), scores across the three comparison groups were found to be different in only the subject area of language arts ($p < 0.05$). Students that received scholarships outperformed both applicant non-recipients and non-applicants. This pattern of scholarship recipients outperforming the other two comparison

groups in language arts scores continued through the sixth grade 2004. No difference was found across groups in overall, reading, or mathematics scores for the duration of Spring 2000 through Spring 2003.

By the end of sixth grade, Spring, 2004, scholarship students exhibited scores better than both public school comparison groups in all areas except mathematics and except in comparison to applicant non-recipients in science. These differences are statistically significant at a level of $p < 0.05$.

In addition, across all analyses the minority status covariate was statistically significant, as was the main effect of time. However, there were no statistically significant differences for the interaction of time and group. In other words, although students improved significantly from grade to grade (as one might expect), scholarship recipients and their public school peers did not differ in their rates of growth on the various measures of student achievement.

3.3.2 ANCOVA with Minority Status and Student Mobility

Although the previous analysis (i.e., ANCOVA using minority status as a covariate) provides a replication of previous analyses conducted to examine the impact of the CSTP, a limitation of this analysis is that by definition the multiple comparison groups may be very different in terms of mobility. In other words, the nature of the analyses conducted requires a focus on seven-year scholarship recipient users. Therefore, the analysis addresses the academic impact on only those scholarship students who remain within one of the participating Cleveland private schools. In contrast, the tracking system used as part of the study resulted in public school comparison groups that may contain students who have attended multiple schools within the Cleveland public school system. Subsequently, the comparison groups may be quantitatively different in terms of levels of student mobility. This analysis was designed to try to account for differences in student mobility that might exist between the scholarship recipient-users and the two public

school comparison groups by including an indicator of student mobility as a covariate in the analysis.

More specifically, analysis of covariance (ANCOVA) was employed to look for achievement differences not only among the targeted groups of students at each assessment period, but also in the pattern of group performance over time. The factorial ANCOVAs include fixed factors of student group or scholarship status, time period, time by group interaction and the covariates, minority status and student mobility.¹² These analyses allow examination of achievement differences associated with the assessment period (i.e., time), student group (i.e., participation in the CSTP), the interaction of assessment period and student group, and the impact of minority status and mobility on student achievement variance. In the present study, student mobility is of particular interest because it indicates whether achievement outcomes are related to whether the student attended more than one school. For the purposes of this study, mobility was coded as having attended a single school or as multiple schools ($n = 1$, $n > 1$). A few students in the sample did attend more than two schools. However, relative to the sample size, extending this variable beyond a dichotomous representation does not produce results of any substantive difference. In addition, given sample sizes and available data, it was not possible to include when a student moves (e.g., at the end of first grade, at the end of third grade) in the analyses.

To examine whether participation in the CSTP is associated with academic achievement, the following sections present results of analyses designed to address this broad question. Within each section mixed-design ANCOVAs were conducted separately on each of the six academic measures of the Terra Nova instrument: overall achievement, reading, language arts, mathematics, science, and social studies achievement. Specifically, the section below presents the results from achievement analyses focusing on differences between

12. Factorial ANCOVA are presented for ease of interpretation. Split-plot factorial design (mixed-design factorial ANCOVA) was also employed to model time as a random effect. These analyses resulted in outcomes with no substantively different results.

seven-year scholarship recipient-users, applicant non-recipients, and non-applicants. Group sample sizes are reported in Table 34.

TABLE 34. Relative Proportion of Sample Size between Comparison Groups

	Number of Students Attending a Single School	Number of Students Attending Multiple Schools	Proportion of Students Attending a Single School
Seven-year scholarship recipient users	135	62	69%
Public applicant-non-recipients	153	97	61%
Public non-applicants	217	126	63%

The following analysis of covariance takes into account adjustments for both minority status and student mobility in the comparison of student achievement between levels of program participation.

Overall Achievement

Descriptive statistics (unadjusted and adjusted) on overall student achievement across the six assessment periods are presented in Table 35. ANCOVA results are displayed in Table 36 with the graphical representation of adjusted means presented in Figure 9.

TABLE 35. Overall Achievement: Early First Grade (Fall 1998) to Late Sixth Grade (Spring 2004)

Student Group		Mean Overall Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-users (n=197)	Unadjusted mean	537	555	587	615	632	643	654	603
	SD	28	30	32	33	33	32	33	--
	Adjusted Mean	534	551	584	612	628	640	651	600

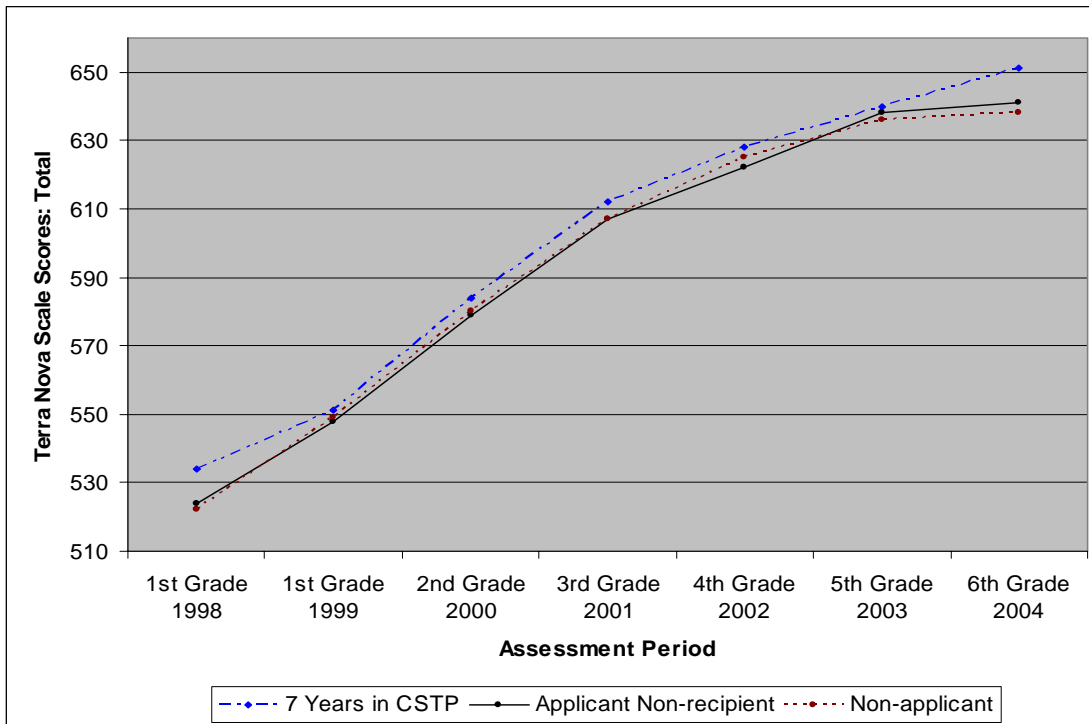
Student Group		Mean Overall Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Public applicant non-recipients (n=259)	Unadjusted mean	522	546	577	605	620	636	639	592
	SD	31	34	32	33	38	33	40	--
	Adjusted Mean	524	548	579	607	622	638	641	594
Public non-applicants (n=343)	Unadjusted Mean	521	548	580	607	624	636	638	593
	SD	30	333	30	34	38	38	41	--
	Adjusted Mean	522	549	580	607	625	636	638	594

TABLE 36. ANCOVA Summary: Overall Achievement Analysis from First Grade 1998 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	37952	2	18976	17.23	<0.0001
Time	9174049	6	1529008	1388.43	<0.0001
Minority Status	339100	1	339100	307.92	<0.0001
Number of schools	29851	1	29851	27.11	<0.0001
Time x Group	17185	12	1432	1.30	0.2104
Corrected Error	6064774	5507			

Significant results were obtained for the main effect of both time and group, with the interaction of these factors found to be not significant (Table 36). Examination of the main effect of minority status revealed a statistically significant difference in overall achievement across the three groups, $p < 0.001$. Additionally, the main effect of number of schools was also significant across the three groups, $p < 0.0001$. Follow-up Sidak multiple comparison procedures found significant differences between the three comparison groups (Scholarship recipients - Applicant non-recipient, $p < 0.017$; Scholarship recipients - Non-applicant, $p < 0.001$).

FIGURE 9. Overall Achievement from First Grade 1998 to Sixth Grade 2004



At the beginning of the study (Fall of first grade), overall achievement differed significantly between scholarship recipients and those groups that did not receive scholarships. Students who used a scholarship had significantly higher overall achievement ($M = 534$) than did both of the public school groups (524 and 522 for applicant non-recipients and non-applicants, respectively). No significant differences across groups appeared in these data from the Spring of 1999 through the Spring of 2003. By the Spring of 2004, however, significant differences again appeared between scholarship recipients and those groups that did not receive scholarships. Students who used a scholarship had significantly higher overall achievement ($M = 651$) than did both of the public school groups (641 and 638 for applicant non-recipients and non-applicants, respectively). Over the seven waves of data collection, the marginal means for overall academic achievement were 600, 594, and 594 for scholarship recipients, public applicant non-recipients and public non-applicants

respectively. A summary of these group differences across time and subject areas can be found in Table 47.

Reading Achievement

Adjusted and unadjusted descriptive statistics on student reading achievement across the six assessment periods are presented in Table 37, and ANCOVA results are displayed in Table 38. Figure 10 presents these data graphically.

TABLE 37. Reading Achievement: Early First Grade (Fall 1998) to Late Sixth Grade (Spring 2004)

Student Group		Mean Reading Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-users (n=197)	Unadjusted mean	550	568	603	624	639	644	655	612
	SD	34	38	34	39	35	39	33	--
	Adjusted Mean	547	565	600	622	636	641	652	609
Public applicant non-recipients (n=259)	Unadjusted mean	536	564	596	614	628	640	641	603
	SD	37	37	35	37	42	37	41	--
	Adjusted Mean	538	566	598	615	630	642	643	605
Public non-applicants (n=343)	Unadjusted Mean	533	563	597	615	631	637	638	602
	SD	38	38	34	41	43	45	43	--
	Adjusted Mean	533	564	597	615	632	638	639	603

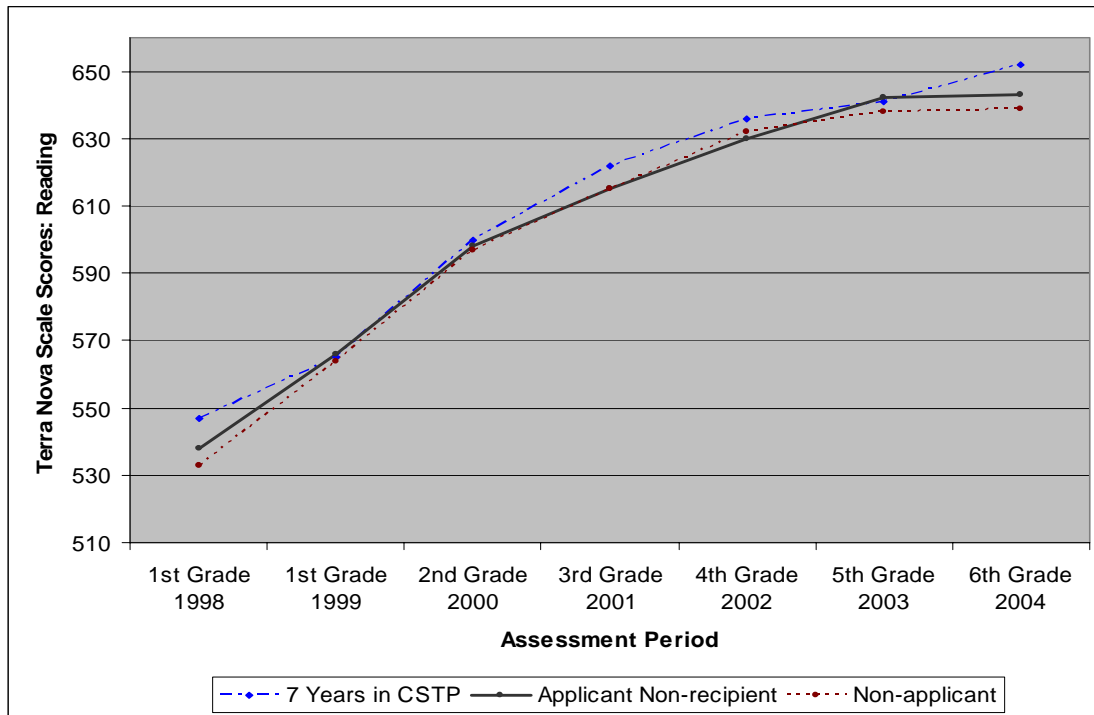
TABLE 38. ANCOVA Summary: Reading Achievement Analysis from First Grade 1998 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	37075	2	18538	12.85	<0.0001
Time	7265909	6	1210985	839.25	<0.0001
Minority Status	280029	1	280029	194.07	<0.0001

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Number of schools	10407	1	10407	7.21	0.0073
Time x Group	23312	12	1943	1.35	0.1846
Corrected Error	7946301	5507			

As shown in Table 38, significant results were obtained for the main effect of both time and group, with the interaction of these factors found to be not significant. Examination of the main effect of group revealed a statistically significant difference in reading achievement across the three groups, $p < 0.0001$. Additionally, the main effect of minority status was found to be significant $p < .0001$. The main effect of number of schools was also significant across the three groups $p < 0.01$. Follow-up Sidak multiple comparison procedures found significant differences between the three comparison groups (Scholarship recipients - Applicant non-recipient, $p < 0.0054$; Scholarship recipients - Non-applicant, $p < 0.0001$).

FIGURE 10. Reading Achievement from First Grade 1998 to Sixth Grade 2004



At the beginning of the study (autumn of first grade), reading achievement differed significantly between scholarship recipients and those groups that did not receive scholarships. Students who used a scholarship had significantly higher reading achievement ($M = 547$) than did either of the public school groups (538 and 533 for applicant non-recipients and non-applicants, respectively). No significant differences across groups appeared in these data from the Spring of 1999 through the Spring of 2003. By the Spring of 2004, however, significant differences again appeared between scholarship recipients and non-applicants. Students who used a scholarship had significantly higher reading achievement ($M = 652$) than did non-applicants but not applicant non-recipients (643 and 639 for applicant non-recipients and non-applicants, respectively). Over the seven waves of data collection, the marginal means for reading achievement were 609, 605, and 603 for scholarship recipi-

ents, public applicant non-recipients and public non-applicants respectively. A summary of these group differences across time and subject areas can be found in Table 47.

Language Arts Achievement

Adjusted and unadjusted descriptive statistics on student language arts achievement across the six assessment periods are presented in Table 39, and ANCOVA results are displayed in Table 40. Figure 11 presents these data graphically.

TABLE 39. Language Arts Achievement: Early First Grade (Fall 1998) to Late Sixth Grade (Spring 2004)

Student Group		Mean Language Arts Achievement by Assessment Period							
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	Marginal means (group)
Seven-year scholarship recipient-users (n=197)	Unadjusted mean	557	572	600	620	637	649	657	613
	SD	36	39	42	35	36	38	39	--
	Adjusted Mean	553	568	597	618	634	647	654	610
Public applicant non-recipients (n=259)	Unadjusted mean	542	560	585	609	622	636	636	599
	SD	38	43	37	33	42	36	43	--
	Adjusted Mean	545	562	586	610	624	637	638	600
Public non-applicants (n=343)	Unadjusted Mean	540	565	588	610	625	636	635	600
	SD	39	40	33	35	36	42	43	--
	Adjusted Mean	541	565	589	610	625	636	635	600

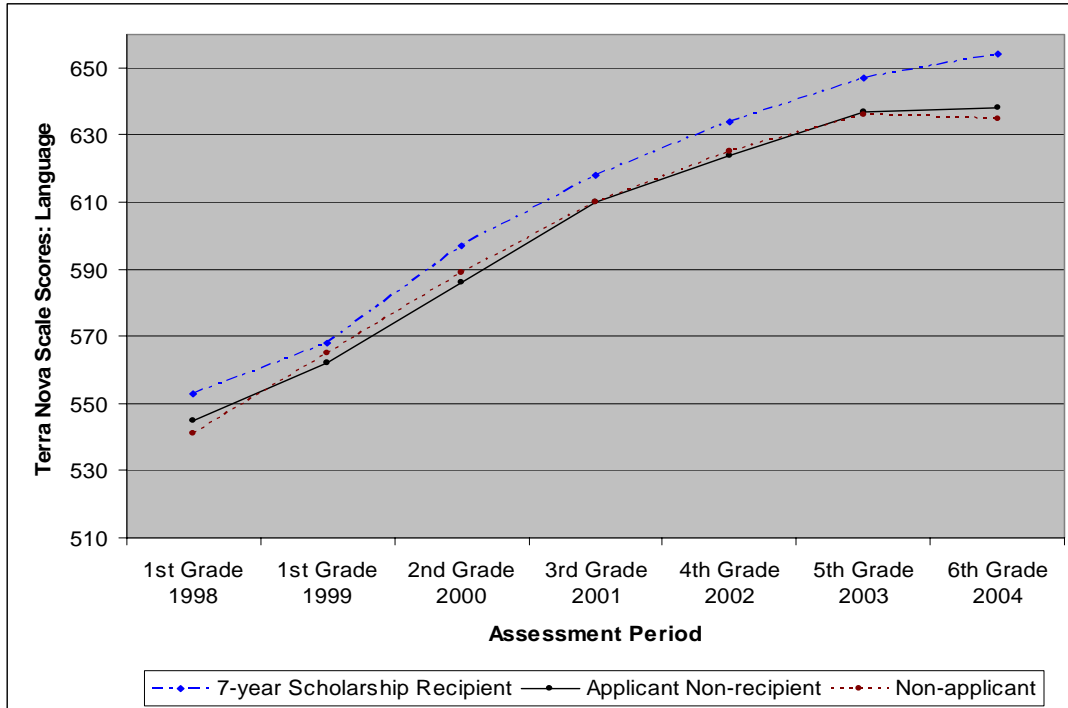
TABLE 40. ANCOVA Summary: Language Arts Achievement Analysis from First Grade 1998 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	9577	2	48789	34.13	<0.0001
Time	6328736	6	1054789	737.84	<0.0001
Minority Status	284334	1	284334	198.89	<0.0001

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Number of schools	35528	1	35528	24.85	<0.0001
Time x Group	19304	12	1609	1.13	0.3338
Corrected Error	7872648	5507			

As shown in Table 40, significant results were obtained for the main effect of both time and group, with the interaction of these factors found to be not significant. Examination of the main effect of group revealed a statistically significant difference in language arts achievement across the three groups, $p < 0.001$. Additionally, the main effect of minority status was found to be significant $p < .0001$. The main effect of number of schools was also significant across the three groups, $p < 0.0001$. Follow-up Sidak multiple comparison procedures found significant differences between the three comparison groups (Scholarship recipients - Applicant non-recipient, $p < 0.001$; Scholarship recipients - Non-applicant, $p < 0.001$).

FIGURE 11. Language Arts Achievement from First Grade 1998 to Sixth Grade 2004



At the beginning of the study (autumn of first grade), language arts achievement differed significantly between scholarship recipients and those groups that did not receive scholarships. Students who used a scholarship had significantly higher language arts achievement ($M = 553$) than did either of the public school groups (544 and 541 for applicant non-recipients and non-applicants, respectively). No significant differences across groups appeared that Spring, 1999. The following Spring, second grade 2000, the same group differences reemerged. Students who used a scholarship had significantly higher language arts achievement ($M = 597$) than did either of the public school groups (586 and 589 for applicant non-recipients and non-applicants, respectively). This trend of differences continued into third grade, Spring 2001 and remained through the last wave of data collection in sixth grade, Spring 2004. Over the seven waves of data collection, the marginal means for language arts achievement were 610, 600, and 600 for scholarship recipients, public

applicant non-recipients and public non-applicants respectively. A summary of these group differences across time and subject areas can be found in Table 47.

Mathematics Achievement

Adjusted and unadjusted descriptive statistics on student mathematics achievement across the six assessment periods are presented in Table 41, and ANCOVA results are displayed in Table 42. Figure 12 presents these data graphically.

