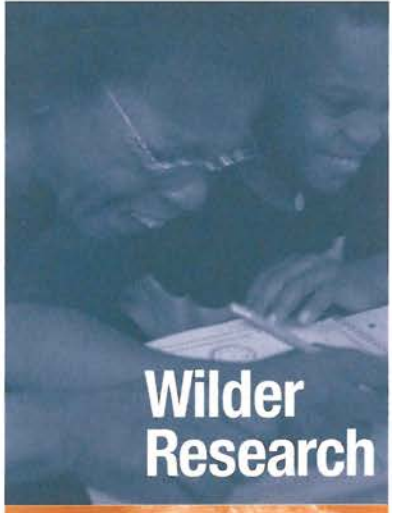

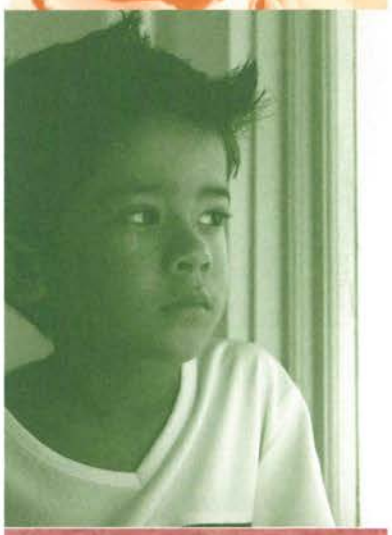

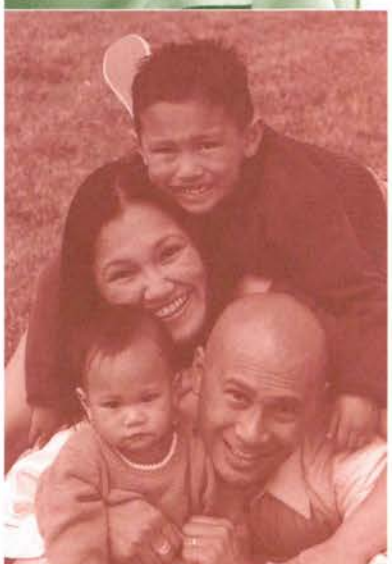

STARBASE Minnesota long-term follow-up study

Overall results

JULY 2012

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Overall results

July 2012

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Summary

> *"STARBASE Minnesota is a 501(c)3 nonprofit organization whose purpose is to inspire and educate urban youth in science, technology, engineering, and mathematics."* —STARBASE Minnesota

STARBASE Minnesota provides fourth- and fifth-grade students with a challenging, week-long science, technology, engineering, and math (STEM) program in a technology-rich environment. The program aims to increase the STEM-related knowledge, skills, and interests of urban youth for greater academic and lifelong success. STARBASE Minnesota is part of a nationwide U.S. Department of Defense (DoD) program aiming to motivate students underrepresented in STEM to explore learning and improve their skills in those areas.

The program has promising short-term results showing increases in participants' STEM knowledge and skills, and contracted with Wilder Research to examine long-term program impacts. Wilder Research conducted its study in three phases from 2009-12. Using a rigorous quasi-experimental design, researchers assessed program impacts related to students' academic achievement in junior high and high school, on-time high school graduation, college enrollment, military enrollment, and interests and involvement in STEM following STARBASE. This summary and report provide an overview of the program, Wilder Research's study methodology, cumulative study findings, and study implications and recommendations.

Program background

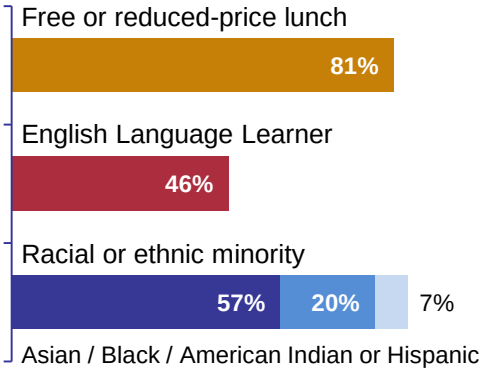
STARBASE Minnesota emphasizes integrated and hands-on STEM learning, scientific-inquiry skills, mathematical concepts, engineering design skills, real-world applications, and exposure to a variety of STEM careers. Participants solve scientific and engineering challenges through a hands-on curriculum. The program takes place in a technology-rich aerospace environment at the Minnesota Air National Guard Base. Funding is provided in large part by the DoD STARBASE program, and supported by the Minnesota National Guard and a number of corporations in the community.

More than 30 Minneapolis and St. Paul elementary schools partner with STARBASE Minnesota each year. The week-long program hosts entire grade levels within schools during the school year. Students are taught by teachers licensed in the state of Minnesota.

Study population

Wilder Research's study followed-up on three cohorts of Saint Paul Public Schools (SPPS) students who participated in STARBASE Minnesota in fourth grade. Study participants were enrolled as 10th-, 11th-, or 12th -grade students in SPPS during the 2008-09 school year when the study began. Consistent with the program's mission, former STARBASE participants in the study represented a diverse population. Figure 1 depicts their demographic characteristics in fourth grade.

1. Profile of former STARBASE participants included in study: Cohorts 1-3 (N=442)



Methodology

STARBASE Minnesota developed a logic model connecting program services to intended short-term, intermediate, and long-term outcomes. Wilder Research's study examined indicators related to the program's long-term vision for its participants. The study's design and methods are summarized here and described in detail in the full report. Additional technical details on study methods are also provided in the Appendix.

Quasi-experimental design

Former STARBASE students were matched one-to-one with demographically and academically similar peers who did not participate in the program. Student pairs were required to match on four characteristics: grade level in 2008-09, high school attended in 2008-09, third-grade math achievement test level score, and third-grade reading achievement test level score. Additionally, pairs needed to match on at least one of the following five characteristics in fourth grade: free or reduced-price lunch eligibility (as a proxy for income), English Language Learner status, special education status, gender, and race or ethnicity.

Based on these criteria, a total of 442 matched pairs were identified, for a total of 884 STARBASE and comparison students in the study. Most student pairs matched on all or most of these demographic characteristics. The matching technique used and the high match rate on all nine characteristics helped ensure that differences between the STARBASE and comparison groups were not likely due to demographic or academic characteristics.

Long-term program effects were examined through analysis of differences between the treatment (STARBASE) and comparison groups on student outcome measures. Differences were further explored based on cohort, demographic characteristics, and program dosage, meaning whether students participated in one or two grade levels. At the time of the study, STARBASE Minnesota was offered to fourth- and sixth-grade students, and most STARBASE study participants (81%) attended the 20-hour program in both grades.

Consideration to school differences

Wilder Research also examined possible school-level differences that might give an advantage to either the treatment or comparison group. Study participants could not have attended an elementary school with a special emphasis on STEM. Researchers also analyzed school-level differences on standardized reading and math tests, and did not find meaningful differences between STARBASE and comparison elementary schools.

Overall findings

Results from Wilder Research's long-term follow-up study indicate STARBASE Minnesota is a meaningful and memorable experience for students, even several years after they participated in the program. In both high school and college, former STARBASE participants provided favorable feedback on the program's impact on their interest in and understanding of STEM areas. When they were in high school, significantly higher percentages of STARBASE than comparison students reported interest in technology and joining the military. Overall, results on long-term outcomes related to on-time high school graduation and college enrollment also favor the STARBASE group, although differences between STARBASE and comparison students on those measures are not statistically significant in most instances.

Taken together, overall results provide some evidence for long-term advantages for students who participated in the program. Additional evidence is provided by "perfect-match" analyses in which high school graduation and college enrollment results appeared more favorable for STARBASE among a subset of study pairs matching on all nine characteristics of interest. In the absence of strong and consistent statistical effects overall, however, the results should be treated as more suggestive of long-term program effects than definitive. Results for individual outcome areas are presented next, followed by a discussion of study implications and future study directions.

Interest in STEM

Wilder Research developed self-administered questionnaires to examine study participants' interest in and understanding of STEM areas, involvement in other STEM opportunities, and future career plans. A paper survey was administered to STARBASE and comparison group students in high school, and an online survey to those STARBASE participants who went on to attend college. Overall, results indicate that former participants perceive the program as a valuable experience which positively impacted their STEM interests and understanding.

Feedback in high school

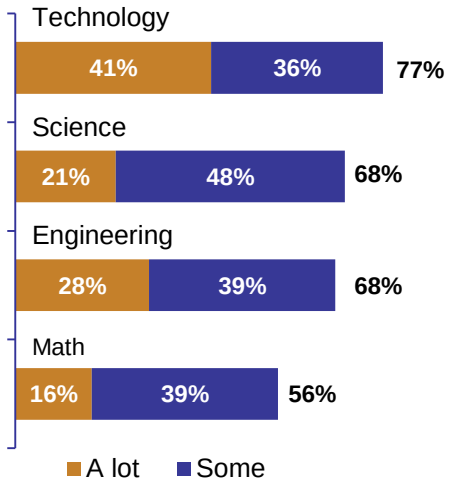
When they were in high school, 507 STARBASE and comparison students completed the survey at four participating SPPS high schools, for a response rate of 71 percent. Depending on their study cohort, students were in 10th, 11th, or 12th grade at the time. Overall, results indicate STARBASE was a valuable experience that helped students learn about STEM areas and careers:

- 82% of former STARBASE participants reported that STARBASE was a valuable learning experience.
- 63% of former STARBASE participants reported the program helped them understand STEM better.
- 73% of former STARBASE participants reported the program helped them learn about STEM careers.

As shown in Figure 2, a majority of the former STARBASE participants also reported the program increased their interest in STEM subjects. This was especially the case with technology, with 77 percent reporting STARBASE increased their interest in technology. Additionally, when compared to the comparison group, significantly higher percentages of STARBASE students reported interest in technology and joining the military.

2. Former STARBASE participants' feedback in high school: Cohorts 1-3 (N=155)

Did STARBASE increase your interest in…



Note. Due to rounding, numbers do not always add up to total.

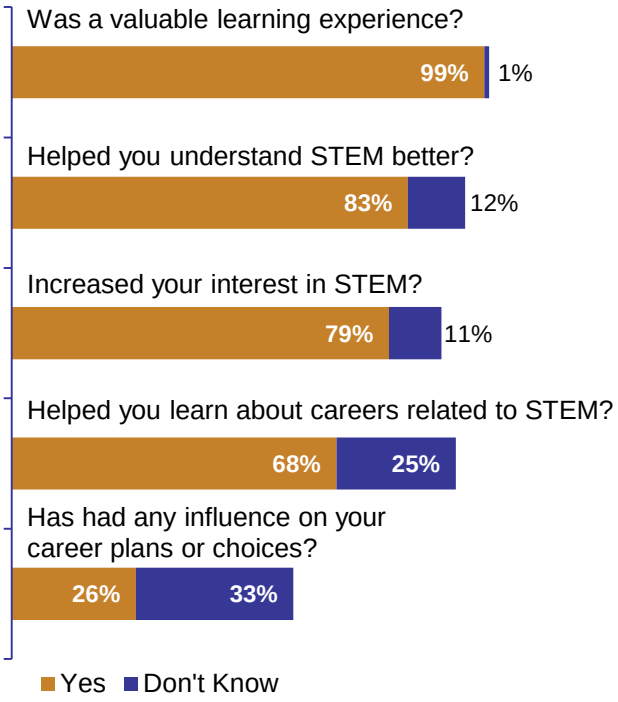
Feedback in college

Wilder Research followed up with the former STARBASE participants again when they reached college. Researchers were able to identify contact information for 130 of the 234 former STARBASE participants across the three cohorts who enrolled in college during the course of the study. A total of 81 students completed the online survey, representing 62 percent of those contacted. Students completed the survey during fall semester of their freshman or sophomore year.

As shown in Figure 3, almost all college students completing the survey reported that STARBASE was a valuable learning experience. Most reported that the program helped them understand STEM better and increased their interest in STEM. A majority indicated STARBASE helped them learn about STEM careers, and about a quarter indicated the program had influenced their career plans.

3. Former STARBASE participants' feedback in college: Cohorts 1-3 (N=81)

Do you think STARBASE...



Academic achievement

Phase I of the study examined the courses taken and academic achievement of STARBASE and comparison students when they were in junior high and high school. Wilder Research looked at a number of indicators, such as students' course selection and academic performance in STEM areas, indicators of STEM momentum, and indicators of overall academic progress and motivation. The Saint Paul Public School District provided school records data on study participants, who were in 10th, 11th, or 12th grade at the time. Due to subsequent changes in district data-sharing policies, researchers were not able to continue assessing these academic indicators as study participants progressed through high school.

In general, STARBASE and comparison students performed similarly on the indicators examined. There were statistically significant differences in favor of STARBASE students in the following three areas, although they could be due to chance given the large number of statistical tests performed:

- Junior high school grade average in science
- 10th-grade Algebra 2 completion, indicating a rigorous math schedule
- Senior high school attendance as a measure of overall academic motivation

Results were also analyzed based on program dosage. Students who attended STARBASE in fourth grade only constituted the lower-dosage group, and students who attended in both fourth and sixth grades the higher-dosage group. There was a modest pattern of higher-dosage STARBASE participants performing slightly better than lower-dosage participants on both the academic achievement measures and survey items in high school.

High school graduation

After high school, students' academic achievement was assessed in terms of on-time high school graduation and college enrollment. The Minnesota Department of Education provided aggregate data on students' on-time high school graduation rates, meaning graduation by the end of their fourth year of high school. Phase II of the study examined the high school graduation rates of Cohorts 1 and 2, and comparable data were added for Cohort 3 once available in Phase III.

Overall results

Looking at all three study cohorts combined, 77 percent of STARBASE and 74 percent of comparison students graduated from high school on time (Figure 4). The overall difference was not statistically significant.

4. STARBASE and comparison students' on-time high school graduation: Cohorts 1-3 (N=883)

Results varied by cohort, with Cohort 2 showing the strongest results and a statistically significant difference in favor of STARBASE. Graduation rates were slightly higher for STARBASE than comparison students in Cohort 1, and did not differ between STARBASE and comparison students in Cohort 3. Consistent with the earlier dosage pattern, higher-dosage students performed better than lower-dosage students in on-time high school graduation overall. Differences were significant in the comparisons between the higher- and lower-dosage STARBASE groups (79% vs. 68%) and between the higher-dosage STARBASE group and comparison group (79% vs. 74%).

Perfect-match analysis

High school graduation rate analyses were also performed on a subset of the study population: the 594 study participants (297 pairs) who matched on all nine characteristics of interest. Results were more favorable for the STARBASE group than in the analysis of all study participants. In the perfect-match analysis, 80 percent of STARBASE students and 74 percent of comparison students graduated from high school on time, and the difference was statistically significant. In establishing the study's matching criteria, researchers strove to balance the size and representativeness of the sample with similarity of matches. Although study pairs were very similar overall, results looked more favorable for STARBASE when demographic differences between STARBASE and comparison students were further controlled in the perfect-match analysis. This provides additional evidence of potential long-term program effects.

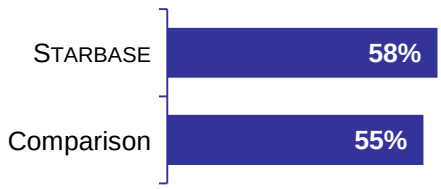
College enrollment

Wilder Research also examined STARBASE and comparison students' college enrollment, based on individual student-level data obtained from the National Student Clearinghouse. Data reflect whether study participants enrolled in college by fall 2011, which would have been just over two years after high school graduation for Cohort 1 if they graduated on time, just over a year after high school graduation for Cohort 2, and the fall after high school graduation for Cohort 3. Phase II reported college enrollment rates as of fall 2010 for Cohorts 1 and 2, and researchers obtained updated enrollment data for all three cohorts as of fall 2011 in Phase III.

Overall results

As with the on-time high school graduation analysis, overall results favored STARBASE but were not statistically significant. As of fall 2011, 58 percent of former STARBASE participants and 55 percent of comparison students had enrolled in college (Figure 5). Results varied by cohort in a pattern similar to the high school graduation data. The modest pattern observed in earlier analyses of STARBASE students with a higher dosage performing better than those with a lower dosage did not emerge in the college-enrollment analysis.

5. STARBASE and comparison students' college enrollment by fall 2011: Cohorts 1-3 (N=884)



College enrollment data were also analyzed based on college characteristics and students' demographic characteristics. A majority of both STARBASE and comparison students who enrolled in college enrolled in public and four-year universities, and almost all attended colleges in Minnesota. Overall, there were no significant differences in college enrollment between STARBASE and comparison students based on their demographic characteristics. However, although differences were not significant, there was a clear pattern of a higher percentage of STARBASE than comparison students enrolling in college within each demographic category.

Perfect-match analysis

As with the high school graduation data, college-enrollment data were also examined for the subset of STARBASE and comparison study participants matching on all nine characteristics of interest. In this analysis of only the 297 perfectly matched pairs, a 4-percentage-point difference separated the two groups (60% of STARBASE vs. 56% of comparison), vs. the 3-percentage-point difference in the analysis of all 442 study pairs. The difference was not significant, although results again appeared more favorable for STARBASE when demographic differences between STARBASE and comparison students were controlled to the extent possible.

Military enrollment

In assessing the program's impact on STEM career interests, Wilder Research also examined STARBASE and comparison students' military enrollment, including civilian and uniform military careers. Data were provided by a U.S. Air Force official. Based on searches in the DoD Global Directory Service, 3 percent of former STARBASE participants and 2 percent of comparison students were enrolled in the military in winter 2011-12. These data are considered to be conservative estimates and should be viewed with caution. In some cases, there was more than one person in the military database with the same name, and an exact match to study participants could not be confirmed.

Study implications and recommendations

The STARBASE program should be credited for undertaking a rigorous study providing an independent examination of long-term program outcomes. Demonstrating long-term impacts can be challenging, even when initial results are strong. Results of Wilder Research's study are favorable for the STARBASE program and suggest possible long-term program impacts, although there were not consistent statistical effects. This suggests it may be important to find ways of sustaining and building on participants' STEM interests and skills over time. Study

results can inform the program's efforts to sustain program effects, as well as any future studies of its long-term impact.

Supporting long-term program impacts

Results of Wilder Research's surveys of former STARBASE participants in high school and college suggest they had relatively limited participation in other STEM activities after STARBASE, despite crediting the program with positively influencing their STEM interests. Finding ways to support students' continued STEM learning and exploration may be particularly important for a predominantly low-income population who may have limited access to other similar opportunities. The program has taken a number of steps to support participants' STEM learning beyond STARBASE.

STARBASE Minnesota provides school teachers with pre- and post-lessons for their classes at school and a curriculum overview with alignment to standards to help integrate programming into school curricula. Students can also participate in post-STARBASE "Clubhouse" activities via the STARBASE website, and earn lanyards and pins for successful completion of these STEM lessons. Beginning in the 2011-12 school year, STARBASE Minnesota also partnered with afterschool programs at some of its Minneapolis sites to implement the national DoD STARBASE 2.0 mentoring program. With the help of volunteer mentors from the community, STARBASE 2.0 aims to reinforce and build on STARBASE program concepts when students reach middle school. Looking to the future, STARBASE Minnesota is pursuing a STEM "Pathways" model, described below.

STEM Pathways model

In Phase II of the study, STARBASE Minnesota supported development of a STEM program inventory to identify other community organizations and programs able to support participants' STEM interests and learning after STARBASE. Wilder Research compiled a directory of 171 local STEM programs and organizations, now available on the STARBASE Minnesota website. Based on this information as well as relationships developed through the Minnesota STEM Network, STARBASE identified potential community partners for a STEM Pathways model.

The STEM Pathways model would link STARBASE Minnesota with local STEM collaborators to form a STEM pipeline for participants. STARBASE would partner with other community organizations to sustain and build on its participants' STEM interests and skills over time. In the model's initial design, STARBASE Minnesota would collaborate with at least five other local STEM programs to connect former STARBASE participants to informal STEM education opportunities from their time in STARBASE through middle school and to high school graduation. Additionally, if available at participants' schools, Pathways students would attend the STARBASE 2.0 mentoring program when they were in middle school.

The model's intent is to increase the likelihood of sustaining initial STARBASE program impacts over time. By collaborating with other programs, STARBASE would leverage existing community resources, thereby minimizing additional costs to any single program. Partnering programs would be reviewed by STARBASE to ensure they provide programming consistent with the STARBASE mission. Given its potential relevance to the national STARBASE program, the model would also be designed to be potentially transferrable to other locations. Study considerations for this model, were it to be piloted, are described below.

Future study directions

STARBASE leadership have expressed a commitment to research. An ongoing evaluation at the national level assesses the program's short-term results, and leadership have expressed interest in continuing to assess the program's long-term impacts. Wilder Research's long-term follow-up study of STARBASE Minnesota points to possible directions and considerations for future studies.

Prospective study

One possible direction for a future study would be a prospective study in which program participants and comparison group students are followed from their time in the program forward. Wilder Research's initial study was retrospective in that it followed up on students several years after they participated in the program. A prospective study would enable researchers to assess changes in STARBASE-comparison group differences over time, and maintain better contact with study participants as they progress through school and beyond.

Additional impacts

It is possible that STARBASE has long-term impacts which were not reflected in the outcomes measured in this study. For example, there could be long-term impacts on students' college major, career choices, critical thinking skills, or motivation to learn. Wilder Research's study addressed college major and career interests to some extent, but only for STARBASE participants in college and not the comparison group. In its future planning, the program can use results of Wilder Research's study to consider what long-term outcomes should and can reasonably be expected and measured following STARBASE participation.

Evaluation of STEM Pathways model/STARBASE 2.0

Study results suggest the importance of finding ways to support and sustain initial program impacts over time. If STARBASE Minnesota piloted the STEM Pathways model, including STARBASE 2.0 as a possible component, a longitudinal study could be designed to explore long-term impacts on students who were intentionally connected to a pipeline of

opportunities following their initial STARBASE participation. A study of Pathways and/or STARBASE 2.0 could address the key question of whether the STARBASE effect could be enhanced by these efforts. The study might include both formative and summative components, providing information useful in refining the Pathways model during its initial years, and ultimately assessing the model's long-term impacts. Because a Pathways study would assess a pilot initiative, it would be considered a demonstration study intended to determine whether the model should be expanded and possibly replicated at other sites.

In this design, STARBASE/Pathways students would be carefully matched to a comparison group at baseline. Three study groups might be identified: students participating in STARBASE only, students participating in both STARBASE and Pathways, and comparison group students not participating in STARBASE or Pathways. Ideally, STARBASE students would be randomly assigned to participate in Pathways in order to most effectively assess the relative contributions of STARBASE and Pathways. As part of the study, it would be important to gather information on the STARBASE, Pathways, and comparison students' participation in other STEM opportunities not intentionally facilitated by Pathways.

Students in the three groups would be followed from baseline at the time of STARBASE participation, through their middle school and high school years, and beyond. It would be important to have the school district's collaboration in the study in order to obtain student records data and have access to study participants. The study's prospective design would enable researchers to contact treatment and comparison students upfront, which could be helpful in maintaining long-term contact with study participants. For example, researchers might provide information about the study in an initial letter as well as incentives for their continued participation. Active consent for study participation could be sought at this time, with considerations to how consent could best be handled with the comparison group. Ultimately, if the Pathways model were deemed effective and expanded to other STARBASE locations, the program could consider a national study that would assess impact across multiple sites.

Introduction

Overview

STARBASE Minnesota is a week-long science, technology, engineering, and math (STEM) program for students in fourth and fifth grades. The program serves more than 3,400 students each year from urban schools in Minneapolis and St. Paul, and is part of a nationwide U.S. Department of Defense (DoD) program aiming to motivate students underrepresented in STEM to explore learning and improve their skills in those areas. Wilder Research conducted a long-term follow-up study of former STARBASE Minnesota participants. Researchers used a rigorous quasi-experimental design to assess long-term program impacts on participants' interest in STEM, academic achievement, high school graduation, college enrollment, and military enrollment. Wilder Research conducted the study in three phases, with the third and final phase completed in spring 2012. This report presents Wilder Research's cumulative findings across all three study phases.

Program description

STARBASE Minnesota offers school-year and summer programming for fourth- through sixth-grade students, as well as field experiences for college students in the education program at the University of St. Thomas. Following are descriptions of STARBASE Minnesota's student programs, including its core school-year program as well as summer programming for students. The core program was the focus of Wilder Research's study. Finally, a brief description of the national STARBASE program is provided.

STARBASE Minnesota

Core program overview

STARBASE Minnesota's core program is a week-long STEM program during the school year. At the time of this study, the program was offered to students in fourth and sixth grades. Beginning in the 2010-11 school year, the program is now offered to fourth and fifth grades. Students use a hands-on curriculum in a technology-rich aerospace environment to solve scientific and engineering challenges. The 20-hour program emphasizes integrated and hands-on STEM learning, scientific-inquiry skills, engineering design, mathematical concepts, real-world applications, and career exposure. Established in 1993, and academically strengthened beginning in 2000 and throughout subsequent years, the program's purpose is to increase the knowledge, skills, and interest of urban youth in STEM for greater academic and lifelong success.

More than 30 Minneapolis and Saint Paul elementary schools partner with STARBASE Minnesota each year, and many have been doing so for several years. The program hosts entire grade levels within schools during the school year and is located at the 133rd Airlift Wing of the Minnesota Air National Guard Base. There is no fee for participation; schools are responsible for providing transportation and student lunches. Classroom teachers and assistants attend with their students. Funding is provided primarily by the U.S. DoD and supported by the Minnesota National Guard. Corporations in the community such as 3M, BAE Systems, Boston Scientific, Delta Air Lines, Ecolab, General Mills, Lockheed Martin, Medtronic, Seagate, Stratasys, Toro, and others provide volunteer, in-kind, and financial support.

Students are taught by teachers licensed in the state of Minnesota. At the beginning and end of each program, students are administered pre- and post-tests to measure change in knowledge and application of STEM skills and their career interests, as well as attitudes toward STEM subjects. Additionally, school teachers are given pre- and post-lessons for their classes at school and a curriculum overview with alignment to state and national standards. Students can also participate in post-STARBASE "Clubhouse" activities via the STARBASE website, and earn lanyards and pins for successful completion of these STEM lessons.

Core program

In the fourth-grade program, STARS 1, students test the earthly limits of flight as they explore current and future design challenges which push the boundaries of speed, atmospheric barriers, and increasing numbers of aircraft in the sky. The student engineers develop scientific inquiry skills as they formulate questions, test predictions, and conduct experiments related to air, motion, rocketry, and heat in the attempt to design a flight vehicle of the future. Students then apply this knowledge as they design their own aircraft using Pro/ENGINEER computer animated design software and as they build, launch, and test a rocket. Math and technology concepts and tools are used throughout the program, such as data collection, median, mode, range, measuring, estimating, and navigation using GPS technology. Students also learn explore STEM-related careers and paths to pursuing those careers.

In the fifth-grade program, STARS 2, students develop STEM skills as they attempt to answer the question, "How can we engineer robotic and human missions to Mars?" Students investigate the planetary conditions of Mars and identify the design and engineering needs of its rover and human Mars exploration missions. Students conduct scientific experiments integrating math, technology, and engineering to learn more about Newton's Laws of Motion, robotics, the atmospheres of Earth and Mars, air pressure, friction, heat transfer, and the vacuum of space. They learn about units of measurement,

estimating, and coordinate graphing, and explore technology-based designs and functions. Students experience the work of scientists and engineers as they use Pro/ENGINEER software to design a rocket and Mars colony. They use robotics software to program and test Mars rovers. Throughout the five-day program, students have the opportunity to explore various STEM careers and paths through challenge videos, a career exploration website, and letters of advice they write to themselves about how they can achieve their career goals.

Summer program

Between 2000 and 2006, STARBASE Minnesota also provided programming to eighth-grade students who were enrolled in Saint Paul Public Schools summer school for academic reasons. At the request of the school district, this STARBASE summer program emphasized the reinforcement of math concepts, not broad-based STEM learning. Eighth-grade participation was not considered in this study for these reasons and due to the small number of participants.

Since 2007, STARBASE Minnesota has provided a supplementary summer program called the Next Generation Summer Camp for fourth- through sixth-grade students in the Twin Cities metropolitan area. Built around engineering concepts, the program's premise is a mission to Mars. Students map the surface of Mars, design rockets and rovers needed for exploration, and plan and design a future city on Mars. This 20-hour program serves approximately 500 youth each summer.

National program

STARBASE Minnesota is part of a U.S. DoD program aiming to motivate students underrepresented in STEM to explore learning and improve their skills in those areas (DoD STARBASE, n.d.). DoD STARBASE currently operates at 76 locations in 40 states plus the District of Columbia and Puerto Rico, and served nearly 70,000 students in 2011 (DoD STARBASE, 2011). In 2010, DoD STARBASE piloted the STARBASE 2.0 afterschool mentoring initiative to reinforce and build on program concepts when students reach middle school. STARBASE Minnesota and this study are funded in large part by the U.S. DoD.

Study purpose

STARBASE Minnesota developed a program logic model that defines the need, solution, and expected program outcomes for students and teachers. The logic model identifies a number of expected initial outcomes during the STARBASE program, intermediate outcomes within a year of participating in STARBASE, long-term outcomes within junior and senior high school, and a long-term vision for students beyond high school. The

purpose of Wilder Research's study was to examine the expected long-term outcomes in high school (Phase I) and at high school graduation and beyond (Phases II and III). At a national level, DoD STARBASE engages in an ongoing assessment of the program's short-term impacts (DoD STARBASE, 2011). In addition to the national evaluation, a previous study of STARBASE Atlantis examined initial program impacts (Lee-Pearce, et al., 1998), and STARBASE Minnesota has conducted some small follow-up surveys to gauge initial and intermediate impacts (Van Wie, 2001, 2006). Evidence of short-term impacts documented in these studies provided rationale for Wilder Research's investigation of long-term program impacts.

Contents of the report

This report presents Wilder Research's cumulative findings across all three phases of the STARBASE Minnesota long-term follow-up study. Findings specific to Phase I and Phase II were presented in earlier reports available on Wilder Research's website (Broton & Mueller, 2009; Mohr & Mueller, 2011). Following an initial section on study methodology, this report presents results for the major outcome areas examined across the three study phases:

- **Interest in STEM** (results of Phase I high school survey and combined results of Phase II and III college surveys)
- **Academic achievement** (results of Phase I school records analysis)
- **High school graduation** (results of Phase III analysis of Cohorts 1-3; preliminary analysis for Cohorts 1-2 was conducted in Phase II)
- **College enrollment** (results of Phase III analysis of Cohorts 1-3; preliminary analysis for Cohorts 1-2 was conducted in Phase II)
- **Military enrollment** (results of Phase III analysis of Cohorts 1-3; preliminary analysis for Cohorts 1-2 was conducted in Phase II)

Finally, the Appendix provides supplemental information, including additional technical details of study methods; supplemental demographic information by cohort and dosage; results of the high school survey; results of the Phase III college survey including students' written comments; results of the school records analysis; supplemental high school graduation and Minnesota Comprehensive Assessment (MCA-II) proficiency data; supplemental college enrollment data; and copies of the high school and Phase III college survey instruments. Complete results of the Phase II college survey and a copy of that instrument were presented in the Phase II report (Mohr & Mueller, 2011).

Methodology

This section provides an overview of Wilder Research's long-term follow-up study of STARBASE Minnesota, including the study design, population, study phases, data sources, and data analysis methods. Additional technical details regarding the matched-comparison design, survey administration and analysis, construction of academic achievement indicators, and tests for statistical significance can be found in the "Technical details of study methods" section of the Appendix.

Study design

Wilder Research used a rigorous matched-comparison design in which former STARBASE students were matched one-to-one with demographically and academically similar peers who did not participate in STARBASE. The effects of the STARBASE program were studied through analysis of differences between these two groups on student outcome measures. Criteria used in developing the STARBASE and comparison groups are described below.

STARBASE group

The study included three cohorts of Saint Paul Public Schools (SPPS) students who participated in STARBASE as 4th-grade students and were enrolled as 10th-, 11th-, or 12th-grade students during the 2008-09 school year. For purposes of study eligibility, students were required to participate in STARBASE in fourth grade to maximize their potential program exposure or dosage, as they could have participated again in sixth grade and even in the summer before eighth grade. Additionally, these students must have been enrolled in SPPS in third grade when they took achievement tests in math and reading.

Researchers had several reasons for using these criteria. The Saint Paul school district was chosen because the majority of students served by STARBASE come from this district, and it seemed likely that study results found in Saint Paul would apply to Minneapolis since the two districts serve similar student populations. Additionally, these student cohorts participated in STARBASE after it was strengthened academically and after the STARBASE student record system was improved, which was important to the feasibility of this study. This study group also likely represented a more stable student population because students were required to be enrolled in SPPS in third and fourth grades as well as in high school, therefore excluding more transient students.

Comparison group

STARBASE students were compared to demographically and academically similar SPPS students who did not participate in the program. To be eligible for the comparison group,

students must have been enrolled in SPPS as a 10th-, 11th-, or 12th-grade student during the 2008-09 school year and during their 3rd- and 4th-grade years. Students who met these criteria were then screened using STARBASE program records to ensure they had not participated in the program.

Matching procedure

A multi-stage matching methodology was used to match STARBASE and comparison students on nine observable characteristics. Student pairs were required to match on the following four characteristics: grade level in 2008-09, high school attended in 2008-09, third-grade math achievement test level score, and third-grade reading achievement test level score. Additionally, pairs had to match on at least one of the following five characteristics in fourth grade: free or reduced-price lunch eligibility (as a proxy for income), English Language Learner status, special education status, gender, and race or ethnicity.

Based on these criteria, 442 of 501 (88%) eligible STARBASE participants were matched to a comparison student. Of the 442 matches, 7 in 10 (69%) student pairs matched on all nine characteristics, and an additional 23 percent matched on seven or eight characteristics. The study sample was composed of these 884 students. STARBASE students who were not matched were least typical with regard to this combination of characteristics and were not included in the sample. The matching technique used and the high match rate on all nine characteristics helped to ensure that any differences found between the STARBASE and comparison groups were not likely due to demographic or academic characteristics. More details on the matching procedure can be found in the Appendix ("Technical details of study methods" section).

Considerations to school differences

Beyond the student-level matching criteria, another selection criterion was that study participants did not attend an elementary school that had a special STEM emphasis. In fourth grade, comparison group students could not have attended an elementary school that participated in STARBASE or had a special emphasis on math, science, or technology (e.g., Crossroads Science). This issue was also taken into consideration with regards to the treatment (STARBASE) group. One of the STARBASE schools had an aerospace program that was just starting at the time. Researchers examined academic results for students in that school, and found that they did not differ in meaningful ways from students in the comparison group. Based on this, the school's emerging STEM emphasis was determined not to be a study factor due to its very early stage at that time.

Researchers also looked for potential school-level differences between STARBASE and comparison elementary schools that might give an advantage to either group. Third- and fifth-grade Minnesota Comprehensive Assessment (MCA) math and reading achievement

test results did not indicate a pattern of academic advantage for students attending STARBASE schools compared to students attending comparison schools. While it was not possible to control for all potential school-level differences, this analysis suggested that STARBASE schools did not have stronger academic programs, including math programs, than comparison schools.

Study population

The 884 study participants comprised three cohorts based on their grade level in 2008-09. The treatment (STARBASE) group also comprised two dosage groups based on students' level of exposure to the program. The numbers of participants in each cohort and dosage group are provided below, followed by demographic information for all STARBASE vs. comparison study participants. Demographic characteristics by cohort and dosage are provided in Figures A4-A9 in the Appendix.

Cohorts

The three study cohorts were defined as follows:

- **Cohort 1:** 12th grade in 2008-09 (146 STARBASE and comparison students or 73 matched pairs)
- **Cohort 2:** 11th grade in 2008-09 (270 STARBASE and comparison students or 135 matched pairs)
- **Cohort 3:** 10th grade in 2008-09 (468 STARBASE and comparison students or 234 matched pairs)

Dosage

Former STARBASE participants were also categorized into two dosage groups based on their level of exposure to the program. Dosage groups were defined as follows:[1]

- **Lower-dosage group:** Participated in STARBASE in 4th grade only (82 students)
- **Higher-dosage group:** Participated in STARBASE in both 4th and 6th grades (359 students)

Eighth-grade participation was not considered in the construction of the dosage variable because the eighth-grade summer program did not emphasize broad-based STEM learning, and there were very few students in the sample who attended STARBASE in eighth grade. Therefore, students with a lower dosage attended STARBASE in fourth grade, did not attend in sixth grade, and may or may not have attended in eighth grade. Students with a higher

[1] Dosage level was not known for one STARBASE student.

dosage attended STARBASE in fourth and sixth grades, and may or may not have attended in eighth grade. Most of the schools that STARBASE students attended in fourth grade participated in STARBASE again two years later when those students were in sixth grade, providing the opportunity for many students to have a higher dosage level.

Demographic characteristics

Figure 6 provides the demographic characteristics of all 884 STARBASE and comparison group students included in the study. As described earlier, student pairs were required to match on one or more of these five demographic characteristics, in addition to matching on all four of the following characteristics: grade level in 2008-09, high school attended in 2008-09, third-grade MCA math level score, and third-grade MCA reading level score. Overall, the two groups were very similar on these demographic characteristics given the matching procedure and high match rate across characteristics. The only statistically significant difference found was in special education status, with STARBASE students significantly more likely to be categorized as special education than comparison group students (11% vs. 8%, respectively). Although the difference was only 3 percentage points, the large sample size and statistical power make it easier to obtain significance.

6. Profile of study participants: Cohorts 1-3 overall

Characteristic[a]		STARBASE N=442	Comparison N=442	Significance
Free or reduced-price lunch	Eligible	81%	83%	ns
	Ineligible	19%	17%	
English Language Learner	Yes	46%	45%	ns
	No	54%	55%	
Special education	Yes	11%	8%	*
	No	89%	92%	
Gender	Male	49%	48%	ns
	Female	51%	52%	
Race/ethnicity	White (not Hispanic)	16%	16%	ns
	Asian	57%	57%	
	Black (not Hispanic)	20%	20%	
	Hispanic	6%	6%	
	American Indian	1%	1%	

* *p<.05*

ns no statistically significant differences between groups

[a] *Characteristic as of 4th grade.*

Note. Demographic characteristics by cohort and dosage are provided in Figures A4-A9 in the Appendix.

Demographic characteristics of matched pairs were also examined by cohort and dosage level. In some cases, there were a very small number of students within each demographic category. Overall, STARBASE and comparison students again appeared very similar. By cohort, the only statistically significant difference found was in the special education status of STARBASE vs. comparison group students in Cohort 2, with Cohort 2 STARBASE students significantly more likely to be categorized as special education (13%) than their matched pairs (6%) (Figure A5). This difference did not appear to place the STARBASE group at a disadvantage in study analyses given that Cohort 2 showed the strongest STARBASE-comparison group differences in favor of STARBASE on the high school graduation and college enrollment indicators. By dosage, the only significant difference was in the special education status of higher-dosage STARBASE vs. comparison students (11% vs. 8%) (Figure A7). Looking at only STARBASE students, the only significant difference by dosage was in race or ethnicity, with significantly more Asian students in the higher-dosage group and significantly more Black students in the lower-dosage group (Figure A9).

Study phases

As previously described, Wilder Research conducted its follow-up study of STARBASE Minnesota participants in three phases. Phase I represented the original study. Following Phase I, additional funding was provided which enabled Wilder Research to design and conduct two subsequent study phases, as described below. This report presents cumulative study findings across all three phases. Complete results for Phases I and II were presented in earlier reports available on Wilder Research's website (Broton & Mueller, 2009; Mohr & Mueller, 2011).

Phase I

In 2007, the Minnesota State Legislature appropriated funding for a follow-up study assessing long-term impacts on academic achievement as a result of participation in STARBASE Minnesota *(Laws of Minnesota* 2007). To this end, the Minnesota Department of Military Affairs contracted with Wilder Research to conduct a follow-up study of program participants. The initial study assessed the potential impact of participation in STARBASE Minnesota on high school students' interest, motivation, knowledge, and skill development in STEM, as well as their career interest in STEM including the military. At the time, study participants were in 10^{th}, 11^{th}, or 12^{th} grade.

Phase II

Following the initial study, the Office of the Assistant Secretary of Defense for Reserve Affairs and STARBASE Minnesota provided funding for two subsequent study phases. Phase II, completed in March 2011, followed up on the first two cohorts of former STARBASE Minnesota participants after high school graduation. These students graduated from high school in spring 2009 (Cohort 1) or spring 2010 (Cohort 2) if they graduated on time. Wilder Research examined their on-time high school graduation rates, college enrollment, military enrollment, and long-term STEM interest and involvement. Phase II also examined the availability of programs in the broader local STEM community to sustain students' STEM interests and skills following participation in STARBASE Minnesota. Wilder Research also intended to continue assessing study participants' performance on the academic achievement indicators designed in Phase I as students progressed through high school, but changes in district data-sharing policies prevented access to this data following the initial study phase.

Phase III

The third and final phase of Wilder Research's study followed up on the third cohort of study participants after high school graduation. These students graduated from high school in spring 2011 if they graduated on time. As in Phase II, Wilder Research assessed students' on-time high school graduation rates, college enrollment, military enrollment, and long-term STEM interest and involvement. Updated college and military enrollment data were obtained for all three cohorts at this time.

Data sources

Wilder Research obtained data from several sources, depending on the outcome area assessed. Following are descriptions of each data source and its use in the study's design or measurement of indicators. Data sources described here include the following:

- STARBASE records
- Saint Paul Public Schools records
- High school student survey
- College student surveys
- High school graduation data
- College enrollment data
- Military enrollment data

STARBASE records

In 1998-99, the STARBASE Minnesota student record system was substantially improved. The STARBASE database provided reliable information on student participation and level of program exposure. STARBASE also recorded students' unique identification (ID) numbers assigned by the school district, which allowed students' school records to be examined four to eight years after program participation. Additionally, the database was used to screen comparison students to ensure they had not participated in the program. The STARBASE student record system included the following information:

- Student name and ID number
- Student grade level and dates of program participation
- Student level of STARBASE dosage (participation in 4th, 6th, 8th grades)

STARBASE also provided program information on which elementary schools and grade levels participated in the program each year.

Saint Paul Public Schools records

SPPS records provided information used to match STARBASE and comparison group students, and to construct study indicators related to academic achievement in junior high and high school. Technical details on the construction and analysis of school records indicators are provided in the Appendix ("Technical details of study methods" section). SPPS provided record data for the three cohorts of students from school years 2005-06 through 2007-08 and the first half of 2008-09 as shown in Figure 7 below. Information was also provided when students were in third and fourth grades for matching purposes.

7. School record data available

	Grade level		
School year	**Cohort 1**	**Cohort 2**	**Cohort 3**
2008-09[a]	12	11	10
2007-08	11	10	9
2006-07	10	9	8
2005-06	9	8	7

[a] *Data were available for the first semester only.*

Saint Paul Public Schools records included the following information:

- Student ID number
- Student demographics (in 4th grade)
- 3rd-grade math and reading achievement test results (MCA)
- School attended in 4th grade (and 6th grade for some cohorts)
- School year in which attended 4th grade
- School attended in 2008-09
- Grade level in 2008-09
- Courses taken in senior high school (and junior high school for some cohorts)
- Grades in senior high school courses (and junior high school for some cohorts)
- Math achievement test results in senior high school (MCA-II) (or junior high school MCA results for some cohorts)
- High school attendance in 2007-08

High school student survey

A total of 716 STARBASE and comparison students at four SPPS senior high schools were identified to participate in the Phase I self-administered survey of high school students. At the time of the survey, students were in 10th, 11th, or 12th grade. A copy of the survey instrument is provided in the Appendix. Topics covered included the following:

- Ratings and comments about STARBASE participation and what it may have meant
- STEM-related activities or programs in which the student was currently participating or had participated
- Level of interest in STEM, and whether STARBASE participation influenced this interest level
- Future educational and career plans, including interest in joining the military

The survey response rate was 71 percent, with 507 of the 716 identified students completing the survey in spring 2009. Additionally, 170 matched student pairs remained

intact representing two-thirds (67%) of all completed surveys, and these 340 surveys were included in the survey analysis. Details on survey administration and characteristics of matched pairs included in the survey are provided in the Appendix ("Technical details of study methods" section).

College student surveys

In Phases II and III, Wilder Research conducted an online survey of former STARBASE students who were enrolled in college. The Phase II survey was administered in November-December 2010 to participants in Cohorts 1 and 2 enrolled in college in fall 2010. These students would have graduated from high school in spring 2009 (Cohort 1) or spring 2010 (Cohort 2) if they graduated on time, and therefore would have been in the fall semester of their freshman or sophomore year at the time of the survey. The Phase III survey was administered in November 2011-January 2012 to Cohort 3 students enrolled in college in fall 2011. Cohort 3 students graduated from high school in spring 2011 if they graduated on time, and would have been in the fall of their freshman year if they graduated on time.

The Phase II and Phase III versions of the survey were very similar, with some questions reordered or slightly reworded in Phase III to capture information important to the program. A copy of the Phase III survey is provided in the Appendix of this report, and the Phase II version is provided in the Appendix of the Phase II report (Mohr & Mueller, 2011). Topics covered in the college surveys were similar to those covered in the high school survey, and included the following:

- Participant perceptions of the impact of STARBASE
- STEM-related activities or programs in which the student was currently participating or had participated, and challenges they faced to participating in other STEM activities after STARBASE
- Level of interest in STEM, and whether STARBASE participation influenced this interest level
- College major and career plans, including interest in joining the military

Information on students' college enrollment at the time of the surveys and the colleges they were attending was obtained from the National Student Clearinghouse. Wilder Research used this information to search for contact information for former STARBASE participants who were enrolled in college in fall 2010 (Phase II) and fall 2011 (Phase III). A number of efforts were undertaken to locate contact information for these students, resulting in identification of contact information for a total of 130 of the 234 students

across the three cohorts who would have been eligible for the survey. Across the two study phases in which the surveys were administered, a total of 81 students completed the surveys, representing 62 percent of those contacted and 35 percent of the former STARBASE students enrolled in college who would have been eligible. Details on survey administration and Wilder Research's contact efforts are provided in the Appendix ("Technical details of study methods" section).

High school graduation data

The Minnesota Department of Education (MDE) provided high school graduation data for STARBASE and comparison students. MDE provided aggregate counts of the higher-dosage, lower-dosage, and comparison students falling into each of the following three categories:

1. Graduated from a public Minnesota high school on time (defined as end of the 2008-09 school year for Cohort 1, end of the 2009-10 school year for Cohort 2, and end of the 2010-11 school year for Cohort 3)

2. Continued to be enrolled in a public Minnesota high school the subsequent fall (fall 2009 for Cohort 1, fall 2010 for Cohort 2, and fall 2011 for Cohort 3)

3. Did not graduate from a public Minnesota high school on time and was not enrolled in a public Minnesota high school the subsequent fall

Graduation status was determined based on a student having a MARSS (Minnesota Automated Reporting Student System) status end code indicating graduation. It is possible that some students falling into the third category could have graduated from a private or out-of-state school. Because enrollment in and graduation from private schools is reported only in aggregate, MDE was not able to link individual study participants to private school records.

Graduation data were requested in both Phase II and Phase III of the study. Data on Cohorts 1 and 2 were requested in Phase II and presented in that report (Mohr & Mueller, 2011). Students in Cohort 3 would have still been enrolled in high school at the time of the Phase II report. Graduation data on the third cohort were available and requested in Phase III. This report presents combined results for all three study cohorts.

Though not a key study outcome, high school standardized test results were also obtained from MDE in Phase III to examine whether STARBASE and comparison students appeared different at the time of graduation, beyond their on-time graduation status. This supplemental Minnesota Comprehensive Assessment (MCA-II) data is described in the "High school graduation" section and provided in the Appendix.

College enrollment data

College enrollment data for STARBASE and comparison students was obtained from the National Student Clearinghouse (NSC). Using study participants' first name, middle initial, last name, and date of birth, the NSC searched its national repository of information from postsecondary institutions. According to the NSC, this repository provides enrollment data from more than 3,300 institutions representing more than 96 percent of national postsecondary enrollment (NSC, n.d.). The following information was provided at the individual student level:

- Whether a student was found at a participating postsecondary institution
- College code and name
- Enrollment beginning and end dates for each term reported
- Last enrollment status reported for each term (e.g., full-time, half-time, less than half-time, leave of absence, withdrawn, deceased)
- Graduation status
- College sequence if the student attended more than one school
- College state
- Whether the college is two-year or four-year and public or private

Participating educational institutions submit information to the NSC on their students' enrollment status multiple times throughout a term. Therefore, enrollment data received reflect the most recent data submitted to the NSC at that point in the fall term. In Phase II, Wilder Research submitted a request to the NSC in November 2010 for students in Cohorts 1 and 2 who would have graduated from high school by that point if they graduated on time. This data was presented in the Phase II report (Mohr & Mueller, 2011). In Phase III, Wilder Research submitted a request to the NSC in November 2011 for all three study cohorts. Students in Cohort 3 would have graduated from high school in spring 2011 if they graduated on time, and enrollment data for students in Cohorts 1 and 2 would have been updated in the year following the Phase II data request. This report presents results based on updated data as of fall 2011 for all three study cohorts.

Military enrollment data

With the help of STARBASE Minnesota staff, Wilder Research submitted a request for military-enrollment data to a local contact in the U.S. Air Force with the rank of Chief Master Sergeant. The DoD Global Directory Service was searched for names of STARBASE and comparison study participants. Data on Cohorts 1 and 2 were requested in winter 2011 and presented in the Phase II report (Mohr & Mueller, 2011). In Phase III, researchers submitted an updated request for all three study cohorts. Cohort 3 would have graduated from high school by that time if they graduated on time, and the military enrollment status of students in Cohorts 1 and 2 could have changed in the year following the Phase II request. Phase III searches were completed in December 2011 and January 2012.

The military database includes all branches of the military and reflects civilian and uniform careers. Individuals appear in the database only if they are currently serving in the military, so it is possible that a study participant could have served and since separated. Additionally, some potential matches could not be verified because a middle initial was not available. For these reasons, these data likely represent a conservative estimate of the number of study participants who had actually enrolled in the military.

Data analysis

The primary focus of data analysis in this study was the assessment of differences between STARBASE and comparison students on student outcome measures. Analyses were conducted to determine any statistically significant differences between the two groups in which STARBASE students performed better than the comparison group. Outcomes were further examined by dosage and study cohort, except in cases where the number of students within each category would have been too small for analysis purposes (e.g., college student survey). College enrollment data were further analyzed based on study participants' demographic characteristics. STARBASE students in each subgroup were compared to their match in these follow-up analyses, with the exception of high school graduation data which was available in aggregate and not at the individual student level. For high school survey items to which only STARBASE students responded, differences in dosage and cohort were analyzed within the STARBASE group.

Testing for statistical significance

A statistically significant difference is one that exceeds the amount of variation that could be expected by chance. Statistical significance is noted in this study where $p<.05$, meaning that there is less than a 5 percent probability that the finding resulted by chance. Statistical tests were performed in analyses of the high school survey data, academic achievement indicators, high school graduation rates, and college enrollment rates. Statistical tests were

not performed on the college student surveys given that only STARBASE students completed those surveys and the number of respondents within some cohort and dosage categories was small. Statistical tests also were not performed on the military enrollment data given limitations with that data described earlier and the small number of STARBASE and comparison students identified in the military database. Researchers used a number of statistical tests to determine significance depending on the type of data measured. Specific tests that were used are described in the Appendix ("Technical details of study methods" section).

Directional hypothesis

When analyzing results, researchers used a directional or one-tailed hypothesis based on the assumption that STARBASE students would perform better than the comparison group on outcome measures, and that higher-dosage STARBASE students would perform better than lower-dosage students (Lee-Pearce, et al., 1998). Because one-tailed tests can be less conservative than two-tailed tests, they should be clearly supported by theory. Use of a one-tailed test also means that statistically significant differences are reported only if they support the directional hypothesis. In other words, if a statistically significant difference had emerged in which the comparison group outperformed the STARBASE group, or in which the lower-dosage group outperformed the higher-dosage group, it would not have been reported.

If a non-directional or two-tailed hypothesis were used (i.e., one that does not assume one group will perform better than the other), the statistically significant results would have changed as follows. For the high school survey results, there would not have been a statistically significant difference in technology interest level by group or how much STARBASE helped students understand science, technology, engineering, or math by dosage level. For the school record results, there would not have been a statistically significant difference in the junior high school weighted grade average in science. Additionally, it would have been reported that comparison students took significantly more technology courses than their STARBASE counterparts in junior high school.

In the analyses of high school graduation data, there would not have been a statistically significant difference in on-time high school graduation between higher-dosage STARBASE and comparison students. By cohort, there would not have been a significant difference in on-time high school graduation between STARBASE and comparison students overall in Cohort 2, or higher-dosage STARBASE and comparison students in Cohort 2. In the college-enrollment analyses, there would not have been a statistically significant difference in college enrollment between lower-dosage STARBASE and comparison students. In supplemental analyses presented in the report, there would not have been a significant difference in overall on-time high school graduation between STARBASE and comparison students who matched on all nine characteristics (i.e., "perfect-match" analysis), or in the high school reading proficiency status of Cohort 2.

Interest in STEM

Wilder Research administered surveys to assess STARBASE and comparison students' long-term interests in STEM. Specifically, surveys addressed students' interests in and understanding of STEM areas, participation in STEM-related activities, educational and career plans, and former STARBASE participants' perceptions of the program's impact on them personally. Both STARBASE and comparison group students were surveyed in high school (Phase I), and only former STARBASE participants were surveyed in college (Phases II and III). This section presents key findings reflecting all three study cohorts from the high school and then college surveys. Most survey results described in this section can be found in figures cited in the text.