TABLE 41. Mathematics Achievement: Early First Grade (Fall 1998) to Late Sixth Grade (Spring 2004)

Student Group		Mean Mathematics Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-users (n=197)	Unadjusted mean	507	524	558	600	619	636	652	585
	SD	34	32	35	37	41	34	40	--
	Adjusted Mean	502	521	554	597	615	633	648	581
Public applicant non-recipients (n=259)	Unadjusted mean	489	514	550	592	610	632	639	575
	SD	33	39	37	40	47	42	52	--
	Adjusted Mean	491	516	552	595	612	634	643	578
Public non-applicants (n=343)	Unadjusted Mean	491	517	554	597	617	635	640	579
	SD	31	39	37	40	48	43	55	--
	Adjusted Mean	491	517	555	597	617	635	641	579

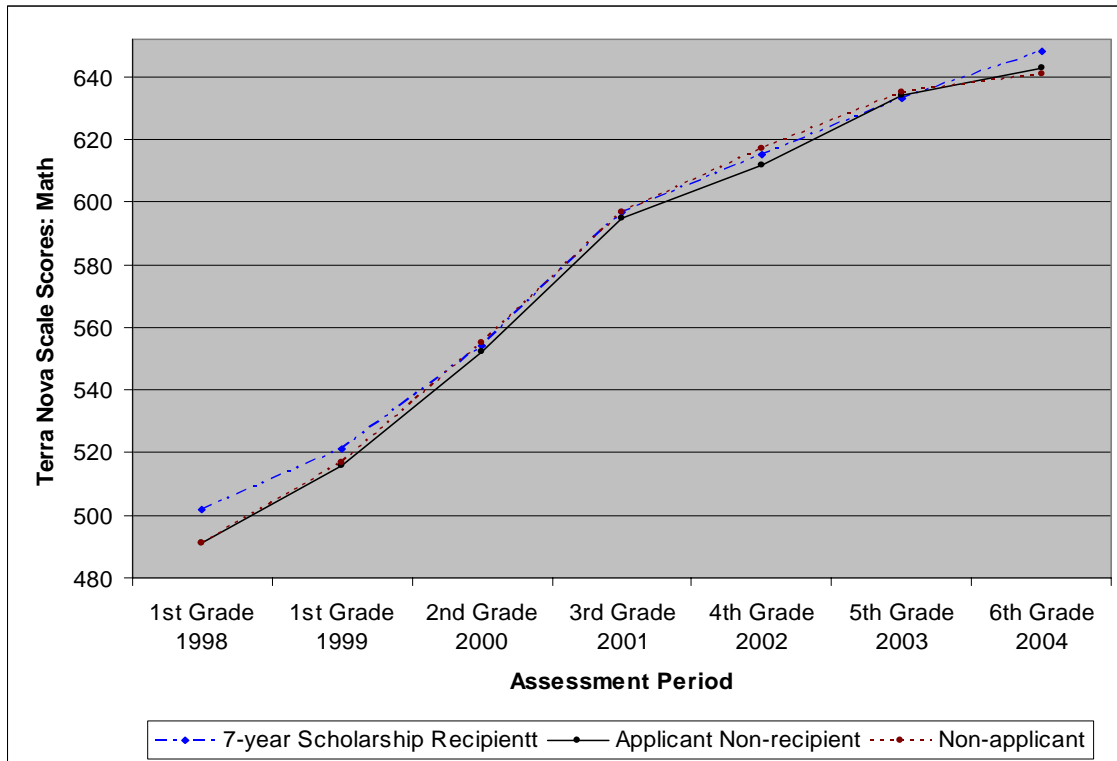
TABLE 42. ANCOVA Summary: Mathematics Achievement Analysis from First Grade 1998 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	9814	2	4907	3.14	0.0433
Time	15200013	6	2533336	1621.87	<0.0001
Minority Status	467437	1	467437	299.26	<0.0001

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Number of schools	42447	1	42447	27.17	<0.0001
Time x Group	56697	12	1947	1.25	0.2441
Corrected Error	8601825	5507			

As shown in Table 42, significant results were obtained for the main effect of both time and group, with the interaction of these factors found to be not significant. Examination of the main effect of group revealed a statistically significant difference in mathematics achievement across the three groups, $p < 0.05$. Additionally, the main effect of minority status was found to be significant $p < .0001$. The main effect of number of schools was also significant across the three groups, $p < 0.0001$. Follow-up Sidak multiple comparison procedures found significant differences between two comparison groups (Scholarship recipients - Applicant non-recipient, $p < 0.05$).

FIGURE 12. Mathematics Achievement from First Grade 1998 to Sixth Grade 2004



At the beginning of the study (autumn of first grade), mathematics achievement differed significantly between scholarship recipients and those groups that did not receive scholarships. Students who used a scholarship had significantly higher mathematics achievement ($M = 502$) than did either of the public school groups (491 and 491 for applicant non-recipients and non-applicants, respectively). No significant differences across groups appeared over the following six data collection waves. Over the seven waves of data collection, the marginal means for mathematics achievement were 581, 578, and 579 for scholarship recipients, public applicant non-recipients, and public non-applicants respectively. A summary of these group differences across time and subject areas can be found in Table 47.

Science Achievement

Adjusted and unadjusted descriptive statistics on student science achievement across the four assessment periods are presented in Table 43, and ANCOVA results are displayed in Table 44. Figure 13 presents these data graphically.

TABLE 43. Science Achievement: Late Third Grade (Spring 2001) to Late Sixth Grade (Spring 2004)

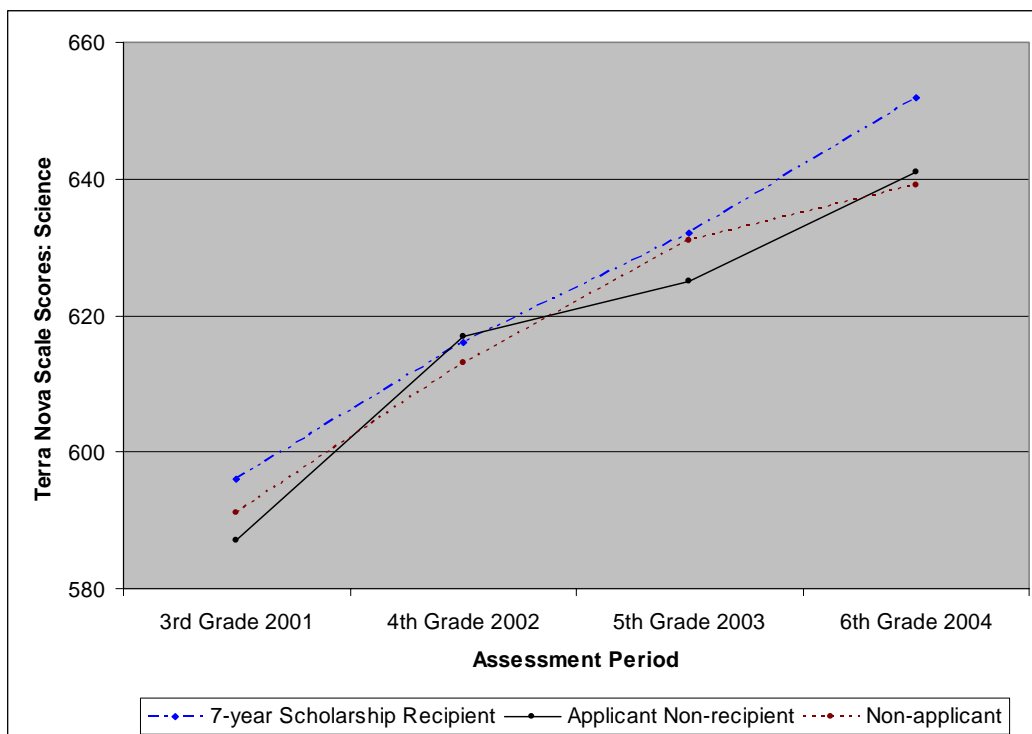
Student Group		Mean Science Achievement by Assessment Period							
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	Marginal means (group)
Seven-year scholarship recipient-users (n=197)	Unadjusted mean	--	--	--	601	623	637	656	629
	SD	--	--	--	39	44	41	43	--
	Adjusted Mean	--	--	--	597	618	633	652	625
Public applicant non-recipients (n=259)	Unadjusted mean	--	--	--	591	611	628	640	618
	SD	--	--	--	48	50	37	49	--
	Adjusted Mean	--	--	--	593	613	630	643	620
Public non-applicants (n=343)	Unadjusted Mean	--	--	--	591	613	631	639	619
	SD	--	--	--	50	49	43	51	--
	Adjusted Mean	--	--	--	591	613	631	639	619

TABLE 44. ANCOVA Summary: Science Achievement Analysis from Third Grade 2001 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	22094	2	11047	5.45	0.0043
Time	109091	3	363639	179.41	<0.0001
Minority Status	333623	1	333623	164.60	<0.0001
Number of schools	19955	1	19955	9.85	0.0017
Time x Group	8463	6	1411	0.70	0.6530
Corrected Error	6376656	3146			

As shown in Table 44, significant results were obtained for the main effect of both time and group, with the interaction of these factors found to be not significant. Examination of the main effect of group revealed a significant difference in science achievement across the three groups, $p < 0.01$. Additionally, the main effect of minority status was found to be significant $p < .0001$. The main effect of number of schools was also significant across the three groups, $p < 0.01$. Follow-up Sidak multiple comparison procedures found significant differences between two pairs of comparison groups (Scholarship recipients - Applicant non-recipient, $p < 0.05$; Scholarship recipients - Non-applicants, $p < 0.01$).

FIGURE 13. Science Achievement from Third Grade 2001 to Sixth Grade 2004



For the first administration of the Terra Nova science exam, (third grade 2001), no statistically significant difference across the three groups was observed. Students who used a scholarship had a mean score of ($M = 625$) with scores from the other two groups

reported as 620 and 619 for applicant non-recipients and non-applicants, respectively. No significant differences across groups appeared until the final wave of data collection during the sixth grade, 2004. By the Spring of 2004, however, significant differences again appeared between scholarship recipients and non-applicants. Students who used a scholarship had significantly higher science achievement ($M = 652$) than did applicant non-recipients and non-applicants (643 and 639 for applicant non-recipients and non-applicants, respectively). Over the four waves of data collection, the marginal means for science achievement were 625, 620, and 619 for scholarship recipients, public applicant non-recipients, and public non-applicants respectively. A summary of these group differences across time and subject areas can be found in Table 47.

Social Studies Achievement

Adjusted and unadjusted descriptive statistics on student social studies achievement across the four assessment periods are presented in Table 45, and ANCOVA results are displayed in Table 46. Figure 14 presents these data graphically.

TABLE 45. Social Studies Achievement: Late Third Grade (Spring 2001) to Late Sixth Grade (Spring 2004)

Student Group		Mean Social Studies Achievement by Assessment Period							
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	Marginal means (group)
Seven-year scholarship recipient-users (n=197)	Unadjusted mean	--	--	--	616	631	635	655	634
	SD	--	--	--	33	42	40	35	--
	Adjusted Mean	--	--	--	613	627	632	652	631
Public applicant non-recipients (n=259)	Unadjusted mean	--	--	--	608	620	623	636	622
	SD	--	--	--	38	42	41	43	--
	Adjusted Mean	--	--	--	610	622	625	638	624

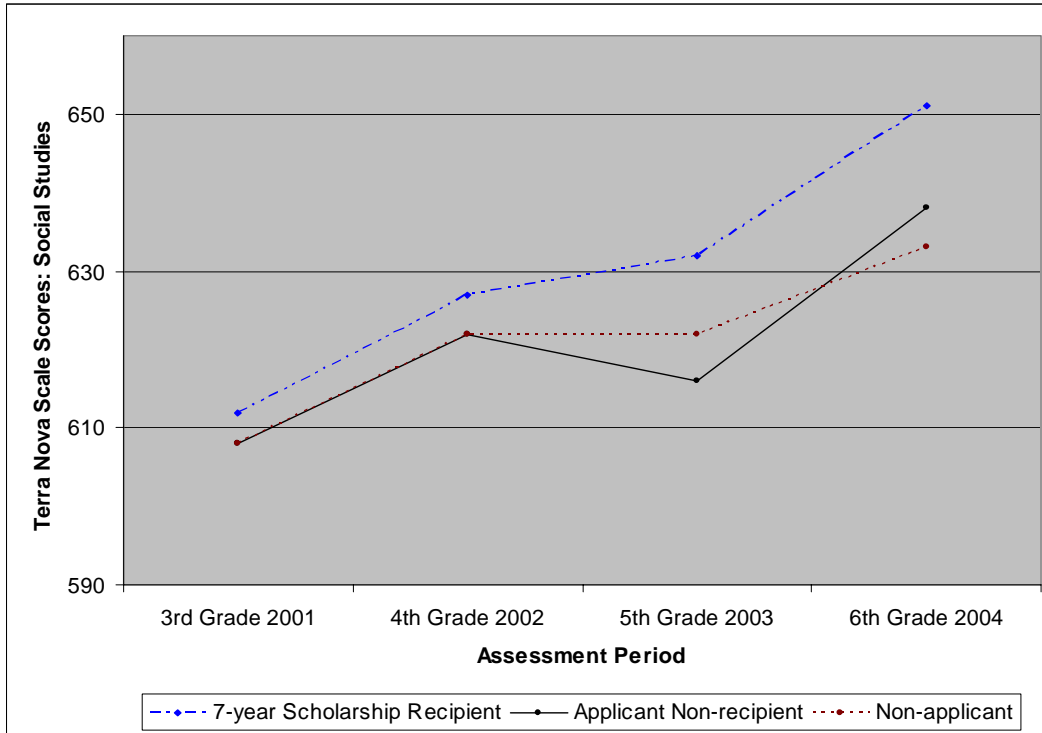
		Mean Social Studies Achievement by Assessment Period							
Student Group		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	Marginal means (group)
Public non-applicants (n=343)	Unadjusted Mean	--	--	--	608	622	621	632	621
	SD	--	--	--	44	43	44	48	--
	Adjusted Mean	--	--	--	608	622	622	633	621

TABLE 46. ANCOVA Summary: Social Studies Achievement Analysis from Third Grade 2001 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	46081	2	23040	136.66	<0.0001
Time	354639	3	118213	10.25	<0.0001
Minority Status	229951	1	229951	136.66	<0.0001
Number of schools	9015	1	9015	5.36	0.0207
Time x Group	18025	6	3004	1.79	0.0981
Corrected Error	6001577	3146			

As shown in Table 46, significant results were obtained for the main effect of both time and group, with the interaction of these factors found to be not significant. Examination of the main effect of group revealed a significant difference in social studies achievement across the three groups, $p < 0.0001$. Additionally, the main effect of minority status was found to be significant $p < .0001$. The main effect of number of schools was also significant across the three groups, $p < 0.05$. Follow-up Sidak multiple comparison procedures found significant differences between two pairs of comparison groups, (Scholarship recipients - Applicant non-recipient, $p < 0.01$; Scholarship recipients – Non-applicants, $p < 0.0001$).

FIGURE 14. Social studies Achievement from Third Grade 2001 to Sixth Grade 2004



For the first administration of the Terra Nova social studies exam, (third grade 2001), no statistically significant difference across the three groups was observed. Students who used a scholarship had a mean score of ($M = 613$) with scores from the other two groups reported as 610 and 608 for applicant non-recipients and non-applicants, respectively. No significant differences across groups appeared until the fifth grade, Spring 2003 data collection. During this administration, a statistically significant difference existed between students that received scholarships ($M = 632$) and applicant non-recipients and non-applicants ($M = 635$ and $M = 622$ respectively). Additionally, significant differences appeared during the final wave of data collection during the sixth grade, 2004. During this final wave differences existed between students that received scholarships and applicant non-recipient, $M = 652$ and $M = 638$ respectively and between students that received scholarships and non-applicants, $M = 652$ and $M = 633$ respectively. Over the four waves

of data collection, the marginal means for social studies achievement were 631, 624, and 621 for scholarship recipients, public applicant non-recipients and public non-applicants respectively. A summary of these group differences across time and subject areas can be found in Table 47.

TABLE 47. Subjects of Significant Pairwise Differences Favoring Scholarship Students Over: (a) Applicant Non-recipients (ANR) and (b) Non-applicants (NA) by Testing Episode

Subject	Testing Episode ^a						
	Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004
Overall	ANR NA	b					ANR NA
Reading	ANR NA						ANR NA
Language Arts	ANR NA		ANR NA	ANR NA	ANR NA	ANR NA	ANR NA
Math	ANR NA						NA
Science	Not Tested					NA	ANR NA
Social Studies	Not Tested					ANR NA	ANR NA

- a. Indicated comparisons in which non-applicants were found to obtain significantly lower scores than applicant non-recipients.
- b. Empty cells indicate no significant difference between scholarship students and the particular comparison group.

Synopsis across Achievement Measures (1998-2004): Seven-Year Scholarship Recipient-users

The following summary describes patterns of achievement among three groups of students: those who used a scholarship for private school enrollment continuously from kindergarten through sixth grade (i.e., seven year scholarship recipient-users), those whose families applied for but did not receive a scholarship and who were attending public schools in 6th grade (i.e., public applicant non-recipients), and those whose families never applied for a scholarship and who were attending public schools in 6th grade (i.e., non-

applicants). Scores in the areas of reading, language arts, mathematics, and overall achievement, computed as the mean of performance in the prior three areas, were obtained at seven points in time, beginning in fall of 1998 and continuing each subsequent Spring through 2004. Achievement in science and social studies was first available in spring of students' third grade year, 2001, and was obtained each subsequent spring.

At the beginning of first grade, fall 1998, students who continued to use a scholarship had higher achievement scores than did students in both of the public school comparison groups, ($p < 0.05$), in all of the four available achievement measures: overall, reading, language arts and mathematics. By the end of first grade (Spring 1999), there was no longer any statistically significant difference in students' achievement scores in these four areas.

By the end of second grade (Spring 2000), scores across the three comparison groups were found to be different in only the subject area of language arts, ($p < 0.05$). Students that received scholarships outperformed both applicant non-recipients and non-applicants. This pattern of scholarship recipients outperforming the other two comparison groups in language arts scores continued through the sixth grade 2004. No difference was found across groups in overall, reading for the duration of Spring 2000 through Spring 2003. No differences were found across groups in science or social studies for the duration of Spring 2001 through Spring 2002. A significant difference was found across groups in social studies in Spring 2003 ($p < .05$). Students that received scholarships outperformed both applicant non-recipients and non-applicants.

By the end of sixth grade, Spring, 2004, scholarship students exhibited higher scores than both public school comparison groups in all areas except mathematics. These differences are statistically significant at a level of $p < 0.05$. Finally, a significant difference was found across all achievement measures for minority status ($p < 0.0001$) as well as for student mobility ($p < 0.05$). However, there were no statistically significant differences in any of the analyses for the interaction of time and group.

Comparison of Models: Modeling with Covariates of Minority Status and Mobility versus Modeling with Only Covariate Minority Status

When comparing the current model with the ANCOVA model that adjusts only for only minority status, no substantive difference is found in achievement score variance attributed to comparison groups. Mobility does appear as a significant covariate in this model, accounting for significant variance in achievement scores. The inclusion of mobility status does not, however, have a substantive impact on variance accounted for by comparison groups. This can be explained through an inspection of the Sums of Squares within the ANCOVA table. With the inclusion of mobility in this model we find a decrease in variance attributed to minority status. To illustrate this point we compare the two model outcomes of overall academic achievement scores, ANCOVA Table 22 and ANCOVA Table 36. In the model where only minority status is used as a covariate, the sum of squared differences (Type III Sums of Squares) is approximately 359,000. When we inspect the model outcome where both minority status and mobility are used as covariates, we find the sum of squared differences for minority status to decrease to 339,000. This decrease in the sum of squared differences in minority status between models is approximately 20,000, which is approximately 75% of the sum of squared differences found attributed to mobility, $SS\text{-III} = 27,000$. This makes conceptual sense as only 85% of students in the sample that have attended more than one school are of minority status. Thus, while mobility does account for significant proportion of model variance, this model variance is primarily a correlate with and partitioned from the model variance explained by minority status.

The overall findings and patterns of statistical significance are almost identical (see Tables 33 and 47) with the exception of the minority status only model finding differences between scholarship students non-applicants for sixth grade science and fifth grade social studies. In addition, in both models (minority status only, and minority status plus student mobility) there is no statistically significant time by group interaction.

3.3.3 ANCOVA adjusting for differences in Prior Achievement

Given that an experimental design with random assignment was not used for the CSTP program, it cannot be assumed that there was equivalence among the student comparison groups prior to start of the intervention. In addition, the inclusion of only seven-year scholarship students in these particular models further complicates the analyses given that the scholarship students that remain in the program for seven years are different than the scholarship students who leave the program (see section 3.3.5 on differential exit from the CSTP). For these same reasons, the previous analyses statistically adjusted for differences in minority status and student mobility. Similarly, an examination of the impact of the CSTP on student achievement needs to account for any prior differences in student achievement. Although the previous analyses replicating prior methodologies provides an understanding of the actual patterns of achievement over time (or patterns adjusted for minority status and mobility), these analyses do not attempt to control for differences in prior achievement.

For the analyses, student achievement test scores administered as part of the study during the fall of 1998 were used as covariates (in addition to minority status and student mobility) to adjust for differences in student achievement. For science and social studies, Spring 2001 test scores were used as covariates given that this is the first year for testing in these two subject areas. Many of the students began the scholarship program in kindergarten, meaning that even for overall, reading, language and mathematics the covariate measure may not account for program impact during kindergarten. However, this variable provides the best available proxy for pre-program achievement test scores. Given that the previous analyses using only minority status and student mobility as covariates indicate there are significant differences at the beginning of first grade (fall 1998) in all subject areas favoring scholarship students, using fall 1998 test scores as a covariate allows the analysis to focus more specifically on impact rather than a continuation of already existing differences in achievement. In addition, the lack of significant interaction

of time by group in these prior analyses, indicating the rates of growth or change do not appear to be different for the multiple comparison groups, further supports the use of fall 1998 test scores as a covariate.

Analysis of covariance (ANCOVA) was employed to look for achievement differences not only among the targeted groups of students at each assessment period, but also in the pattern of group performance over time. The factorial ANCOVAs include fixed factors of student group or scholarship status, time period, time by group interaction and the covariates, fall 1998 achievement score, minority status and student mobility.¹³ These analyses allow examination of achievement differences associated with the assessment period (i.e., time), student group (i.e., participation in the CSTP), the interaction of assessment period and student group, and the impact of minority status and mobility on student achievement variance.

The section below presents the results from achievement analyses focusing on differences between seven-year scholarship recipient-users, applicant non-recipients, and non-applicants. Group sample sizes are reported in Table 48.

TABLE 48. Relative Proportion of Sample Size between Comparison Groups

	Number of Students Attending a Single School	Number of Students Attending Multiple Schools	Proportion of Students Attending a Single School
Seven-year scholarship recipient users	135	62	69%
Applicant, non-recipient	153	97	61%
Public non-applicants	217	126	63%

13. Factorial ANCOVA are presented for ease of interpretation. Split-plot factorial design (mixed-design factorial ANCOVA) was also employed to model time as a random effect. These analyses resulted in outcomes with no substantively different results.

The following analysis of covariance takes into account adjustments for minority status, student mobility, as well as the student's initial achievement score from the fall of 1998 in the comparison of student achievement between the multiple comparison groups. Thus, all scores are a function of how the student performed at the outset of the data collection. It should also be noted that the marginal means given in this section should be used only as a comparison in this section and not with other sections. Because the first year scores are no longer included, the marginal means are inflated compared to previous analyses where first year scores are included.

Overall Achievement

Descriptive statistics (unadjusted and adjusted) on overall student achievement across the six assessment periods are presented in Table 49. ANCOVA results are displayed in Table 50 with the graphical representation of adjusted means presented in Figure 15.