Perceptions in high school

The high school survey questionnaire was divided into two sections. The first section applied to STARBASE students only and contained questions directly related to STARBASE Minnesota. For these items, differences in dosage and cohort were analyzed within the STARBASE group, with statistically significant differences between subgroups reported. The second part of the questionnaire applied to both STARBASE and comparison group students. Questions in this section related to students' interest and participation in STEM more broadly and to their future plans. Responses to these survey items were analyzed between groups (STARBASE vs. comparison), and any statistically significant differences were further analyzed by dosage and cohort. Results are presented here first for the STARBASE group and then for the STARBASE vs. comparison group. A copy of the high school survey and its more complete results are provided in the Appendix of this report as well as in the Phase I report (Broton & Mueller, 2009).

STARBASE group

Students were asked if they participated in STARBASE in elementary school, and almost all of the students (92%) that program records indicated participated in STARBASE in fourth grade reported doing so. Students were then asked to briefly write what they remembered most about participating in the program, and their responses were categorized by theme. The most common student response theme was building and launching rockets (43%). Other frequent responses included learning about rockets and airplanes (24%), seeing airplanes and helicopters in-person (23%), and the computer flight simulation (22%). Additional response themes can be found in the Appendix (Figure A10).

Learning about STEM and related careers

Based on a four-point scale (a lot, somewhat, a little, or none), 63 percent of former STARBASE participants reported that STARBASE helped them understand STEM either a lot or somewhat better. Follow-up analyses indicated that more higher-dosage than lower-dosage students reported that STARBASE helped them understand STEM subjects better, and this difference was statistically significant (Figure 8). Further analyses by cohort did not yield any statistically significant differences.

8. How much better STARBASE helped students understand STEM: Cohort 1-3 high school results overall and by dosage*

	N	A lot	Some	A little	None
STARBASE	155	18%	45%	33%	5%
Higher dosage	134	19%	46%	31%	3%
Lower dosage	21	10%	33%	43%	14%

* *p<.05*

Nearly three-quarters (73%) of former STARBASE participants indicated that STARBASE helped them learn either a lot or some about careers related to STEM based on the same four-point scale. Further analyses showed a statistically significant difference between dosage levels. Specifically, when the categories of some, a little, and none were combined, more higher-dosage (31%) than lower-dosage students (0%) indicated they learned a lot about STEM-related careers (Figure 9). There were no statistically significant differences when examined by cohort.

9. How much STARBASE helped students learn about careers related to STEM: Cohort 1-3 high school results overall and by dosage*

	N	A lot	Some	A little	None
STARBASE	155	27%	46%	21%	6%
Higher dosage	134	31%**	44%	19%	5%
Lower dosage	21	0%**	57%	33%	10%

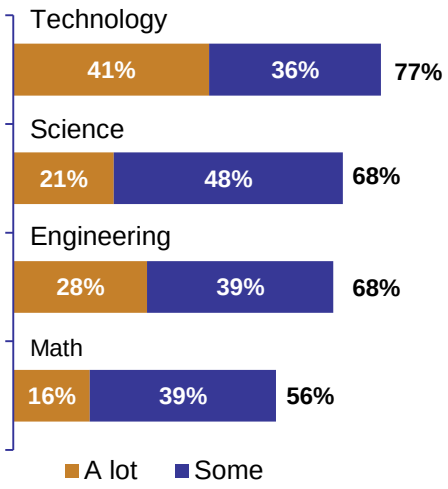
* *p<.05*

** *p<.01*

Increased interest in STEM

Students were asked to rate how much STARBASE increased their interest in STEM on a four-point scale (a lot, some, a little, or none). More than three-quarters (77%) indicated that STARBASE increased their interest in technology either a lot or some. About two-thirds (68%) reported that STARBASE increased their interest in engineering and science either a lot or some, and the majority (56%) reported that STARBASE increased their interest in math either a lot or some. While the majority of students reported that STARBASE increased their interest in all STEM subjects either a lot or some, the increased interest in technology was especially strong. Four in 10 students reported that STARBASE increased their interest in technology a lot (Figure 10). Follow-up analyses did not show any statistically significant differences between subgroups. The increased interest in STEM subjects stimulated by STARBASE led some students (18%) to get involved in STEM-related activities or programs (Figure A17).

10. How much STARBASE increased students' interest in STEM: Cohort 1-3 high school results (N=155)



Note. Due to rounding, numbers do not always add up to total. See Figure A11 for more details.

STARBASE experience and influence

Most former STARBASE participants (82%) reported that STARBASE was a valuable learning experience, and 17 percent indicated they were unsure if it was. About one-quarter (26%) of students indicated that their participation in the program continued to impact them, and 57 percent reported they were unsure if it did. Former participants were asked to elaborate on how STARBASE continued to impact them, and their responses were grouped by theme. Students' most common response was that they still used the knowledge

and experiences gained at STARBASE (8%). Other students expressed that they learned about or wanted to pursue a STEM-related career, or learned about STEM in general (5%-6% each) (Figure A12).

STARBASE and comparison groups

This section presents results for high school survey questions asked of both STARBASE and comparison students. Statistically significant differences between these groups and between cohort and dosage subgroups are noted.

Interest in STEM

STARBASE and comparison students were asked to rate their level of interest (a lot, some, a little, or none) in each of the four STEM subjects. In most subject areas, responses were similar between the groups. For example, 27 percent of both STARBASE and comparison students indicated a lot of interest in science. However, there was a statistically significant overall difference in students' interest level in technology, with more STARBASE than comparison students reporting a higher level of interest in technology. To learn more about this difference, further analyses were conducted combining the three categories of some, a little, and none. When STARBASE and comparison students were compared on two categories, a lot of interest vs. some or less, the difference was also statistically significant. More STARBASE (49%) than comparison students (34%) indicated a lot of interest in technology (Figure 11).

11. Level of interest in STEM: Cohort 1-3 high school results

Subject	Group	N	A lot	Some	A little	None
Technology*	STARBASE	168	49%**	32%	13%	6%
	Comparison	168	34%**	40%	22%	4%
Science	STARBASE	168	27%	48%	20%	5%
	Comparison	168	27%	44%	23%	6%
Math	STARBASE	167	27%	44%	20%	10%
	Comparison	167	29%	35%	25%	11%
Engineering	STARBASE	168	28%	30%	29%	13%
	Comparison	168	22%	35%	24%	19%

* *p<.05*

** *p<.01*

Further analyses split the STARBASE group by dosage and cohort, and each subgroup was compared to their demographically and academically similar peers (i.e., one-to-one matched comparison). In each subgroup, more STARBASE than comparison students indicated a lot of interest in technology, although the difference was statistically significant only for the following analyses: higher-dosage STARBASE vs. comparison students, and Cohort 2 STARBASE vs. comparison students (Figure 12). The statistically significant results should be considered with caution, however, as some subgroups had similar percentage differences between STARBASE and comparison students (e.g., higher dosage=16% difference and lower dosage=15% difference), but one was significant (higher dosage) and one was not, most likely due to differences in the size of the groups. Statistical significance is a function of the difference between the groups, the variability within groups, and the size of the groups.

12. A lot of interest in technology by subgroup: Cohort 1-3 high school results by dosage and cohort

			Percentage with a lot of interest in technology		
		N[a]	STARBASE	Comparison	Significance
Dosage	Higher	142	49%	33%	**
	Lower	26	54%	39%	ns[b]
Cohort	Cohort 1	24	42%	17%	ns[c]
	Cohort 2	60	48%	32%	*
	Cohort 3	84	52%	41%	ns

* *p<.05*

** *p<.01*

ns not statistically significant

[a] *Refers to the number in each group of the matched-pairs comparison (e.g., 142 STARBASE students were compared to 142 comparison students).*

[b] *Note that the percentage difference between STARBASE and comparison students in the dosage subgroup is similar for both higher- and lower-dosage students. However, there may not be enough power to detect a statistically significant difference in the lower-dosage category given the small sample size.*

[c] *Note that the percentage difference between STARBASE and comparison students in the cohort subgroup is similar for both Cohorts 1 and 2. However, there may not be enough power to detect a statistically significant difference in Cohort 1 given the small sample size.*

Note. Response options include a lot, some, a little, or none. Response options some, a little, and none were combined for this analysis.

Future military plans

Students were also asked to indicate how much interest they had in joining the military (a lot, some, a little, or none). Nearly half (46%) of STARBASE students reported having at

least a little interest in joining the military, including 6 percent who reported a lot of interest. Three in 10 comparison students indicated they had at least a little interest in joining the military, including 5 percent who indicated a lot of interest. The overall difference between the groups was statistically significant. Further analyses were conducted combining the three categories of a lot, some, and a little. When comparing STARBASE and comparison students on two categories, at least a little interest and no interest in joining the military, the difference was also statistically significant with more STARBASE students indicating interest in joining the military (Figure 13).

13. Level of interest in joining the military: Cohort 1-3 high school results*

	N	A lot	Some	A little	None**
STARBASE	140	6%	16%	24%	54%
Comparison	140	5%	14%	11%	69%

* *p<.05*

** *p<.01*

The STARBASE group was further split by dosage and cohort, and compared to the respective comparison subgroup. More STARBASE than comparison students indicated at least a little interest in joining the military in all subgroups, and the results were statistically significant within three of the subgroups. Most interesting may be that 38 percent of Cohort 1 STARBASE students indicated at least a little interest in joining the military compared to 5 percent of Cohort 1 comparison students. A statistically significant difference was also found in the following subgroups: Cohort 3 and higher dosage (Figure 14).

14. At least a little interest in joining the military by subgroup: Cohort 1-3 high school results by dosage and cohort

			Percentage with a little, some, or a lot of interest in joining the military		
		N[a]	STARBASE	Comparison	Significance
Dosage	Higher	116	47%	30%	**
	Lower	24	42%	33%	ns
Cohort	Cohort 1	21	38%	5%	**
	Cohort 2	49	37%	29%	ns
	Cohort 3	70	56%	40%	*

* *p<.05*

** *p<.01*

ns not statistically significant

Note. Response options include a lot, some, a little, none, or don't know. Students who responded don't know were excluded. Response options a little, some, and a lot were combined for this analysis.

Activities and experiences

Both STARBASE and comparison group students were asked about their current participation in STEM-related activities or programs and those related to the military. Again, students were in 10th, 11th, or 12th grade at the time of the survey, depending on their study cohort. Current STEM program participation rates were very similar, with 12 percent of STARBASE students and 13 percent of comparison students reporting participation in such a group. Examples of STEM programs in which students participated include Project Lead the Way, math league, small learning communities, career pathways, and pre-college programs. Slightly more STARBASE (13%) than comparison students (8%) reported participating in a military-related program, although this difference was not statistically significant. The most common military-related program in which students reported currently participating was JROTC.

About one-third of students in each group (33% STARBASE and 31% comparison) indicated that a past experience or activity other than STARBASE increased their interest in STEM. When asked to elaborate on this experience, the most common student response, regardless of group, was that a STEM-related class or lab at school piqued their interest in the field. Other common response themes included field trips, informal learning with friends or family, science fairs, and aerospace camp (Figure A13).

Favorite core subject

Students were asked to indicate their favorite core subject based on four options: English, math, science, or social studies. Survey results indicated that the most common favorite core subject among both STARBASE and comparison students was math (34% STARBASE and 35% comparison). Science was a close second among STARBASE students (33%) and tied for second with English among comparison students (26% each). About one in five STARBASE students (22%) rated English as their favorite core subject, and fewer students in both groups indicated that social studies was their favorite (12% STARBASE and 13% comparison) (Figure A14). Differences between groups were not statistically significant, but it may be encouraging that a majority of all students rated math or science as their favorite core subject.

Future educational plans

A series of questions related to future plans was included in the high school survey. Again, students were at various stages in their high school career when the survey was administered, depending on their study cohort. There were no statistically significant differences between STARBASE and comparison students' responses to these questions. Students were asked to indicate what their plans were for taking more science, math, computer, or engineering classes in high school from a list of four options (yes, more

than what's required; yes, only what's required; no; or don't know). Results were similar for both groups, but slightly fewer STARBASE than comparison students (41% vs. 44%) indicated they planned to take more science, math, computer, or engineering classes than required. About 4 in 10 (42%) STARBASE students reported they were going to take the required amount of STEM courses in high school, and about one-third (33%) of comparison students chose this response. Fewer students reported they were not planning to take any more STEM classes or were unsure (18% STARBASE and 23% comparison) (Figure A15).

Almost all students (95% STARBASE and 94% comparison) indicated they planned to attend either a two- or four-year college; others were unsure (4% STARBASE and 5% comparison). Nearly half of STARBASE students (47%) and slightly fewer comparison students (41%) reported that they planned to pursue a STEM-related career. Nearly half of students in both groups (46% each) reported that they did not know if they were going to pursue a career in a STEM field.

Dosage

For most items on the high school survey, slightly more higher-dosage than lower-dosage STARBASE students indicated greater interest and participation in STEM-related subjects and activities. Further analyses indicated that these dosage differences were not likely due to demographic or academic differences between the higher- and lower-dosage subgroups (see "Technical details of study methods" in the Appendix). Analyses indicated statistically significant differences between higher- and lower-dosage students on the following measures:

- STARBASE helped in understanding STEM better (Figure 8)
- STARBASE helped in learning about careers related to STEM (Figure 9)
- Currently participate in activities or programs related to STEM (Figure A21)

In addition to learning about STEM-related careers, more higher-dosage (49%) than lower-dosage students (37%) indicated that they planned to pursue a STEM-related career, although this difference was not statistically significant (Figure A27). Additional dosage differences that were not statistically significant can be found in the Appendix (Figures A16-A26). While consistent throughout the survey, this higher-dosage finding should be considered with caution, as the differences between higher- and lower-dosage subgroups were often small and there may have been other contributing factors that were not included in the analysis. As described later in the report, a similar pattern of higher-dosage students performing better than lower-dosage STARBASE students was found in the school records (academic achievement) and high school graduation analyses, but not in the analysis of college enrollment data. High school survey items were also examined by cohort, but no patterns emerged.

Perceptions in college

The remainder of this section presents results from the surveys of former STARBASE participants who enrolled in college during the course of the study. Respondents completed the survey 9-10 years after they initially participated in STARBASE in fourth grade. As previously described, Cohorts 1 and 2 were surveyed in Phase II and Cohort 3 in Phase III following their high school graduation. Results presented here combine responses on the Phase II and Phase III surveys for questions that were consistent across the two versions. A copy of the Phase III survey and its complete results, including students' written comments, are provided in the Appendix. A copy of the Phase II version and its complete results, including students' written comments, were provided in the Phase II report (Mohr & Mueller, 2011). As described in the Appendix, availability of student contact information varied to a large extent by school (see "Technical details of study methods" section).

Learning about STEM and related careers

Consistent with the high school survey results, a majority of former STARBASE participants responding to the college survey reported that STARBASE helped them learn about STEM subjects and careers. Asked whether the program helped them understand STEM better, 83 percent responding in college answered "yes." A majority (68%) reported that STARBASE helped them learn about careers related to STEM, and 26 percent indicated it had influenced their career plans or choices (Figure 15). The 21 respondents indicating STARBASE influenced their career plans or choices were asked to explain their responses. The most common answers were that STARBASE made them interested in pursuing a career in STEM or gave them a better perspective on STEM fields. A couple of respondents said that STARBASE helped them clarify their career interests in areas outside of STEM.

15. College students' overall perceptions of STARBASE: Cohort 1-3 college results (N=81)

Do you think STARBASE…	Yes	No	Don't know
Helped you understand science, technology, engineering, or math better?	67 (83%)	4 (5%)	10 (12%)
Increased your interest in science, technology, engineering, or math?	64 (79%)	8 (10%)	9 (11%)
Increased your interest in the military? This could include interest in the military in general as well as interest in joining the military.	18 (22%)	54 (67%)	9 (11%)
Helped you learn about careers related to science, technology, engineering, or math?	55 (68%)	6 (7%)	20 (25%)
Has had any influence on your career plans or choices?[a]	21 (26%)	33 (41%)	27 (33%)

[a] *Question wording differed slightly on the Phase II survey (i.e., "Do you think STARBASE has influenced your career plans?"). Those who answered "yes" were asked to explain their responses. Cohort 3 respondents' complete comments are provided in the Appendix. Cohort 1 and 2 respondents' complete comments are provided in the Appendix of the Phase II report (Mohr & Mueller, 2011).*

Increased interest in STEM

Also consistent with the high school results, former STARBASE participants responding to the college survey generally indicated the program increased their interest in STEM. Asked whether STARBASE increased their interest in STEM, 79 percent answered "yes" (Figure 15). Those who reported STARBASE increased their interest in STEM were then asked separately about the program's impact on their interest in each of the four STEM areas. Most of those students indicated STARBASE increased their interest in science (84%) and technology (83%), and a majority indicated it increased their interest in engineering (64%) and math (55%) (Figure 16).

16. Impact of STARBASE on interest in science, technology, engineering, and math: Cohort 1-3 college results (N=64)

Specifically, do you think STARBASE increased your interest in…	Yes	No	Don't know
Science?	54 (84%)	6 (9%)	4 (6%)
Technology? (e.g., computers)	53 (83%)	8 (13%)	3 (5%)
Engineering?	41 (64%)	15 (23%)	8 (13%)
Math?	35 (55%)	19 (30%)	10 (16%)

Note. This question was asked only of those who answered "yes" when asked, "Do you think STARBASE increased your interest in science, technology, engineering, or math?"

College students were also asked about their interests in joining the military and getting a job related to STEM. As would be expected given that the survey was administered only to students enrolled in college, a smaller percentage (22%) indicated STARBASE increased their interest in the military specifically (Figure 15). Asked about their current employment interests, 81 percent indicated they had some or a lot of interest in getting a job related to STEM, and 46 percent indicated they had some or a lot of interest in getting a job teaching STEM specifically (Figure 17).

17. STEM job interest: Cohort 1-3 college results (N=81)

How much interest do you have in…	A lot	Some	Very little/ None
Getting a job related to science, technology, engineering, or math?	22 (27%)	44 (54%)	15 (19%)
Getting a job teaching science, technology, engineering, or math?	8 (10%)	29 (36%)	44 (54%)

Participation in STEM in elementary, junior high, or high school

College students were also asked about their participation in other STEM-related activities following STARBASE. Their responses suggested there was a gap between their interest in STEM activities following STARBASE, based on responses to other questions, and their actual engagement in STEM activities. Nineteen percent reported that they participated in other activities, clubs, or programs related to STEM when they were in elementary, junior high, or high school following their participation in STARBASE (Figure 18). Of the 15 students who indicated they had, 20 percent said they became involved in STEM activities or programs because of STARBASE, and an additional 33 percent indicated they did not know whether STARBASE influenced their participation in those activities.

18. Participation in other STEM activities after STARBASE: Cohort 1-3 college results (N=81)

After participating in STARBASE, did you participate in any other activities, clubs, or programs related to science, technology, engineering, or math when you were in elementary, junior high, or high school?	
Yes	15 (19%)
No	55 (68%)
Don't know	11 (14%)

Despite their somewhat low participation, only 19 percent of college students reported that they faced challenges to participation in other STEM activities in elementary, junior high, or high school. However, it is possible that some students were not fully aware of challenges influencing their ability to participate in other activities given their young age at the time of STARBASE. Those indicating they faced challenges most frequently reported that they were too busy with other activities, transportation would have been difficult, they were not aware of other opportunities available to them, there were not enough opportunities, they needed to be home to care for siblings, opportunities did not fit their specific interests, or their parents or caregivers were not aware of other opportunities (Figure 19). Asked in a separate question whether there were any STEM opportunities they would have liked to participate in but which were not available to them in elementary, junior high, or high school, 19 percent of the former STARBASE participants in college indicated there were.

19. Challenges to participation in other STEM activities: Cohort 1-3 college results

Did you face any challenges to participating in other science, technology, engineering, or math activities, clubs, or programs when you were in elementary, junior high, or high school? (N=81)	
Yes	15 (19%)
No	58 (72%)
Don't know	8 (10%)
If yes, which challenges did you face? (N=15)[a]	
I was too busy with other activities.	11 (73%)
Transportation would have been difficult.	10 (67%)
I was not aware of what other opportunities were available to me.	10 (67%)
There were not enough opportunities available to me.	6 (40%)
I needed to be home to care for my sibling(s).	6 (40%)
Opportunities did not fit my specific interests.	5 (33%)
My parents or caregivers were not aware of other opportunities.	4 (27%)
Available opportunities were too expensive.	2 (13%)
Opportunities were not applicable to me based on my age, gender, or other factors.	0 (0%)
Other challenges.	0 (0%)

[a] *Participants were presented with response options and asked to indicate all that apply.*

Participation in STEM in college

Students were also asked about their participation in STEM in college. At the time of the survey, 38 percent of former STARBASE participants enrolled in college reported that they had taken or were planning to take additional STEM-related classes in college beyond what was required (Figure 20).

20. STEM coursework: Cohort 1-3 college results (N=80)

Have you taken or are you planning to take any additional science, technology, engineering, or math classes in college beyond what is required?	
Yes, more than what's required	30 (38%)
No, only what's required	32 (40%)
Don't know	18 (23%)

Asked about their involvement in STEM activities, 14 percent indicated they had participated in STEM-related activities, clubs, or programs at their college or university (Figure 21). Again, the survey was administered relatively early in students' college careers, so some students may have still been exploring college interests.

21. Participation in STEM activities in college: Cohort 1-3 college results (N=81)

At your college or university, have you participated in any activities, clubs, or programs related to science, technology, engineering, or math?	
Yes	11 (14%)
No	70 (86%)

Note. The 11 respondents answering "yes" were asked to indicate the types of activities in which they have participated. Their answers included the following: "doing research in a lab on kidney failure," "doing a lot with technology in biology and psychology classes," "environmental club and weather club," "environmental science club and related philanthropic excursions," Focus on Cultivating Scientists, Forensic Science Society, geology club, math club, Air Force ROTC, pre-med activities, and a work study position in information technology.

Approximately two-thirds of college students (67%) had decided on their college major or field of study at the time of the survey. These students were fairly evenly split between having chosen a major in a STEM field or in a field outside of STEM (48% vs. 52%) (Figure 22).

22. College major or field of study: Cohort 1-3 college results

Have you decided on a major or field of study in college? (N=81)	
Yes	54 (67%)
No	16 (20%)
Don't know	11 (14%)
Open-ended question: If yes, what is your major or field of study?[a] (N=54)	
Science/technology/engineering/math (STEM)[b]	26 (48%)
Other[c]	28 (52%)

[a] *Response themes developed by Wilder Research based on students' responses.*

[b] *Fields of study categorized here include the following: accounting, biology, biology education, "biomedical science and astronomy," chemical engineering, civil engineering, computer science, engineering, forensic science, genetics, geology, mechanical engineering, nursing, "pediatrician," pharmacy, physical therapy, pre-dental, and pre-med.*

[c] *Fields of study categorized here include the following: advertising, broadcast journalism, business management, criminal justice, education, elementary education, geography, "law enforcement and environmental studies," liberal arts, outdoor education, political science, psychology/child psychology, public relations, social work, social science, sociology, "speech-language hearing sciences and child psychology," and "worship leading."*

Note. In some cases, a student indicated more than one major. If at least one of the majors was STEM-related, they were counted as having a STEM major or field of study. Two respondents indicated they were "interested in" or "would like to study" the field they indicated, suggesting they may not have formally decided on the field.

The 27 former STARBASE participants who did not report having decided on a major were asked whether they were considering a major related to STEM, and 37 percent of those students indicated they were (Figure 23). Because the survey was not administered to comparison group students, it is not known how these results might compare to those of similar students who did not participate in the program.

23. Considering major or field of study in STEM if undecided: Cohort 1-3 college results (N=27)

Are you considering a major or field of study related to science, technology, engineering, or math?	
Yes	10 (37%)
No	2 (7%)
Don't know	15 (56%)

Note. This question was asked only of those who answered "no" or "don't know" when asked, "Have you decided on a major or field of study in college?" In Phase II, this question was worded as, "Are you considering a major or field of study in a science, technology, engineering, or math discipline? This would include any field that emphasizes skills in one of these areas."

STARBASE experience and influence

College students were asked to describe what they remembered most about participating in the program. They most frequently reported that they remembered building and launching rockets, airplanes, gliders, or kites; flight simulations; being on the base and seeing airplanes and helicopters in person; learning about rockets or airplanes; getting code names; and other activities or experiments (Figure 24).

24. What students remember most about participating in STARBASE: Cohort 1-3 college results (N=81)

What do you remember most about participating in STARBASE?[a,b]	
Building and launching rockets, airplanes, gliders, or kites	42 (52%)
Flight simulations	36 (44%)
Being on the base/seeing airplanes and helicopters in person	28 (35%)
Learning about rockets or airplanes	22 (27%)
Getting code names	17 (21%)
Other activities or experiments	14 (17%)
Having fun/being excited to go to STARBASE	6 (7%)
Working as a team	6 (7%)
Learning about physics or other scientific concepts	5 (6%)

[a] *Response themes developed by Wilder Research based on students' responses.*

[b] *Students' responses could be placed in multiple themes, so percentages do not sum to 100 percent.*

Note. Cohort 3 respondents' complete comments are provided in the Appendix. Cohort 1 and 2 respondents' complete comments are provided in the Appendix of the Phase II report (Mohr & Mueller, 2011).

Almost all college students (99%) reported that STARBASE was a valuable learning experience. Asked whether their participation in STARBASE continues to impact them today, 40 percent answered "yes" and an additional 35 percent indicated they did not know (Figure 25). The 32 respondents who indicated that STARBASE continues to impact them today were asked to explain their responses. They most frequently indicated that STARBASE influenced their career or education choice, they have a continued interest in aviation or aerospace, they still use information they learned in STARBASE, and STARBASE gave them a better appreciation for or understanding of science.

25. STARBASE experience and influence: Cohort 1-3 college results (N=81)

Do you think STARBASE…	Yes	No	Don't know
Do you think STARBASE was a valuable learning experience?	80 (99%)	0 (0%)	1 (1%)
Do you think participation in STARBASE continues to impact you today?[a]	32 (40%)	21 (26%)	28 (35%)

[a] *Those who answered "yes" were asked to explain their responses. Cohort 3 respondents' complete comments are provided in the Appendix. Cohort 1 and 2 respondents' complete comments are provided in the Appendix of the Phase II report (Mohr & Mueller, 2011).*

The survey also included an open-ended question asking college students to describe the most important thing they gained from their participation in STARBASE. Students most frequently indicated they gained an appreciation of science or STEM areas or an understanding of scientific principles; had a fun experience or experienced the joy of exploration; gained knowledge of aircraft or space; benefitted from career exploration; gained an appreciation for, knowledge of, or interest in technology; gained knowledge of their personal interests and learning style; and experienced working on a team (Figure 26).

26. Most important thing gained from participation in STARBASE: Cohort 1-3 college results (N=81)

What was the most important thing you gained from your participation in STARBASE?[a,b]	
Appreciation of science or STEM areas/understanding of scientific principles	18 (22%)
Fun experience/joy of exploration	16 (20%)
Knowledge of aircraft/space	14 (17%)
Career exploration	12 (15%)
Appreciation for, knowledge of, or interest in technology specifically	11 (14%)
Gained knowledge of personal interests or learning style	9 (11%)
Experience working on a team	9 (11%)
I don't remember/don't know	7 (9%)
Experiencing science in a different way	4 (5%)
The experience of seeing airplanes/helicopters in person	3 (4%)
Better understanding of military aircraft/airway uses	2 (2%)

[a] *Response themes developed by Wilder Research based on students' responses.*

[b] *Students' responses could be placed in multiple themes, so percentages do not sum to 100 percent.*

Note. Cohort 3 respondents' complete comments are provided in the Appendix. Cohort 1 and 2 respondents' complete comments are provided in the Appendix of the Phase II report (Mohr & Mueller, 2011).

Academic achievement

In Phase I of the study, Wilder Research examined academic achievement indicators related to students' course selection and academic performance in junior high and high school (Broton & Mueller, 2009). This section provides an overview of the analysis followed by key findings.

Analysis

Wilder Research used SPPS student record data to examine academic achievement indicators in junior high and high school. Indicators included students' course selection and academic performance in science, math, technology, and JROTC courses as well as overall. Data were provided through first semester of the 2008-09 school year, when Cohort 1 students were in 12th grade, Cohort 2 in 11th grade, and Cohort 3 in 10th grade.

Junior and senior high school measures were analyzed separately at four points in time: 1) 7th-8th grade records, 2) 9th-grade records, 3) 9th-10th grade records, and 4) 9th-12th grade records (Figure A2). This analysis plan enabled researchers to determine if differences emerged at different points in students' academic careers. The same set of indicators was measured in each of the four grade levels, to the extent possible and appropriate. Details on the construction of academic achievement indicators are provided in the Appendix (see "Technical details of study methods" section).

Results from school record-based measures are reported here only for statistically significant differences between the STARBASE and comparison groups, and dosage and cohort subgroups. All measures, regardless of significance, are included in the Appendix (Figures A48-A75). Given the large number of measures analyzed (more than 80), researchers would anticipate the analyses to show a few statistically significant differences. Statistical significance means that there is less than a 1 in 20 probability that the difference occurred by chance. Conversely, this means that a statistically significant difference will likely emerge every 20 or so analyses, just by chance.

Results

STARBASE and comparison students performed very similarly on the school record-based outcome measures. Three statistically significant differences emerged from the analyses and are described below. Again, these differences could be due to chance, rather than a program impact, because of the large number of statistical tests conducted.

Junior high weighted grade average in science

In junior high school, STARBASE students had a statistically significantly higher weighted grade average in science (2.93) than comparison students (2.71) based on a four-point scale (Figure A48). Follow-up analyses indicated that the difference occurred among the higher-dosage STARBASE students, who outperformed their comparison matches (3.06 vs. 2.75) (Figures 27 & A61). Other science-related indicators, such as the number of science courses completed, number of science honors courses completed, math and science combined weighted grade average, and the combined percentage of math, science, and technology courses passed, did not yield any statistically significant differences. Additionally, no science-specific outcome measured in the high school records or survey analyses resulted in any statistically significant differences, suggesting that the junior high school weighted grade average in science was an isolated occurrence of significance.

27. Junior high school weighted grade average in science: Cohort 3

Subgroup	N[a]	STARBASE	Comparison	Significance
All	161	2.93	2.71	*
Higher dosage	129	3.06	2.75	*
Lower dosage	32	2.43	2.55	ns

* *p<.05*

ns not statistically significant

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 161 STARBASE students were compared to 161 comparison students).*

10th-grade Algebra 2 completion

A second statistically significant difference emerged from the indicators measured in the 10th-grade cumulative analysis. More STARBASE (46%) than comparison students (35%) successfully completed Algebra 2 or a higher level math course during their first two years of high school. This is an important finding considering that when these students were in high school, Algebra 2 was often not taken until 11th grade, suggesting a rigorous math schedule for nearly half of STARBASE students. Further analyses examining dosage and cohort indicated statistically significant differences in the higher-dosage and Cohort 2 subgroups (Figure 28).

28. Successfully completed Algebra 2 or higher level math in 10th grade: Cohorts 1 and 2

Subgroup	N[a]	STARBASE	Comparison	Significance
All	193	46%	35%	**
Higher dosage	157	47%	34%	**
Lower dosage	35	46%	37%	ns
Cohort 1	66	41%	36%	ns
Cohort 2	127	49%	34%	**

** *p<.01*

ns not statistically significant

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 193 STARBASE students were compared to 193 comparison students).*

The STARBASE advantage was not seen in 12th grade, when almost all students in both groups had completed Algebra 2 or a higher-level math course (91% STARBASE and 88% comparison) (Figure A56). Additionally, statistically significant differences did not emerge in other math-related indicators such as highest level math course completed, number of math courses completed, number of math honors courses completed, math weighted grade average, or the combined percentage of math, science, and technology courses passed. Furthermore, no math-specific outcome measured in junior high school, other senior high school (i.e., 9th or 12th grade), or survey analyses resulted in any statistically significant differences, suggesting that the Algebra 2 completion difference was an isolated finding of significance.

Senior high school attendance

During the 2007-08 school year, STARBASE students were absent an average of 8.3 days, while comparison students were absent 9.5 days on average. This difference was statistically significant, but further analyses that examined differences by dosage and cohort were not. Additionally, the percentage of students who were chronically absent did not significantly differ between STARBASE and comparison students (Figure A58).

Dosage

Similar to high school survey results, examination of student record-based measures over time suggested a very modest pattern of STARBASE students with a higher dosage performing slightly better on more measures than those with a lower dosage. This pattern was seen on the indicators measured in junior high school and 9th grade, but did not continue in 10th grade or after. Specifically in these early grades, higher-dosage students took slightly more honors courses overall, as well as in math and science particularly, than lower-dosage students. Also, higher-dosage students had slightly better weighted grade averages and passed a higher percentage of courses overall, and in math and science, compared to lower-dosage students (Figures A61-A64). While these differences were not statistically significant, and very small (usually only a few tenths or hundredths of a point separated the groups), the pattern, coupled with survey results, suggested that a higher dosage of STARBASE may be influencing students' course choices and academic performance to a slight extent. Further analyses indicated that these dosage differences were not likely due to demographic or academic differences between the higher- and lower-dosage subgroups (see "Technical details of study methods" in the Appendix). School record-based outcome measures were also examined by cohort, but no patterns emerged.

High school graduation

In study Phases II and III, Wilder Research examined on-time high school graduation rates for STARBASE and comparison students. Data were available on Cohorts 1 and 2 in Phase II, and became available on Cohort 3 in Phase III. This section presents combined data for all three cohorts.

Analysis

The Minnesota Department of Education (MDE) provided aggregate high school graduation data on 883 of the 884 study participants, including the 441 STARBASE students for which program dosage was known and the 442 comparison group students. MDE data indicated whether students 1) graduated on time, 2) continued to be enrolled in high school the subsequent fall, or 3) did not graduate and were no longer enrolled in high school. As described in the Methodology section, data reflect graduation from and enrollment in public Minnesota high schools, as student-level data was not available from private schools. Therefore, it is possible that some students falling into the third category graduated from a private or out-of-state school. Due to the small numbers of students falling into the latter two groups, categories were consolidated into the following two groups for purposes of analysis: graduated on-time (Category 1 above) and did not graduate on-time (Categories 2 and 3 above).

Results

Overall and by cohort

Overall, STARBASE students appeared to have higher on-time high school graduation rates than comparison students, with 77 percent of STARBASE and 74 percent of comparison students graduating from high school on time. However, the overall difference between STARBASE and comparison groups was not statistically significant. Results also varied by cohort. Cohort 2 showed the strongest results and a statistically significant difference in favor of STARBASE (80% vs. 70%). On-time graduation rates were slightly higher for STARBASE than comparison students in Cohort 1 (84% vs. 82%), and did not differ between STARBASE and comparison students in Cohort 3 (73% each) (Figure 29).

29. On-time high school graduation: Cohorts 1-3 overall and by cohort

		N[a]	Percentage graduating on time[b]	Significance
All study participants	STARBASE	441	77%	ns
	Comparison	442	74%	
Cohort 1	STARBASE	73	84%	ns
	Comparison	73	82%	
Cohort 2	STARBASE	134	80%	*
	Comparison	135	70%	
Cohort 3	STARBASE	234	73%	ns
	Comparison	234	73%	

* *p<.05*

ns no statistically significant differences between groups

[a] *The Minnesota Department of Education (MDE) provided aggregate data on the 883 study participants with known program dosage (program dosage was unknown for one study participant).*

[b] *"On-time" defined as graduating from a public Minnesota high school by the end of the fourth year of high school.*

Dosage

The earlier high school survey and school-records results suggested a very modest pattern of STARBASE students with a higher dosage performing slightly better on more measures than those with a lower dosage. Overall, higher-dosage students also performed better than lower-dosage students in the on-time high school graduation analyses. Differences were statistically significant in the comparisons between the higher- and lower-dosage STARBASE groups (79% vs. 68%) and between the higher-dosage STARBASE group and comparison group (79% vs. 74%) (Figure 30). However, the proportion of lower-dosage STARBASE students graduating on time was lower than that of the comparison group (68% vs. 74%).

30. On-time high school graduation: Cohorts 1-3 by dosage

		N[a]	Percentage graduating on time[b]	Significance
All study participants	Higher-dosage[c]	359	79%	*[c]
	Lower-dosage[c]	82	68%	
	Comparison[c]	442	74%	
Cohort 1	Higher-dosage	57	82%	ns
	Lower-dosage[d]	16	88%	
	Comparison	73	82%	
Cohort 2	Higher-dosage[e]	115	81%	*[e]
	Lower-dosage[d]	19	74%	
	Comparison[e]	135	70%	
Cohort 3	Higher-dosage[f]	187	76%	*[f]
	Lower-dosage[f]	47	60%	
	Comparison	234	73%	

* *p<.05*

ns no statistically significant differences between groups

[a] *The Minnesota Department of Education (MDE) provided aggregate data on the 883 study participants with known program dosage (program dosage was unknown for one study participant).*

[b] *"On-time" defined as graduating from a public Minnesota high school by the end of the fourth year of high school.*

[c] *A significant difference (p<.05) was found between the higher- and lower-dosage groups, and the higher-dosage and comparison groups, but not between the lower-dosage and comparison groups.*

[d] *It should be noted that sample sizes for the lower-dosage group are small.*

[e] *A significant difference (p<.05) was found between the higher-dosage and comparison groups, but not between the higher- and lower-dosage groups or lower-dosage and comparison groups.*

[f] *A significant difference (p<.05) was found between the higher- and lower-dosage groups, but not between the higher-dosage and comparison groups or lower-dosage and comparison groups.*

The dosage pattern varied by cohort, although it should be noted that sample sizes for the lower-dosage group were small when broken down by cohort. In Cohort 1, the percentage of lower-dosage STARBASE students graduating on time (88%) exceeded that of higher-dosage and comparison students (82% each). Cohort 2 followed the expected pattern, with higher-dosage STARBASE students showing the highest on-time graduation rate (81%), followed by lower-dosage STARBASE students (74%), and then comparison students (70%). Cohort 3, the largest cohort, reflected the overall pattern with higher-dosage STARBASE students showing the highest on-time graduation rate (76%), followed by comparison students (73%), and then lower-dosage STARBASE students (60%). Differences by cohort were significant only in the case of higher-dosage vs. comparison students in Cohort 2, and higher- vs. lower-dosage students in Cohort 3 (Figure 30).

Supplemental analyses

Following the primary analyses of high school graduation data overall, by cohort, and by dosage, researchers pursued supplemental analyses to further examine STARBASE vs. comparison students in high school and at high school graduation.

Perfect-match analysis

High school graduation rate analyses were also performed on a subset of the study population: those STARBASE and comparison students who matched on all nine characteristics of interest. As explained in the Methodology section, student pairs were required to match on four characteristics (grade level in 2008-09, high school attended in 2008-09, third-grade math achievement test level score, and third-grade reading achievement test level score), and at least one of five characteristics of interest in fourth grade (free or reduced-price lunch eligibility, English Language Learner status, special education status, gender, and race or ethnicity). In establishing the criteria, researchers strove to balance the size and representativeness of the sample (i.e., not eliminating too many potential study participants) with similarity of matches. Based on the matching criteria, the 442 study pairs were very similar, as shown in Figure 6.

When looking at high school graduation rates for only the 594 study participants (297 pairs) that matched on all nine characteristics, results were more favorable for the STARBASE group than in the analysis of all study participants. In this perfect-match analysis, 80 percent of STARBASE students and 74 percent of comparison students graduated from high school on time, and the difference was statistically significant (Figure A76). This suggests that although they were very similar, any demographic differences that did exist between STARBASE and comparison students overall may have tended to favor the comparison group. By cohort, results for the perfect matches were most favorable for STARBASE in Cohort 2, consistent with the analysis of all study participants. By dosage, a significant difference was again found between higher-dosage and comparison students, but not between other groups (Figures A76-77).

High school proficiency

Though not a key study outcome, high school standardized test results were obtained to examine whether STARBASE and comparison students appeared different at the time of graduation, beyond their on-time graduation status. The Minnesota Department of Education provided aggregate proficiency data for the 11th-grade math, 10th-grade reading, and high school science Minnesota Comprehensive Assessments (MCA-II), indicating whether students met or exceeded state standards. As shown in Figures A78-80, overall results favored the STARBASE group in reading and science and were the same for STARBASE and comparison students in math. Overall differences were not statistically significant.

College enrollment

Students' college enrollment status was examined to understand whether STARBASE participants were more likely to enroll in college than similar students who did not participate in the program. Wilder Research obtained student-level college enrollment data from the National Student Clearinghouse (NSC), as well as information on the characteristics of the colleges they attended.

Analysis

All 884 study participants were included in the college enrollment analyses, with the 442 matched pairs remaining intact. Results were also examined by cohort, level of program dosage, and demographic characteristics. For purposes of these analyses, researchers defined college enrollment as having ever attended college, regardless of the student's final enrollment status.

In Phase II, college enrollment data was requested as of fall 2010 for students in Cohorts 1 and 2, who graduated from high school in spring 2009 or spring 2010, respectively, if they graduated on time. In Phase III, data was requested in fall 2011 for Cohort 3 students, who graduated from high school in spring 2011 if graduating on time. Updated data was also requested for Cohorts 1 and 2 at this time. Therefore, data presented in this section reflects whether students in Cohort 1 had enrolled in college by fall semester just over two years following their high school graduation, whether students in Cohort 2 had enrolled in college by fall semester just over one year following their high school graduation, and whether students in Cohort 3 had enrolled in college by the fall semester immediately following their high school graduation if they graduated on time. As would be expected given the varying lengths of time since high school graduation, college enrollment rates were highest for Cohort 1, followed by Cohort 2 and then Cohort 3.

Results

Overall and by cohort

As with the on-time high school graduation data, overall college enrollment results favored the STARBASE program but were not statistically significant. Overall, 58 percent of STARBASE and 55 percent of comparison students enrolled in college by fall 2011. Results also varied by cohort in a pattern similar to that of the high school graduation results. Cohort 2 showed the most favorable college enrollment results for STARBASE vs. comparison students (67% vs. 58%). College enrollment rates were slightly higher for STARBASE than comparison students in Cohort 1 (70% vs. 67%), and did not differ

between the two groups in Cohort 3 (50% each). Differences overall and by cohort were not statistically significant (Figure 31).

31. College enrollment: Cohorts 1-3 overall, by cohort, and by dosage

			Percentage enrolling in college		
		N[a]	STARBASE	Comparison	Significance
All study participants		442	58%	55%	ns
Cohort	Cohort 1	73	70%	67%	ns
	Cohort 2	135	67%	58%	ns
	Cohort 3	234	50%	50%	ns
Dosage	Higher	359	58%	57%	ns
	Lower	82	59%	46%	*

* *p<.05*

ns not statistically significant

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 442 STARBASE students were compared to 442 comparison students).*

Note. Data reflect enrollment as of fall 2011. If they graduated from high school on time, this would be the fall after high school graduation for Cohort 3, just over a year after high school graduation for Cohort 2, and just over two years after high school graduation for Cohort 1. Differences in percentages enrolled across cohorts are likely at least partially due to varying lengths of time since high school graduation.

Dosage

The modest pattern observed in earlier analyses of STARBASE students with a higher dosage performing better than those with a lower dosage did not emerge in the college-enrollment analysis. When looking only at STARBASE students, college enrollment results were similar for higher- vs. lower-dosage students overall. Fifty-eight percent of higher-dosage and 59 percent of lower-dosage STARBASE students enrolled in college by fall 2011 (Figure 32).

32. College enrollment: Cohort 1-3 STARBASE students by dosage

		N	Percentage enrolling in college	Significance
Dosage[a]	Higher	359	58%	ns
	Lower	82	59%	

ns not statistically significant

[a] *Program dosage was unknown for one STARBASE student.*

Looking only at STARBASE students by cohort, higher percentages of lower- than higher-dosage students enrolled in college in Cohorts 1 and 2, and a higher percentage of higher- than lower-dosage students enrolled in Cohort 3 as of fall 2011. These analyses were based on small samples of lower-dosage students by cohort. Differences were not statistically significant (Figure 33).

33. College enrollment: STARBASE students by cohort and dosage

	N[a]	Percentage enrolling in college: Higher dosage	Percentage enrolling in college: Lower dosage	Significance
Cohort 1	73	68%	75%	ns
Cohort 2	134	65%	74%	ns
Cohort 3	234	51%	47%	ns

ns not statistically significant

[a] *Note the small sample sizes for lower-dosage students (Cohort 1 included 57 higher-dosage and 16 lower-dosage students; Cohort 2 included 115 higher-dosage and 19 lower-dosage students; Cohort 3 included 187 higher-dosage and 47 lower-dosage students).*

Looking at STARBASE students in relation to their matched pairs, overall there was a significant difference between lower-dosage STARBASE and comparison students (59% vs. 46%), but not between higher-dosage and comparison students (58% vs. 57%) (Figure 31). Matched-pair results for each dosage group were also examined by cohort. These analyses compared higher- or lower-dosage STARBASE students to their matched pairs within each cohort. Results varied by cohort within the higher-dosage group, with the percentage of STARBASE students enrolled in college exceeding that of comparison students in Cohort 2 but not the other two cohorts. In the lower-dosage group, higher percentages of STARBASE than comparison students enrolled in college in each cohort. Again, differences were not statistically significant, and samples within the lower-dosage group were small when broken down by cohort (Figure 34).

34. College enrollment: Cohort 1-3 higher- vs. lower-dosage STARBASE students by cohort

			Percentage enrolling in college		
		N[a]	STARBASE	Comparison	Significance
Higher dosage	Cohort 1	57	68%	70%	ns
	Cohort 2	115	65%	60%	ns
	Cohort 3	187	51%	51%	ns
Lower dosage[b]	Cohort 1	16	75%	56%	ns[c]
	Cohort 2	19	74%	47%	ns[c]
	Cohort 3	47	47%	43%	ns

ns not statistically significant

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 57 STARBASE students were compared to 57 comparison students).*

[b] *These analyses should be viewed with caution due to the small sample sizes.*

[c] *Note the small sample size. There may not be enough power to detect a statistically significant difference.*

Demographics

Differences in college enrollment between STARBASE and comparison students were also analyzed by demographic characteristics, including race, gender, and free or reduced-price lunch eligibility as a proxy for income. Overall, there were no significant differences in college enrollment between STARBASE and comparison students based on their demographic characteristics. However, although differences were not significant, there was a clear pattern of a higher percentage of STARBASE than comparison students enrolling in college within each demographic category (Figure 35). Additional data on individual cohorts' college enrollment by demographic characteristics are provided in the Appendix (Figures A81-A83).

35. College enrollment: Cohorts 1-3 by race, gender, and income status

			Percentage enrolling in college		
		N[a]	STARBASE	Comparison	Significance[b]
Race[c]	Asian	216	63%	60%	ns
	Black (not Hispanic)	58	55%	47%	ns
	White (not Hispanic)	40	60%	53%	ns
Gender	Female	206	63%	59%	ns
	Male	193	56%	50%	ns
Free or reduced-price lunch	Eligible	345	58%	54%	ns
	Ineligible	59	64%	58%	ns

ns not statistically significant

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 216 STARBASE students were compared to 216 comparison students).*

[b] *Generalized linear models (GLMs) and McNemar tests were used to examine relationships among STARBASE participation, college enrollment, and demographic characteristics. The GLM provides an omnibus test of whether there is an overall interaction among the variables, and McNemar tests pinpoint where any specific differences between groups occur. No significant differences were found.*

[c] *Analysis excludes Hispanic and American Indian participants due to insufficient numbers in each group.*

Note. Analyses reflect students' demographic characteristics in fourth grade. Student pairs were not required to match on every demographic characteristic. These analyses exclude pairs that did not match on the specific characteristic of interest. For example, the analysis based on free or reduced-price lunch status excludes 38 pairs that did not match on this variable.

College characteristics

As shown in Figure 36, STARBASE and comparison study participants who enrolled in college were similar in the characteristics of the colleges they chose. The vast majority of both STARBASE and comparison students who enrolled in college attended an in-state school, with 92 percent of STARBASE and 93 percent of comparison students enrolling in a Minnesota college or university. A majority of both STARBASE and comparison students enrolling in college enrolled in public (70% and 75%, respectively) and four-year (66% and 61%, respectively) colleges or universities. Additional data on individual cohorts' college characteristics are provided in the Appendix (Figures A84-A86).

36. College enrollment: Cohorts 1-3 by college characteristic

		Percentage enrolling in each type of college			
		STARBASE	Comparison	N[a]	Significance
Public vs. private	Public	70%	75%	148	ns
	Private	30%	25%		
2-year vs. 4-year	2-year	34%	39%	148	ns
	4-year	66%	61%		
Minnesota vs. outstate	Minnesota	92%	93%	148	ns
	Outstate	8%	7%		

ns not statistically significant

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 148 STARBASE students were compared to 148 comparison students).*

Note. In cases where a student attended more than one college, these analyses reflect the first college the student attended.

Perfect-match analysis

As with the high school graduation data, college-enrollment data were also examined for the subset of STARBASE and comparison study participants matching on all nine characteristics of interest. When controlling for all nine characteristics, a 4-percentage-point difference separated the two groups, vs. the 3-percentage-point difference in the analysis of all 442 study pairs. Looking at only the 297 pairs matching on all nine characteristics, 60 percent of STARBASE and 56 percent of comparison students enrolled in college. Consistent with the results of all study pairs, Cohort 2 results were most favorable for STARBASE in the perfect-match analysis (Figure A87). Again, these results suggest that any differences between STARBASE and comparison students may have tended to favor the STARBASE group.

Military enrollment

Based on searches conducted in the DoD Global Directory Service, 3 percent of the former STARBASE participants and 2 percent of comparison group students were enrolled in the military in civilian or uniform careers in winter 2011-12. As described in the Methodology section, these are likely conservative estimates of the number who had entered the military. While the groups appeared similar in their military enrollment, results are consistent with the pattern in high school graduation and college enrollment data of favorable but not statistically significant results for the STARBASE program (Figure 37).

37. Military enrollment: Cohorts 1-3

		Record of military enrollment		
	N	Yes	No	Significance
STARBASE[a]	442	13 (3%)	429 (97%)	ns
Comparison[b]	442	11 (2%)	431 (98%)	

ns not statistically significant

[a] *Ten of the 359 higher-dosage students (3%) were enrolled in the military, and 3 of 82 lower-dosage students (4%) were enrolled. Six entered the Army, five the Air Force, and two the Navy.*

[b] *Six entered the Army, two the Air Force, two the Marines, and one the Navy.*

Note. These are likely to be conservative estimates of the number enrolling in the military. Study participants were identified in the database based on name. In some cases, a middle name or other identifying information would have been needed to confirm a potential match. Additionally, it is possible that some study participants could have served and since separated from the military, and not appeared in database searches at this time for that reason.

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Appendix

Technical details of study methods

Participant profile data by cohort and dosage

Phase I high school student survey results

Phase III college student survey results

Phase III responses to open-ended survey questions

Phase I student records results

Supplemental college enrollment data by cohort

Phase I high school student survey

Phase III college student survey

Technical details of study methods

This cumulative study report encompasses all three phases of Wilder Research's long-term follow-up study of STARBASE Minnesota participants. Complete results of Phases I and II were also presented in earlier reports available on Wilder Research's website (Broton & Mueller, 2009; Mohr & Mueller, 2011). This technical appendix provides additional details related to study methods and results. Additional details are provided in the following areas:

- Matching procedure
- High school survey
- College survey
- School records
- Tests for statistical significance

Matching procedure

As described in the body of the report, this study used a matched-comparison design. Students who participated in STARBASE were compared to demographically and academically similar students who did not participate in STARBASE. The matching procedure is described in greater depth below.

Identify potential STARBASE group students

Working with Saint Paul Public Schools (SPPS) and STARBASE program records, Wilder Research identified students who met the following criteria: 1) enrolled in SPPS during the 2008-09 school year as a 10^{th}-, 11^{th}-, or 12^{th}-grade student, 2) enrolled in SPPS in 3^{rd} and 4^{th} grades, and 3) attended STARBASE as a 4^{th}-grade student (i.e., in 2000-01 for the 12^{th}-grade cohort, Cohort 1; 2001-02 for the 11^{th}-grade cohort, Cohort 2; and 2002-03 for the 10^{th}-grade cohort, Cohort 3). These criteria yielded an initial sample size of 501 students (i.e., 256 in 10^{th} grade, 153 in 11^{th} grade, and 92 in 12^{th} grade).

Identify potential comparison group students

Based on SPPS records, Wilder Research identified students who met the following criteria: 1) enrolled in SPPS during the 2008-09 school year as a 10^{th}-, 11^{th}-, or 12^{th}-grade student, 2) enrolled in SPPS in 3^{rd} and 4^{th} grades, and 3) did not attend an elementary school that participated in STARBASE or had a special emphasis on math, science, or

technology (e.g., Crossroads Science) in 4th grade (or 6th grade for the 12th-grade cohort as 6th-grade school data were available only for this cohort). Students who met these criteria were then screened using STARBASE program records to ensure they had not participated in the program. These criteria yielded a sample size of 3,943 students from which to identify matches.

Match STARBASE and comparison students

Wilder Research identified a list of characteristics (variables) on which students were matched. Student pairs were required to match on the following variables: grade level in 2008-09, high school attended in 2008-09, third-grade Minnesota Comprehensive Assessment (MCA) math level score, and third-grade MCA reading level score. Additionally, student pairs were required to match on one or more of the following five variables: economic status (i.e., free or reduced-price lunch eligibility in fourth grade), English Language Learner status (i.e., limited English proficiency description in fourth grade), special education status (i.e., individualized education plan in fourth grade), gender, and race or ethnicity (i.e., White not Hispanic, Asian, or Black/American Indian/Hispanic). This matching procedure produced 442 student pairs, including 69 percent that matched on all nine characteristics, 15 percent that matched on eight characteristics, 8 percent that matched on seven characteristics, 6 percent that matched six characteristics, and 2 percent that matched on five characteristics. Overall, a match was found for 88 percent of STARBASE students meeting the study criteria. Students without a match were excluded from the study.