TABLE 49. Overall Achievement: First Grade (Spring 1999) to Late Sixth Grade (Spring 2004)

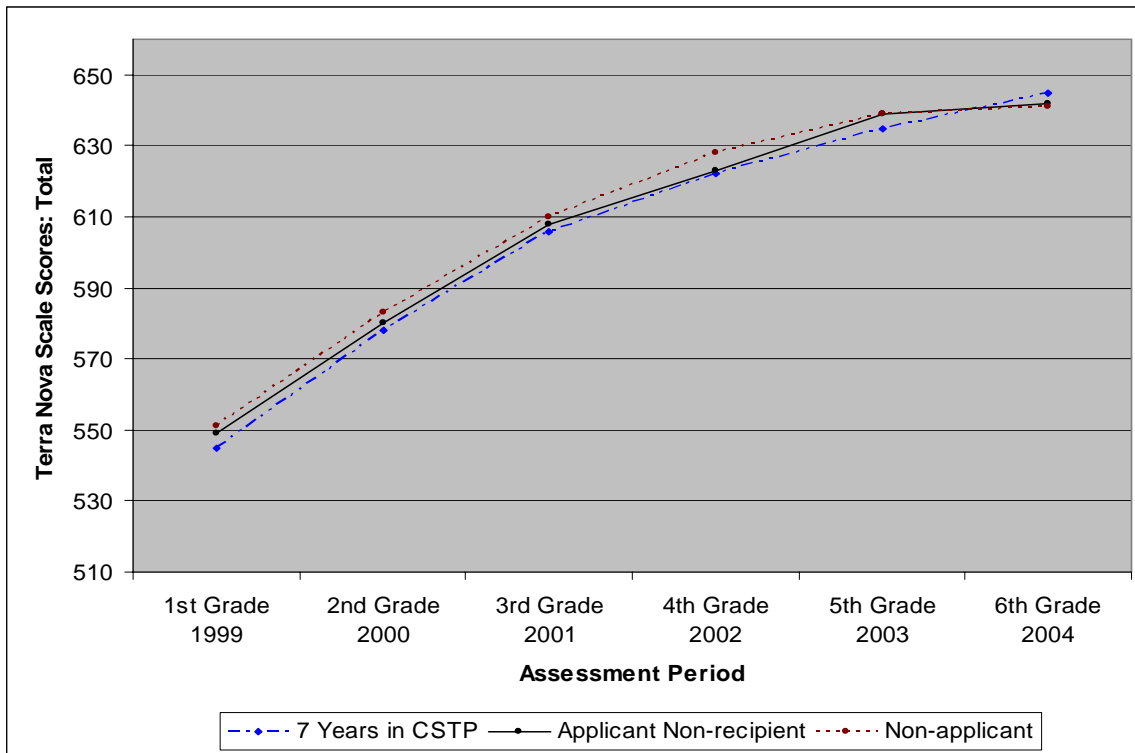
Student Group		Mean Overall Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-users (n=197)	Unadjusted mean	--	555	587	615	632	643	654	614
	SD	--	30	32	33	33	30	33	--
	Adjusted Mean	--	545	578	606	622	635	645	605
Public applicant non-recipients (n=259)	Unadjusted mean	--	546	577	605	620	636	639	592
	SD	--	34	32	33	38	33	40	--
	Adjusted Mean	--	549	580	608	623	639	642	604
Public non-applicants (n=343)	Unadjusted Mean	--	548	580	607	624	636	638	606
	SD	--	33	30	34	38	38	41	--
	Adjusted Mean	--	551	583	610	628	639	641	609

TABLE 50. ANCOVA Summary: Overall Achievement Analysis from First Grade 1999 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	8277	2	8277	5.43	0.0044
Time	4973200	5	994640	1303.82	<0.0001
Minority Status	15776	1	15776	20.68	<0.0001
Number of schools	6529	1	6529	8.56	0.0035
Fall 1998 Score	1822425	1	1822425	2388.91	<0.0001
Time x Group	14408	10	1141	1.50	0.1342
Corrected Error	3599975	4719			

As shown in Table 50, significant results were obtained for the main effect of group, time, minority status, number of schools, and fall 1998 score with the interaction of time and group found to be not significant. Follow-up Sidak multiple comparison procedures found a significant difference between the scholarship recipients and non-applicants, $p < 0.001$).

FIGURE 15. Overall Achievement from First Grade 1999 to Sixth Grade 2004



At the start of the comparisons (Spring of first grade), overall achievement differed significantly between scholarship recipients and those groups that did not apply for scholarships. Students who did not apply for a scholarship had significantly higher overall achievement ($M = 551$) than did students who used a scholarship ($M = 545$) while applicant non-recipients ($M = 549$) did not differ significantly from the other groups. No other significant differences across groups appeared in these data from the Spring of 1999 through the Spring of 2004. Over the six waves of data collection, the marginal means for overall academic achievement were 605, 604, and 609 for scholarship recipients, public applicant non-recipients and public non-applicants respectively. A summary of these group differences across time and subject areas can be found in Table 61.

Reading Achievement

Adjusted and unadjusted descriptive statistics on student reading achievement across the six assessment periods are presented in Table 51, and ANCOVA results are displayed in Table 52. Figure 16 presents these data graphically.

TABLE 51. Reading Achievement: First Grade (Spring 1999) to Late Sixth Grade (Spring 2004)

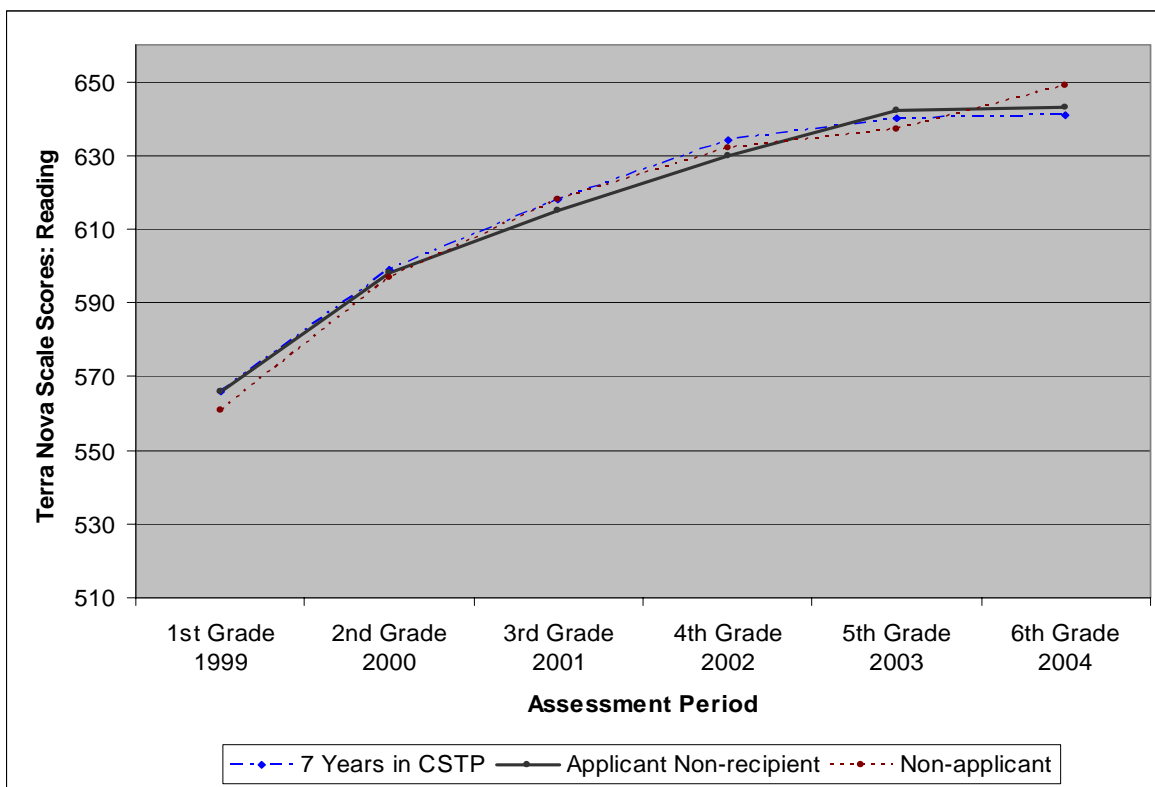
Student Group		Mean Reading Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-users (n=197)	Unadjusted mean	--	568	603	624	639	644	655	622
	SD	--	38	34	39	35	39	33	--
	Adjusted Mean	--	561	597	618	632	637	649	616
Public applicant non-recipients (n=259)	Unadjusted mean	--	564	596	614	628	640	641	614
	SD	--	37	35	37	42	37	41	--
	Adjusted Mean	--	566	598	615	630	642	643	616
Public non-applicants (n=343)	Unadjusted Mean	--	563	597	615	631	637	638	614
	SD	--	38	34	41	43	45	43	--
	Adjusted Mean	--	566	599	618	634	640	641	616

TABLE 52. ANCOVA Summary: Reading Achievement Analysis from First Grade 1999 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	420	2	210	0.17	0.8431
Time	3440902	5	688180	559.54	<0.0001
Minority Status	50752	1	50752	41.26	<0.0001
Number of schools	15428	1	15428	12.54	0.0004
Fall 1998 Score	1142146	1	1142146	928.65	<0.0001
Time x Group	15001	10	1500	1.22	0.2724
Corrected Error	5803912	4719			

As shown in Table 51, significant results were obtained for the main effect of time, minority status, number of schools, and fall 1998 score with the main effect for group and the interaction of time and group found to be not significant. Follow-up Sidak multiple comparison procedures found no significant differences between the three comparison groups.

FIGURE 16. Reading Achievement from First Grade 1999 to Sixth Grade 2004



There were no significant differences found across groups for reading achievement. Over the six waves of data collection, the marginal means for reading achievement were 616, 616, and 616 for scholarship recipients, public applicant non-recipients and public non-applicants respectively. A summary of these group differences across time and subject areas can be found in Table 61.

Language Achievement

Adjusted and unadjusted descriptive statistics on student language achievement across the six assessment periods are presented in Table 53, and ANCOVA results are displayed in Table 54. Figure 17 presents these data graphically.

TABLE 53. Language Arts Achievement: First Grade (Spring 1999) to Late Sixth Grade (Spring 2004)

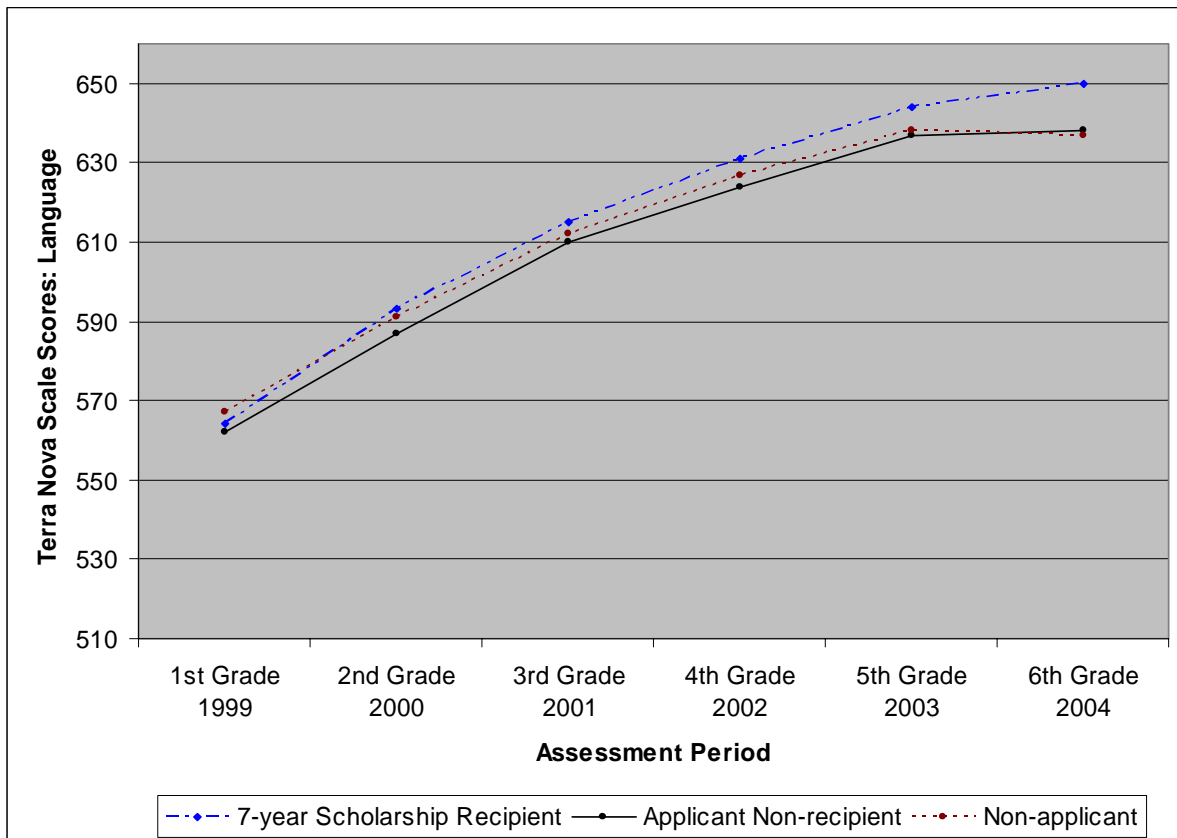
Student Group		Mean Language Arts Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-users (n=197)	Unadjusted mean	--	572	600	620	637	649	657	623
	SD	--	39	42	35	36	38	39	--
	Adjusted Mean	--	564	593	615	631	644	650	616
Public applicant non-recipients (n=259)	Unadjusted mean	--	560	585	609	622	636	636	608
	SD	--	43	37	33	42	36	43	--
	Adjusted Mean	--	562	587	610	624	637	638	610
Public non-applicants (n=343)	Unadjusted Mean	--	565	588	610	625	636	635	610
	SD	--	40	33	35	36	42	43	--
	Adjusted Mean	--	567	591	612	627	638	637	612

TABLE 54. ANCOVA Summary: Language Arts Achievement Analysis from First Grade 1999 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	25149	2	12574	10.77	<0.0001
Time	3450175	5	690035	597.18	<0.0001
Minority Status	40776	1	40776	37.93	<0.0001
Number of schools	3724	1	3724	3.19	0.0741
Fall 1998 Score	1307559	1	1307559	1120.23	<0.0001
Time x Group	16893	10	1689	1.45	0.1529
Corrected Error	5508136	4719			

As shown in Table 54, significant results were obtained for the main effect of group, time, minority status, and fall 1998 score. Number of schools and the interaction of time and group were found to be not significant. Follow-up Sidak multiple comparison procedures found significant differences between the three comparison groups (Scholarship recipients - Applicant non-recipient, $p < 0.001$; Scholarship recipients - Non-applicant, $p = 0.051$).

FIGURE 17. Language Achievement from First Grade 1999 to Sixth Grade 2004



There were no significant differences across groups were found until the last wave of data collection in sixth grade, Spring 2004 when scholarship recipients ($M = 650$) scored significantly higher than applicant non-recipients ($M = 638$) and non-applicants ($M = 637$). Over the six waves of data collection, the marginal means for language achievement were

616, 610, and 612 for scholarship recipients, public applicant non-recipients and public non-applicants respectively. A summary of these group differences across time and subject areas can be found in Table 61.

Mathematics Achievement

Adjusted and unadjusted descriptive statistics on student mathematics achievement across the six assessment periods are presented in Table 55, and ANCOVA results are displayed in Table 56. Figure 18 presents these data graphically.

TABLE 55. Mathematics Achievement: First Grade (Spring 1999) to Late Sixth Grade (Spring 2004)

Student Group		Mean Mathematics Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-users (n=197)	Unadjusted mean	--	524	558	600	619	636	652	598
	SD	--	32	35	37	41	34	40	--
	Adjusted Mean	--	516	549	592	609	628	642	589
Public applicant non-recipients (n=259)	Unadjusted mean	--	514	550	592	610	632	639	590
	SD	--	39	37	40	47	42	52	--
	Adjusted Mean	--	518	554	597	615	636	645	594
Public non-applicants (n=343)	Unadjusted Mean	--	517	554	597	617	635	640	593
	SD	--	39	37	40	48	43	55	--
	Adjusted Mean	--	519	556	598	619	637	642	595

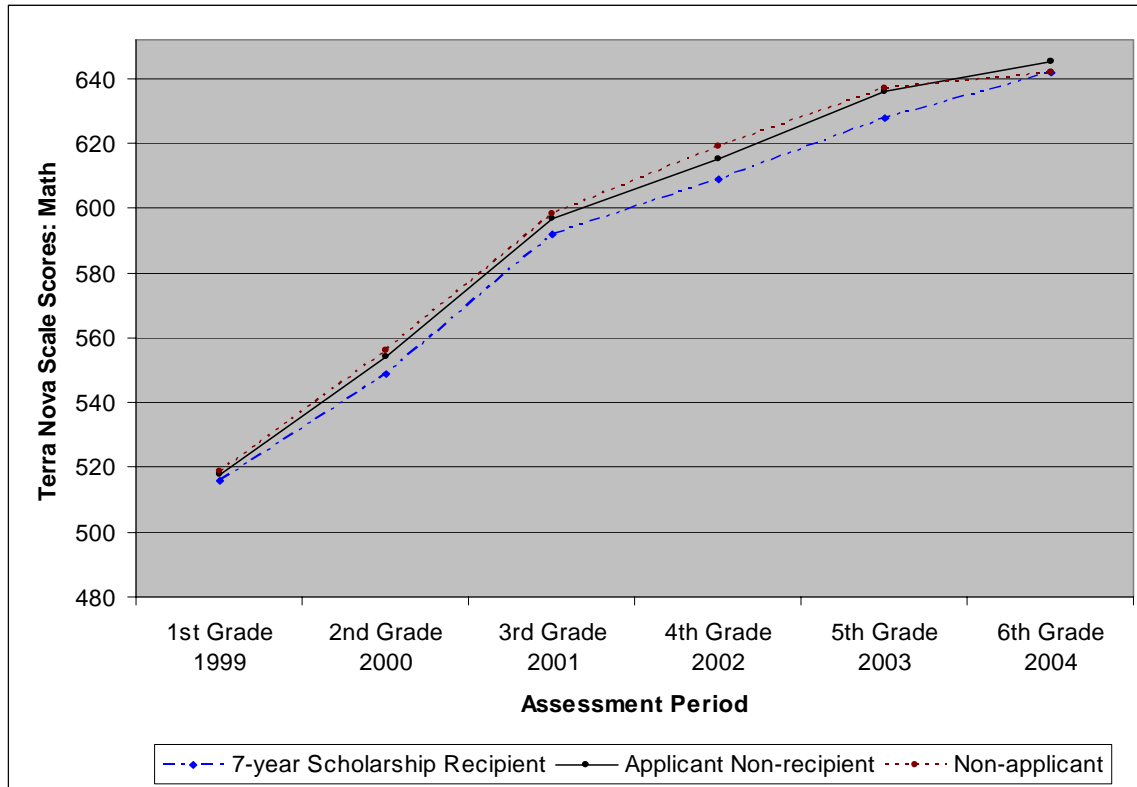
TABLE 56. ANCOVA Summary: Mathematics Achievement Analysis from First Grade 1999 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	26389	2	13194	10.29	<0.0001
Time	8956695	5	1791339	1396.85	<0.0001

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Minority Status	18095	1	78095	60.90	<0.0001
Number of schools	14399	1	14399	11.23	0.0008
Fall 1998 Score	1772966	1	1772966	1382.52	<0.0001
Time x Group	12557	10	12257	0.98	0.4591
Corrected Error	6051700	4719			

As shown in Table 56, significant results were obtained for the main effect of group, time, minority status, number of schools, and fall 1998 score, with the interaction of time and group found to be not significant. Follow-up Sidak multiple comparison procedures found significant differences between the three comparison groups (Scholarship recipients - Applicant non-recipient, $p = 0.0022$; Scholarship recipients - Non-applicants, $p < 0.001$).

FIGURE 18. Mathematics Achievement from First Grade 1999 to Sixth Grade 2004



No significant differences in mathematics achievement across groups was found until 2nd grade, the Spring of 2000. At this time, non-applicants ($M = 556$) scored significantly higher than scholarship recipients ($M = 549$). Applicant non-recipient scores ($M = 554$) did not differ significantly from either group in the Spring of 2000. No significant differences were found across groups in 2001. In 2002, non-applicants ($M = 619$) again scored significantly higher than scholarship recipients ($M = 609$) but not applicant non-recipients ($M = 615$). A similar result was found in the Spring of 2003 when non-applicants ($M = 637$) scored significantly higher than scholarship recipients ($M = 628$), but not applicant non-recipients ($M = 636$). No significant differences were found across groups in the Spring of 2004 when students were sixth graders. Over the six waves of data collection, the marginal means for mathematics achievement were 589, 593, and 595 for scholarship

recipients, public applicant non-recipients, and public non-applicants respectively. A summary of these group differences across time and subject areas can be found in Table 61.

Science Achievement

Adjusted and unadjusted descriptive statistics on student science achievement across the three assessment periods are presented in Table 57, and ANCOVA results are displayed in Table 58. Figure 19 presents these data graphically.

TABLE 57. Science Achievement: Fourth Grade (Spring 2002) to Late Sixth Grade (Spring 2004)

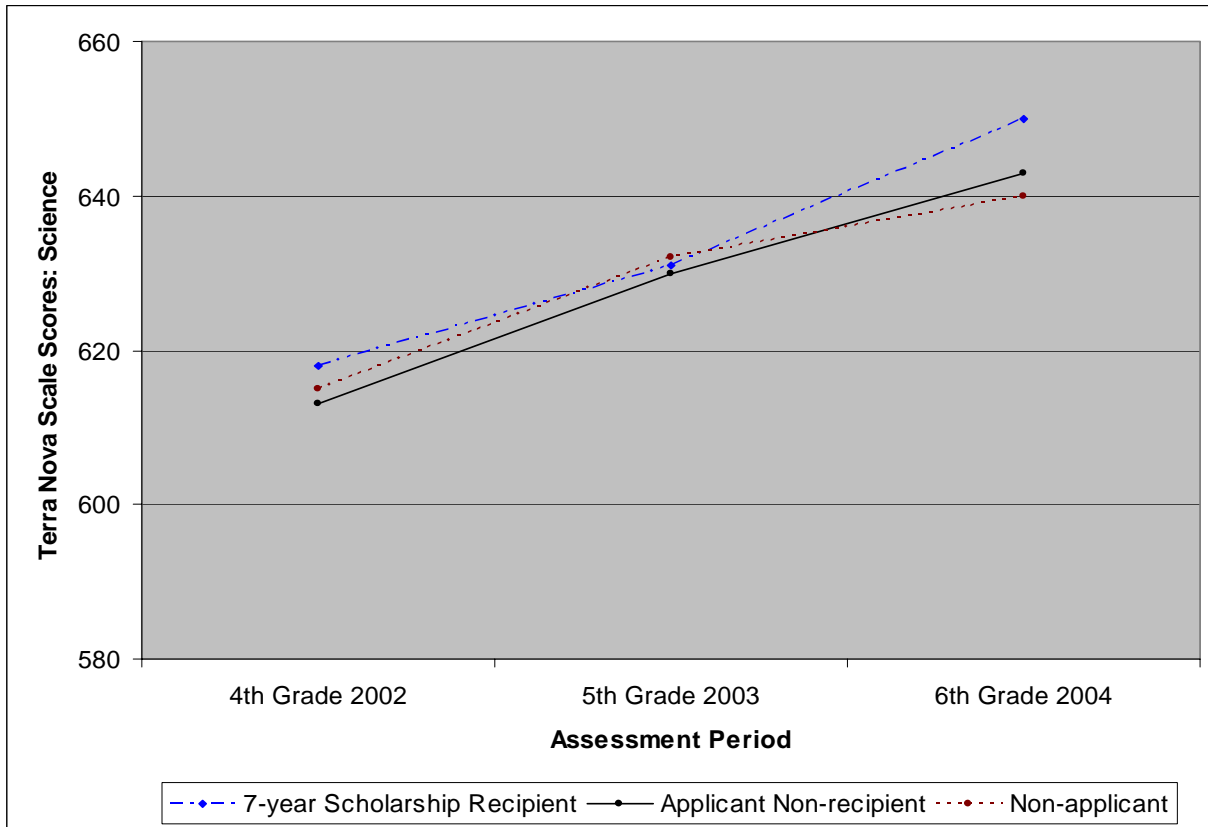
Student Group		Mean Science Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-users (n=197)	Unadjusted mean	--	--	--	--	623	637	656	639
	SD	--	--	--	--	44	41	43	--
	Adjusted Mean	--	--	--	--	618	631	650	633
Public applicant non-recipients (n=259)	Unadjusted mean	--	--	--	--	610	628	640	626
	SD	--	--	--	--	50	37	49	--
	Adjusted Mean	--	--	--	--	613	630	643	629
Public non-applicants (n=343)	Unadjusted Mean	--	--	--	--	613	631	639	628
	SD	--	--	--	--	49	43	51	--
	Adjusted Mean	--	--	--	--	615	632	640	629

TABLE 58. ANCOVA Summary: Science Achievement Analysis from Fourth Grade 2002 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	4957	2	2479	1.94	0.1444
Time	337373	2	168686	131.79	<0.0001
Minority Status	38082	1	38082	29.75	<0.0001
Number of schools	531	1	531	0.42	0.5194
Spring 2001 Score	1708227	1	1708227	1334.60	<0.0001
Time x Group	8293	4	2073	1.62	0.1665
Corrected Error	3018143	2358			

As shown in Table 58, significant results were obtained for the main effect of time, minority status, and Spring 2001 score. There were no statistically significant differences for the main effect of group, number of schools and the interaction of time and group. Follow-up Sidak multiple comparison procedures found no significant differences between groups.

FIGURE 19. Science Achievement from Fourth Grade 2002 to Sixth Grade 2004



For the first comparison year of the Terra Nova science exam, (fourth grade 2002), no statistically significant difference across the three groups was observed. Students who used a scholarship had a mean score of ($M = 618$) with scores from the other two groups reported as 613 and 615 for applicant non-recipients and non-applicants, respectively. No significant differences across groups appeared until the final wave of data collection during the sixth grade, 2004. Students who used a scholarship had significantly higher science achievement ($M = 650$) than did non-applicants ($M = 640$), but not applicant non-recipients ($M = 643$). Over the three waves of data collection, the marginal means for science achievement were 633, 629, and 629 for scholarship recipients, public applicant non-

recipients, and public non-applicants respectively. A summary of these group differences across time and subject areas can be found in Table 61.

Social studies Achievement

Adjusted and unadjusted descriptive statistics on student social studies achievement across the three assessment periods are presented in Table 59, and ANCOVA results are displayed in Table 60. Figure 20 presents these data graphically.

TABLE 59. Social Studies Achievement: Fourth Grade (Spring 2002) to Late Sixth Grade (Spring 2004)

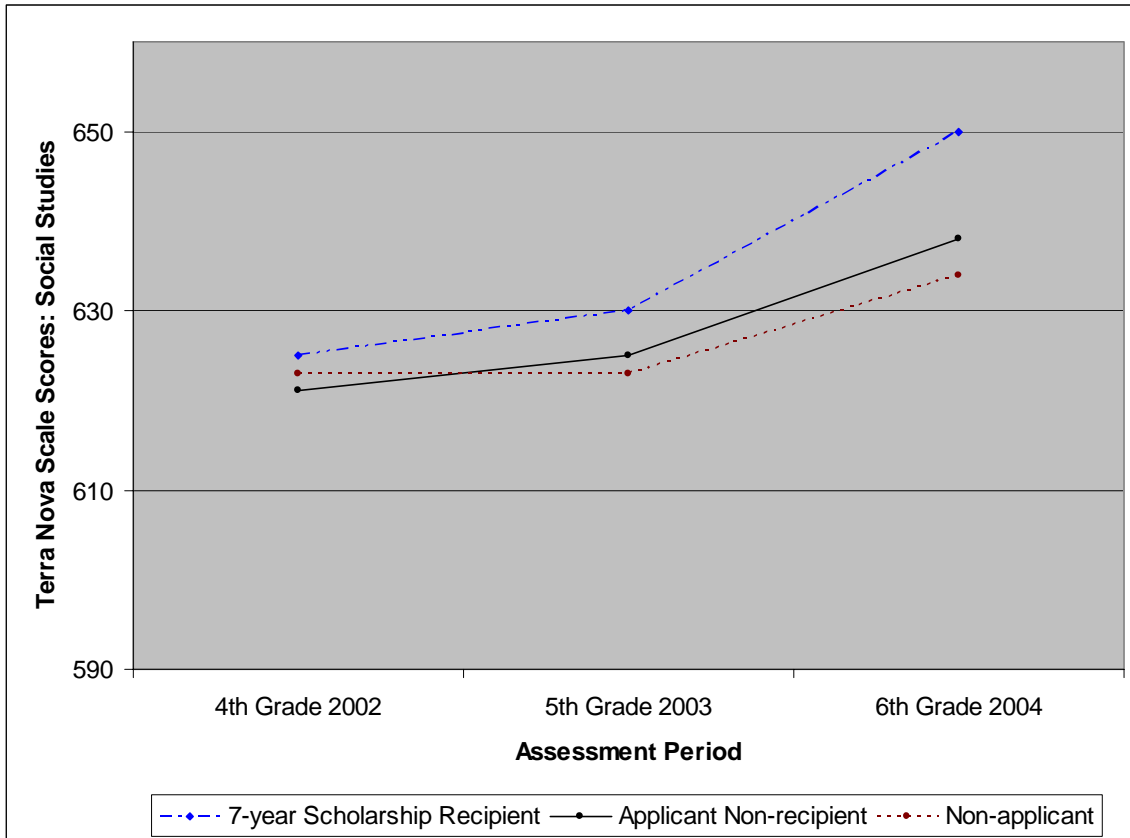
Student Group		Mean Social Studies Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-users (n=197)	Unadjusted mean	--	--	--	--	631	635	655	640
	SD	--	--	--	--	42	40	35	--
	Adjusted Mean	--	--	--	--	625	630	650	635
Public applicant non-recipients (n=259)	Unadjusted mean	--	--	--	--	620	623	636	626
	SD	--	--	--	--	42	41	43	--
	Adjusted Mean	--	--	--	--	621	625	638	628
Public non-applicants (n=343)	Unadjusted Mean	--	--	--	--	622	621	631	625
	SD	--	--	--	--	43	44	48	--
	Adjusted Mean	--	--	--	--	623	623	634	627

TABLE 60. ANCOVA Summary: Social Studies Achievement Analysis from Fourth Grade 2002 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	27529	2	13765	11.11	<0.0001
Time	131641	2	65821	53.14	<0.0001
Minority Status	51936	1	51936	41.93	<0.0001
Number of schools	2313	1	2313	1.87	0.1719
Spring 2001 Score	1185959	1	1185959	957.41	<0.0001
Time x Group	12347	4	3087	2.49	0.0413
Corrected Error	2920906	2358			

As shown in Table 60, significant results were obtained for the main effect of group, time, minority status, and Spring 2001 score, with the main effect of number of schools found to be not significant. Examination of the interaction of time and group revealed a significant difference in social studies achievement across the three groups, $p = 0.0413$. Follow-up Sidak multiple comparison procedures found significant differences between the comparison groups, (Scholarship recipients - Applicant non-recipient, $p < 0.01$; Scholarship recipients – Non-applicants, $p < 0.0001$).

FIGURE 20. Social studies Achievement from Fourth Grade 2002 to Sixth Grade 2004



For the first comparison year of the Terra Nova social studies exam, (fourth grade 2002), no statistically significant difference across the three groups was observed. Students who used a scholarship had a mean score of ($M = 625$) with scores from the other two groups reported as 623 and 621 for applicant non-recipients and non-applicants, respectively. No significant differences across groups appeared until the sixth grade, Spring 2004 data collection. During this final wave differences existed between students that received scholarships and applicant non-recipient ($M = 650$ and $M = 638$ respectively), and between students that received scholarships and non-applicants, ($M = 650$ and $M = 634$ respectively). Over the three waves of data collection, the marginal means for social studies achievement were 635, 628, and 627 for scholarship recipients, public applicant non-

recipients and public non-applicants respectively. A summary of these group differences across time and subject areas can be found in Table 61.

TABLE 61. Subjects of Significant Pairwise Differences between Scholarship Students (7), Applicant Non-recipients (ANR) and Non-applicants (NA) by Testing Episode

Subject	Testing Episode						
	Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004
Overall	--	a NA>7					
Reading	--						
Language Arts	--						7>ANR 7>NA
Math	--		NA>7		NA>7	NA>7	
Science	Not Tested			--			7>NA
Social Studies	Not Tested			--			7>ANR 7>NA

a. Empty cells indicate no significant differences

Synopsis across Achievement Measures (1998-2004): Seven-Year Scholarship

After adjusting for differences in minority status, student mobility and prior achievement, there is a statistically significant difference in terms of overall achievement at the end of the first grade with public school non-applicants outperforming 7-year scholarship students. There are no statistically significant differences in any of the individual subject areas at the end of the first grade. In fact, until the end of sixth grade there is only one subject area that reveals any statistically significant differences: mathematics. In mathematics, public school non-applicants outperform 7-year scholarship students in the 2nd, 4th and 5th grades. There are no statistically significant differences in mathematics by the end of the students' sixth grade of school. However, there are statistically significant differences in language and social studies at the end of the sixth grade, with 7-year scholar-

ship students outperforming their public school peers; and statistically significant differences in science at the end of the sixth grade, with 7-year scholarship students outperforming public school non-applicants in science achievement.

In addition, across all analyses, there are statistically significant main effects of minority status, time and prior achievement (i.e. fall 1998 test scores). In addition, student mobility (i.e. number of schools) is statistically significant for overall achievement, reading, and mathematics; and the time by group interaction is statistically significant for social studies. In all other subject areas there was no difference in the rates of growth in achievement between the various comparison groups of students.

3.3.4 Analysis including poverty status

Given that valid and reliable socio-economic status data was not available for all three student comparison groups, but yet is deemed to be an important factor to examine as part of the research on the impact of the CSTP program, a separate analysis of impact on student achievement was also conducted including an indicator of poverty status. This analysis focuses specifically on 7-year scholarship recipients and applicant non-recipients; and non-applicants are excluded from the analyses due to the absence of needed extant data. First, on the complete sample, a comparison between students in poverty and students not in poverty (regardless of scholarship status) was conducted to test whether poverty status had a significant effect on subject-area achievement scores. Following this analysis, the sample was divided in two: those students of poverty status and those students not of poverty status. On these two sub-samples, analyses were conducted comparing 7-year scholarship users to applicant non-recipients. Due to the small sample size (as shown in table 62) the interaction of poverty status by scholarship status was not tested. Overall mean achievement scores across time for both the poverty and non-poverty groups are plotted on the same figures for ease of comparison.

Poverty status is used as a representation of family financial status because it takes into account both income and family size, and is the best available indicator of socio-economic status. It is computed using the 1997 Federal Poverty Guidelines (<http://aspe.os.dhhs.gov/poverty/97poverty.htm>); these guidelines were also used by the Cleveland Scholarship Tutor Program to define scholarship eligibility. In the following analyses, poverty status computations are based on income and family size reported for the 1997-1998 school year. For example, using this calculation, a family with two people earning less than \$10,610 is considered to be in poverty as would be a family of four people earning less than \$16,050. Relative sample sizes of each group are shown in Table 62.

TABLE 62. Relative Proportion of Sample Size between Comparison Groups

	Number of Students from Families Defined as in Poverty	Number of Students from Families Defined as Not in Poverty	Proportion of Students from Families Defined as in Poverty
Seven-year scholarship recipient users	121	76	61%
Scholarship applicant non-recipients (Public)	56	55	50%

ANCOVA of Student Achievement across Poverty Status

The following analysis of covariance takes into account statistical adjustments for minority status, student mobility, as well as Fall 1998 achievement scores in the comparison of student achievement for students that come from families that can be defined as in poverty or not in poverty (regardless of whether the student is a 7-year scholarship user or an applicant non-recipient).

TABLE 63. ANCOVA Summary: Reading Achievement Analysis from First Grade 1999 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	542	2	542	0.50	0.4799
Time	136023	5	267205	246.20	<0.0001
Minority Status	9596	1	9596	8.84	0.0030
Number of schools	1465	1	1465	1.35	0.2454
Poverty	4060	1	4060	3.74	0.0533
Fall 1998 Score	504351	1	504351	464.70	<0.0001
Time x Group	6094	5	1219	1.12	0.3459
Corrected Error	1981793	1826			

As shown in Table 63, significant results were obtained for the main effect of minority status, time, and Fall 1998 achievement. These effects were found to be significant at the level of $p < 0.05$. Group, number of schools, poverty status and the time by group interaction were not statistically significant.

TABLE 64. ANCOVA Summary: Language Arts Achievement Analysis from First Grade 1999 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	9967	1	9967	8.74	0.0031
Time	1367907	5	273581	240.03	<0.0001
Minority Status	13165	1	13165	11.55	0.0007
Number of schools	3174	1	3174	2.79	0.0953
Poverty	7361	1	7361	6.46	0.0111
Fall 1998 Score	588248	1	588248	516.11	<0.0001
Time x Group	3616	5	723	0.63	0.6734
Corrected Error	2081234	1826			

As shown in Table 64, significant results were obtained for the main effect of comparison group, time, minority status, poverty status, and Fall 1998 achievement. These effects

were found to be significant at the level of $p < 0.05$. Number of schools and the time by group interaction were not statistically significant.

TABLE 65. ANCOVA Summary: Mathematics Achievement Analysis from First Grade 1999 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	1511	1	1511	1.31	0.2530
Time	3332085	5	666417	576.44	<0.0001
Minority Status	25780	1	25780	22.30	<0.0001
Number of schools	114	1	114	0.10	0.7538
Poverty	3225	1	3225	2.79	0.0951
Fall 1998 Score	514993	1	514993	445.46	<0.0001
Time x Group	903	5	181	0.16	0.9782
Corrected Error	2111007	1826			

As shown in Table 65, significant results were obtained for the main effect of time, minority status, and Fall 1998 achievement. These effects were found to be significant at the level of $p < 0.05$. Group, number of schools, poverty status and the time by group interaction were not statistically significant.

TABLE 66. ANCOVA Summary: Overall Achievement Analysis from First Grade 1999 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	467	1	467	0.72	0.3968
Time	1905273	5	381055	586.66	<0.0001
Minority Status	589	1	589	0.91	0.3413
Number of schools	2507	1	2507	3.86	0.0496
Poverty	3205	1	3205	4.93	0.0264
Fall 1998 Score	752275	1	752275	1158.18	<0.0001
Time x Group	2273	5	455	0.70	0.6235
Corrected Error	2149310	1826			

As shown in Table 66, significant results were obtained for the main effect of time, number of schools, poverty status, and Fall 1998 achievement. These effects were found to be significant at the level of $p < 0.05$. Group, minority status and the time by group interaction were not statistically significant.

TABLE 67. ANCOVA Summary: Science Achievement Analysis from First Grade 1999 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	1090	1	1090	0.98	0.3213
Time	131835	2	65917	59.57	<0.0001
Minority Status	17879	1	17879	16.16	<0.0001
Number of schools	1261	1	1261	1.14	0.2860
Poverty	58	1	58	0.05	0.8196
Spring 2001 Score	560877	1	560877	506.84	<0.0001
Time x Group	1704	2	852	0.77	0.4632
Corrected Error	1008135	911			

As shown in Table 67, significant results were obtained for the main effect of time, minority status, and Spring 2001 achievement. These effects were found to be significant at the level of $p < 0.05$. Group, number of schools, poverty status, and the time by group interaction were not statistically significant.

TABLE 68. ANCOVA Summary: Social Studies Achievement Analysis from First Grade 1999 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	12329	1	12329	10.94	0.0010
Time	79743	2	39871	35.37	<0.0001
Minority Status	29645	1	29645	26.30	<0.0001
Number of schools	324	1	324	0.29	0.5923
Poverty	26	1	26	0.02	0.8788
Spring 2001 Score	374487	1	374487	332.21	<0.0001

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Time x Group	2130	2	2130	0.94	0.3892
Corrected Error	1026936	1826			

As shown in Table 68, significant results were obtained for the main effect of comparison group, time, minority status and Spring 2001 achievement. These effects were found to be non-significant at the level of $p < 0.05$. Number of schools, poverty status, and the time by group interaction were not statistically significant.

Summary: ANCOVA of Student Achievement across Poverty Status

As shown above, poverty status (regardless of scholarship status) has a significant effect on language and overall achievement. That is, difference in adjusted mean scores on language and the overall achievement tests, when participants are grouped by poverty status, appear to be attributed to factors (poverty status) other than random chance. Given this, the research team continued the analysis by dividing the sample into two sub-groups, those students classified as in poverty status and those students classified to not be in poverty status. The following two analyses compare 7-year scholarship users to applicant non-recipients within these two sub-samples. Results from these two analysis are presented sequentially by subject area. Significant pairwise differences on each score for each year are shown in Table 93 following all analyses.

Overall Achievement for students in poverty

Descriptive statistics (unadjusted and adjusted) on overall student achievement for students in poverty across the six assessment periods are presented in Table 69. ANCOVA results are displayed in Table 70 with the graphical representation of adjusted means presented in Figure 21.

TABLE 69. Overall Achievement for Students in Poverty: Late First Grade (Spring 1999) to Late Sixth Grade (Spring 2004)

Student Group		Mean Overall Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-users poverty (n=121)	Unadjusted mean	--	552	583	612	628	641	653	612
	SD	--	29	33	30	30	31	31	--
	Adjusted Mean	--	548	579	609	624	637	649	608
Public applicant non-recipients poverty (n=56)	Unadjusted mean	--	546	575	602	619	634	635	602
	SD	--	28	30	31	32	31	34	--
	Adjusted Mean	--	556	584	609	628	641	644	610

TABLE 70. ANCOVA Summary: Overall Achievement Analysis from First Grade 1999 to Sixth Grade 2004 for Students in Poverty

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	1345	1	1345	2.39	0.1231
Time	1013624	5	202725	359.05	<0.0001
Minority Status	1404	1	1404	2.49	0.1151
Number of schools	1684	1	1684	2.98	0.0844
Fall 1998 Score	342446	1	342446	606.51	<0.0001
Time x Group	3369	5	674	1.19	0.3102
Corrected Error	587765	1041			

As shown in Table 70, significant results were obtained for the main effect of time and Fall 1998 achievement. These effects were found to be significant at the level of $p < 0.05$.

Overall Achievement for students not in poverty

Descriptive statistics (unadjusted and adjusted) on overall student achievement for students not in poverty across the six assessment periods are presented in Table 71.

ANCOVA results are displayed in Table 72 with the graphical representation of adjusted means presented in Figure 21.