High school survey

Survey administration

In Phase I, Wilder Research administered a survey to study participants when they were in high school. A total of 762 students (381 STARBASE and 381 comparison) across all three cohorts at four SPPS senior high schools were identified to participate in the survey. Harding, Johnson, and Central senior high school students were eligible because those schools had the largest numbers of STARBASE study participants enrolled, as well as Arlington Senior High School students due to the school's STEM focus.

Administrators at some high schools identified survey eligible students who were no longer enrolled, dropping the sample by 40 students, and another 6 students were dropped due to missing program information. Of those students still remaining eligible, 507 completed the survey during an advisory period in April 2009 for a response rate of 71 percent. Of those completed surveys, 170 student pairs (67%) remained intact, and these 340 surveys were used in the survey analysis. Most student pairs (70%) matched on all nine

characteristics, 12 percent had eight characteristics in common, 10 percent matched on seven characteristics, 5 percent matched on six characteristics, and just 3 percent matched on five characteristics.

Characteristics of matched pairs included in survey

Demographic characteristics of matched pairs included in the survey analysis were examined. As indicated earlier, student pairs were required to match on four academic and demographic characteristics (i.e., grade level in 2008-09, high school attended in 2008-09, third-grade MCA math level score, and third-grade MCA reading level score). Additionally, student pairs were required to match on one or more of five additional demographic characteristics, and most student pairs matched on all or most of these characteristics. As shown in Figure A1, STARBASE and comparison students included in the high school survey analysis were very similar with regard to the five demographic matching characteristics. Students' third-grade MCA math and reading scores and grade level in 2008-09 were also included to show the frequency distributions for these characteristics.

A1. Profile of matched pairs included in survey data analysis: Cohorts 1-3

Characteristic		STARBASE N=170	Comparison N=170
Free or reduced-price lunch[a]	Eligible	82%	87%
	Ineligible	18%	13%
English Language Learner[a]	Yes	52%	52%
	No	48%	48%
Special education[a]	Yes	10%	7%
	No	90%	94%
Gender[a]	Male	49%	49%
	Female	51%	51%
Race/ethnicity[a]	White not Hispanic	15%	13%
	Asian or Pacific Islander	65%	67%
	Black or American Indian or Hispanic	21%	21%
MCA math level score[b, c]	Significantly below grade level/ Not meeting standards	12%	12%
	Slightly below grade level/ Partially meeting standards	45%	45%
	Successfully on grade level/ Meeting standards	29%	29%
	Above grade level/ Exceeding standards	13%	13%
	Well above grade level	1%	1%
MCA reading level score[b, d]	Significantly below grade level Not or partially meeting standards	55%	55%
	Slightly below to successfully on grade level/ Meeting or exceeding standards	35%	35%
	Above to well above grade level	10%	10%
Grade level in 2008-09[b]	10th (Cohort 3)	51%	51%
	11th (Cohort 2)	35%	35%
	12th (Cohort 1)	14%	14%

[a] *Characteristic as of 4th grade.*

[b] *Student pairs were required to match on 3rd-grade MCA math level score, 3rd-grade MCA reading level score, and grade level in 2008-09, so there is no difference between STARBASE and comparison groups. It's included only to show the frequency distribution of these characteristics.*

[c] *The 11th- and 12th-grade cohorts' (Cohorts 1 and 2) 3rd-grade MCA math results were categorized into four levels while the 10th-grade cohort's (Cohort 3) 3rd-grade MCA math results had five levels due to scoring changes between 2001 and 2002. The "well above grade level" category only includes students from the 10th-grade cohort.*

[d] *The 11th- and 12th-grade cohorts' (Cohorts 1 and 2) 3rd-grade MCA reading results were categorized into four levels while the 10th-grade cohort's (Cohort 3) 3rd-grade MCA reading results had five levels due to scoring changes between 2001 and 2002. For study purposes, the 11th- and 12th-grade cohorts' level scores were collapsed into two categories and the 10th-grade cohort's level scores were collapsed into three categories based on score distribution. The "above to well above grade level" category only includes students from the 10th-grade cohort.*

Note. There were no statistically significant differences found between groups.

The demographic and academic characteristics of higher-dosage (84%) and lower-dosage (16%) STARBASE students who were included in the survey analysis were also compared. There were no statistically significant differences between the subgroups based on the following characteristics: grade level in 2008-09, third-grade MCA math level score, third-grade MCA reading level score, free or reduced-price lunch eligibility, English Language Learner status, special education status, gender, and race or ethnicity.

College survey

In Phases II and III, Wilder Research administered an online survey to former STARBASE participants who were enrolled in college. Data from the National Student Clearinghouse (NSC) was used to identify students eligible to participate in the survey and the colleges they were attending. Based on NSC data, 117 former STARBASE participants in Cohorts 1 and 2 were enrolled in college in fall 2010 and therefore eligible for the Phase II survey, and 117 Cohort 3 STARBASE participants were enrolled in college in fall 2011 and therefore eligible for the Phase III college student survey. Across the two phases, Wilder Research was able to locate contact information for a total of 130 of these 234 eligible students. Completed surveys were received from 81 students, representing 62 percent of those contacted and 35 percent of those who would have been eligible.

To locate students' e-mail addresses, Wilder Research searched online college and university student directories where available. In cases where a college or university did not make student e-mail addresses available online, Wilder Research staff called the school to ask whether that information could be provided or whether a college registrar or other representative was willing to e-mail potential participants on Wilder Research's behalf. In a number of cases, a representative from the college e-mailed eligible students information about the survey and instructions for providing their e-mail addresses if they were willing to participate. For students who could not be located through these avenues, Wilder Research staff used Wilder's organizational account to search for potential respondents on the social-networking site Facebook, and sent a standard message with survey information and an invitation to provide their e-mail address. In Phase III, Wilder Research and STARBASE Minnesota also worked with a representative from SPPS to mail letters providing information on the survey and how to participate. Wilder Research and STARBASE wrote and provided copies of the letter, and SPPS mailed them to students' last known permanent address at the time they were enrolled in SPPS.

Despite intensive efforts to locate students' e-mail addresses, availability of e-mail addresses varied to a large extent by school, and in some cases e-mail addresses were unavailable for a school offering a high concentration of technical programs. Students at these schools may have been more likely to pursue a STEM-related program. Because this survey was administered only to former STARBASE participants who enrolled in

college, and because survey administration largely depended on the availability of student contact information at a college level, results may not represent all former STARBASE study participants or all former participants enrolled in college. In particular, survey results should not be viewed as representative of former participants pursuing military interests, as the survey was administered only to those enrolled in college at the time. Given that the survey was administered to a specific subpopulation, researchers did not compare demographic characteristics of college survey respondents to non-respondents.

Due to the length of time since students' participation in the program, Wilder Research offered an incentive to encourage completion of the survey. In Phase II, respondents were offered a $10 gift card to either Target or Walmart. In an effort to increase the response rate, respondents were offered a $20 gift card to Target or Walmart in Phase III. Wilder Research also followed up on the initial e-mail notifications about the survey with reminder e-mails and deadline extension e-mails. The surveys included an initial screening question verifying that students had participated in the STARBASE program at the Minnesota Air National Guard base.

School records

In Phase I, SPPS record data were used to examine student outcome measures. Data were provided through the first semester of the 2008-09 school year, when Cohort 1 was in 12th grade, Cohort 2 in 11th grade, and Cohort 3 in 10th grade. Wilder Research analyzed outcome measures at four points in time including 8th grade cumulatively, 9th grade, 10th grade cumulatively, and 12th grade cumulatively.

Analysis

Researchers used the records of as many cohorts as possible for each set of outcomes measured. For example, when measuring outcomes from students' ninth-grade year, the records of Cohorts 1-3 were used, but when analyzing outcomes based on students' senior high school career (i.e., 9th-12th grade), only the records of Cohort 1 were used. The school record data analysis plan is summarized in Figure A2 below.

A2. School record data analysis plan: Cohorts 1-3

Grade level outcomes measured in	Grade levels included	Cohort
8th grade cumulative	7, 8	3
9th grade	9	1, 2, 3
10th grade cumulative	9, 10	1, 2[a]
12th grade cumulative	9, 10, 11, 12[b]	1

[a] *Cohort 3 (10th grade in 2008-09) was not included because data were available for the first semester only.*

[b] *Data were available for the first semester only.*

The same set of indicators was measured in each of the four grade levels, to the extent possible and appropriate. For example, junior high school students are unable to enroll in JROTC courses, so that indicator was not examined in the eighth-grade cumulative analysis. Specific indicators assessed at each of the four grade levels are described below.

8th-grade cumulative

The eighth-grade cumulative (i.e., junior high school) outcome measures included a count of successfully completed courses, weighted grade average of courses, and percentage of courses passed. Science, math, and technology courses were counted by department and overall as a group. Honors courses taken in all subjects, plus math and science honors courses in particular, were also counted. The weighted grade average was calculated for math and science courses separately, then combined, and also for all courses taken, regardless of subject. The percentage of courses passed measure was analyzed combining math, science, and technology courses as well as for all courses (Figure A48). Finally, the highest level of math course passed was analyzed (Figure A49). For each of these junior high school indicator measures, the difference between STARBASE and comparison students was examined.

9th grade

The indicators measured in 9th grade included the junior high school measures described above, plus a few additional measures. A course count and weighted grade average of JROTC courses, an honors technology course count, and technology weighted grade average were added in the high school indicator measures. Additionally, the number of lab sciences (i.e., biology, chemistry, and physics) students successfully passed was counted. Finally, a benchmark indicator was included to determine the percentage of students who completed Algebra 2 or a higher math course (Figures A50-A51). Again, the difference

between STARBASE and comparison students, based on ninth-grade records, was analyzed for each indicator measure.

10th-grade cumulative and 12th-grade cumulative

The indicators measured in 10th and 12th grades cumulatively (i.e., 9th-10th grade and 9th-12th grade combined records) (Figures A52-A57) were nearly the same as those in the 9th-grade analysis. Additions include a benchmark indicator determining the percentage of students who had completed all three lab sciences (i.e., biology, chemistry, and physics) and a STEM momentum measure (Figures A54 & A57). This STEM measure combines students' highest math level and the number of lab sciences passed.

Additionally, students' attendance from the 2007-08 school year was analyzed along with the most recent math achievement scores available (i.e., MCA math results). For the 10th- and 11th-grade cohorts, the MCA 8th-grade math test was analyzed, and for the 12th-grade cohort, the MCA-II 11th-grade math test was examined. STARBASE and comparison students' attendance and math scores were compared (Figures A58-A59).

Construction of indicators

Following are descriptions of key academic achievement indicators used in the study and how each was constructed. In constructing indicators, researchers relied heavily on the SPPS seven-digit course number system (e.g., S4-0510-1) which was introduced in 2004. Each digit(s) represents a department (e.g., science, math), grade level group (e.g., junior or senior high school), learning level (e.g., general, honors, advanced placement), subgroup (e.g., biology, chemistry), individual course number (e.g. microbiology), or term (1st semester). Courses taken outside of SPPS, such as post-secondary enrollment options (PSEO) classes, were not available for inclusion in the study. It should also be noted that SPPS data indicated that seven students took both eighth-grade courses and ninth-grade courses during their ninth-grade school year. For these cases, researchers coded all courses taken during students' ninth-grade school year as ninth-grade courses.

Highest math passed

Modeled after Adelman's (1999) "HIGHMATH" (highest level of mathematics reached in high school) variable, this indicator had six categories: 1) general math, 2) algebra 1, 3) geometry, 4) algebra 2, 5) pre-calculus, trigonometry, or statistics, and 6) calculus. It was obvious for most course titles where the course should be placed (e.g., Algebra 1) and the SPPS Program Manager for Secondary Math confirmed the classification of less obvious course titles (e.g., High School Math) (Marty Gaslin, personal communication, April 14, 2009). Additionally, equivalent categories were determined for Integrated Math courses which utilize an embedded spiraling approach that combines a number of math

subject areas (e.g., algebra and geometry) into one course. For example, Integrated Math 1 was classified as Algebra 1 and Integrated Math 4 was classified as pre-calculus, trigonometry, or statistics (Marty Gaslin, personal communication, April 14, 2009).

Honors courses

For study purposes, honors courses include those classified as honors, advanced placement, international baccalaureate, or college in the schools.

Percentage of courses passed

Course letter grades A+ through D-, P, and CR were classified as passing. Course letter grades of N, NM, NP, I, and W were classified as not passing. The number of passed courses were added together and divided by the total number of courses (i.e., passed + not passed) to determine the percentage of courses passed. Course data were from the end of the term; so, in theory courses that students legitimately dropped early in the term were excluded from the data set (Steven Schellenberg, SPPS, personal communication, April 8, 2009). Because credits earned and on-track-to-graduate information were not available, this indicator was constructed to give insight into students' overall academic progress.

STEM momentum

This indicator was modeled after Adelman's (2006) "SCIMOM" (high school momentum in science and mathematics) variable. It had four categories: Sufficient) student reached a level of math beyond Algebra 2 and successfully completed three or more core lab science classes (i.e., biology, chemistry, or physics); Modest) student reached a level of math equivalent to Algebra 2 and successfully completed three or more core lab science classes *or* student reached a level of math beyond Algebra 2 and successfully completed two core lab science classes; Minimal) student reached a level of math equivalent to Algebra 2 and successfully completed two core lab science classes; and Weak) student fell short of the above criteria.

Weighted grade average

Each individual course letter grade was assigned a numerical value (e.g., A=4.0, C=2.0), and classes with a learning level of honors, advanced placement, international baccalaureate, or college in the schools were weighted by multiplying by 1.25 (e.g., honors class A=5.0) based on SPPS policy (Thompson, 2004). These numerical values were added together and divided by the number of courses to determine the weighted grade average. Researchers were not able to calculate weighted grade point average since credit information was unavailable.

Characteristics of students included in the analysis

Of the 442 matched student pairs in the study sample, 430 matched student pairs (97%) had available record data given the analysis plan above. Specific sample sizes varied by grade level and outcome measure (Figures A48-A75).

Analyses were conducted to determine the demographic characteristics of the matched student pairs included in the school records data portion of the study. These analyses showed that STARBASE and comparison students had very similar profiles on the five demographic characteristics used in the matching process. See Figure A3 below for details. Students' third-grade MCA math and reading scores and grade level in 2008-09 were also included to show the frequency distributions for these characteristics.

A3. Profile of matched pairs included in school record data analysis: Cohorts 1-3

Characteristic		STARBASE N=430	Comparison N=430
Free or reduced-price lunch[a]	Eligible	81%	83%
	Ineligible	19%	17%
English Language Learner[a]	Yes	46%	45%
	No	54%	55%
Special education[a*]	Yes	12%	8%
	No	88%	92%
Gender[a]	Male	50%	48%
	Female	51%	52%
Race/ethnicity[a]	White not Hispanic	16%	16%
	Asian or Pacific Islander	56%	57%
	Black or American Indian or Hispanic	28%	27%
MCA math level score[b, c]	Significantly below grade level/ Not meeting standards	17%	17%
	Slightly below grade level/ Partially meeting standards	44%	44%
	Successfully on grade level/ Meeting standards	22%	22%
	Above grade level/ Exceeding standards	16%	16%
	Well above grade level	1%	1%
MCA reading level score[b, d]	Significantly below grade level/ Not or partially meeting standards	54%	54%
	Slightly below to successfully on grade level/ Meeting or exceeding standards	36%	36%
	Above to well above grade level	11%	11%
Grade level in 2008-09[b]	10th (Cohort 3)	54%	54%
	11th (Cohort 2)	31%	31%
	12th (Cohort 1)	16%	16%

* *p<.05*

[a] *Characteristic as of 4th grade.*

[b] *Student pairs were required to match on 3rd-grade MCA math level score, 3rd-grade MCA reading level score, and grade level in 2008-09, so there is no difference between STARBASE and comparison groups. It is included only to show the frequency distribution of these characteristics.*

[c] *The 11th- and 12th-grade cohorts' (Cohorts 1 and 2) 3rd-grade MCA math results were categorized into four levels, while the 10th-grade cohort's (Cohort 3) 3rd-grade MCA math results had five levels due to scoring changes between 2001 and 2002. The "well above grade level" category includes only students from the 10th-grade cohort.*

[d] *The 11th- and 12th-grade cohorts' (Cohorts 1 and 2) 3rd-grade MCA reading results were categorized into four levels while the 10th-grade cohort's (Cohort 3) 3rd-grade MCA reading results had five levels due to scoring changes between 2001 and 2002. For study purposes, the 11th- and 12th-grade cohorts' level scores were collapsed into two categories and the 10th-grade cohorts' level scores were collapsed into three categories based on score distribution. The "above to well above grade level" category only includes students from the 10th-grade cohort.*

Additionally, the demographic and academic characteristics of higher-dosage (81%) and lower-dosage (19%) STARBASE students who were included in the school record analysis were compared. There was a statistically significant difference in race or ethnicity between dosage subgroups as more Asian students were included in the higher-dosage subgroup and more Black/American Indian/Hispanic students were in the lower-dosage subgroup. There were no statistically significant differences based on the following characteristics: grade level in 2008-09, third-grade MCA math level score, third-grade MCA reading level score, free or reduced-price lunch eligibility, English Language Learner status, special education status, and gender.

Tests for statistical significance

In this matched-comparison study, a number of statistical tests were used to determine significance based on the type of data measured. As described in the Methodology section of the report, researchers used a directional or one-tailed hypothesis because of the assumption that STARBASE students would perform better than comparison group students and that higher-dosage STARBASE students would perform better than lower-dosage STARBASE students on outcome measures (Lee-Pearce, et al., 1998). This means that statistically significant differences were reported only if they supported the directional hypothesis.

For unpaired nominal and ordinal data, *Pearson's chi square* (X^2) and *Z-tests of proportions* were used to test for association between variables. *Pearson's chi square* was used in analyses involving dichotomous variables, and *Z-tests of proportions* in analyses involving more than two categories. For example, *Pearson's chi square* was used in the college-enrollment comparisons of higher- vs. lower-dosage STARBASE students as well as the comparisons of STARBASE vs. comparison students involving aggregate high school graduation data. *Z-tests of proportions* were used in comparisons of high school graduation rates among higher-dosage, lower-dosage, and comparison students. The *Z-tests of proportions* enabled researchers to pinpoint the specific group comparisons where significant differences occurred between those who did and did not graduate from high school on time (e.g., between higher-dosage and comparison students in Cohort 2).

To examine differences between matched pairs, the *McNemar* test was used in analyses involving dichotomous nominal variables, such as the analysis of differences in college enrollment between STARBASE students and their matched pairs. *McNemar-Bowker* was used in matched-pair analyses involving non-dichotomous nominal and ordinal data, such as the analysis of high school students' STEM interest level or students' highest math course passed. Finally, some matched-pair analyses involved three nominal variables. *Generalized linear models* (GLM) were used to examine relationships among STARBASE participation, college enrollment, and demographic characteristics. The GLM provided an

omnibus test of whether there was an overall interaction among the variables, and *McNemar* tests were used to pinpoint where any specific differences between groups occurred.

References

Adelman, C. (1999). *Answers in the Tool Box: Academic Intensity, Attendance Patterns, and Bachelor's Degree Attainment.* Washington, D.C.: U.S. Department of Education.

Adelman, C. (2006). *The Toolbox Revisited: Paths to Degree Completion From High School Through College.* Washington, D.C.: U.S. Department of Education.

Lee-Pearce, M.L., Plowman, T.S., & Touchstone, D. (1998). STARBASE-Atlantis, a school without walls: A comparative study of an innovative science program for at-risk urban elementary students. *Journal of Education for Students Placed at Risk, 3(3),* 223-235.

Thompson, M. (2004, October 6). Grade point system and new honors course weighting formula for students in the class of 2008 and beyond. Saint Paul Public Schools memo, St. Paul, MN.

Participant profile data by cohort and dosage

A4. Profile of matched pairs: Cohort 1

Characteristic[a]		STARBASE N=73	Comparison N=73	Significance
Free or reduced-price lunch	Eligible	73%	75%	ns
	Ineligible	27%	25%	
English Language Learner	Yes	51%	49%	ns
	No	49%	51%	
Special education	Yes	7%	8%	ns
	No	93%	92%	
Gender	Male	49%	47%	ns
	Female	51%	53%	
Race/ethnicity	White (not Hispanic)	16%	15%	ns[b]
	Asian	58%	59%	
	Black (not Hispanic)	19%	18%	
	Hispanic	7%	7%	
	American Indian	-	1%	

ns no statistically significant differences between groups

[a] *Characteristic as of 4th grade.*

[b] *The McNemar-Bowker test was used to test differences between matched pairs in race or ethnicity, but could not be run in this case without students in the STARBASE American Indian group. However, results show that Cohort 1 STARBASE and comparison students were very similar by race or ethnicity.*

A5. Profile of matched pairs: Cohort 2

Characteristic[a]		STARBASE N=135	Comparison N=135	Significance
Free or reduced-price lunch	Eligible	77%	83%	ns
	Ineligible	23%	17%	
English Language Learner	Yes	39%	39%	ns
	No	61%	61%	
Special education	Yes	13%	6%	*
	No	87%	94%	
Gender	Male	44%	45%	ns
	Female	56%	55%	
Race/ethnicity	White (not Hispanic)	22%	20%	ns
	Asian	47%	53%	
	Black (not Hispanic)	21%	19%	
	Hispanic	7%	7%	
	American Indian	2%	1%	

* *p<.05*

ns no statistically significant differences between groups

[a] *Characteristic as of 4th grade.*

A6. Profile of matched pairs: Cohort 3

Characteristic[a]		STARBASE N=234	Comparison N=234	Significance
Free or reduced-price lunch	Eligible	86%	86%	ns
	Ineligible	14%	14%	
English Language Learner	Yes	49%	48%	ns
	No	51%	52%	
Special education	Yes	12%	9%	ns
	No	88%	91%	
Gender	Male	52%	50%	ns
	Female	48%	50%	
Race/ethnicity	White (not Hispanic)	12%	13%	ns
	Asian	62%	59%	
	Black (not Hispanic)	20%	21%	
	Hispanic	6%	6%	
	American Indian	1%	<1%	

ns no statistically significant differences between groups

[a] *Characteristic as of 4th grade.*

A7. Profile of matched pairs: Cohort 1-3 higher-dosage vs. comparison students

Characteristic[a]		Higher dosage N=359	Comparison N=359	Significance
Free or reduced-price lunch	Eligible	81%	83%	ns
	Ineligible	19%	17%	
English Language Learner	Yes	48%	46%	ns
	No	52%	54%	
Special education	Yes	11%	8%	*
	No	89%	92%	
Gender	Male	49%	48%	ns
	Female	51%	52%	
Race/ethnicity	White (not Hispanic)	16%	16%	ns
	Asian	60%	60%	
	Black (not Hispanic)	16%	18%	
	Hispanic	6%	6%	
	American Indian	1%	1%	

* *p<.05*

ns no statistically significant differences between groups

[a] *Characteristic as of 4th grade.*

A8. Profile of matched pairs: Cohort 1-3 lower-dosage vs. comparison students

Characteristic[a]		Lower dosage N=82	Comparison N=82	Significance
Free or reduced-price lunch	Eligible	83%	87%	ns
	Ineligible	17%	13%	
English Language Learner	Yes	38%	43%	ns
	No	62%	57%	
Special education	Yes	10%	9%	ns
	No	90%	91%	
Gender	Male	49%	46%	ns
	Female	51%	54%	
Race/ethnicity	White (not Hispanic)	12%	16%	ns
	Asian	41%	46%	
	Black (not Hispanic)	39%	29%	
	Hispanic	6%	7%	
	American Indian	1%	1%	

ns no statistically significant differences between groups

[a] *Characteristic as of 4th grade.*

A9. Profile of STARBASE students: Cohort 1-3 higher- vs. lower-dosage students

Characteristic[a]		Higher dosage N=359	Lower dosage N=82	Significance
Free or reduced-price lunch	Eligible	81%	83%	ns
	Ineligible	19%	17%	
English Language Learner	Yes	48%	38%	ns
	No	52%	62%	
Special education	Yes	11%	10%	ns
	No	89%	90%	
Gender	Male	49%	49%	ns
	Female	51%	51%	
Race/ethnicity	White (not Hispanic)	16%	12%	*[b]
	Asian[b]	60%	41%	
	Black (not Hispanic)[b]	16%	39%	
	Hispanic	6%	6%	
	American Indian	1%	1%	

* *p<.05*

ns no statistically significant differences between groups

[a] *Characteristic as of 4th grade.*

[b] *There were significantly more Asian students in the higher-dosage group, and significantly more Black students in the lower-dosage group.*

Phase I high school student survey results

A10. What students remember most about participating in STARBASE: Cohort 1-3 high school results (N=153)

Response theme[a]	Percentage[b]
Building and launching rockets or gliders	43%
Learning about rockets or airplanes	24%
Seeing the airplanes and helicopters in-person	23%
Computer flight simulation	22%
Other activities and experiments	13%
Learning about science and space	9%
Call names/signs	8%

[a] *Response themes developed by Wilder Research based on students' responses.*

[b] *Students' responses could be placed in multiple themes, so percentages do not sum to 100 percent.*

Note. Other response themes include the following: having fun, making airplanes, building things, making and flying kites, watching movies, working with computers, the teachers, and don't remember (2-7 responses each).

A11. How much STARBASE increased students' interest in science, technology, engineering, and math: Cohort 1-3 high school results (N=155)

Subject	A lot	Some	A little	None
Technology	41%	36%	14%	10%
Engineering	28%	39%	20%	12%
Science	21%	48%	20%	12%
Math	16%	39%	27%	18%

A12. How participation in STARBASE continues to impact students today: Cohort 1-3 high school results (N=155)

Response theme[a]	Percentage[b]
Knowledge and experience gained is used now	8%
Learned about STEM	6%
Learned about or want to pursue a career related to science, math, technology, or engineering	5%
Learned about aerospace (or STARBASE specific component)	4%
Realization of interest in or want to learn more about science, math, technology, or engineering	3%

[a] *Response themes developed by Wilder Research based on students' responses.*

[b] *Students' responses could be placed in multiple themes. Percentages based on total STARBASE group (N=155).*

Notes. 1) Only responses from students who indicated that STARBASE continues to impact them today (26%) were included.

2) Other response themes include the following: learned something else and joined JROTC (2-3 responses each).

A13. Type of past experience or activity (besides STARBASE) that increased students' interest in STEM: Cohort 1-3 high school results

	STARBASE N=52		Comparison N=50	
Response theme[a]	Number	Percentage[b]	Number	Percentage[b]
STEM-related class or lab at school	15	29%	17	34%
Informal STEM learning	9	17%	6	12%
Aerospace camp	7	14%	-	-
Field trips or other activities	5	10%	7	14%
Science fair	2	4%	5	10%

[a] *Response themes developed by Wilder Research based on students' responses.*

[b] *Students' responses could be placed in multiple themes. Percentages based on the number of students who indicated that a past experience increased their interest in science, math, technology, or engineering (N=52, 50).*

Notes. 1) Only responses from students who indicated that a past experience increased their interest in science, math, technology, or engineering (34% STARBASE and 31% comparison) were included.