TABLE 71. Overall Achievement for Students Not in Poverty: Late First Grade (Spring 1999) to Late Sixth Grade (Spring 2004)

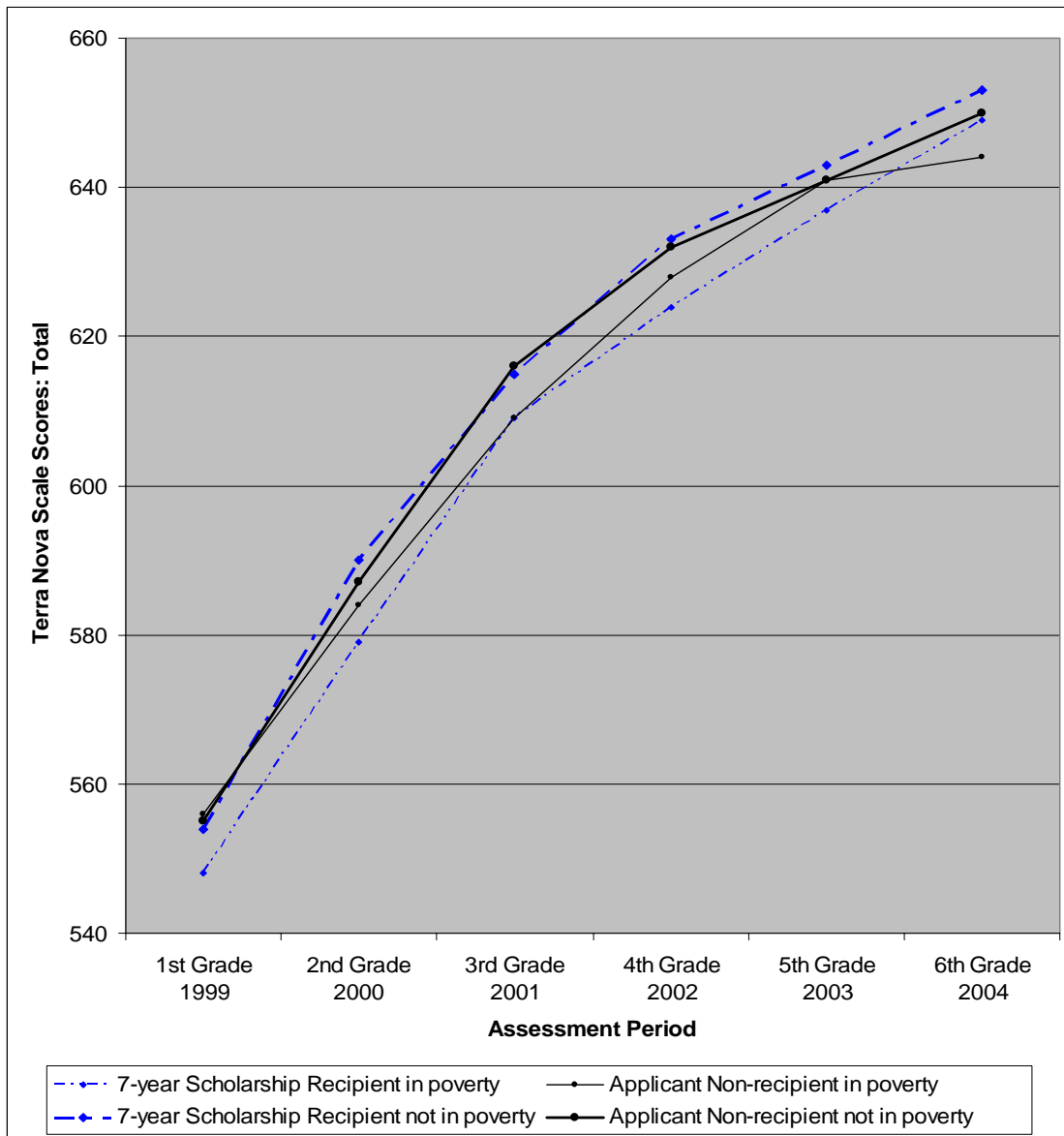
Student Group		Mean Social Studies Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-users poverty (n=76)	Unadjusted mean	--	559	594	618	638	647	657	619
	SD	--	32	30	37	36	35	35	--
	Adjusted Mean	--	554	590	615	633	643	653	615
Public applicant non-recipients poverty (n=55)	Unadjusted mean	--	549	582	611	626	637	645	608
	SD	--	40	35	34	44	39	49	--
	Adjusted Mean	--	555	587	616	632	641	650	614

TABLE 72. ANCOVA Summary: Overall Achievement Analysis from First Grade 1999 to Sixth Grade 2004 for Students Not in Poverty

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	182	1	182	0.24	0.6261
Time	863199	5	172640	224.71	<0.0001
Minority Status	78	1	78	0.10	0.7506
Number of schools	1353	1	1353	1.76	0.1850
Fall 1998 Score	405065	1	405065	527.24	<0.0001
Time x Group	519	5	104	0.14	0.9842
Corrected Error	592342	771			

As shown in Table 72, significant results were obtained for the main effect of time and Fall 1998 achievement. These effects were found to be significant at the level of $p < 0.05$.

FIGURE 21. Overall Achievement from First Grade 1999 to Sixth Grade 2004



Reading Achievement for students in poverty

Adjusted and unadjusted descriptive statistics on student reading achievement for students in poverty across the six assessment periods are presented in Table 73, and ANCOVA results are displayed in Table 74. Figure 22 presents these data graphically.

TABLE 73. Reading Achievement for Students in Poverty: Late First Grade (Spring 1999) to Late Sixth Grade (Spring 2004)

Student Group		Mean Reading Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-users poverty (n=121)	Unadjusted mean	--	568	599	621	635	642	653	620
	SD	--	35	36	31	33	38	31	--
	Adjusted Mean	--	565	597	619	632	639	651	617
Public applicant non-recipients poverty (n=56)	Unadjusted mean	--	568	594	613	626	642	637	613
	SD	--	29	28	31	34	26	37	--
	Adjusted Mean	--	572	600	617	632	648	642	619

TABLE 74. ANCOVA Summary: Reading Achievement Analysis from First Grade 1999 to Sixth Grade 2004 for Students in Poverty

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	410	1	410	0.45	0.5022
Time	674591	5	13491	148.37	<0.0001
Minority Status	14370	1	14370	15.80	<0.0001
Number of schools	3822	1	3822	4.20	0.0406
Fall 1998 Score	160733	1	160733	176.73	<0.0001
Time x Group	6921	5	1384	1.52	0.1801
Corrected Error	946612	1041			

As shown in Table 74, significant results were obtained for the main effect of minority status, time, number of schools, and Fall 1998 achievement. These effects were found to be significant at the level of $p < 0.05$.

Reading Achievement for students not in poverty

Adjusted and unadjusted descriptive statistics on student reading achievement for students not in poverty across the six assessment periods are presented in Table 75, and ANCOVA results are displayed in Table 76. Figure 22 presents these data graphically.

TABLE 75. Reading Achievement for Students Not in Poverty: Late First Grade (Spring 1999) to Late Sixth Grade (Spring 2004)

Student Group		Mean Social Studies Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-users poverty (n=76)	Unadjusted mean	--	569	609	628	645	648	658	626
	SD	--	43	29	50	38	40	35	--
	Adjusted Mean	--	564	606	625	642	645	654	623
Public applicant non-recipients poverty (n=55)	Unadjusted mean	--	564	601	622	632	642	647	618
	SD	--	48	39	39	53	45	52	--
	Adjusted Mean	--	571	606	626	636	646	652	623

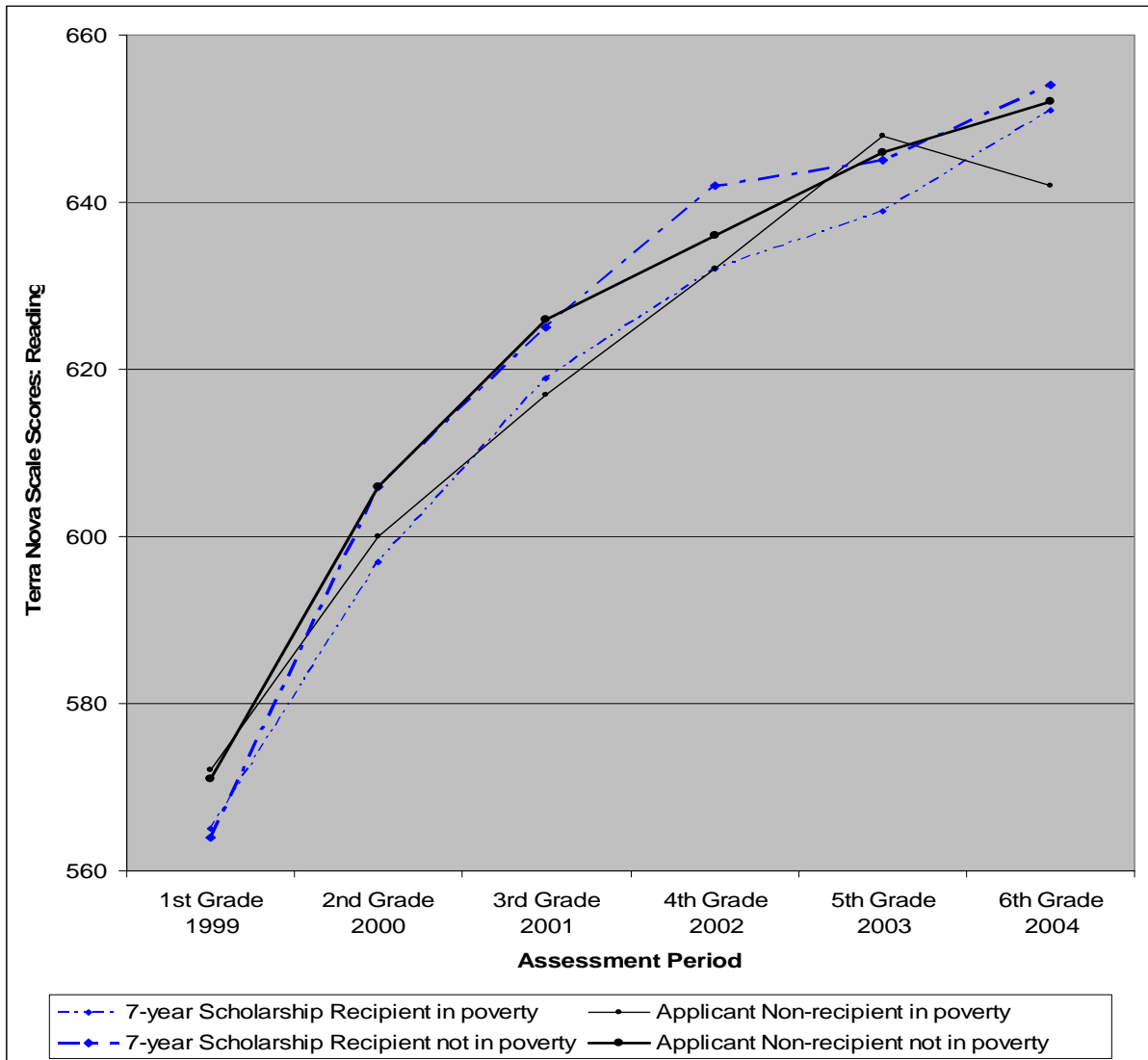
TABLE 76. ANCOVA Summary: Reading Achievement Analysis from First Grade 1999 to Sixth Grade 2004 for Students Not in Poverty

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	17	1	17	0.01	0.9096
Time	649008	5	129802	99.99	<0.0001
Minority Status	36	1	36	0.03	<0.8679
Number of Schools	28	1	28	0.02	0.8824

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Fall 1998 Score	357087	1	357087	275.08	<0.0001
Time x Group	1509	5	302	0.23	0.9483
Corrected Error	1000851	771			

As shown in Table 76, significant results were obtained for the main effect of time and Fall 1998 achievement. These effects were found to be significant at the level of $p < 0.05$.

FIGURE 22. Reading Achievement from First Grade 1999 to Sixth Grade 2004



Language Achievement for students in poverty

Adjusted and unadjusted descriptive statistics on student language achievement for students in poverty across the six assessment periods are presented in Table 77, and ANCOVA results are displayed in Table 78. Figure 23 presents these data graphically.

TABLE 77. Language Arts Achievement for Students in Poverty: Late First Grade (Spring 1999) to Late Sixth Grade (Spring 2004)

Student Group		Mean Language Arts Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-user poverty (n = 121)	Unadjusted Mean	-	568	596	617	631	646	656	619
	SD	-	39	45	33	34	35	40	
	Adjusted Mean	-	564	592	615	628	644	653	616
Public applicant non-recipient poverty (n = 56)	Unadjusted Mean	-	560	584	607	622	637	635	608
	SD	-	40	40	33	33	34	39	
	Adjusted Mean	-	568	594	612	629	642	642	615

TABLE 78. ANCOVA Summary: Language Arts Achievement Analysis from First Grade 1999 to Sixth Grade 2004 for Students in Poverty

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	362	1	362	0.33	0.5643
Time	761779	5	152356	140.06	<0.0001
Minority Status	10415	1	10415	9.57	0.0020
Number of Schools	4590	1	4590	4.22	0.0402
Fall 1998 Score	274531	1	274531	252.38	<0.0001
Time x Group	5704	5	941	0.86	0.5041
Corrected Error	1132361	1041			

As shown in Table 78, significant results were obtained for the main effect of time, minority status, number of schools and Fall 1998 achievement. These effects were found to be significant at the level of $p < 0.05$.

Language Achievement for students not in poverty

Adjusted and unadjusted descriptive statistics on student language achievement for students not in poverty across the six assessment periods are presented in Table 79, and ANCOVA results are displayed in Table 80. Figure 23 presents these data graphically.

TABLE 79. Language Arts Achievement for Students Not in Poverty: Late First Grade (Spring 1999) to Late Sixth Grade (Spring 2004)

Student Group		Mean Language Arts Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient non-poverty (n = 76)	Unadjusted Mean	-	578	606	624	647	652	658	628
	SD	-	38	37	37	39	40	38	
	Adjusted Mean	-	574	603	623	644	651	656	625
Public applicant non-recipient non-poverty (n = 55)	Unadjusted Mean	-	564	591	612	629	635	641	612
	SD	-	42	40	36	46	43	56	
	Adjusted Mean	-	569	594	614	633	636	644	615

TABLE 80. ANCOVA Summary: Language Arts Achievement Analysis from First Grade 1999 to Sixth Grade 2004 for Students Not in Poverty

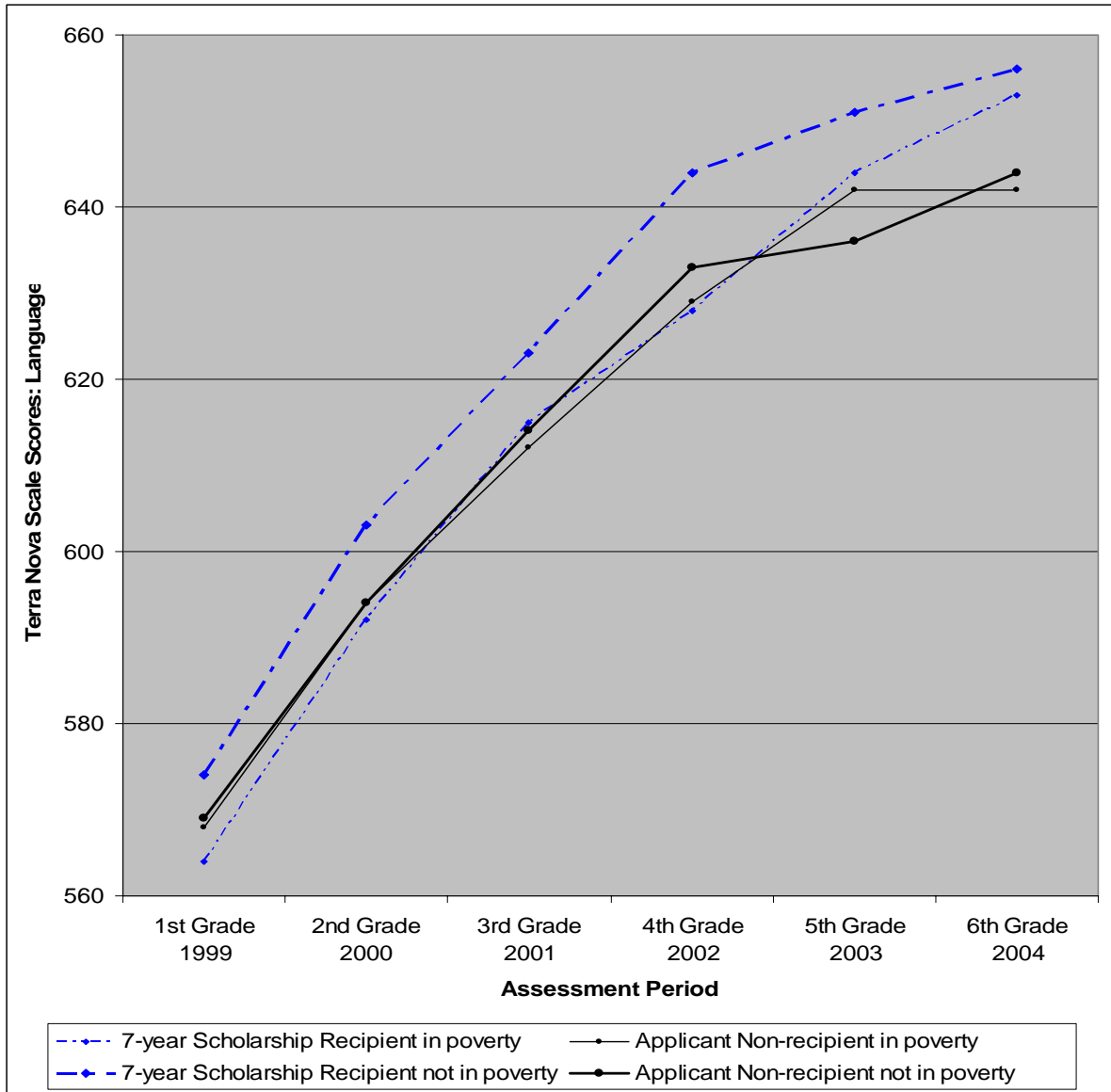
Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	16657	1	16657	13.77	0.0002
Time	589308	5	119862	97.46	<0.0001
Minority Status	2645	1	2645	2.19	0.1396
Number of Schools	222	1	222	0.18	0.6686
Fall 1998 Score	316538	1	316538	261.74	<0.0001

Analyses and Results

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Time x Group	754	5	151	0.12	0.9869
Corrected Error	932415	771			

As shown in Table 80, significant results were obtained for the main effect of group, time and Fall 1998 achievement. These effects were found to be significant at the level of $p < 0.05$.

FIGURE 23. Language Achievement from First Grade 1999 to Sixth Grade 2004



Mathematics Achievement for students in poverty

Adjusted and unadjusted descriptive statistics on mathematics achievement in students in poverty across the six assessment periods are presented in Table 81 and ANCOVA results are displayed in Table 82. Figure 24 presents these data graphically.

TABLE 81. Mathematics Achievement for Students in Poverty: Late First Grade (Spring 1999) to Late Sixth Grade (Spring 2004)

Student Group		Mean Mathematics Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-user (n = 121)	Unadjusted Mean	-	521	553	598	617	634	650	596
	SD	-	33	33	37	36	32	35	
	Adjusted Mean	-	517	550	595	614	631	648	593
Public applicant non-recipient (n = 56)	Unadjusted Mean	-	512	546	585	608	622	635	585
	SD	-	32	35	42	50	47	48	
	Adjusted Mean	-	521	554	593	616	628	642	592

TABLE 82. ANCOVA Summary: Mathematics Achievement Analysis from First Grade 1999 to Sixth Grade 2004 for Students in Poverty

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	0	1	0	0.00	0.9888
Time	1774312	5	354862	350.64	<0.0001
Minority Status	10002	1	10002	9.88	0.0017
Number of Schools	48	1	48	0.05	0.8270
Fall 1998 Score	297981	1	297981	294.43	<0.0001
Time x Group	1960	5	392	0.39	0.8576
Corrected Error	1053539	1041			

As shown in Table 82, group differences were found for the main effect of time, minority status and Fall 1998 achievement. These effects were found to be significant at the level of $p < 0.05$.

Mathematics Achievement for students not in poverty

Adjusted and unadjusted descriptive statistics on mathematics achievement in students not in poverty across the six assessment periods are presented in Table 83, and ANCOVA results are displayed in Table 84. Figure 24 presents these data graphically.

TABLE 83. Mathematics Achievement for Students Not in Poverty: Late First Grade (Spring 1999) to Late Sixth Grade (Spring 2004)

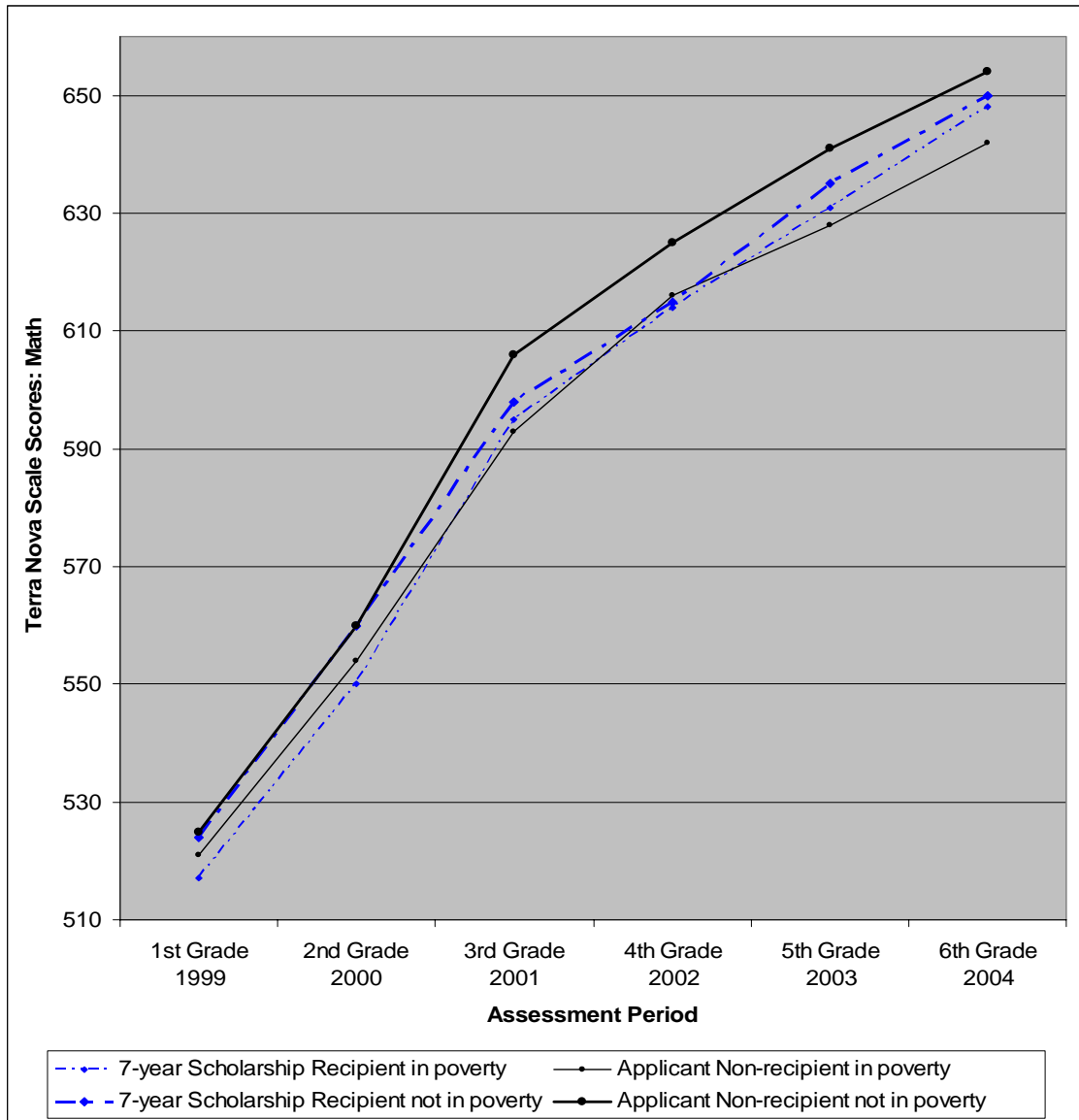
		Mean Mathematics Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-non-poverty (n = 76)	Unadjusted Mean	-	529	565	602	621	640	654	602
	SD	-	29	37	37	47	36	47	
	Adjusted Mean	-	524	560	598	615	635	650	597
Public applicant non-recipient non-poverty (n = 55)	Unadjusted Mean	-	518	554	600	616	637	648	596
	SD	-	52	40	38	48	41	53	
	Adjusted Mean	-	525	560	606	625	641	654	602

TABLE 84. ANCOVA Summary: Mathematics Achievement Analysis from First Grade 1999 to Sixth Grade 2004 for Students Not in Poverty

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	3680	1	3680	2.70	0.1006
Time	1500176	5	300035	220.33	<0.0001
Minority Status	17536	1	17536	12.88	0.0004
Number of Schools	0	1	0	0.00	0.9985
Fall 1998 Score	210104	1	210104	154.29	<0.0001
Time x Group	2095	5	419	0.31	0.9084
Corrected Error	1049932	771			

As shown in Table 84, group differences were found for the main effect of time, minority status, and Fall 1998 achievement. These effects were found to be significant at the level of $p < 0.05$.