2) Other response themes include the following: job, internship or job shadow, STEM camp, JROTC, 3M, Project Lead the Way, or other STEM clubs or programs.

A14. Students' favorite core subject: Cohort 1-3 high school results

	STARBASE N=163	Comparison N=163
Math	34%	35%
Science	33%	26%
English/Language Arts	22%	26%
Social Studies	12%	13%

A15. Plans for taking more science, math, computer or engineering classes in high school: Cohort 1-3 high school results

	STARBASE N=166	Comparison N=166
Yes, more than what's required	41%	44%
Yes, only what's required	42%	33%
No or don't know	18%	23%

A16. How much STARBASE increased students' interest in science, technology, engineering, and math by dosage: Cohort 1-3 high school results

Subject	Dosage	N	A lot	Some	A little	None
Technology	Higher dosage	134	43%	37%	13%	8%
	Lower dosage	21	29%	33%	14%	24%
Engineering	Higher dosage	134	28%	40%	20%	11%
	Lower dosage	21	29%	33%	19%	19%
Science	Higher dosage	134	23%	46%	20%	10%
	Lower dosage	21	5%	57%	19%	19%
Math	Higher dosage	134	16%	40%	26%	18%
	Lower dosage	21	14%	38%	29%	19%

Note. Includes STARBASE students only.

A17. Students got involved in STEM activities or programs because of STARBASE by dosage: Cohort 1-3 high school results

	N	Yes	No
STARBASE	155	18%	82%
Higher dosage	134	19%	81%
Lower dosage	21	14%	86%

Note. Includes STARBASE students only.

A18. STARBASE was a valuable learning experience by dosage: Cohort 1-3 high school results

	N	Yes	No	Don't know
STARBASE	155	82%	1%	17%
Higher dosage	134	81%	1%	17%
Lower dosage	21	86%	0%	14%

Note. Includes STARBASE students only.

A19. Participation in STARBASE continues to impact you today by dosage: Cohort 1-3 high school results

	N	Yes	No	Don't know
STARBASE	155	26%	17%	57%
Higher dosage	134	28%	16%	57%
Lower dosage	21	19%	24%	57%

Note. Includes STARBASE students only.

A20. How much interest students have in science, technology, engineering, and math by dosage: Cohort 1-3 high school results

Subject		N	A lot	Some	A little	None
Technology	Higher dosage	143	48%	34%	11%	6%
	Lower dosage	27	52%	22%	22%	4%
Science	Higher dosage	143	27%	49%	18%	6%
	Lower dosage	27	26%	41%	30%	4%
Math	Higher dosage	143	26%	46%	18%	10%
	Lower dosage	27	30%	33%	26%	11%
Engineering	Higher dosage	143	28%	32%	28%	13%
	Lower dosage	27	26%	26%	33%	15%

Note. Includes only STARBASE students.

A21. Current participation rates in STEM-related programs by dosage: Cohort 1-3 high school results*

	N	Percentage participating in a program, club, or activity
STARBASE	168	12%
Higher dosage	142	14%
Lower dosage	26	0%

* *p<.05*

Note. Includes only STARBASE students.

A22. Current participation rates in military-related programs by dosage: Cohort 1-3 high school results

	N	Percentage participating in a program, club, or activity
STARBASE	170	13%
Higher dosage	143	12%
Lower dosage	27	19%

Note. Includes only STARBASE students.

A23. Past experience or activity (besides STARBASE) increased students' interest in STEM by dosage: Cohort 1-3 high school results

	N	Percentage responding yes
STARBASE	170	34%
Higher dosage	143	34%
Lower dosage	27	30%

Note. Includes only STARBASE students.

A24. Students' favorite core subject by dosage: Cohort 1-3 high school results

	STARBASE N=167	Higher dosage N=140	Lower dosage N=27
Math	34%	33%	41%
Science	32%	32%	30%
English/Language Arts	22%	22%	19%
Social Studies	13%	13%	11%

Note. Includes only STARBASE students.

A25. Plans for taking more science, math, computer or engineering classes in high school by dosage: Cohort 1-3 high school results

	STARBASE N=169	Higher dosage N=140	Lower dosage N=27
Yes, more than what's required	40%	41%	37%
Yes, only what's required	43%	42%	48%
No or don't know	17%	18%	15%

Note. Includes only STARBASE students.

A26. Plans for attending college by dosage: Cohort 1-3 high school results

Going to college (2- or 4-year)?	N	Yes
STARBASE	170	95%
Higher dosage	143	96%
Lower dosage	27	93%

Note. Includes only STARBASE students.

A27. Plans for pursuing a job related to STEM by dosage: Cohort 1-3 high school results

	N	Yes
STARBASE	170	47%
Higher dosage	143	49%
Lower dosage	27	37%

Note. Includes only STARBASE students.

A28. What students remember most about participating in STARBASE: Cohort 3 college results (N=45)

What do you remember most about participating in STARBASE?[a,b]	
Building and launching rockets, airplanes, gliders, or kites	26 (58%)
Flight simulations	26 (58%)
Being on the base/seeing airplanes and helicopters in person	14 (31%)
Learning about rockets or airplanes	10 (22%)
Getting code names	7 (16%)
Other activities or experiments	5 (11%)
Having fun/being excited to go to STARBASE	1 (2%)
Working as a team	1 (2%)
Learning about physics or other scientific concepts	1 (2%)

[a] *Response themes developed by Wilder Research based on students' responses.*

[b] *Students' responses could be placed in multiple themes, so percentages do not sum to 100 percent.*

Note. Includes only STARBASE students. Respondents' complete comments are provided in the Appendix.

A29. College students' overall perceptions of STARBASE: Cohort 3 college results (N=45)

Do you think STARBASE…	Yes	No	Don't know
Was a valuable learning experience?	45 (100%)	0 (0%)	0 (0%)
Helped you understand science, technology, engineering, or math better?	39 (87%)	2 (4%)	4 (9%)
Increased your interest in science, technology, engineering, or math?	38 (84%)	4 (9%)	3 (7%)
Increased your interest in the military? This could include interest in the military in general as well as interest in joining the military.	10 (22%)	30 (67%)	5 (11%)
Helped you learn about careers related to science, technology, engineering, or math?	34 (76%)	3 (7%)	8 (18%)
Has had any influence on your career plans or choices?	14 (31%)	16 (36%)	15 (33%)

A30. Career Impact: Cohort 3 college results (N=14)

Open-ended question: Please explain the influence STARBASE has had on your career plans or choices.[a]	
Pursuing a career in science/engineering	5 respondents
Gave me a better perspective on STEM fields	4 respondents
Pursuing a career in science education	3 respondents
Other	2 respondents

[a] *Response themes developed by Wilder Research based on students' responses.*

Note. This question was asked only of those who answered "yes" when asked, "Do you think STARBASE has had any influence on your career plans or choices?"

Note. Includes only STARBASE students. Respondents' complete comments are provided in the Appendix.

A31. Impact of STARBASE on interest in science, technology, engineering, and math: Cohort 3 college results (N=38)

Specifically, do you think STARBASE increased your interest in…	Yes	No	Don't know
Science?	32 (84%)	3 (8%)	3 (8%)
Technology? (e.g., computers)	28 (74%)	7 (18%)	3 (8%)
Engineering?	20 (53%)	11 (29%)	7 (18%)
Math?	20 (53%)	10 (26%)	8 (21%)

Note. Includes only STARBASE students. This question was asked only of those who answered "yes" when asked, "Do you think STARBASE increased your interest in science, technology, engineering, or math?"

A32. Most important thing gained from participation in STARBASE: Cohort 3 college results (N=45)

What was the most important thing you gained from your participation in STARBASE?[a,b]	
Fun experience/joy of exploration	10 (22%)
Knowledge of aircraft/space	10 (22%)
Appreciation of science or STEM areas/understanding of scientific principles	9 (20%)
Career exploration	8 (18%)
Appreciation for, knowledge of, or interest in technology specifically	4 (9%)
Experience working on a team	4 (9%)
I don't remember/don't know	4 (9%)
Gained knowledge of personal interests or learning style	2 (4%)
Experiencing science in a different way	2 (4%)

[a] *Response themes developed by Wilder Research based on students' responses.*

[b] *Students' responses could be placed in multiple themes, so percentages do not sum to 100 percent.*

Note. Includes only STARBASE students. Respondents' complete comments are provided in the Appendix.

A33. Current impact of STARBASE: Cohort 3 college results (N=45)

Do you think your participation in STARBASE continues to impact you today?	
Yes	20 (44%)
No	14 (31%)
Don't know	11 (24%)
Open-ended question: If yes, how so? (N=20)[a,b]	
Influenced career or education choices	6 respondents
Still use the information I learned in STARBASE	5 respondents
Continued interest in aviation	4 respondents
Better appreciation and understanding of science	4 respondents
Continued interest in STEM	2 respondents
Discussed STARBASE with siblings who participated	2 respondents
Other	3 respondents

[a] *Response themes developed by Wilder Research based on students' responses.*

[b] *Students' responses could be placed in multiple themes.*

Note. Includes only STARBASE students. Respondents' complete comments are provided in the Appendix.

A34. Level of interest in science, technology, engineering, and math: Cohort 3 college results (N=45)

How much interest do you currently have in…	A lot	Some	Very little/ None
Science?	18 (40%)	19 (42%)	8 (18%)
Technology? (e.g., computers)	20 (44%)	18 (40%)	7 (16%)
Engineering?	6 (13%)	21 (47%)	18 (40%)
Math?	14 (31%)	16 (36%)	15 (33%)

Note. Includes only STARBASE students.

A35. College major or field of study: Cohort 3 college results

Have you decided on a major or field of study in college? (N=45)	
Yes	33 (73%)
No	7 (16%)
Don't know	5 (11%)
Open-ended question: If yes, what is your major or field of study?[a] (N=33)	
Science/technology/engineering/math (STEM)[b]	17 (52%)
Other[c]	16 (48%)

[a] *Response themes developed by Wilder Research based on students' responses.*

[b] *Responses categorized here include the following: accounting, biology, biology education, civil engineering, computer science, engineering, forensic science, nursing, physical therapy, pre-dental, and pre-med.*

[c] *Responses categorized here include the following: advertising, business management, criminal justice, education, elementary education, geography, psychology, public relations, social work, sociology, and "worship leading."*

Note. Includes only STARBASE students.

A36. Considering major or field of study in STEM if undecided: Cohort 3 college results (N=12)

Are you considering a major or field of study related to science, technology, engineering, or math?	
Yes	5 (42%)
No	0 (0%)
Don't know	7 (58%)

Note. Includes only STARBASE students. This question was asked only of those who answered "no" or "don't know" when asked, "Have you decided on a major or field of study in college?"

A37. STEM coursework: Cohort 3 college results (N=44)

Have you taken or are you planning to take any additional science, technology, engineering, or math classes in college beyond what is required?	
Yes, more than what's required	15 (34%)
No, only what's required	19 (43%)
Don't know	10 (23%)

Note. Includes only STARBASE students.

A38. STEM job interest: Cohort 3 college results (N=45)

How much interest do you have in…	A lot	Some	Very little/ None
Getting a job related to science, technology, engineering, or math?	13 (29%)	24 (53%)	8 (18%)
Getting a job teaching science, technology, engineering, or math?	6 (13%)	16 (36%)	23 (51%)

Note. Includes only STARBASE students.

A39. Participation in STEM activities in college: Cohort 3 college results (N=45)

At your college or university, have you participated in any activities, clubs, or programs related to science, technology, engineering, or math?	
Yes	6 (13%)
No	39 (87%)

Note. Includes only STARBASE students. The six respondents answering "yes" were asked to indicate the types of activities in which they have participated. Their answers included the following: Focus on Cultivating Scientists, math club, Forensic Science Society, Air Force ROTC, pre-med activities, and a work study position in information technology.

A40. Participation in military activities in junior high, high school, or college: Cohort 3 college results (N=45)

Have you participated in any activities, clubs, or programs related to the military since STARBASE, either in junior high, high school, or at your college or university (e.g., Junior ROTC or ROTC)?	
Yes	6 (13%)
No	39 (87%)

Note. Includes only STARBASE students. The six respondents answering "yes" were asked to indicate the types of activities in which they have participated. All six indicated JROTC, and one also indicated ROTC.

A41. College students' military enrollment: Cohort 3 college results (N=45)

Are you currently enrolled in any form of the military?	
Yes	0 (0%)
No	45 (100%)

Note. *Includes only STARBASE students.*

A42. College students' level of interest in joining the military: Cohort 3 college results (N=45)

How much interest do you have in pursuing a civilian or uniform military career?	
A lot	2 (4%)
Some	11 (24%)
Very little/none	32 (71%)

Note. *Includes only STARBASE students.*

A43. Participation in other STEM activities after STARBASE: Cohort 3 college results (N=45)

After participating in STARBASE, did you participate in any other activities, clubs, or programs related to science, technology, engineering, or math when you were in elementary, junior high, or high school?	
Yes	9 (20%)
No	30 (67%)
Don't know	6 (13%)

Note. *Includes only STARBASE students.*

A44. STARBASE influence on participation in other STEM activities: Cohort 3 college results (N=9)

Did you get involved in any of these science, technology, engineering, or math activities or programs <u>because</u> of STARBASE?	
Yes	2
No	4
Don't know	3

Note. Includes only STARBASE students. This question was asked of those who answered "yes" when asked, "After participating in STARBASE, did you participate in any other activities, clubs, or programs related to science, technology, engineering, or math when you were in elementary, junior high, or high school?" The two respondents answering "yes" were asked to specify the activities in a follow-up question. One answered, "JROTC – we built rockets and launched them," and the other answered, "all of them."

A45. Challenges to participation in other STEM activities: Cohort 3 college results

Did you face any challenges to participating in other science, technology, engineering, or math activities, clubs, or programs when you were in elementary, junior high, or high school? (N=45)	
Yes	9 (20%)
No	30 (67%)
Don't know	6 (13%)
If yes, which challenges did you face? (N=9)[a]	
I was too busy with other activities.	6
Transportation would have been difficult.	6
I was not aware of what other opportunities were available to me.	6
There were not enough opportunities available to me.	4
I needed to be home to care for my sibling(s).	4
My parents or caregivers were not aware of other opportunities.	3
Opportunities did not fit my specific interests.	2
Available opportunities were too expensive.	1
Opportunities were not applicable to me based on my age, gender, or other factors.	0
Other challenges.	0

[a] *Participants were presented with response options and asked to indicate all that apply.*

Note. Includes only STARBASE students.

A46. Availability of other STEM opportunities: Cohort 3 college results (N=45)

Were there any science, technology, engineering, or math opportunities you would have liked to participate in but that were not available to you in elementary, junior high, or high school?	
Yes	9 (20%)
No	22 (49%)
Don't know	14 (31%)

Note. Includes only STARBASE students.

A47. Final comments: Cohort 3 college results (N=37)

Are there any final comments you would like to share with the STARBASE program?[a,b]	
It was a great experience. I had a lot of fun.	19 (51%)
Thank you for the experience!	6 (16%)
It's a great program.	5 (14%)
STARBASE should continue to be available to students. More students should have this experience. Older students could benefit from the experience as well.	5 (14%)
It introduced me to and encouraged an understanding of STEM fields.	5 (14%)
I learned a lot.	1 (3%)
STARBASE provides a great opportunity to or helped me explore science and careers. I was inspired.	1 (3%)
No/none.	1 (3%)

[a] *Response themes developed by Wilder Research based on students' responses.*

[b] *Students' responses could be placed in multiple themes, so percentages do not sum to 100 percent.*

Note. Includes only STARBASE students. Respondents' complete comments are provided in the Appendix.

Phase III responses to open-ended survey questions (Cohort 3 STARBASE students' college results)

What do you remember most about participating in STARBASE? (N=45)

> The part I remember the most about STARBASE was having my own nickname. My nickname was FAITH, and I also remembered the flight stimulator. :) We also watched a lot of Magic School Bus episodes about space and flight.
>
> The flight simulation and building a plane. Those were the best at STARBASE.
>
> Making rockets, and testing them out on the last day of STARBASE.
>
> Looking at all of the old grounded aircraft.
>
> I remember making a rocket, the flying simulation, and going inside of a bomber plane.
>
> The rocket launch, eating with the bees and hitting them with my bare hands, the [Blackbird], how it has small cameras that can see us all the way from earth, also our group project after watching Apollo 13 to see if we can stop our shuttle from leaking so that we can [breathe].
>
> Something I remember the most is the last day. In 4th grade, I think we did a simulation lab of what [it] is like to be in outer space, and in 6th grade, we made [rocket ships] and we launched them in an open field.
>
> I think I remember making rockets and shooting them. That was one of the coolest things I've ever done.
>
> The tour of the airplanes and air base.
>
> What I remember most about STARBASE is learning about science and [practicing] being a pilot and controlling computer planes, and my most memorable moment is making rockets and shooting them the next day.
>
> Building kites with STARBASE leaders Sky and Willow. We made them out of tarps, straws, tape, and thread. This was after practicing flying on the computer. I think my STARBASE name was Cloud.
>
> I remember learning information about airplanes, building small rockets, and using a flight simulator.
>
> Flight simulator on a computer, building a rocket, painting the rocket, having cool names that were related to flight or weather... This was a long time ago!

Flying an airplane from a game simulator on the computer. I also remembered that everyone had to answer certain types of [questions], and because of that, everyone [was] given different jobs in the room to have. Like for example, I remember I had to play [the] role of a doctor.

I remember making rockets and using them down by the lake. I also remember touring the grounds and looking at the super cool planes. Most importantly, I remember flight simulation!!

What I remember most about participating in STARBASE was the activity that was held with making a plane and seeing how far it can fly. [The] learning about planes was wow.

Making a kite, our STARBASE name.

The airplane part where we [got] to control an airplane in a game.

I [remember] going to STARBASE with many friends and getting to see the airplanes they have there. I still remember my favorite airplane there. [It] is called the Blackbird, I believe. I also remember the computer in the room where we get to learn how to control [an] airplane. It was the best thing that I [liked] in STARBASE.

The thing that I remember the most is going to look at the helicopters, tanks, and making the rockets with my friends and then shooting them into the sky. In addition, I also remember playing with the airplane software where we have the control to control the plane and we are sitting in the pilot's seat.

I remember making the rockets, seeing the jets, and the awesome conservers.

Making rockets and doing simulators.

I remember looking at the planes and the simulator.

I remember learning about airplanes and making things that we got to test out like rockets and kites.

Getting to play the game on the computer pretending to be in a plane, choosing our nicknames, the nasty lunches, watching movies in our groups, and how fun it was when it wasn't "work" work.

The flight simulators and being able to go outside and see the airplanes.

I remember making the rockets, then going out to the field and seeing how far we can launch them, [as] well as doing simulations and actually getting to go in and see some different aircrafts.

The thing that stuck with me the most was learning about the various [aircrafts].

Building a rocket and seeing [whose] flew higher.

We [learned] about [planes].

I mostly remember when we looked at the planes. I have never [forgotten] the Blackbird.

I remember creating flying gliders and testing them outside for flight.

Learning about parts of an airplane.

One of the things that I remember most about STARBASE are the names that we picked out for ourselves and the names we got to learn such as Delta, [etc.] I also remember learning how to fly a plane on the computer.

I remember playing with the flight simulator.

The flight stimulator.

I remember doing the simulator and looking at planes.

Flight stimulator, model planes.

I remember flying the pilot in the [simulator] room on top of Farnsworth elementary. I was not that bad at flying it. I can't really remember anything, since it's been so long.

We made kites, made rockets, played games, and I [remember] we had nicknames.

The airplane game where you can control it. The wooden cart that moved with the rubber band. Aerodynamics, drag, [thrust], why the airplane wings are shaped like [they are] now. Making a wooden airplane [and] drawing a picture of a wing to put on the airplane, [testing] it, and [seeing] in the group whose went farther, then [using] those wings as the whole group to win the game. The glass and the [vacuum] with the shaving cream, and of course watching the Magic School Bus!

Playing [on] the computer and pretending like we were going into space. I also remember flying the planes that we made.

I remembered learning about the different types of planes there were and how to fly one in the simulators.

I remember the [teachers] teaching us about drag, lift, thrust, and all sorts of flying elements. I also [remember] the flight simulator and the tour of the C-130.

I remember working on problems and making planes and kites. We would see which person had the best flying kite or plane. I also remember touring the airplanes.

What was the most important thing you gained from your participation in STARBASE? (N=45)

I believe the most important part during my participation in STARBASE was that it made me realize the different careers in science, and the interesting things about [space].

Learning new things such as [that] a marshmallow would shrink in a vacuum, or was it the other [way?] It's been a while.

I learned important terms, mostly relating to science.

Just having lots [of] fun.

Learning how an airplane jet works.

Knowing how to make your own rocket, and using acid and bases to help the rocket to launch up into the air.

Something important I gained from my participation in STARBASE is learning what [it] is like to be in space, and how they survive.

Definitely experience and memories!

I knew it was possible to be anything I wanted to be with hard work.

I learned that no matter if a person [takes] a curvy road or the straight road, [if] going at the same pace, they will get to their destination at the same time.

A good time.

I was exposed to information that I would have never gained outside of the program.

It really gave me an opportunity to peek into a field of professions I never would have been exposed to. So to answer this question, it ignited my curiosity.

The most important thing I gained from my participation back in fourth and sixth [grades was] communication skills.

I think it was a good bonding time outside of the classroom, and it was an overall fun experience.

The most important thing that I gained from STARBASE is the knowledge of [how] to see what is different and to enjoy what the career holds.

Getting to know the airplane parts.

How to make a rocket.

I gained a future [idea] of what I want to do and [of becoming] someone I want to be known as. A career.

The most important thing that I learned from my participation in STARBASE was that science, technology, engineering, and math [are] fun.

It showed me what jobs are available through the field of science.

How to work as a team.

N/A

One important thing I gained from participating in the STARBASE program would be that science, math, and engineering are interesting subjects. The STARBASE program made learning about those fields of study interesting and fun!

Being able to say that I experienced what many kids my age at the time didn't have the opportunity to.

I don't know, truth be told. I've always hated heights, but I've always wanted to learn how to fly, and part of that may have come from the program.

I gained a confidence in myself with sciences. Before I was not very confident, but going to STARBASE I was taught in a way that I was able to understand.

I learned that there were more options in engineering and technology [than] I had previously been exposed to.

[Irrelevant response.]

Can't recall.

Mostly I think I gained an appreciation [of] science.

STARBASE helped me understand the implementation of science and math in technology.

Learning how to pilot an airplane on a computer game.

How important science, math, and engineering can be in a career.

I'm not exactly sure what the most important thing I gained was. But I think I learned a lot in general, and it helped a lot not being in the classroom setting and learning hands-on.

Knowledge about planes.

I'm not quite sure how much I remember.

A memorable event.

My technology skills [had] gotten better [than] before. It will and can help kids in the future with science, math, engineering, and technology.

The most important thing that I remembered was leadership and teamwork. I [gained] a lot of knowledge from that.

The [interest] in engineering.

Learning about the different planes and space shuttles that there are.

The most important thing I gained from my participation in STARBASE was teamwork.

The most important thing I got out of STARBASE was becoming more interested in planes. I also wanted to become a military pilot, but I figured out that I needed 20/20 vision which I don't have.

It was a great experience, and I got to do a lot of cool things I know I wouldn't get to do elsewhere.

Do you think your participation in STARBASE continues to impact you today? If yes, how so? (N=20)

I still have an interest in aviation.

It influenced me to [pursue] a career in the sciences.

Watching movies and [watching the] history channel about rockets and space brings [back memories] about STARBASE.

STARBASE is [continuing] to impact me because it gave me somewhere to start. For an example, it gave me an idea of what I am strong in and what I am weak in.

Reminds me how things work such as [Newton's] Laws.

I am able to discuss the program with my younger brother who is currently in the 6th grade.

[It continues] to [impact] me because my younger sister and little brother attended STARBASE. So with that knowledge, it [makes] me [want] to help my younger sister to see the [outcomes] of STARBASE.

It makes me want to work [at an] airport or in [an] airplane. I love airplanes these days.

I am currently going for my Bachelor of Science Degree in Elementary Education, and I am also getting a STEM certificate which is shortened for science, technology, engineering, and math. Therefore, I am still continuing my studies in these four major areas. In addition, I am also doing work study with the Information Technology department at my university. Therefore, I am learning a lot about computers every day.

I still remember all the fun science experiments we did, and now I want to major in biology and I think of those fun things.

I am still interested in avionics and engineering.

As mentioned before, I still want to learn how to fly an airplane, and part of that may have been from the flight simulators that I got to do while I was there.

I believe that it allowed me to enjoy different sciences, [as] well as respect people that do have a career in engineering and as well as people that do fly aircrafts.

I always think about the aircrafts that we were shown, and I just made a reference to [it in] class the other day when talking about different technologies that the U.S. military had. Also, it made me appreciate science and gain curiosity about different things pertaining to it.

As a young child, I was not exposed to many academic activities or programs outside of school. STARBASE was one of the few experiences that led me to explore the sciences. Currently, I am intending to major in Biology at Hamline University.

It helps me or anyone understand more and better in science, math, technology, and engineering because you will need that in middle school years and up.

It continues to impact me because I have a better understanding about science and had the chance to do [experiments, which] I still use in today's life.

Now that I am older and [wiser,] I know why this happened and that happened. Back then it was all a mystery, [and] right now I know why it happened and how it happened.

It makes [me] want to return and learn more at a higher level of education.

I still remember some of the things we did, for example doing trial and error. We built planes and rebuilt them so they would fly further.

Do you think STARBASE has had any influence on your career plans or choices? If yes, please explain. (N=14)

> It has influenced me to pursue science.
>
> It opens up my mind to push myself to learn new things that might interest me, and it has.
>
> STARBASE has influenced me [in] my career plans and choices [through] how we get to experience what other careers are like, and how I would feel like if I was a part of the real team.
>
> [It influenced me to think about if] I want to teach students math or science because there is a lot to learn.
>
> Helping others and the environment around us.
>
> It [showed] me that STEM could be fun, especially when you are sharing it with children. Therefore, that is why I am going to become an elementary teacher and teach them all the fun things about STEM as they are still children. I want to teach them before they think of STEM as something boring and hard to do towards middle school and high school. I want them to enjoy STEM like I had done in elementary school.
>
> The whole experience has pushed me towards biology sciences.
>
> I am in AF-ROTC. STARBASE was the first time I was introduced to the Air Force.
>
> Looking back on my experience, I am now thinking of a career in the engineering field.
>
> I never was able to understand/appreciate sciences beforehand, [and] now I am attending college with the intentions of following a path that requires many science studies.
>
> The staff there influenced me to want to help kids and elementary students get a better feeling of science.
>
> Got [me] hooked on STEM.
>
> It made me want to become an engineer, but I couldn't get into the college of my desire.
>
> It has definitely given me a better view of the STEM fields. STARBASE has shown me that these fields aren't just all about being serious, [but that] we can have fun while learning about them, too.