FIGURE 24. Mathematics Achievement from First Grade 1999 to Sixth Grade 2004



Science Achievement for students in poverty

Adjusted and unadjusted descriptive statistics on student science achievement across the four assessment periods are presented in Table 85, and ANCOVA results are displayed in Table 86. Figure 25 presents these data graphically.

TABLE 85. Science Achievement for Students in Poverty: Late Fourth Grade (Spring 2002) to Late Sixth Grade (Spring 2004)

		Mean Science Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-user (n = 121)	Unadjusted Mean	-	-	-	-	618	633	654	635
	SD	-	-	-	-	42	34	41	
	Adjusted Mean	-	-	-	-	614	631	650	632
Public applicant non-recipient (n = 56)	Unadjusted Mean	-	-	-	-	613	623	638	625
	SD	-	-	-	-	40	36	40	
	Adjusted Mean	-	-	-	-	621	628	645	631

TABLE 86. ANCOVA Summary: Science Achievement Analysis from Fourth Grade 2002 to Sixth Grade 2004 for Students in Poverty

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	69	1	69	0.07	0.7856
Time	70673	2	35336	37.66	<0.0001
Minority Status	5847	1	5847	6.24	0.0128
Number of Schools	416	1	416	0.44	0.5059
Spring 2001 Score	269053	1	269053	286.75	<0.0001
Time x Group	2087	2	1043	1.11	0.3297
Corrected Error	486962	519			

As shown in Table 86, significant results were obtained for the main effect of time, minority status, and Spring 2001 achievement. These effects were found to be significant at the level of $p < 0.05$.

Science Achievement for students not in poverty

Adjusted and unadjusted descriptive statistics on student science achievement across the four assessment periods are presented in Table 87, and ANCOVA results are displayed in Table 88. Figure 25 presents these data graphically.

TABLE 87. Science Achievement for Students Not in Poverty: Late Fourth Grade (Spring 2002) to Late Sixth Grade (Spring 2004)

Student Group		Mean Science Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-non-poverty (n = 76)	Unadjusted Mean	-	-	-	-	631	643	661	645
	SD	-	-	-	-	46	50	46	
	Adjusted Mean	-	-	-	-	628	640	659	642
Public applicant non-recipient non-poverty (n = 55)	Unadjusted Mean	-	-	-	-	617	636	647	633
	SD	-	-	-	-	46	42	54	
	Adjusted Mean	-	-	-	-	622	640	650	637

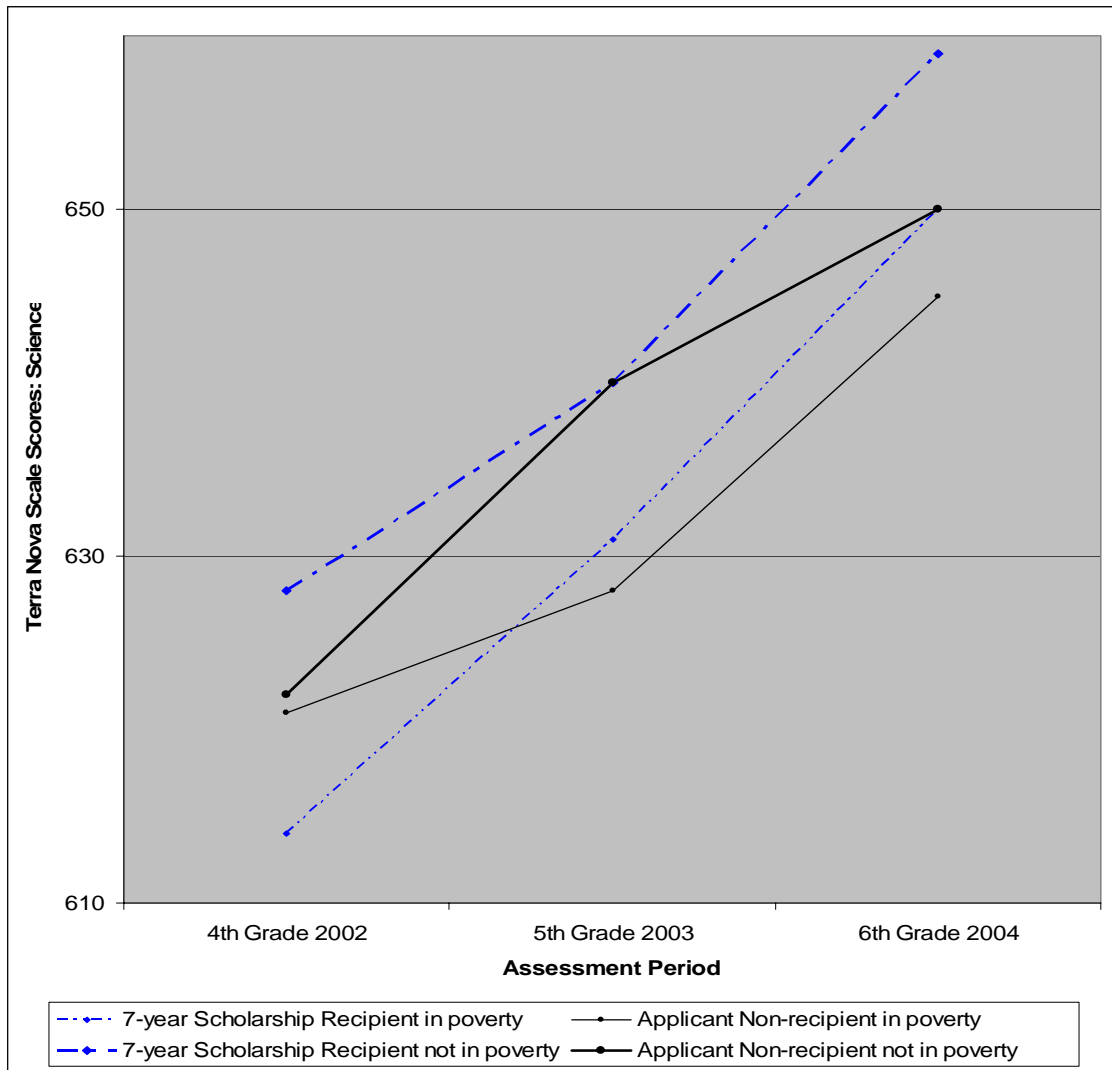
TABLE 88. ANCOVA Summary: Science Achievement Analysis from Fourth Grade 2002 to Sixth Grade 2004 for Students Not in Poverty

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	2082	1	2082	1.58	0.2101
Time	57067	2	28533	21.60	<0.0001
Minority Status	10829	1	10829	8.20	0.0044
Number of Schools	746	1	746	0.56	0.4528

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Spring 2001Score	300867	1	300867	227.74	<0.0001
Time x Group	1082	2	541	0.41	0.6643
Corrected Error	507295	384			

As shown in Table 88, significant results were obtained for the main effect of time, minority status and Spring 2001 achievement. These effects were found to be significant at the level of $p < 0.05$.

FIGURE 25. Science Achievement from Fourth Grade 2002 to Sixth Grade 2004



Social Studies Achievement for students in poverty

Adjusted and unadjusted descriptive statistics on student social studies achievement in students across the four assessment periods are presented in Table 89, and ANCOVA results are displayed in Table 90. Figure 26 presents these data graphically.

TABLE 89. Social Studies Achievement for Students in Poverty: Late Fourth Grade (Spring 2002) to Late Sixth Grade (Spring 2004)

Student Group		Mean Social Studies Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-user (n = 121)	Unadjusted Mean	-	-	-	-	629	633	653	638
	SD	-	-	-	-	36	41	30	
	Adjusted Mean	-	-	-	-	627	631	651	636
Public applicant non-recipient (n = 56)	Unadjusted Mean	-	-	-	-	618	613	636	622
	SD	-	-	-	-	32	41	38	
	Adjusted Mean	-	-	-	-	623	617	640	627

TABLE 90. ANCOVA Summary: Social Studies Achievement Analysis from Fourth Grade 2002 to Sixth Grade 2004 for Students in Poverty

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	9236	1	9236	10.28	0.0014
Time	43892	2	21946	24.42	<0.0001
Minority Status	11011	1	11011	12.25	0.0005
Number of Schools	1045	1	1045	1.16	0.2514
Spring 2001 Score	185427	1	185427	206.34	<0.0001
Time x Group	1517	2	759	0.84	0.4305
Corrected Error	466401	519			

As shown in Table 90, significant results were obtained for the main effects of group, time, minority status, and Spring 2001 achievement. These effects were found to be significant at the level of $p < 0.05$

Social Studies Achievement for students not in poverty

Adjusted and unadjusted descriptive statistics on student social studies achievement in students across the four assessment periods are presented in Table 91, and ANCOVA results are displayed in Table 92. Figure 26 presents these data graphically.

TABLE 91. Social Studies Achievement for Students Not in Poverty: Late Fourth Grade (Spring 2002) to Late Sixth Grade (Spring 2004)

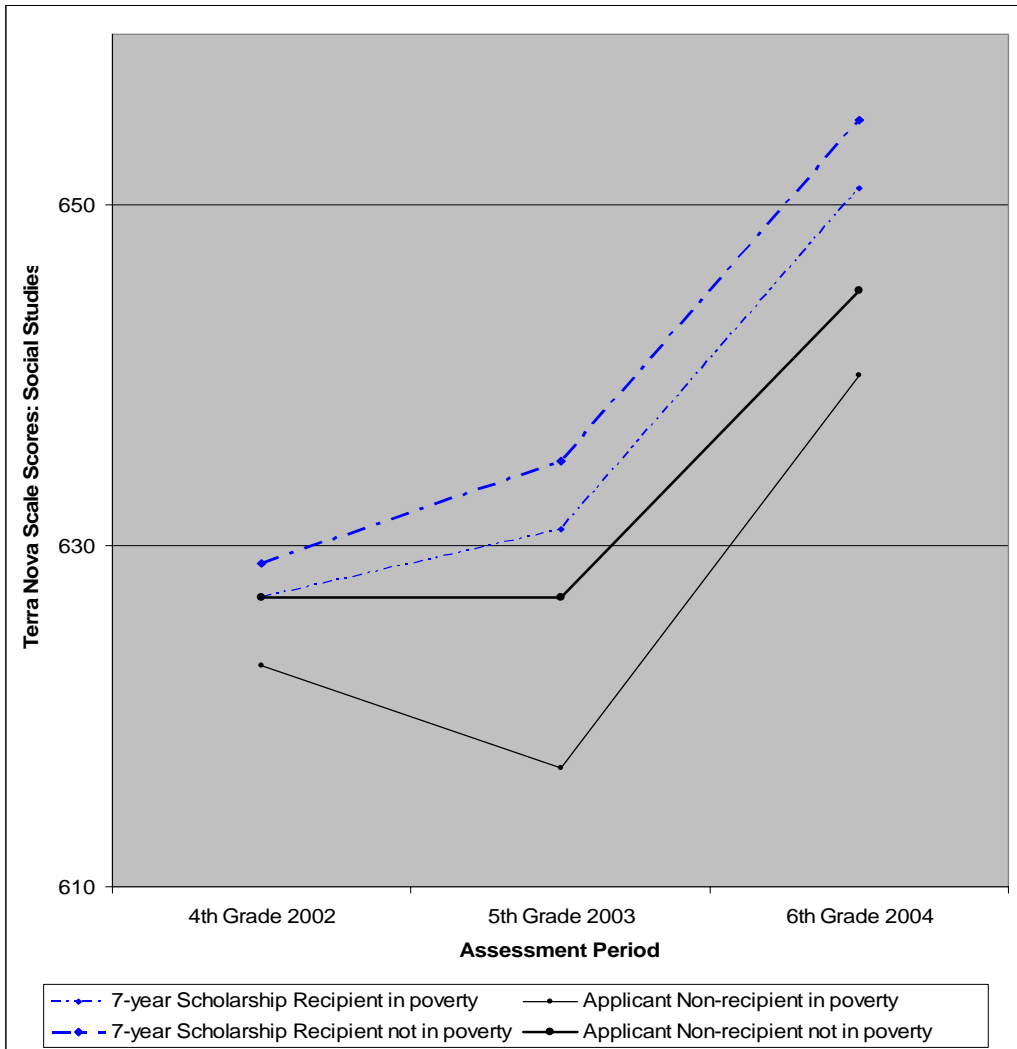
		Mean Social Studies Achievement by Assessment Period							Marginal means (group)
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004	
Seven-year scholarship recipient-non-poverty (n = 76)	Unadjusted Mean	-	-	-	-	633	639	658	643
	SD	-	-	-	-	50	39	42	
	Adjusted Mean	-	-	-	-	629	635	655	640
Public applicant non-recipient non-poverty (n = 55)	Unadjusted Mean	-	-	-	-	623	623	641	629
	SD	-	-	-	-	52	47	43	
	Adjusted Mean	-	-	-	-	627	627	645	633

TABLE 92. ANCOVA Summary: Science Achievement Analysis from Fourth Grade 2002 to Sixth Grade 2004 for Students Not in Poverty

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	3633	1	3633	2.51	0.1142
Time	35940	2	17970	12.40	<0.0001
Minority Status	19121	1	19121	13.19	0.0003
Number of Schools	113	1	113	0.08	0.7802
Spring 2001 Score	188712	1	18712	130.19	<0.0001
Time x Group	967	2	484	0.33	0.7165
Corrected Error	556599	384			

As shown in Table 92, significant results were obtained for the main effect of time, minority status, and Spring 2001 achievement. These effects were found to be significant at the level of $p < 0.05$.

FIGURE 26. Social studies Achievement from Fourth Grade 2002 to Sixth Grade 2004



Summary of Significant Differences by Subject Area

The table below provides an overview of significant differences across the various subject areas, as well as overall achievement. All group differences are based on group mean

scores statistically adjusted for minority status, number of schools, and by Fall 1998 achievement scores in respective subject areas. Science and Social achievement adjustment scores were based on Spring 2001 subject area scores given that this was the first year of testing in these areas.

TABLE 93. Significant Pairwise Differences Between Seven-Year Scholarship Students (7) and Applicant Non-recipients (ANR) by Testing Episode for Students in Poverty and Students Not in Poverty

Subject	Testing Episode						
	Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004
Overall	--	In Poverty: ANR>7	a				
Reading	--						
Language Arts	--					Not in Poverty: 7>ANR	
Math	--						
Science	Not Tested			--			
Social Studies	Not Tested			--		In Poverty: 7>ANR	

a. Empty cells indicate no significant difference.

Summary Regarding Analysis with Poverty Status

This set of analyses described patterns of achievement among the following four groups of students:

- Those whose families were considered in poverty based on the 1997 Federal Poverty Guidelines (<http://aspe.os.dhhs.gov/poverty/97poverty.htm>) at the outset of data collection and who used a scholarship for private school enrollment continuously from kindergarten through sixth grade (i.e., seven year scholarship recipients).
- Those whose families who were considered in poverty and applied for but did not receive a scholarship and who were attending public schools in 6th grade (i.e., public applicant non-recipients).

- Those whose families were considered not in poverty based on the 1997 Federal Poverty Guidelines and who used a scholarship for private school enrollment continuously from kindergarten through sixth grade.
- Those whose families who were considered not in poverty and applied for but did not receive a scholarship and who were attending public schools in 6th grade.

The analyses take into account adjustments for minority status, student mobility and prior achievement. The following provides a summary of the results related to analyses using an indicator of poverty status.

Poverty status

Based on 1997 income and family size reported by applicants to the scholarship program, 62% (N = 121) of students who would be 7-year scholarship recipients and 50% (N = 56) of students who applied for but did not receive a scholarship were considered in poverty.

A significant difference was found between students in poverty and students not in poverty (regardless of scholarship status) on the overall achievement and language scores. Due to the small sample size the interaction of poverty status and scholarship status was not tested. This finding then led to the subsequent analysis on the two sub-groups of students who were of poverty status and students where were not of poverty status.

Students in poverty

At the beginning of first grade, fall 1999, students who continued to use a scholarship to attend private schools had a significantly lower adjusted overall mean achievement score than did students in the public school comparison group, ($p < 0.05$). By the end of second grade (Spring 2000), this difference was no longer present.

No difference was found between groups for the duration of Spring 2000 through Spring 2002. In the Spring of 2003, students who continued to use a scholarship to attend private schools had higher social studies achievement scores ($p < 0.05$) than students in the public school comparison group.

At the end of sixth grade (Spring 2004) no significant differences were found between 7-year scholarship users and their comparable peers who remained in the public schools.

Students not in poverty

The only significant difference found between scholarship users and applicant non-recipients not in poverty occurred during the fifth grade, 2003 on the language achievement test. Here, students attending private school had a higher adjusted mean score than those students attending public school, $p < 0.05$.

3.3.5 Differential Exit from the CSTP: Former Scholarship Recipients and Academic Achievement

Question Three also examines the achievement of students who participated in the scholarship program for at least one year, but who elected to leave the program at some subsequent point and enroll in public schools. The following six groups of former scholarship recipient-users were identified for these analyses:

- a. six-year former recipient-users who withdrew from the CSTP after participating in kindergarten and have attended public schools in the CMSD for six years (in first through sixth grade);
- b. five-year former recipient-users who withdrew from the CSTP after participating in kindergarten and first grade and have attended public schools for five years (from second through sixth grade);
- c. four-year former recipient-users who withdrew from the CSTP after participating from kindergarten to second grade and have attended public schools in third through sixth grade;
- d. three-year former recipient-users who withdrew from the CSTP after participating from kindergarten through third grade and have attended public schools from fourth to sixth grade;
- e. two-year former recipient-users who used a scholarship from kindergarten through fourth grade but who enrolled in public school in fifth and sixth grade; and
- f. one-year former recipient-users who used a scholarship from kindergarten through fifth grade but who enrolled in public school in sixth grade.

Because the primary intent of these analyses is to examine whether differential levels of achievement are related to families’ decisions to continue in the CSTP or to move their children to public schools, no adjustment was made in students’ scores for minority status or other covariates.

Correlational Analysis of Duration of Participation in the CSTP among Former Scholarship Recipient-users

A correlational analysis was conducted to examine whether the amount of time scholarship recipient-users participated in the CSTP before withdrawing to attend public schools was related to achievement. The results are presented in Table 94. Examination of achievement scores at the end of sixth grade (Spring 2004) indicate no statistically significant relationships between the length of time students spent in the scholarship program with the six achievement measures.

TABLE 94. Correlations between Duration of Participation in the CSTP and Sixth-Grade Achievement among Current and Former Scholarship Recipient-users

	Achievement Measures					
	Reading	Language Arts	Mathematics	Science	Social Studies	Overall
Correlation coefficient	-0.021	-0.048	-0.030	-0.090	-0.039	-0.038
p-Value	0.80	0.57	0.72	0.28	0.65	0.65
N	145	145	145	145	145	145

Group Comparisons: Achievement as a Function of Differential Exit from the CSTP

To further examine achievement differences across the six assessment periods, analysis of variance was conducted on the achievement measures available from early first grade through the end of sixth grade. The analyses are organized around the question: how does the achievement of each former recipient-users group compare to seven-year continuous recipient-users (i.e., students who used a scholarship from kindergarten through sixth

grade) over time? To address this question, ANOVAs were designed to examine the achievement of former recipient-users and seven-year continuous recipient-users on each of the measures. When indicated by a significant omnibus test, pairwise comparisons were used to further examine potential between-group differences.

Tables 95 through 106 present both descriptive statistics and ANOVA results from first grade (1998-99) to sixth grade (2002-04) for former scholarship recipient-users and seven-year recipient-users on six achievement measures: overall achievement, reading, language arts, mathematics, science, and social studies achievement, respectively. Figures 27 through 32 graphically display these data.