After participating in STARBASE, did you participate in any other activities, clubs, or programs related to science, technology, engineering, or math when you were in elementary, junior high, or high school? If yes, please indicate the types of activities, clubs, or programs in which you participated. (N=9)

> STEM
>
> I was a member of the Science Research Institute. Also I participated in an aviation class and an aviation camp.
>
> 3M STEP program
>
> ROTC
>
> Various computer things, Lego Robotics, Mad Science
>
> Math team
>
> I have participated in the Science Research Institute program my junior year and senior year in high school.
>
> JROTC, Junior Class Board
>
> Building a toothpick bridge. Building a tower with tape and sticks.

After participating in STARBASE, did you participate in any other activities, clubs, or programs related to science, technology, engineering, or math when you were in elementary, junior high, or high school? If yes, which of these activities, clubs, or programs did you find most helpful? (N=9)

> STEM was very fun and interesting.
>
> I found the aviation camp the most helpful.
>
> 3M STEP Program
>
> ROTC
>
> Actually, the Robotics was good because of how it forced my team and [me] to creatively come up with ways to solve the various challenges presented to us.
>
> Math team
>
> The Science Research Institute program was very helpful because I was able to learn more in depth about environmental science. I especially enjoyed analyzing animal behavior and niche occupations. I was also able to present a research experiment I conducted during the program in science classes at my high school. This program has influenced my decision to major in biology.

> JROTC
>
> The bridge

Were there any science, technology, engineering, or math opportunities you would have liked to participate in but that were not available to you in elementary, junior high, or high school? If yes, what types of opportunities would you like to have had? (N=9)

> Math team
>
> A STARBASE-type program offered in high school. That might have attracted my attention.
>
> Science clubs in high schools – we don't have much of those in Saint Paul Public Schools.
>
> Robotics club
>
> Science club, making robots
>
> Joined the Math team in middle and high school
>
> Robotic club
>
> More programs that involves STEM
>
> Flight simulators

Are there any final comments you would like to share with the STARBASE program? (N=37)

> There [isn't] much I'd like to add, but it was overall a great learning experience!
>
> I would like to come back and experience it again now that I'm older and [wiser].
>
> I had [an] awesome time at STARBASE from what I still remember. It was nice to have it as a 5-day program because the students were taught so much. I enjoyed making the rockets the most!
>
> The program was a great experience, and I loved it.
>
> I think that this program is a great program that teaches students lots of science and engineering and shows them what they can do in the future [in] careers pertaining to those majors.
>
> STARBASE is a program that really helps people. [Even] though I am 18, I still remember some of the things that I did when I was a fourth, fifth grader going to STARBASE to learn about engineering, math, science, and technology.

I think it's a great program. Although some kids might grow up forgetting about what the program actually is about, I'm sure most will not forget their experiences with STARBASE.

I learned many things when I visited STARBASE as a kid. I loved the experience very much and making rockets, they should continue to do that.

No.

Thank you for the experience!

This was a fantastic five days I had. Even though I'm a freshman in college, I can still remember how I felt launching a rocket as a 4th grader. Thank you for having the STARBASE program!

I think that STARBASE was a great learning experience. Both my brother and I had [the] opportunity to participate in the STARBASE program, and it was interesting hearing the things that he did during his time there and how they related and were different.

I am grateful to have [been in the] STARBASE program, and I [enjoyed] it. This program should keep going because it gives the students [opportunities] to explore.

I love to do hands-on [activities] with STARBASE.

STARBASE was awesome. Keep up the good work.

STARBASE is a great place. I would love to go back there and control the airplane on the computer again.

I think that the STARBASE program should be continued because it gives children the experiences of their lifetime. For me, going to STARBASE was one of my best experiences because I am not a very outgoing person. Therefore, it makes me cherish all the little things that I have done and was able to do.

Thank you for providing an opportunity like this for students.

STARBASE was probably my favorite part of my elementary school years. I went in 4th and 6th grade, and both times were very fun and interesting. I hope that other kids get the chance to do STARBASE at some point in time.

I had a very good time as a young student at the STARBASE program. I am content that I was able to take part in participating.

Thank you for the experience and the generous time given to teach us what you knew.

Thanks for having it around! Science is a great thing, and a love for it should be introduced to everyone.

I really enjoyed the STARBASE program. I found it to be very beneficial.

Thanks for the opportunity.

I forgot all about STARBASE up until I got the e-mail today, and [it] brought back some good memories. I think it was a great program for kids, and I think it would've been better if I had the chance in junior high or high school to go back.

I have many happy childhood memories, and visiting STARBASE was one of them. I've enjoyed flying gliders, rocket take-offs, and gazing at cool aircrafts. This program has the potential to encourage and help build the next generation of scientists and engineers.

I think the STARBASE program helps students understand more about science, technology, and math.

It was a good experience to have when I was young. It was very cool to learn about.

I think it is a really good program. I really enjoyed it, and my little brothers just went through it and they loved [it] as much as I did.

I loved the program. I'll never forget it. And I remember my nickname was Queen Star, I'll never forget – flashback from my childhood, haha.

It was a good program. It was very interesting at the time. I began to forget what exactly we did.

Keep doing what you guys do, because it helps a lot for the [future of] kids.

I had a great time at STARBASE. I would love to come back one day if I could.

One more thing, I still remember building a rocket!

It was a fun experience to explore inside of [an] airplane.

I think that the STARBASE program was fun, inviting, and interesting.

It is a very great and fun program that can help [students] expand [their] daily school activities into something more out there in the real world and help students see how math and [science are] used in an everyday situation.

A48. 8th-grade cumulative (junior high school) outcome measures: Cohort 3

Outcome measure	N[a]	Mean STARBASE	Mean Comparison	Difference & significance
Course count				
Math	161	2.19	2.14	.043
Science	161	2.05	2.04	.006
Technology	161	0.02	0.13	-.112
Math + Science + Technology	161	4.25	4.32	-.062
Math honors	161	0.25	0.25	-
Science honors	161	0.59	0.53	.062
Math + Science honors	161	0.84	0.78	.062
All honors	161	2.41	2.08	.329
Weighted grade average				
Math	159	2.48	2.47	.011
Science	161	2.93	2.71	.222*
Math + Science	161	2.71	2.60	.108
All	161	2.90	2.84	.060
Percentage of courses passed				
Math + Science + Technology	161	93%	92%	1.1%
All	161	93%	93%	0%

* *p<.05*

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 161 STARBASE students were compared to 161 comparison students).*

Note. Includes 7th- and 8th-grade SPPS records for the 10th-grade cohort (Cohort 3).

A49. 8th-grade cumulative (junior high school) highest math course passed: Cohort 3

	N	General Math	Algebra 1	Geometry
STARBASE	154	61%	30%	9%
Comparison	154	57%	37%	6%

Note. Includes 7th- and 8th-grade SPPS records for the 10th-grade cohort (Cohort 3).

A50. 9th-grade outcome measures: Cohorts 1-3

Outcome measure	N[a]	Mean: STARBASE	Mean: Comparison	Difference & significance
Course count				
Math	422	0.92	0.95	-.021
Science	422	0.93	0.92	.012
Technology	422	0.28	0.27	.014
Math + Science + Technology	422	2.14	2.14	.005
Lab sciences[b]	422	0.24	0.27	-.031
JROTC	422	0.13	0.13	.005
Math honors	422	0.28	0.27	.007
Science honors	422	0.32	0.31	.009
Technology honors	422	0	0	-
Math + Science honors	422	0.60	0.58	.017
All honors	422	1.42	1.41	.007
Weighted grade average				
Math	396	2.46	2.48	-.017
Science	407	2.48	2.44	.031
Technology	38	2.55	2.51	.041
Math + Science + Technology	415	2.45	2.45	.005
JROTC	13	3.53	3.22	.303
All	421	2.59	2.57	.019
Percentage of courses passed				
Math + Science + Technology	417	86%	87%	-.6%
All	424	89%	89%	0%
Percentage yes				
Successfully completed algebra 2 or higher math course	422	6%	8%	-1.4%

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 422 STARBASE students were compared to 422 comparison students).*

[b] *Lab sciences include biology, chemistry, and physics.*

Note. Includes 9th-grade SPPS records for the 10th-, 11th-, and 12th-grade cohorts (Cohorts 1-3).

A51. 9th-grade highest math course passed: Cohorts 1-3

	N	General Math	Algebra 1	Geometry	Algebra 2	Pre-Calculus[a]
STARBASE	343	2%	57%	34%	7%	1%
Comparison	343	3%	60%	28%	8%	1%

[a] *Pre-calculus also includes trigonometry and statistics.*

Note. Includes 9th-grade SPPS records for the 10th-, 11th-, and 12th-grade cohorts (Cohorts 1-3).

A52. 10th-grade cumulative outcome measures: Cohorts 1-2

Outcome measure	N[a]	Mean STARBASE	Mean Comparison	Difference & significance
Course count				
Math	193	1.90	1.92	-.016
Science	193	1.92	1.91	.005
Technology	193	0.54	0.66	-.124
Math + Science + Technology	193	4.36	4.49	-.135
Lab sciences[b]	193	1.19	1.23	-.036
JROTC	193	0.22	0.20	.021
Math honors	193	0.72	0.63	.093
Science honors	193	0.75	0.68	.067
Technology honors	193	0	0	-
Math + Science honors	193	1.47	1.31	.161
All honors	193	3.38	3.15	.228
Weighted grade average				
Math	189	2.41	2.44	-.026
Science	190	2.59	2.50	.090
Technology	46	2.80	2.80	-.004
Math + Science + Technology	192	2.52	2.49	.035
JROTC[c]	-	-	-	-
All	193	2.69	2.62	.069
Percentage of courses passed				
Math + Science + Technology	192	88%	88%	.4%
All	193	91%	90%	1.1%
Percentage yes				
Successfully completed biology, chemistry, and physics	193	0%	0%	-
Successfully completed algebra 2 or higher math course[d]	193	46%	35%	11.4%**

** *p<.01*

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 193 STARBASE students were compared to 193 comparison students).*

[b] *Lab sciences include biology, chemistry, and physics.*

[c] *Sample size too small to report (N<10).*

[d] *Wilder Research checked for differential effects by free or reduced-price lunch eligibility, English Language Learner status, gender, and race or ethnicity. The following subgroups were statistically significant: males (p<.01), English Language Learners (p<.05), and free or reduced-price lunch eligible (p<.05). A substantive difference was found in the free or reduced-price lunch ineligible subgroup.*

Note. Includes 9th- and 10th-grade SPPS records for 11th- and 12th-grade cohorts (Cohorts 1-2).

A53. 10th-grade cumulative highest math course passed: Cohorts 1-2

	N	General Math	Algebra 1	Geometry	Algebra 2	Pre-Calculus[a]	Calculus
STARBASE	182	1%	12%	39%	39%	9%	1%
Comparison	182	2%	13%	50%	28%	8%	1%

[a] *Pre-calculus also includes trigonometry and statistics.*

Note. *Includes 9th- and 10th-grade SPPS records for 11th- and 12th-grade cohorts (Cohorts 1-2).*

A54. 10th-grade cumulative STEM momentum: Cohorts 1-2

	N	Sufficient	Modest	Minimal	Weak
STARBASE	193	1%	8%	12%	80%
Comparison	193	-	6%	16%	78%

Notes. *1) Includes 9th- and 10th-grade SPPS records for 11th- and 12th-grade cohorts (Cohorts 1-2).*

2) STEM momentum categories include the following: Sufficient: student reached a level of math beyond algebra 2 and successfully completed three or more core lab science classes (i.e., biology, chemistry, or physics), Modest: student reached a level of math equivalent to algebra 2 and successfully completed three or more core lab science classes or student reached a level of math beyond algebra 2 and successfully completed two core lab science classes, Minimal: student reached a level of math equivalent to algebra 2 and successfully completed two core lab science classes, and Weak: student fell short of the above criteria.

A55. 12th-grade cumulative (senior high school) outcome measures: Cohort 1

Outcome measure	N[a]	Mean STARBASE	Mean Comparison	Difference & significance[d]
Course count				
Math	64	3.75	3.78	-.031
Science	64	3.80	3.70	.094
Technology	64	1.17	1.22	-.047
Math + Science + Technology	64	8.72	8.70	.016
Lab sciences[b]	64	2.83	2.86	-.031
JROTC	64	0.33	0.34	-.016
Math honors	64	1.67	1.77	-.094
Science honors	64	1.52	1.42	.094
Technology honors	64	0.05	0.06	-.016
Math + Science + Technology honors	64	3.23	3.25	-.016
All honors	64	6.94	7.31	-.375
Weighted grade average				
Math	63	2.41	2.49	-.077
Science	64	2.52	2.66	-.138
Technology	28	2.97	2.72	.245
Math + Science + Technology	64	2.52	2.61	-.096
JROTC[c]	-	-	-	-
All	64	2.78	2.80	-.022
Percentage of courses passed				
Math + Science + Technology	64	90%	89%	.3%
All	64	93%	92%	1.6%
Percentage yes				
Successfully completed biology, chemistry, and physics	64	42%	45%	-3.1%
Successfully completed algebra 2 or higher math course	64	91%	88%	3.1%

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 64 STARBASE students were compared to 64 comparison students).*

[b] *Lab sciences include biology, chemistry, and physics.*

[c] *Sample size too small to report (N<10).*

[c] *There were not any statistically significant results.*

Note. Includes 9th-, 10th-, 11th- and the first semester of 12th-grade SPPS records for the 12th-grade cohort (Cohort 1).

A56. 12th-grade cumulative (senior high school) highest math course passed: Cohort 1

	N	General Math	Algebra 1	Geometry	Algebra 2	Pre-Calculus[a]	Calculus
STARBASE	62	2%	2%	5%	26%	36%	31%
Comparison	62	-	5%	7%	18%	45%	26%

[a] *Pre-calculus also includes trigonometry and statistics.*

Note. Includes 9th-, 10th-, 11th- and the first semester of 12th-grade SPPS records for the 12th-grade cohort (Cohort 1).

A57. 12th-grade cumulative (senior high school) STEM momentum: Cohort 1

	N	Sufficient	Modest	Minimal	Weak
STARBASE	64	52%	23%	13%	13%
Comparison	64	55%	23%	3%	19%

Notes. 1) Includes 9th-, 10th-, 11th- and the first semester of 12th-grade SPPS records for the 12th-grade cohort (Cohort 1).

2) STEM momentum categories include the following: Sufficient: student reached a level of math beyond Algebra 2 and successfully completed three or more core lab science classes (i.e., biology, chemistry, or physics), Modest: student reached a level of math equivalent to Algebra 2 and successfully completed three or more core lab science classes or student reached a level of math beyond Algebra 2 and successfully completed two core lab science classes, Minimal: student reached a level of math equivalent to Algebra 2 and successfully completed two core lab science classes, and Weak: student fell short of the above criteria.

A58. Attendance, 2007-08 school year: Cohorts 1-3

Subgroup	Group	N	Percentage of students chronically absent[a]	Number of days absent	Difference & significance
All	STARBASE	417	25%	8.3	-1.2*
	Comparison	417	30%	9.5	
Higher dosage	STARBASE	335	24%*	8.1	-1.2
	Comparison	335	30%	9.3	
Lower dosage	STARBASE	81	31%	9.2	-0.7
	Comparison	81	30%	9.9	
10th grade (Cohort 3)	STARBASE	207	26%	8.4	-0.6
	Comparison	207	25%	9.0	
11th grade (Cohort 2)	STARBASE	132	27%*	8.4	-1.8
	Comparison	132	37%	10.2	
12th grade (Cohort 1)	STARBASE	78	23%	8.2	-1.4
	Comparison	78	33%	9.6	

* *p<.05*

[a] *Chronically absent is defined as being absent for 11 or more days during a single school year.*

Note. Includes only students who were enrolled 160 or more days during the 2007-08 school year.

A59. Math achievement level and scaled scores (MCA or MCA-II): Cohorts 1-3

				Level scores				Scaled scores		
Cohort	Group	Test	N	Exceeds standards	Meets standards	Partially meets standards	Does not meet standards	N	Average score	Difference & significance[d]
10th grade[a] (Cohort 3)	STARBASE	MCA	192	10%	37%	32%	21%	189	848	-1.0
	Comparison	MCA	192	13%	33%	34%	20%	189	849	
11th grade[b] (Cohort 2)	STARBASE	MCA	113	10%	41%	32%	18%	113	849	1.0
	Comparison	MCA	113	12%	35%	28%	25%	113	848	
12th grade[c] (Cohort 1)	STARBASE	MCA-II	75	5%	15%	21%	59%	75	1136	-3.4
	Comparison	MCA-II	75	4%	21%	25%	49%	75	1139	

[a] *The 10th-grade cohort (Cohort 3) took the MCA math achievement test in 8th grade in 2007.*

[b] *The 11th-grade cohort (Cohort 2) took the MCA math achievement test in 8th grade in 2006.*

[c] *The 12th-grade cohort (Cohort 1) took the MCA-II math achievement test in 11th grade in 2008.*

[d] *There were not any statistically significant results.*

A60. Math achievement level and scaled scores (MCA or MCA-II) by dosage: Cohorts 1-3 (see figure notes)

			Level scores				Scaled scores		
Subgroup	Group	N	Exceeds standards	Meets standards	Partially meets standards	Does not meet standards	N	Average score	Difference & significance[d]
Higher dosage MCA[a,b]	STARBASE	252	11%	39%	33%	18%	250	849	0.1
	Comparison	252	12%	37%	31%	20%	250	849	
Lower dosage MCA[a,b]	STARBASE	53	8%	34%	26%	32%	52	845	-1.9
	Comparison	53	13%	21%	36%	30%	52	847	
Higher dosage MCA-II[c]	STARBASE	57	7%	14%	23%	56%	57	1136	-3.4
	Comparison	57	4%	23%	25%	49%	57	1139	
Lower dosage MCA-II[c]	STARBASE	18	-	17%	17%	67%	18	1135	-3.6
	Comparison	18	6%	17%	28%	50%	18	1139	

[a] *The 10th-grade cohort (Cohort 3) took the MCA math achievement test in 8th grade in 2007.*

[b] *The 11th-grade cohort (Cohort 2) took the MCA math achievement test in 8th grade in 2006.*

[c] *The 12th-grade cohort (Cohort 1) took the MCA-II math achievement test in 11th grade in 2008.*

[d] *There were not any statistically significant results.*

A61. 8th-grade cumulative (junior high school) outcome measures by dosage: Cohort 3

	Dosage	N[a]	Mean STARBASE	Mean Comparison	Difference & significance
Course count					
Math	Higher dosage	129	2.16	2.16	-.008
	Lower dosage	32	2.31	2.06	.250
Science	Higher dosage	129	2.05	2.04	.008
	Lower dosage	32	2.06	2.06	-
Technology	Higher dosage	129	0.01	0.13	-.124
	Lower dosage	32	0.06	0.13	-.063
Math + Science + Technology	Higher dosage	129	4.21	4.33	-.124
	Lower dosage	32	4.44	4.25	.188
Math honors	Higher dosage	129	0.26	0.26	-
	Lower dosage	32	0.22	0.22	-
Science honors	Higher dosage	129	0.60	0.57	.039
	Lower dosage	32	0.53	0.38	.156
Math + Science honors	Higher dosage	129	0.86	0.82	.039
	Lower dosage	32	0.75	0.59	.156
All honors	Higher dosage	129	2.52	2.22	.302
	Lower dosage	32	1.97	1.53	.438
Weighted grade average					
Math	Higher dosage	127	2.57	2.51	.052
	Lower dosage	32	2.16	2.31	-.149
Science	Higher dosage	129	3.06	2.75	.307*
	Lower dosage	32	2.43	2.55	-.122
Math + Science	Higher dosage	129	2.81	2.64	.171
	Lower dosage	32	2.30	2.44	-.144
All	Higher dosage	129	3.01	2.88	.121
	Lower dosage	32	2.49	2.68	-.188
Percentage of courses passed					
Math + Science + Technology	Higher dosage	129	94%	92%	1.6%
	Lower dosage	32	89%	90%	-1.2%
All	Higher dosage	129	94%	94%	.3%
	Lower dosage	32	90%	92%	-1.1%

* *p<.05*

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 129 STARBASE students were compared to 129 comparison students).*

Note. Includes 7th- and 8th-grade SPPS records for the 10th-grade cohort (Cohort 3).

A62. 8th-grade cumulative (junior high school) highest math course passed by dosage: Cohort 3

		N	General Math	Algebra 1	Geometry
Higher dosage	STARBASE	124	57%	34%	10%
	Comparison	124	54%	40%	6%
Lower dosage	STARBASE	30	80%	13%	7%
	Comparison	30	70%	23%	7%

Note. Includes 7th- and 8th-grade SPPS records for the 10th-grade cohort (Cohort 3).

A63. 9th-grade outcome measures by dosage: Cohorts 1-3

	Dosage	N[a]	Mean		Difference & significance
			STARBASE	Comparison	
Course count					
Math	Higher dosage	341	0.93	0.94	-.015
	Lower dosage	80	0.91	0.95	-.038
Science	Higher dosage	341	0.94	0.91	.026
	Lower dosage	80	0.91	0.96	-.050
Technology	Higher dosage	341	0.28	0.28	.006
	Lower dosage	80	0.30	0.25	.050
Math + Science + Technology	Higher dosage	341	2.14	2.13	.018
	Lower dosage	80	2.13	2.16	-.038
Lab sciences[b]	Higher dosage	341	0.25	0.27	-.023
	Lower dosage	80	0.21	0.28	-.063
JROTC	Higher dosage	341	0.13	0.13	-
	Lower dosage	80	0.15	0.13	.025
Math honors	Higher dosage	341	0.29	0.26	.029
	Lower dosage	80	0.24	0.33	-.088
Science honors	Higher dosage	341	0.33	0.33	.006
	Lower dosage	80	0.28	0.25	.025
Technology honors	Higher dosage	341	0	0	-
	Lower dosage	80	0	0	-
Math + Science honors	Higher dosage	341	0.62	0.59	.035
	Lower dosage	80	0.51	0.58	-.063
All honors	Higher dosage	341	1.47	1.43	.041
	Lower dosage	80	1.25	1.39	-.138

A63. 9th-grade outcome measures by dosage: Cohort 1-3 (continued)

	Dosage	N[a]	Mean		Difference & significance
			STARBASE	Comparison	
Weighted grade average					
Math	Higher dosage	322	2.53	2.51	.022
	Lower dosage	73	2.17	2.36	-.187
Science	Higher dosage	330	2.54	2.45	.093
	Lower dosage	76	2.21	2.46	-.245
Technology	Higher dosage	28	2.38	2.38	.002
	Lower dosage	10	3.05	2.90	.152
Math + Science + Technology	Higher dosage	337	2.51	2.46	.049
	Lower dosage	77	2.19	2.38	-.191
JROTC	Higher dosage[c]	-	-	-	-
	Lower dosage[c]	-	-	-	-
All	Higher dosage	343	2.65	2.59	.059
	Lower dosage	77	2.37	2.54	-.171
Percentage of courses passed					
Math + Science + Technology	Higher dosage	337	88%	87%	1.1%
	Lower dosage	79	80%	88%	-7.7%
All	Higher dosage	343	90%	89%	1.2%**
	Lower dosage	80	85%	91%	-5.6%
Percentage yes					
Successfully completed algebra 2 or higher math	Higher dosage	341	7%	7%	-.8%
	Lower dosage	80	6%	10%	-3.7%

** *p<.01*

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 322 STARBASE students were compared to 322 comparison students).*

[b] *Lab sciences include biology, chemistry, and physics.*

[c] *Sample size too small to report (N<10).*

Note. Includes 9th-grade SPPS records for the 10th-, 11th-, and 12th-grade cohorts (Cohorts 1-3).

A64. 9th-grade highest math course passed by dosage: Cohorts 1-3

		N	General Math	Algebra 1	Geometry	Algebra 2	Pre-Calculus[a]
Higher dosage	STARBASE	279	2%	55%	36%	7%	1%
	Comparison	279	3%	61%	28%	8%	<1%
Lower dosage	STARBASE	63	5%	64%	25%	6%	-
	Comparison	63	3%	56%	30%	8%	3%

[a] *Pre-calculus also includes trigonometry and statistics.*

Note. Includes 9th-grade SPPS records for the 10th-, 11th-, and 12th-grade cohorts (Cohorts 1-3).

A65. 10th-grade cumulative outcome measures by dosage: Cohorts 1-2

	Dosage	N[a]	Mean STARBASE	Mean Comparison	Difference & significance
Course count					
Math	Higher dosage	157	1.89	1.90	-.013
	Lower dosage	35	1.97	1.94	.029
Science	Higher dosage	157	1.90	1.88	.019
	Lower dosage	35	2.00	2.01	-.057
Technology	Higher dosage	157	0.55	0.72	-.172
	Lower dosage	35	0.49	0.43	.057
Math + Science + Technology	Higher dosage	157	4.33	4.50	-.166
	Lower dosage	35	4.46	4.43	.029
Lab sciences[b]	Higher dosage	157	1.18	1.22	-.038
	Lower dosage	35	1.23	1.26	-.029
JROTC	Higher dosage	157	0.24	0.20	.038
	Lower dosage	35	0.17	0.23	-.057
Math honors	Higher dosage	157	0.76	0.63	.134*
	Lower dosage	35	0.54	0.63	-.086
Science honors	Higher dosage	157	0.74	0.71	.025
	Lower dosage	35	0.83	0.57	.257*
Technology honors	Higher dosage	157	0	0	-
	Lower dosage	35	0	0	-
Math + Science honors	Higher dosage	157	1.50	1.34	.159
	Lower dosage	35	1.37	1.20	.171
All honors	Higher dosage	157	3.36	3.21	.147
	Lower dosage	35	3.57	2.97	.600

A65. 10th-grade cumulative outcome measures by dosage: Cohorts 1-2 (continued)

	Dosage	N[a]	Mean STARBASE	Mean Comparison	Difference & significance
Weighted grade average					
Math	Higher dosage	154	2.41	2.41	.002
	Lower dosage	34	2.45	2.63	-.176
Science	Higher dosage	154	2.60	2.47	.130
	Lower dosage	35	2.60	2.72	-.114
Technology	Higher dosage	38	2.62	2.75	-.129
	Lower dosage[c]	-	-	-	-
Math + Science + Technology	Higher dosage	156	2.52	2.46	.059
	Lower dosage	35	2.55	2.65	-.099
JROTC	Higher dosage[c]	-	-	-	-
	Lower dosage	-	-	-	-
All	Higher dosage	157	2.69	2.59	.103
	Lower dosage	35	2.70	2.81	-.114
Percentage of courses passed					
Math + Science + Technology	Higher dosage	156	88%	87%	1.2%
	Lower dosage	35	89%	93%	-4.4%
All	Higher dosage	157	91%	89%	1.6%
	Lower dosage	35	92%	94%	-2.1%
Percentage yes					
Successfully completed algebra 2 or higher math	Higher dosage	157	47%	34%	12.1%**
	Lower dosage	35	46%	37%	8.6%

* *p<.05*

** *p<.01*

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 193 STARBASE students were compared to 193 comparison students).*

[b] *Lab sciences include biology, chemistry, and physics.*

[c] *Sample size too small to report (N<10).*

Note. Includes 9th- and 10th-grade SPPS records for 11th- and 12th-grade cohorts (Cohorts 1-2).