TABLE 95. Overall Achievement: Differential Exit from the CSTP Fall 1998 to Spring 2004 - Former Recipient-users vs. Seven-year Recipient-users

Student Group		Mean Overall Achievement by Assessment Period						
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004
Seven-year scholarship recipient-users (7 years in CSTP)	Mean	537	555	587	615	632	643	654
	SD	28	30	--	33	33	32	33
	N	197	197	197	197	197	197	197
1-year former scholarship recipient-users (6 years in CSTP)	Mean	528	542	572	603	617	636	635
	SD	34	32	32	31	38	36	35
	N	30	30	30	30	30	30	30
2-year former scholarship recipient-users (5 years in CSTP)	Mean	522	542	568	593	610	626	620
	SD	21	21	26	26	29	34	42
	N	23	23	23	23	23	23	23
3-year former scholarship recipient-users (4 years in CSTP)	Mean	519	542	570	603	626	635	639
	SD	24	27	29	33	29	34	29
	N	29	29	29	29	29	29	29
4-year former scholarship recipient-users (3 years in CSTP)	Mean	517	540	571	601	619	632	635
	SD	29	27	27	26	32	28	41
	N	37	37	37	37	37	37	37
5-year former scholarship recipient-users	Mean	522	532	573	592	620	630	631
	SD	31	36	33	34	45	46	40

Analyses and Results

		Mean Overall Achievement by Assessment Period						
Student Group		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004
(2 years in CSTP)	N	21	21	21	21	21	21	21
6-year former scholarship recipient-users	Mean	517	527	576	619	642	637	642
	SD	22	40	23	17	27	37	40
(1 year in CSTP)	N	5	5	5	5	5	5	5

TABLE 96. ANOVA Summary: Overall Achievement Analysis from First Grade 1998 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	141954	6	141954	23.35	0.0001
Time	1588134	6	1588134	261.23	0.0001
Time x Group	21097	36	21097	0.58	0.9792
Corrected Error	6689869	2393			

FIGURE 27. Overall Achievement by Differential Exit: Former Recipient-users and Seven-year Recipient-users 1998-2004

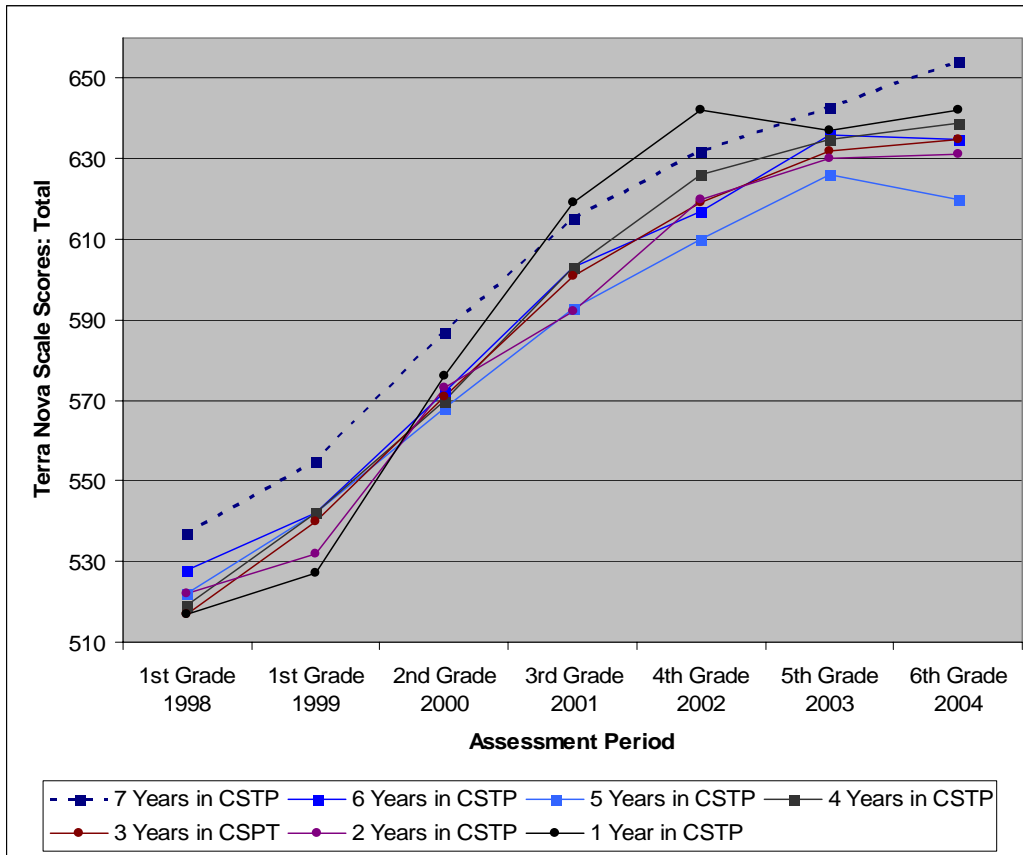


TABLE 97. Reading Achievement: Differential Exit from the CSTP Fall 1998 to Spring 2004 - Former Recipient-users vs. Seven-year Recipient-users

		Mean Reading Achievement by Assessment Period						
Student Group		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004
Seven-year scholarship recipient-users (7 years in CSTP)	Mean	550	569	603	624	639	644	655
	SD	34	38	34	39	35	39	33
	N	197	197	197	197	197	197	197
1-year former scholarship recipient-users (6 years in CSTP)	Mean	541	552	588	616	628	635	639
	SD	36	35	43	39	42	37	36
	N	30	30	30	30	30	30	30

Analyses and Results

		Mean Reading Achievement by Assessment Period						
Student Group		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004
2-year former scholarship recipient-users (5 years in CSTP)	Mean	537	559	586	603	615	627	629
	SD	21	33	26	24	32	37	37
	N	23	23	23	23	23	23	23
3-year former scholarship recipient-users (4 years in CSTP)	Mean	533	555	592	615	635	637	640
	SD	32	27	28	41	35	37	27
	N	29	29	29	29	29	29	29
4-year former scholarship recipient-users (3 years in CSTP)	Mean	531	550	591	613	624	636	637
	SD	35	33	42	35	40	33	50
	N	37	37	37	37	37	37	37
5-year former scholarship recipient-users (2 years in CSTP)	Mean	536	550	597	600	626	633	636
	SD	27	34	32	37	62	50	45
	N	21	21	21	21	21	21	21
6-year former scholarship recipient-users (1 year in CSTP)	Mean	529	520	598	626	648	644	646
	SD	36	74	29	26	25	35	41
	N	5	5	5	5	5	5	5

TABLE 98. ANOVA Summary: Reading Achievement Analysis from First Grade 1998 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	115834	6	19306	14.51	0.0001
Time	1331167	6	221861	166.75	0.0001
Time x Group	27038	36	751	0.56	0.9831
Corrected Error		2393			

FIGURE 28. Reading Achievement by Differential Exit: Former Recipient-users and Seven-year Recipient-users 1998-2004

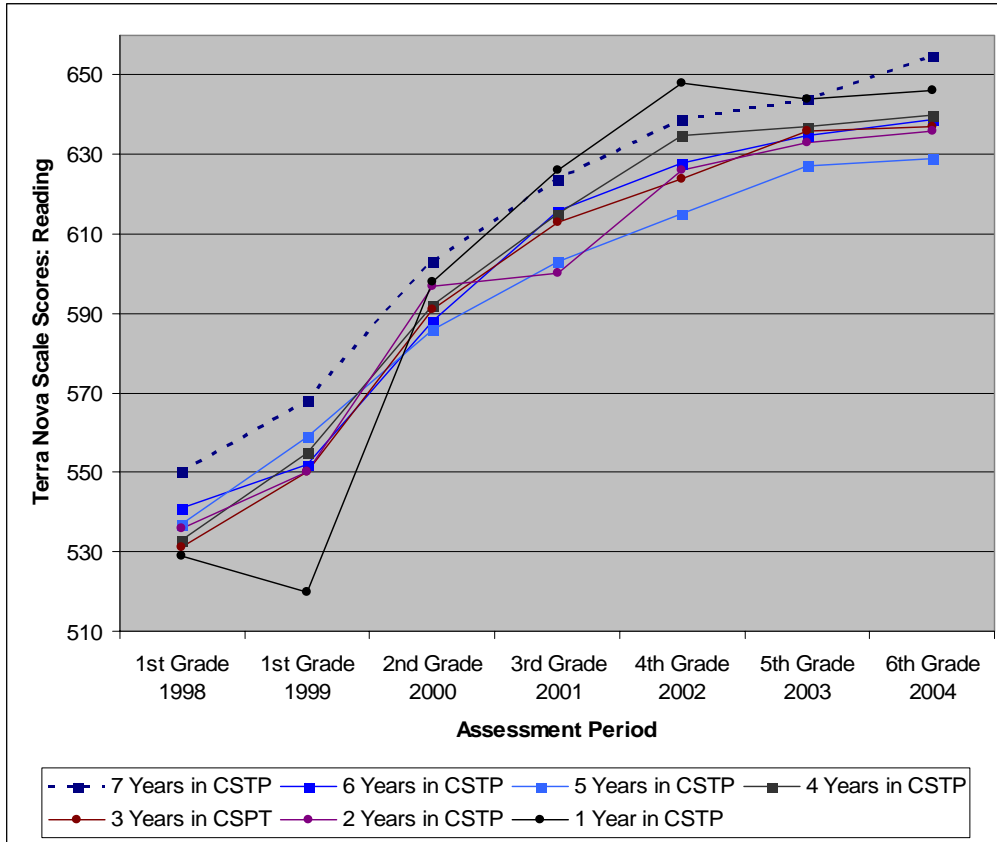


TABLE 99. Language Arts Achievement: Differential Exit from the CSTP Fall 1998 to Spring 2004 - Former recipient-users vs. Seven-year Recipient-users

		Mean Language Arts Achievement by Assessment Period						
Student Group		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004
Seven-year scholarship recipient-users (7 years in CSTP)	Mean	556	572	600	620	637	649	657
	SD	36	39	42	35	36	37	39
	N	197	197	197	197	197	197	197
1-year former scholarship recipient-users (6 years in CSTP)	Mean	543	556	589	602	619	643	632
	SD	38	40	29	35	46	39	35
	N	30	30	30	30	30	30	30

Analyses and Results

Student Group		Mean Language Arts Achievement by Assessment Period						
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004
2-year former scholarship recipient-users (5 years in CSTP)	Mean	536	555	579	598	611	628	615
	SD	37	29	37	30	29	45	45
	N	23	23	23	23	23	23	23
3-year former scholarship recipient-users (4 years in CSTP)	Mean	535	561	585	610	628	633	639
	SD	34	30	35	31	35	40	27
	N	29	29	29	29	29	29	29
4-year former scholarship recipient-users (3 years in CSTP)	Mean	541	558	580	605	622	627	636
	SD	36	43	29	25	40	35	45
	N	37	37	37	37	37	37	37
5-year former scholarship recipient-users (2 years in CSTP)	Mean	531	544	581	592	627	626	627
	SD	35	40	34	43	35	56	43
	N	21	21	21	21	21	21	21
6-year former scholarship recipient-users (1 year in CSTP)	Mean	540	546	576	624	636	637	636
	SD	29	42	20	23	20	49	47
	N	5	5	5	5	5	5	5

TABLE 100. ANOVA Summary: Language Arts Achievement Analysis from First Grade 1998 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	206064	6	34344	24.45	0.0001
Time	1104213	6	184035	131.04	0.0001
Time x Group	27510	36	764	0.54	0.9878
Corrected Error	6495862	2393			

FIGURE 29. Language Arts Achievement by Differential Exit: Former Recipient-users and Seven-year Recipient-users 1998-2004

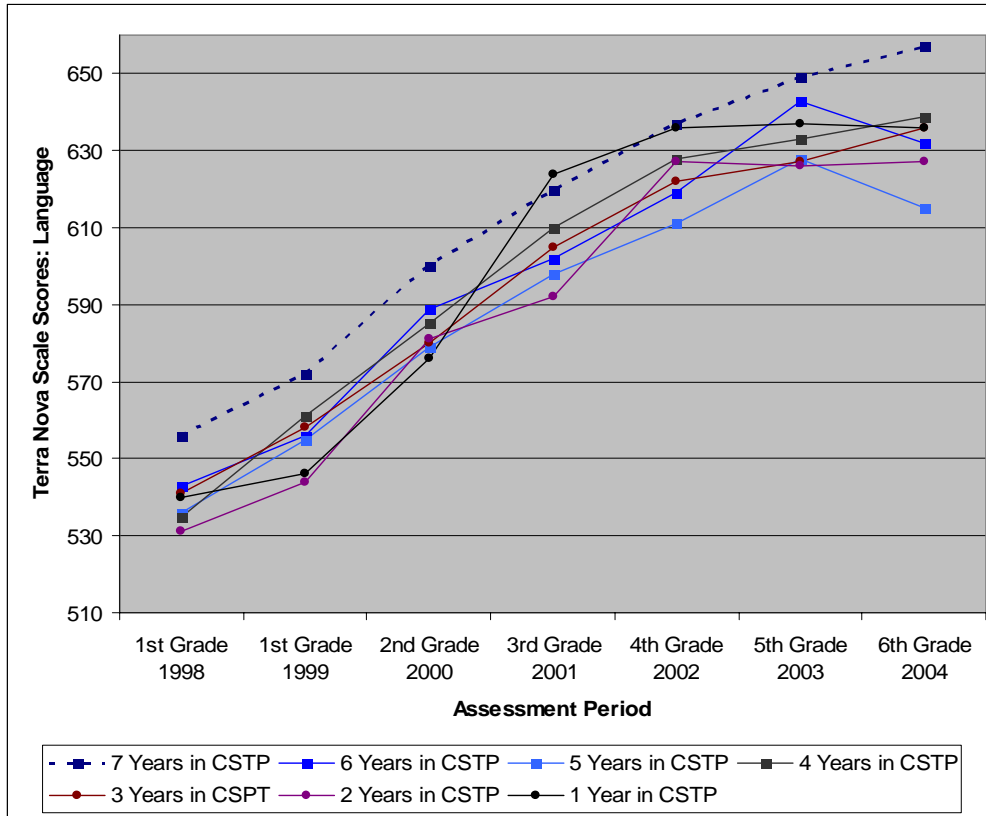


TABLE 101. Mathematics Achievement: Differential Exit from the CSTP Fall 1998 to Spring 2004 - Former recipient-users vs. Seven-year Recipient-users

Student Group		Mean Mathematics Achievement by Assessment Period						
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004
Seven-year scholarship recipient-users (7 years in CSTP)	Mean	506	524	558	600	619	636	652
	SD	34	32	35	37	41	34	40
	N	197	197	197	197	197	197	197
1-year former scholarship recipient-users (6 years in CSTP)	Mean	501	517	540	591	603	631	635
	SD	44	39	37	45	40	45	48
	N	30	30	30	30	30	30	30

Analyses and Results

		Mean Mathematics Achievement by Assessment Period						
Student Group		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004
2-year former scholarship recipient-users (5 years in CSTP)	Mean	494	510	539	578	602	622	615
	SD	24	18	28	34	35	33	61
	N	23	23	23	23	23	23	23
3-year former scholarship recipient-users (4 years in CSTP)	Mean	489	511	534	585	616	635	639
	SD	26	36	36	44	28	36	51
	N	29	29	29	29	29	29	29
4-year former scholarship recipient-users (3 years in CSTP)	Mean	479	512	542	586	612	634	632
	SD	43	22	26	28	30	30	43
	N	37	37	37	37	37	37	37
5-year former scholarship recipient-users (2 years in CSTP)	Mean	498	504	542	584	607	630	630
	SD	45	43	42	41	59	45	60
	N	21	21	21	21	21	21	21
6-year former scholarship recipient-users (1 year in CSTP)	Mean	484	515	555	607	643	628	645
	SD	26	17	30	16	45	30	39
	N	5	5	5	5	5	5	5

TABLE 102. ANOVA Summary: Mathematics Achievement Analysis from First Grade 1998 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	115034	6	19172	13.88	0.0001
Time	2512638	6	418773	303.07	0.0001
Time x Group	42939	36	1193	0.86	0.7009
Corrected Error	10047679	2393			

FIGURE 30. Mathematics Achievement by Differential Exit: Former Recipient-users and Seven-year Recipient-users 1998-2004

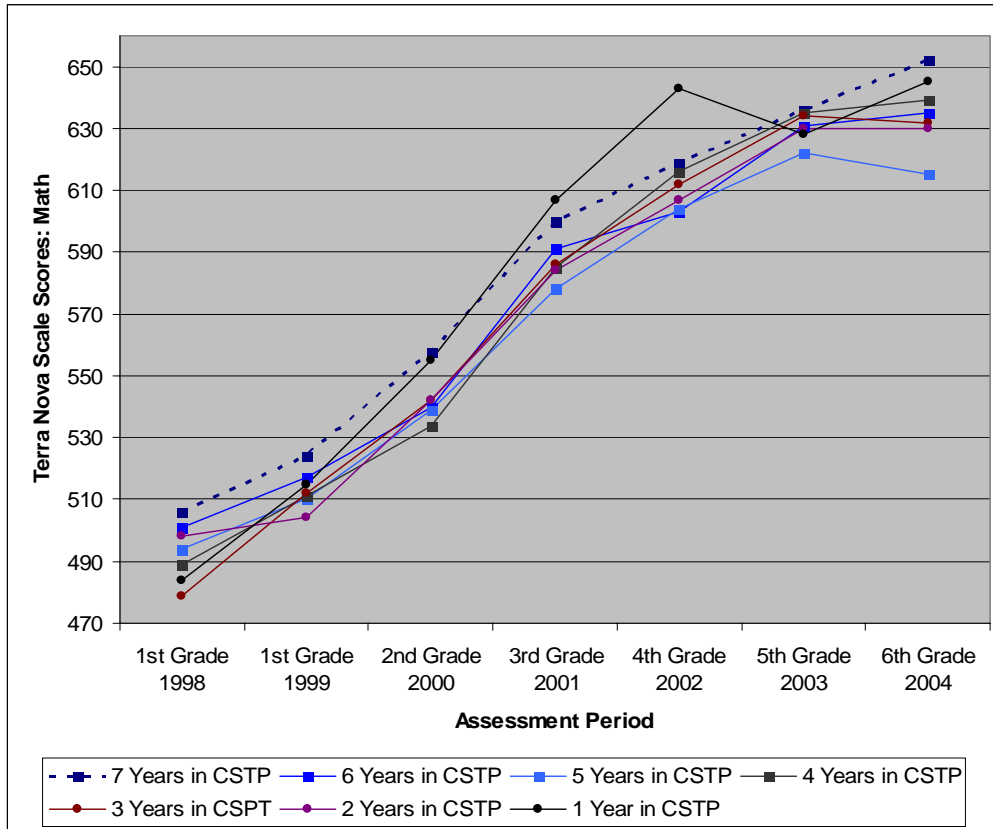


TABLE 103. Science Achievement: Differential Exit from the CSTP Fall 1998 to Spring 2004 - Former recipient-users vs. Seven-year Recipient-users

Student Group		Mean Science Achievement by Assessment Period						
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004
Seven-year scholarship recipient-users (7 years in CSTP)	Mean	--	--	--	601	623	637	656
	SD	--	--	--	39	44	41	43
	N	--	--	--	197	197	197	197
1-year former scholarship recipient-users (6 years in CSTP)	Mean	--	--	--	576	606	614	635
	SD	--	--	--	43	39	64	45
	N	--	--	--	30	30	30	30

Analyses and Results

		Mean Science Achievement by Assessment Period						
Student Group		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004
2-year former scholarship recipient-users (5 years in CSTP)	Mean	--	--	--	574	595	621	606
	SD	--	--	--	37	47	30	53
	N	--	--	--	23	23	23	23
3-year former scholarship recipient-users (4 years in CSTP)	Mean	--	--	--	590	618	627	634
	SD	--	--	--	40	53	51	55
	N	--	--	--	29	29	29	29
4-year former scholarship recipient-users (3 years in CSTP)	Mean	--	--	--	591	604	627	635
	SD	--	--	--	36	47	45	49
	N	--	--	--	37	37	37	37
5-year former scholarship recipient-users (2 years in CSTP)	Mean	--	--	--	587	620	626	639
	SD	--	--	--	50	48	44	50
	N	--	--	--	21	21	21	21
6-year former scholarship recipient-users (1 year in CSTP)	Mean	--	--	--	602	625	625	639
	SD	--	--	--	34	44	55	35
	N	--	--	--	5	5	5	5

TABLE 104. ANOVA Summary: Science Achievement Analysis from First Grade 1998 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	130681	6	21780	11.27	0.0001
Time	148832	3	49611	25.68	0.0001
Time x Group	22496	18	1250	0.65	0.8641
Corrected Error	3228634	1367			

FIGURE 31. Science Achievement by Differential Exit: Former Recipient-users and Seven-year Recipient-users 1998-2004

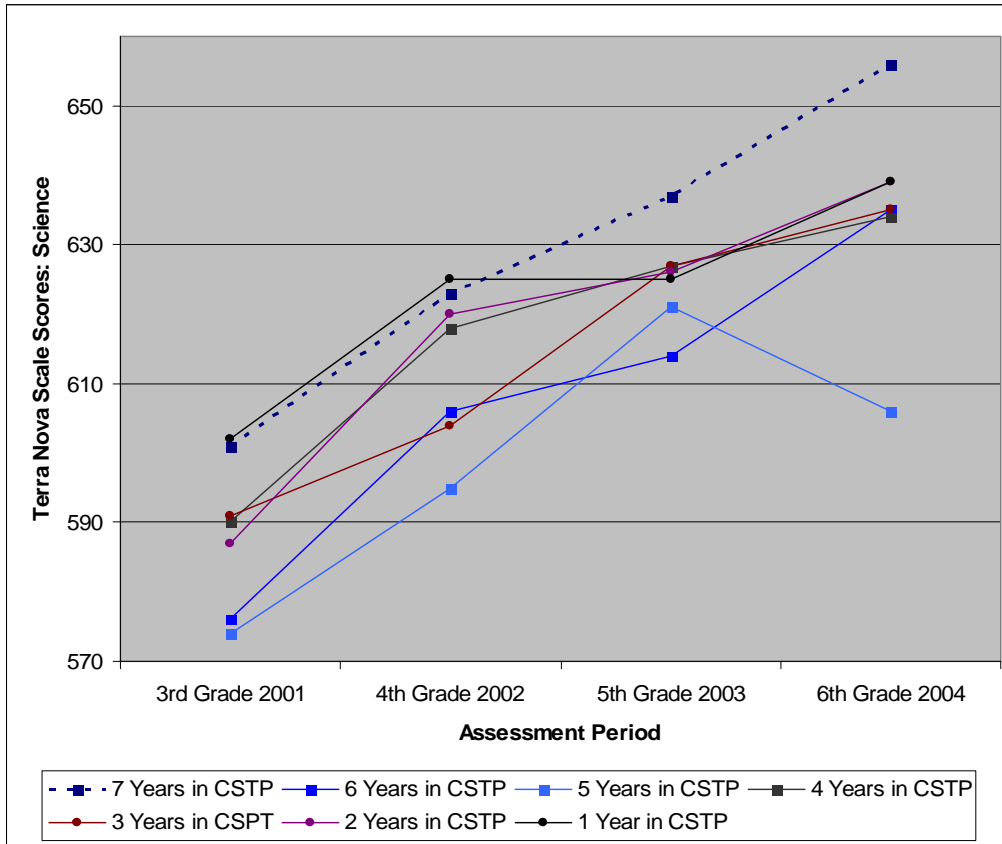


TABLE 105. Social Studies Achievement: Differential Exit from the CSTP Fall 1998 to Spring 2004 - Former recipient-users vs. Seven-year Recipient-users

Student Group		Mean Social Studies Achievement by Assessment Period						
		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004
Seven-year scholarship recipient-users (7 years in CSTP)	Mean	--	--	--	616	630	635	655
	SD	--	--	--	33	42	40	35
	N	--	--	--	197	197	197	197
1-year former scholarship recipient-users (6 years in CSTP)	Mean	--	--	--	604	611	624	636
	SD	--	--	--	37	50	53	34
	N	--	--	--	30	30	30	30

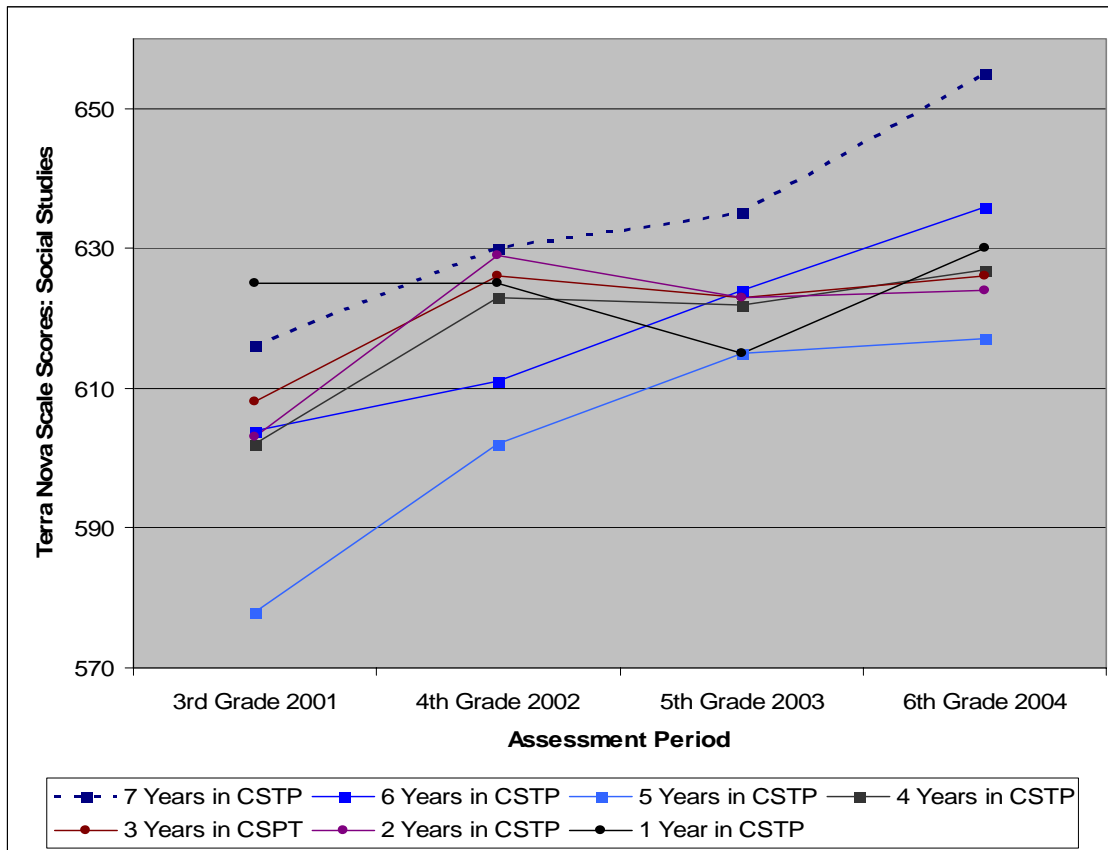
Analyses and Results

		Mean Social Studies Achievement by Assessment Period						
Student Group		Fall 1st Grade 1998	Spring 1st Grade 1999	Spring 2nd Grade 2000	Spring 3rd Grade 2001	Spring 4th Grade 2002	Spring 5th Grade 2003	Spring 6th Grade 2004
2-year former scholarship recipient-users (5 years in CSTP)	Mean	--	--	--	578	602	615	617
	SD	--	--	--	54	46	29	40
	N	--	--	--	23	23	23	23
3-year former scholarship recipient-users (4 years in CSTP)	Mean	--	--	--	602	623	622	627
	SD	--	--	--	40	40	45	40
	N	--	--	--	29	29	29	29
4-year former scholarship recipient-users (3 years in CSTP)	Mean	--	--	--	608	626	623	626
	SD	--	--	--	29	27	39	59
	N	--	--	--	37	37	37	37
5-year former scholarship recipient-users (2 years in CSTP)	Mean	--	--	--	603	629	623	624
	SD	--	--	--	57	44	43	55
	N	--	--	--	21	21	21	21
6-year former scholarship recipient-users (1 year in CSTP)	Mean	--	--	--	625	625	615	630
	SD	--	--	--	35	29	37	44
	N	--	--	--	5	5	5	5

TABLE 106. ANOVA Summary: Social Studies Achievement Analysis from First Grade 1998 to Sixth Grade 2004

Source of Variance	Type III Sums of Squares	Degrees of Freedom	Mean Square	F	p-Value
Group	119900	6	19983	12.44	0.0001
Time	43441	3	14480	9.01	0.0001
Time x Group	27418	18	1523	0.92	0.5191
Corrected Error	2496016	1367			

FIGURE 32. Social Studies Achievement by Differential Exit: Former Recipient-users and Seven-Year Recipient-users 1998-2004



Significant results were found for both the main effect of time and the main effect of group for each of the six achievement areas. There were no indications of group by time interactions. Table 107 details the difference in marginal means across these seven groups of interest.

TABLE 107. Statistically Significant Marginal Mean Pairwise Differences by Number of Years in Scholarship Program

Subject	Cohort by Years in Program						
	7 years in Program (N=197)	6 Years in Program (N=30)	5 Years in Program (N=23)	4 Years in Program (N=29)	3 Years in Program (N=37)	2 Years in Program (N=21)	1 Year in Program (N=5)
Overall		7 yrs.	7 yrs	7 yrs	7 yrs	7 yrs	
	6 yrs	a					
	5 yrs						
	4 yrs						
	3 yrs						
	2 yrs						
Reading		7 yrs	7 yrs	7 yrs	7 yrs	7 yrs	
	6 yrs						
	5 yrs						
	4 yrs						
	3 yrs						
	2 yrs						
Language Arts		7 yrs	7 yrs	7 yrs	7 yrs	7 yrs	
	6 yrs						
	5 yrs						
	4 yrs						
	3 yrs						
	2 yrs						
Math		7 yrs	7 yrs	7 yrs	7 yrs	7 yrs	
	6 yrs						
	5 yrs						
	4 yrs						
	3 yrs						
	2 yrs						
Science		7 yrs	7 yrs		7 yrs		
	6 yrs						
	5 yrs						
	3 yrs						

		Cohort by Years in Program					
Subject	7 years in Program (N=197)	6 Years in Program (N=30)	5 Years in Program (N=23)	4 Years in Program (N=29)	3 Years in Program (N=37)	2 Years in Program (N=21)	1 Year in Program (N=5)
Social Studies		7 yrs	7 yrs	7 yrs	7 yrs	7 yrs	
	6 yrs						
	5 yrs				5 yrs		
	4 yrs						
	3 yrs		3 yrs				
	2 yrs						

a. Empty cells indicate no significant difference between groups.

The primary trend revealed in these data is a difference between students who have been in the scholarship program for seven years and all other participants that had dropped out of the program. This pattern is revealed in Table 107 as well as in each of the Figures, 26 through 31. Table 107 notes all instances of statistical significance for the various comparisons, with empty cells indicating no statistically significant differences. That a pattern of differences did not reveal itself between 7-year scholarship recipients and those students who dropped out of the program after only one year may be a function of anomaly given the small sample size, $n = 5$, for the latter group. As shown in Figures 27-32, significant differences between groups do not typically appear until after the students have left the program. Thus, it appears that there is a relationship between ceasing scholarship use and lower achievement test scores. However, asserting causation would be inappropriate in this case.

3.3.6 Summary of Question Three

Question Three and its relevant constituent sub-questions examine the effects of participating in the CSTP on student academic achievement. This analysis makes use of a longitudinal sample of public and private school children who entered first grade in the autumn of 1998 and who were, in the Spring of 2004, enrolled in sixth grade (N=197). Principal among these students is a group of children who have participated continuously in the scholarship program for seven years, kindergarten through sixth grade. The aca-

ademic performance of the seven-year recipient-users is compared across the period from first through sixth grade to two primary groups of public school children: (a) students whose families applied for but did not receive a scholarship and who have attended public schools from first through sixth grade, and (b) students whose families never applied for a scholarship and who have attended public schools from first through sixth grade. Using mixed design analyses, the academic performance of these three groups of children is compared across time, between groups, and as a function of both time and group.

The longitudinal nature of the current study also has allowed the evaluation team to identify additional comparisons afforded by these data. This is the group of students who used a scholarship to attend a private school for one or more years beginning in kindergarten, but who gave up their scholarship and enrolled in public schools. Because these students began as scholarship participants in the first year of the study, it has been possible to follow their academic progress during the time they participated in the program and as they moved from private to public schools. Embedded within Question Three the academic performance of the former recipient-users allows examination of what we refer to as differential exit from the program.

The issue of whether and to what extent participation in the scholarship program affects students' academic performance is complex. Despite the longevity of the current study, it is unwise to make conclusive statements in this regard and, particularly, to attempt to generalize beyond the data available over the seven-year period (e.g., to future performance) or to choice programs operating in other contexts. However, the current results allow some conclusions to be drawn about the impact of the program for those who participate. The replication of previous analyses indicate that students in the longitudinal sample who were using a scholarship to attend private schools at the beginning of first grade during Fall 1998 were achieving at higher levels than both of the primary comparison groups in all measured areas. However, only differences in language arts appeared to remain consistent throughout subsequent years, with differences in reading, mathematics, science,

and social studies not evident during the other data collection periods. In other words, it appears that over the course of first and second grade, the performance of public school students rose to similar levels as students using scholarships for reading and math; but scholarship students continued to outperform public school students throughout all testing periods in language arts. Sample size was constant across the years, removing the possibility of sample size fluctuation as a cause for difference in significance among annual scores. However, in sixth grade, differences in scores between scholarship students and the two comparison public school student groups reappeared in all areas except mathematics.

Additional analyses were also conducted that incorporated an indicator of student mobility. When comparing the current model with the ANCOVA model that adjusts only for only minority status, no substantive difference is found in achievement score variance attributed to comparison groups. The subject areas and patterns of achievement differences over time are almost identical to the previous analyses that included only minority status as a covariate. The only differences that appear are that there are no statistically significant differences for applicant non-recipients in 5th grade social studies and 6th grade science. Therefore, although mobility does appear as a significant covariate in this model, the inclusion of mobility status does not have a substantive impact on the variance accounted for by comparison groups. Primarily, this is due to the correlation between minority status and student mobility, resulting in the variance being partitioned between these two covariates.

Finally, analyses were conducted that included an indicator of poverty status. The analyses take into account adjustments for minority status as well as student mobility. A significant difference was found between students in poverty and students not in poverty (regardless of scholarship status) on overall reading, language arts, mathematics, and science scores. Students classified as *not* in poverty, on average, scored higher than students classified as in poverty, regardless of scholarship status. Due to the small sample size the interaction of

poverty status and scholarship status was not tested. This finding then led to the subsequent analysis on the two sub-groups of students who were of poverty status and students where were not of poverty status. These findings included the following: (1) At the end of sixth grade (Spring 2004), 7-year scholarship students in poverty exhibited no significant differences from the public school applicant non-recipients in poverty and (2) At the end of sixth grade (Spring 2004), 7-year scholarship users who were not in poverty exhibited no significant differences from the public school and applicant non-recipients who were not in poverty. However, it is unclear how the relatively small sample sizes may have effected the ability to detect statistically significant differences. A few statistically significant differences did appear in fifth grade (Spring 2003): 7-year scholarship students not in poverty scored higher on language arts; and 7-year scholarship students in poverty scored higher in social studies.

In terms of differential exit from the scholarship program, it appears that overall, students who remained in the scholarship program performed better than those who left the scholarship program across all subject areas over the seven years studied.¹⁴ While this trend persists across the six academic measures, the higher achievement by students in the scholarship program is most similar to the comparison group of former scholar recipients in the subject area of mathematics. Here, although marginal mean group differences remained significant, former scholarship recipients received similar scores and exhibited similar gains to students that remained in the scholarship program. The greatest difference between students that remained in the scholarship program and former scholarship recipients is shown to be in language arts. Here, students who remained in the scholarship program and former scholarship recipients exhibit similar gains, but mean scores of former scholarship recipients are markedly lower than the scores achieved by students who remain in the scholarship program.

14. This statement excludes students who were in the program for one year and then dropped out as there were only five in the sample and thus their scores cannot be considered a representative distribution.



4 Summary and Conclusions

In general, the analyses from the most current CSTP data available supports the overall conclusions drawn from previous years of the longitudinal study. For example, the following conclusions related to student, teacher and classroom characteristics are similar to previous years:

- Scholarship students are less likely to be African-American or Latino/a than their public school peers. In terms of the types of students participating in the state-funded voucher program, the analyses continue to indicate that program participants differ significantly from their public school peers in terms of minority status. Scholarship recipient-users in private schools are less likely to be African-American or Latino/a (63%) than their public school peers from all comparison groups (scholarship applicant non-recipient, 86%; scholarship recipient non-user, 89%; and non-applicants, 82%).
- Students who exited the scholarship program were more likely to be African American or Latino/a than were students who remained in the scholarship program; and students who exited the program tended to have lower levels of achievement than students who remained in the scholarship program. Almost 90% of students leaving the scholarship program are racial-ethnic minority students, as compared to 63% of the overall scholarship student population. However, this differential exit alone does not account for the differences between scholarship students and public school students. Analyses of data for students entering the scholarship program (as opposed to only accounting for those remaining in the program) also indicates lower percentages of racial-ethnic minorities being awarded scholarships than the general public school population demographics. In addition, across all six academic measures, those students leaving the scholarship program had lower levels of achievement than those students who remained in the CSTP program.
- The majority of scholarship students were already attending a private school prior to receiving the scholarship. Approximately 61-72% of scholarship students attended a private school during the school year immediately prior to entering the

CSTP. Therefore, there appear to be relatively few public school students who are using the CSTP program as a form of school choice to attend private school.

- Although similar in some ways, the types of teachers and classrooms that scholarship students in private schools and their peers in public schools experience differ in terms of teacher education level. There are many similarities in terms of public and private school teachers and classroom characteristics. The vast majority of both public and private school teachers are certified, have similar levels of previous teaching experience (approximately 11 years), and similar levels of previous experience at their current school (approximately 6 years). There are small, but statistically significant differences in class size (i.e., 22.9 students in private schools versus 19.8 in public). However, the most significant difference, both statistically and practically between public and private schools is in terms of teachers highest education level. Whereas, 50.8% of public school teachers have a master's degree or higher, only 18.0% of private school teachers have attained a master's degree or higher.

In terms of impact on student achievement, results were also similar to previous years in that those students who would continue to use a scholarship to attend private schools began their schooling at the start of first grade with higher achievement scores. In other words, seven-year scholarship recipient–users had statistically significant higher achievement test scores than their public school peers in all measured areas (reading, language, math and overall) at the beginning of first grade (Fall, 1998). Therefore, to provide the most valid analyses of the impact of the CSTP program on student achievement, analyses were conducted that adjusted for these early differences between 7-year scholarship students and their public school peers.

Results indicate that by the end of the sixth grade, after controlling for differences in minority status, student mobility and prior achievement, there are no statistically significant differences in overall achievement scores between students who have used a scholarship throughout their academic career (i.e., kindergarten through sixth grade) and students in the two public school comparison groups. However, there are statistically significant differences ($p < .05$) in three specific subject areas: language, science and social studies. Sixth grade scholarship students who had been in the CSTP since kindergarten outperformed both public school comparison groups in language and social studies; and these sixth grade scholarship students also outperformed public school non-applicants in

science. Interesting, these findings favoring 7-year scholarship students do not appear until the students' sixth grade year. Given that these differences are emerging during the early middle school years, it is possible that the impact of the CSTP program is different in the early elementary years than it is during middle school years. It might seem logical to assume that perhaps these differences in sixth grade can be accounted for by public students' transition from elementary school to middle school, and a concurrent decrease in growth due to the transition, whereas private school students tend to remain in a single school throughout this same period. However, Cleveland public schools include grade K-8 in one building, thereby providing a structure similar to private schools. Despite the lack of physical changes due to middle school, there are still generally differences in curricula and organization during middle school years that may help to account for these differences.

It is also interesting to note that after adjusting for prior differences in academic achievement, public school non-applicants outperform 7-year scholarship students at various points during the study, primarily in the area of mathematics. Although there is no statistically significant difference in mathematics at the end of the sixth grade, this finding warrants further examination.

In examining the impact of the scholarship program on student achievement it is also important to place these findings within a broader context that helps us to understand the practical significance of these findings. First, Table 10 below provides effect size calculations for those subject areas where there were statistically significant differences to provide a better understanding of the magnitude of these differences between scholarship students and the public school comparison group students. Using Cohen's (1988) guidelines, these effect sizes range from small to moderate. The largest effect sizes are for lan-

guage arts and social studies, with medium effect sizes (.29 and .32 for language; .31 and .38 for social studies).

TABLE 108. Effect Sizes for Statistically Significant Sixth Grade Achievement Scores

	Language	Science	Social Studies
7-year Scholarship Recipient-users (N=197) vs. Public Scholarship Applicant Non-recipients (N=259)	0.29		0.31
7-year Scholarship Recipient-users (N=197) vs. Public Non-applicants (N=343)	0.32	0.21	0.38

In addition examining effect sizes, placing the achievement test scores within a broader context of national norms also helps to provide a context for interpreting these differences. Table 11 below provides both the grade mean equivalent and the national percentile rank for each of the subject areas where there were statistically significant differences in achievement scores. This Table helps to provide a better understanding of the types of differences exhibited between scholarship students and the public school comparison groups. For example, in language arts, the area where the most consistent and largest differences were found between scholarship students and their peers, scholarship students' adjusted grade mean equivalent was 5.4 (interpreted as 5 years and 4 month) as compared to 4.6 (interpreted as 4 years and 6 months) for public applicant non-recipients and 4.4 (interpreted as 4 years and 4 months) for public non-applicants. In other words, in terms of national norms, sixth grade public school students in the comparison groups are achieving at the equivalent of students mid-way through the fourth grade, whereas scholarship recipients are achieving at a level equivalent to mid-way through fifth grade . Although these scholarship students are still below national norms (i.e., given the timing

of the testing period, the expected grade mean equivalent would be approximately 6.9, or 6 years and 9 months), the seven-year scholarship recipients test scores are closer to average for sixth graders than are the scores of their public school peers who are almost two grade levels behind in language arts achievement. In terms of national percentiles, these scholarship recipients are scoring in the 41st percentile nationally in language arts, as compared to the 29th and 28th percentiles for public school non-applicants and public school applicant non-recipients, respectively.

TABLE 109. Sixth Grade (Spring 2004) Test Scores by Student Group in Achievement Areas Demonstrating Significant Differences: Grade Mean Equivalent (GME) and National Percentile Rank (NP)

Group		Language	Science	Social Studies
7-year Scholarship Recipient-users (N=197)	Score	650	650	650
	GME	5.4	5.6	5.4
	NP	41	37	37
Public Scholarship Applicant Non-recipients (N=259)	Score	638		638
	GME	4.6		4.4
	NP	29		25
Public Non-applicants (N=343)	Score	637	640	634
	GME	4.4	4.9	<4.4
	NP	28	27	22

Although the patterns of findings are not as complicated as those in previous years of the study, the changing patterns over time warrant caution in interpreting findings, while also highlighting the importance of further study. The emergence of statistically significant differences in sixth grade, with 7-year scholarship students outperforming public school students in several subject areas (i.e., scholarship students outperform both public school applicant non-recipients and non-applicant in language and social studies after controlling for minority status, prior achievement and mobility; and scholarship students outperform public school non-applicants in science after controlling for minority status, prior achievement and mobility) raises questions about potential differences in impact during the elementary school years versus the middle school years. Given that CMSD public

schools are organized such that students generally remain in the same school building from K-8 (similar in structure to most private schools) the higher performance levels of the 7-year scholarship students cannot be attributed to academic losses that might typically be associated with public school students making the transition from an elementary school to a middle school.

Therefore, the question remains as to whether there is something different about these middle school years (e.g., stage of adolescent development, changes in subject matter or curriculum and instruction, different expectations for higher levels thinking) that might account for the emergence of statistically significant differences in some subject areas during the sixth grade. Particularly as students progress through these middle school years and beyond, it will be critical to continue to collect new student achievement data to provide more conclusive evidence regarding the long-term impact of publicly-funded school vouchers on student achievement. This type of data is needed to better understand whether the emerging differences during sixth grade in some subject areas is an anomaly, a delayed impact of CSTP, or the beginning of a period of differential impact that might emerge during the middle school years. Given that many of the public school students will begin high school next year, making tracking these students as they transition to new schools both complex and resource-intensive, the 2005-2006 academic year represents a critical year to collect new achievement data to better understand the achievement differences that emerged during the beginning of these students' middle school years. In addition to administering academic achievement tests to the now eighth grade students, data related to any differences in middle school curriculum and instruction in the respective public and private schools would be useful to disentangle the impact of CSTP.