A66. 10th-grade cumulative highest math course passed by dosage: Cohorts 1-2

		N	General Math	Algebra 1	Geometry	Algebra 2	Pre-Calculus[a]	Calculus
Higher dosage	STARBASE	148	1%	12%	39%	39%	9%	1%
	Comparison	148	2%	14%	49%	26%	8%	1%
Lower dosage	STARBASE	33	3%	9%	39%	36%	12%	-
	Comparison	33	-	9%	52%	33%	6%	-

[a] *Pre-calculus also includes trigonometry and statistics.*

Note. Includes 9th- and 10th-grade SPPS records for 11th- and 12th-grade cohorts (Cohorts 1-2).

A67. 10th-grade cumulative STEM momentum by dosage: Cohorts 1-2

		N	Sufficient	Modest	Minimal	Weak
Higher dosage	STARBASE	157	1%	8%	12%	80%
	Comparison	157	-	6%	15%	78%
Lower dosage	STARBASE	35	-	9%	11%	80%
	Comparison	35	-	6%	20%	74%

Notes. 1) Includes 9th- and 10th-grade SPPS records for 11th- and 12th-grade cohorts (Cohorts 1-2).

2) STEM momentum categories include the following: Sufficient: student reached a level of math beyond Algebra 2 and successfully completed three or more core lab science classes (i.e., biology, chemistry, or physics), Modest: student reached a level of math equivalent to Algebra 2 and successfully completed three or more core lab science classes or student reached a level of math beyond Algebra 2 and successfully completed two core lab science classes, Minimal: student reached a level of math equivalent to Algebra 2 and successfully completed two core lab science classes, and Weak: student fell short of the above criteria.

A68. 12th-grade cumulative by dosage: Cohort 1

	Dosage	N[a]	Mean STARBASE	Mean Comparison	Difference & significance
Course count					
Math	Higher dosage	48	3.69	3.75	-.063
	Lower dosage	16	3.94	3.88	.063
Science	Higher dosage	48	3.67	3.71	-.042
	Lower dosage	16	4.19	3.69	.500**
Technology	Higher dosage	48	1.29	1.42	-.125
	Lower dosage	16	0.81	0.63	.188
Math + Science + Technology	Higher dosage	48	8.65	8.88	-.229
	Lower dosage	16	8.94	8.19	.750
Lab sciences[b]	Higher dosage	48	2.67	2.85	-.188
	Lower dosage	16	3.31	2.89	.438*
JROTC	Higher dosage	48	0.40	0.33	.063
	Lower dosage	16	0.13	0.38	-.250
Math honors	Higher dosage	48	1.69	1.75	-.063
	Lower dosage	16	1.63	1.81	-.188
Science honors	Higher dosage	48	1.48	1.50	-.021
	Lower dosage	16	1.63	1.19	.438
Technology honors	Higher dosage	48	0.06	0.09	-.021
	Lower dosage	16	-	-	-
Math + Science + Technology honors	Higher dosage	48	3.23	3.33	-.104
	Lower dosage	16	3.25	3.00	.250
All honors	Higher dosage	48	6.83	7.38	-.542
	Lower dosage	16	7.25	7.13	.125
Weighted grade average					
Math	Higher dosage	47	2.46	2.47	-.016
	Lower dosage	16	2.26	2.52	-.257
Science	Higher dosage	48	2.53	2.63	-.105
	Lower dosage	16	2.51	2.75	-.237
Technology	Higher dosage	23	2.86	2.84	.025
	Lower dosage[c]	-	-	-	-
Math + Science + Technology	Higher dosage	48	2.54	2.61	-.074
	Lower dosage	16	2.44	2.60	-.162
JROTC	Higher dosage[c]	-	-	-	-
	Lower dosage	-	-	-	-
All	Higher dosage	48	2.79	2.77	.011
	Lower dosage	16	2.75	2.88	-.121

A68. 12th-grade cumulative by dosage: Cohort 1 (continued)

	Dosage	N[a]	Mean STARBASE	Mean Comparison	Difference & significance
Percentage of courses passed					
Math + Science + Technology	Higher dosage	48	90%	89%	.7%
	Lower dosage	16	90%	91%	-.8%
All	Higher dosage	48	93%	91%	2.4%
	Lower dosage	16	94%	94%	-.6%
Percentage yes					
Successfully completed biology, chemistry, and physics	Higher dosage	48	35%	42%	-6.3%
	Lower dosage	16	63%	56%	6.2%
Successfully completed algebra 2 or higher math	Higher dosage	48	88%	90%	-2.1%
	Lower dosage	16	100%	81%	18.7%

* *p<.05*

** *p<.01*

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 48 STARBASE students were compared to 48 comparison students).*

[b] *Lab sciences include biology, chemistry, and physics.*

[c] *Sample size too small to report (N<10).*

Note. Includes 9th-, 10th-, 11th- and the first semester of 12th-grade SPPS records for the 12th-grade cohort (Cohort 1).

A69. 12th-grade cumulative (senior high school) highest math course passed by dosage: Cohort 1

		N	General Math	Algebra 1	Geometry	Algebra 2	Pre-Calculus[a]	Calculus
Higher dosage	STARBASE	48	2%	2%	7%	20%	41%	28%
	Comparison	48	-	4%	4%	20%	50%	22%
Lower dosage	STARBASE	16	-	-	-	44%	19%	38%
	Comparison	16	-	6%	13%	13%	31%	38%

[a] *Pre-calculus also includes trigonometry and statistics.*

Note. Includes 9th-, 10th-, 11th- and the first semester of 12th-grade SPPS records for the 12th-grade cohort (Cohort 1).

A70. 12th-grade cumulative (senior high school) STEM momentum by dosage: Cohort 1

		N	Sufficient	Modest	Minimal	Weak
Higher dosage	STARBASE	48	52%	19%	13%	17%
	Comparison	48	56%	23%	4%	17%
Lower dosage	STARBASE	16	50%	38%	13%	-
	Comparison	16	50%	25%	-	25%

Notes. 1) Includes 9th-, 10th-, 11th- and the first semester of 12th-grade SPPS records for the 12th-grade cohort (Cohort 1).

2) STEM momentum categories include the following: Sufficient: student reached a level of math beyond Algebra 2 and successfully completed three or more core lab science classes (i.e., biology, chemistry, or physics), Modest: student reached a level of math equivalent to Algebra 2 and successfully completed three or more core lab science classes or student reached a level of math beyond Algebra 2 and successfully completed two core lab science classes, Minimal: student reached a level of math equivalent to Algebra 2 and successfully completed two core lab science classes, and Weak: student fell short of the above criteria.

A71. 9th-grade outcome measures by cohort: Cohorts 1-3

	Cohort (Grade in 2008-09)	N[a]	Mean STARBASE	Mean Comparison	Difference & significance
Course count					
Math	Cohort 3 (10th)	222	0.91	0.93	-.014
	Cohort 2 (11th)	132	0.93	0.95	-.015
	Cohort 1 (12th)	68	0.94	1.00	-.059
Science	Cohort 3 (10th)	222	0.91	0.91	-.009
	Cohort 2 (11th)	132	0.96	0.90	.061
	Cohort 1 (12th)	68	0.96	0.97	-.015
Technology	Cohort 3 (10th)	222	0.30	0.26	.036
	Cohort 2 (11th)	132	0.27	0.23	.030
	Cohort 1 (12th)	68	0.28	0.37	-.088
Math + Science + Technology	Cohort 3 (10th)	222	2.12	2.10	.014
	Cohort 2 (11th)	132	2.16	2.08	.076
	Cohort 1 (12th)	68	2.18	2.34	-.162
Lab sciences[b]	Cohort 3 (10th)	222	0.23	0.26	-.032
	Cohort 2 (11th)	132	0.22	0.22	-
	Cohort 1 (12th)	68	0.34	0.43	-.088
JROTC	Cohort 3 (10th)	222	0.13	0.13	-.005
	Cohort 2 (11th)	132	0.14	0.13	.008
	Cohort 1 (12th)	68	0.13	0.10	.029
Math honors	Cohort 3 (10th)	222	0.27	0.30	-.023
	Cohort 2 (11th)	132	0.30	0.24	.061
	Cohort 1 (12th)	68	0.24	0.24	-
Science honors	Cohort 3 (10th)	222	0.28	0.29	-.009
	Cohort 2 (11th)	132	0.36	0.33	.030
	Cohort 1 (12th)	68	0.37	0.34	.029
Technology honors	Cohort 3 (10th)	222	-	-	-
	Cohort 2 (11th)	132	-	-	-
	Cohort 1 (12th)	68	-	-	-
Math + Science honors	Cohort 3 (10th)	222	0.56	0.59	-.032
	Cohort 2 (11th)	132	0.67	0.58	.091
	Cohort 1 (12th)	68	0.60	0.57	.029
All honors	Cohort 3 (10th)	222	1.32	1.41	-.090
	Cohort 2 (11th)	132	1.58	1.30	.280
	Cohort 1 (12th)	68	1.44	1.65	-.206

A71. 9th-grade outcome measures by cohort: Cohorts 1-3 (continued)

	Cohort (Grade in 2008-09)	N[a]	Mean STARBASE	Mean Comparison	Difference & significance
Weighted grade average					
Math	Cohort 3 (10th)	205	2.45	2.45	.003
	Cohort 2 (11th)	128	2.48	2.43	.053
	Cohort 1 (12th)	63	2.46	2.69	-.222
Science	Cohort 3 (10th)	217	2.40	2.49	-.095
	Cohort 2 (11th)	125	2.58	2.29	.294*
	Cohort 1 (12th)	65	2.53	2.58	-.051
Technology	Cohort 3 (10th)	22	2.24	2.34	-.107
	Cohort 2 (11th)	-	-	-	-
	Cohort 1 (12th)	-	-	-	-
Math + Science + Technology	Cohort 3 (10th)	219	2.39	2.45	-.052
	Cohort 2 (11th)	131	2.51	2.35	.166
	Cohort 1 (12th)	65	2.52	2.64	-.126
JROTC	Cohort 3 (10th)[c]	-	-	-	-
	Cohort 2 (11th)[c]	-	-	-	-
	Cohort 1 (12th)[c]	-	-	-	-
All	Cohort 3 (10th)	222	2.52	2.59	-.063
	Cohort 2 (11th)	132	2.68	2.47	.212*
	Cohort 1 (12th)	67	2.65	2.74	-.092
Percentage of courses passed					
Math + Science + Technology	Cohort 3 (10th)	220	85%	87%	-2.2%
	Cohort 2 (11th)	131	87%	85%	2.1%
	Cohort 1 (12th)	66	90%	90%	-.5%
All	Cohort 3 (10th)	224	88%	90%	-1.8%
	Cohort 2 (11th)	132	90%	87%	3.2%*
	Cohort 1 (12th)	68	91%	91%	-.3%
Percentage yes					
Successfully completed algebra 2 or higher math	Cohort 3 (10th)	222	8%	8%	.4%
	Cohort 2 (11th)	132	7%	8%	-.8%
	Cohort 1 (12th)	68	-	9%	-8.8%

* *p<.05*

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 222 STARBASE students were compared to 222 comparison students).*

[b] *Lab sciences include biology, chemistry, and physics.*

[c] *Sample size too small to report (N<10).*

Note. Includes 9th-grade SPPS records for the 10th-, 11th-, and 12th-grade cohorts (Cohorts 1-3).

A72. 9th-grade highest math course passed by cohort: Cohorts 1-3

		N	General Math	Algebra 1	Geometry	Algebra 2	Pre-Calculus[a]
10th grade (Cohort 3)	STARBASE	175	2%	58%	29%	10%	1%
	Comparison	175	3%	61%	27%	8%	1%
11th grade* (Cohort 2)	STARBASE	112	2%	55%	37%	5%	2%
	Comparison	112	2%	63%	27%	8%	1%
12th grade (Cohort 1)	STARBASE	56	4%	55%	41%	-	-
	Comparison	56	2%	55%	32%	9%	2%

* *p<.05*

[a] *Pre-calculus also includes trigonometry and statistics.*

Note. Includes 9th-grade SPPS records for the 10th-, 11th-, and 12th-grade cohorts (Cohorts 1-3).

A73. 10th-grade cumulative outcome measures by cohort: Cohorts 1-2

	Cohort (Grade in 2008-09)	N[a]	Mean STARBASE	Mean Comparison	Difference & significance
Course count					
Math	Cohort 2 (11th)	127	1.91	1.91	-.008
	Cohort 1 (12th)	66	1.89	1.92	-.030
Science	Cohort 2 (11th)	127	1.94	1.91	.039
	Cohort 1 (12th)	66	1.86	1.92	-.061
Technology	Cohort 2 (11th)	127	0.55	0.69	-.142
	Cohort 1 (12th)	66	0.52	0.61	-.091
Math + Science + Technology	Cohort 2 (11th)	127	4.40	4.51	-.110
	Cohort 1 (12th)	66	4.27	4.45	-.182
Lab sciences[b]	Cohort 2 (11th)	127	1.18	1.17	.008
	Cohort 1 (12th)	66	1.21	1.33	-.121
JROTC	Cohort 2 (11th)	127	0.21	0.20	.016
	Cohort 1 (12th)	66	0.24	0.21	.030
Math honors	Cohort 2 (11th)	127	0.73	0.63	.102
	Cohort 1 (12th)	66	0.70	0.62	.076
Science honors	Cohort 2 (11th)	127	0.75	0.69	.063
	Cohort 1 (12th)	66	0.76	0.68	.076
Technology honors	Cohort 2 (11th)	127	-	-	-
	Cohort 1 (12th)	66	-	-	-
Math + Science honors	Cohort 2 (11th)	127	1.48	1.32	.165
	Cohort 1 (12th)	66	1.45	1.30	.152
All honors	Cohort 2 (11th)	127	3.43	3.00	.425
	Cohort 1 (12th)	66	3.29	3.44	-.152

A73. 10th-grade cumulative outcome measures by cohort: Cohorts 1-2 (continued)

	Cohort (Grade in 2008-09)	N[a]	Mean STARBASE	Mean Comparison	Difference & significance
Weighted grade average					
Math	Cohort 2 (11th)	125	2.44	2.37	.068
	Cohort 1 (12th)	64	2.36	2.56	-.208
Science	Cohort 2 (11th)	125	2.65	2.46	.192
	Cohort 1 (12th)	65	2.49	2.59	-.105
Technology	Cohort 2 (11th)	30	2.83	2.82	.013
	Cohort 1 (12th)	16	2.73	2.76	-.035
Math + Science + Technology	Cohort 2 (11th)	127	2.56	2.44	.121
	Cohort 1 (12th)	65	2.45	2.58	-.131
JROTC	Cohort 2 (11th)[c]	-	-	-	-
	Cohort 1 (12th)[c]	-	-	-	-
All	Cohort 2 (11th)	127	2.72	2.55	.170
	Cohort 1 (12th)	66	2.63	2.76	-.126
Percentage of courses passed					
Math + Science + Technology	Cohort 2 (11th)	127	88%	87%	.7%
	Cohort 1 (12th)	65	88%	88%	-.3%
All	Cohort 2 (11th)	127	91%	89%	1.8%
	Cohort 1 (12th)	66	90%	91%	-.3%
Percentage yes					
Successfully completed algebra 2 or higher math	Cohort 2 (11th)	127	49%	34%	14.9%**
	Cohort 1 (12th)	66	41%	36%	4.5%

** *p<.01*

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 193 STARBASE students were compared to 193 comparison students).*

[b] *Lab sciences include biology, chemistry, and physics.*

[c] *Sample size too small to report (N<10).*

Note. Includes 9th- and 10th-grade SPPS records for 11th- and 12th-grade cohorts (Cohorts 1-2).

A74. 10th-grade cumulative highest math course passed by cohort: Cohorts 1-2

		N	General Math	Algebra 1	Geometry	Algebra 2	Pre-Calculus[a]	Calculus
Cohort 2 (11th grade)	STARBASE	122	1%	12%	37%	41%	9%	1%
	Comparison	122	2%	14%	50%	27%	7%	1%
Cohort 1 (12th grade)	STARBASE	60	2%	12%	43%	33%	10%	-
	Comparison	60	2%	10%	50%	28%	10%	-

[a] *Pre-calculus also includes trigonometry and statistics.*

Note. *Includes 9th- and 10th-grade SPPS records for 11th- and 12th-grade cohorts (Cohorts 1-2).*

A75. 10th-grade cumulative STEM momentum by cohort: Cohorts 1-2

		N	Sufficient	Modest	Minimal	Weak
Cohort 2 (11th grade)	STARBASE	127	1%	8%	9%	82%
	Comparison	127	-	5%	14%	81%
Cohort 1 (12th grade)	STARBASE	66	-	8%	17%	76%
	Comparison	66	-	9%	20%	71%

Notes. *1) Includes 9th- and 10th-grade SPPS records for 11th- and 12th-grade cohorts (Cohorts 1-2).*

2) STEM momentum categories include the following: Sufficient: student reached a level of math beyond Algebra 2 and successfully completed three or more core lab science classes (i.e., biology, chemistry, or physics), Modest: student reached a level of math equivalent to Algebra 2 and successfully completed three or more core lab science classes or student reached a level of math beyond Algebra 2 and successfully completed two core lab science classes, Minimal: student reached a level of math equivalent to Algebra 2 and successfully completed two core lab science classes, and Weak: student fell short of the above criteria.

Supplemental high school graduation and MCA proficiency data

A76. On-time high school graduation of perfect matches[a]: Cohorts 1-3 overall and by cohort

		N[a]	Percentage graduating on time[b]	Significance
All perfect matches[a]	STARBASE	297	80%	*
	Comparison	297	74%	
Cohort 1	STARBASE	55	85%	ns
	Comparison	55	78%	
Cohort 2	STARBASE	84	87%	*
	Comparison	84	75%	
Cohort 3	STARBASE	158	75%	ns
	Comparison	158	73%	

* *p<.05*

ns no statistically significant differences between groups

[a] *The Minnesota Department of Education (MDE) provided aggregate data on the 297 pairs (594 study participants) who matched on all nine characteristics of interest. These included the four characteristics on which pairs were required to match: grade level in 2008-09, high school attended in 2008-09, third-grade math achievement test level score, and third-grade reading achievement test level score. Pairs included in this analysis also matched on each of the following five characteristics in fourth grade, although they were required to match on only one for inclusion in the study: free or reduced-price lunch eligibility, English Language Learner status, special education status, gender, and race or ethnicity.*

[b] *"On-time" defined as graduating from a public Minnesota high school by the end of the fourth year of high school.*

A77. On-time high school graduation of perfect matches[a]: Cohorts 1-3 by dosage

		N[a]	Percentage graduating on time[b]	Significance
All perfect matches[a]	Higher-dosage[c]	241	82%	*[c]
	Lower-dosage	56	73%	
	Comparison[c]	297	74%	

* *p<.05*

[a] *The Minnesota Department of Education (MDE) provided aggregate data on the 297 pairs (594 study participants) who matched on all nine characteristics of interest. These included the four characteristics on which pairs were required to match: grade level in 2008-09, high school attended in 2008-09, third-grade math achievement test level score, and third-grade reading achievement test level score. Pairs included in this analysis also matched on each of the following five characteristics in fourth grade, although they were required to match on only one for inclusion in the study: free or reduced-price lunch eligibility, English Language Learner status, special education status, gender, and race or ethnicity.*

[b] *"On-time" defined as graduating from a public Minnesota high school by the end of the fourth year of high school.*

[c] *A significant difference (p<.05) was found between the higher-dosage and comparison groups, but not between the higher- and lower-dosage groups or lower-dosage and comparison groups. Note that the sample size of the lower-dosage group is smaller.*

A78. 11th-grade MCA-II math proficiency: Cohorts 1-3 overall and by cohort and dosage

		N[a]	Percentage proficient[b]	Significance
All study participants	STARBASE	405	27%	ns
	Comparison	393	27%	
Cohort 1	STARBASE	70	19%	ns
	Comparison	65	23%	
Cohort 2	STARBASE	125	29%	ns
	Comparison	121	21%	
Cohort 3	STARBASE	210	30%	ns
	Comparison	207	31%	
STARBASE participants (Cohorts 1-3)	Higher-dosage	333	27%	ns
	Lower-dosage	72	31%	

ns no statistically significant differences between groups

[a] *The Minnesota Department of Education (MDE) provided aggregate data on the 798 study participants for whom 11th-grade Minnesota Comprehensive Assessment (MCA-II) math proficiency status was available.*

[b] *"Proficient" defined as meeting or exceeding state standards for grade level.*

A79. 10th-grade MCA-II reading proficiency: Cohorts 2-3 overall and by cohort and dosage[a]

		N[a]	Percentage proficient[b]	Significance
All study participants	STARBASE	350	61%	ns
	Comparison	342	57%	
Cohort 2	STARBASE	127	71%	*
	Comparison	125	60%	
Cohort 3	STARBASE	223	55%	ns
	Comparison	217	56%	
STARBASE participants (Cohorts 2-3)	Higher-dosage	288	62%	ns
	Lower-dosage	62	53%	

* *p<.05*

ns no statistically significant differences between groups

[a] *The Minnesota Department of Education (MDE) provided aggregate data on the 692 study participants in Cohorts 2 and 3 for whom 10th-grade Minnesota Comprehensive Assessment (MCA-II) reading proficiency status was available; 10th-grade MCA-II reading proficiency was not available for Cohort 1.*

[b] *"Proficient" defined as meeting or exceeding state standards for grade level.*

A80. High school MCA-II science proficiency: Cohorts 1-3 overall and by cohort and dosage[a]

		N[a]	Percentage proficient[b]	Significance
All study participants	STARBASE	317	28%	ns
	Comparison	310	25%	
Cohort 1[c]	STARBASE	10	20% (N=2)[c]	ns
	Comparison	5	20% (N=1)[c]	
Cohort 2	STARBASE	108	22%	ns
	Comparison	101	21%	
Cohort 3	STARBASE	199	32%	ns
	Comparison	204	27%	
STARBASE participants (Cohorts 1-3)	Higher-dosage	263	28%	ns
	Lower-dosage	54	30%	

ns no statistically significant differences between groups

[a] *The Minnesota Department of Education (MDE) provided aggregate data on the 627 study participants for whom high school Minnesota Comprehensive Assessment (MCA-II) science proficiency status was available. In high school, students are required to take the MCA-II in science the year in high school when they complete life science.*

[b] *"Proficient" defined as meeting or exceeding state standards for grade level.*

[c] *Note that MCA-II science proficiency was available for a very small number of Cohort 1 study participants. The MCA-II science test was not introduced until the 2007-08 school year.*

Supplemental college enrollment data

A81. College enrollment: Cohort 1 by race, gender, and income status

			Percentage enrolling in college		
		N[a]	STARBASE	Comparison	Significance[b]
Race[c,d]	Asian or Pacific Islander	39	72%	67%	ns
	Black (not Hispanic)	10	70%	70%	ns
	White (not Hispanic)	8	63%	75%	ns
Gender*[e]	Female	36	83%	64%	ns[e]
	Male	33	58%	70%	ns[e]
Free or reduced-price lunch	Eligible	51	71%	67%	ns
	Ineligible	16	63%	63%	ns

* *p<.05*

ns not statistically significant

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 39 STARBASE students were compared to 39 comparison students).*

[b] *Generalized linear models (GLMs) and McNemar tests were used to examine relationships among STARBASE participation, college enrollment, and demographic characteristics. The GLM provides an omnibus test of whether there is an overall interaction among the variables, and McNemar tests pinpoint where any specific differences between groups occur.*

[c] *Analysis excludes Hispanic and American Indian participants due to insufficient numbers in each group.*

[d] *These analyses should be viewed with caution due to the small sample sizes.*

[e] *The GLM test showed a statistically significant result when testing the overall interaction among gender, college enrollment, and STARBASE participation in Cohort 1, but subsequent McNemar tests did not show significant differences between female STARBASE vs. comparison students or between male STARBASE vs. comparison students.*

Note. Student pairs were not required to match on every demographic characteristic. These analyses exclude pairs that did not match on the specific characteristic of interest. For example, the analysis based on free or reduced-price lunch status excludes 6 pairs that did not match on this variable.

A82. College enrollment: Cohort 2 by race, gender, and income status

			Percentage enrolling in college		
		N[a]	STARBASE	Comparison	Significance[b]
Race[c,d]	Asian or Pacific Islander	54	72%	65%	ns
	Black (not Hispanic)	20	75%	50%	ns
	White (not Hispanic)	15	60%	67%	ns
Gender	Female	68	69%	63%	ns
	Male	54	67%	46%	*[e]
Free or reduced-price lunch	Eligible	100	70%	56%	*[f]
	Ineligible	19	68%	63%	ns

* *p<.05*

ns not statistically significant

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 54 STARBASE students were compared to 54 comparison students).*

[b] *Generalized linear models (GLMs) and McNemar tests were used to examine relationships among STARBASE participation, college enrollment, and demographic characteristics. The GLM provides an omnibus test of whether there is an overall interaction among the variables, and McNemar tests pinpoint where any specific differences between groups occur.*

[c] *Analysis excludes Hispanic and American Indian participants due to insufficient numbers in each group.*

[d] *Note that with smaller sample sizes, there may not be enough power to detect a statistically significant difference.*

[e] *A significant difference in college enrollment was found among Cohort 2 male STARBASE vs. comparison students. The GLM testing the overall interaction among gender, college enrollment, and STARBASE participation in Cohort 2 was not significant.*

[f] *A significant difference in college enrollment was found among Cohort 2 STARBASE vs. comparison students who were eligible for free or reduced-price lunch. The GLM testing the overall interaction among free or reduced-price lunch status, college enrollment, and STARBASE participation in Cohort 2 was not significant.*

Note. Student pairs were not required to match on every demographic characteristic. These analyses exclude pairs that did not match on the specific characteristic of interest. For example, the analysis based on free or reduced-price lunch status excludes 16 pairs that did not match on this variable.

A83. College enrollment: Cohort 3 by race, gender, and income status

			Percentage enrolling in college		
		N[a]	STARBASE	Comparison	Significance[b]
Race[c,d]	Asian or Pacific Islander	123	55%	55%	ns
	Black (not Hispanic)	28	36%	36%	ns
	White (not Hispanic)	17	59%	29%	ns
Gender	Female	102	51%	55%	ns
	Male	106	51%	45%	ns
Free or reduced-price lunch	Eligible	194	48%	49%	ns
	Ineligible	24	63%	50%	ns

ns not statistically significant

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 123 STARBASE students were compared to 123 comparison students).*

[b] *Generalized linear models (GLMs) and McNemar tests were used to examine relationships among STARBASE participation, college enrollment, and demographic characteristics. The GLM provides an omnibus test of whether there is an overall interaction among the variables, and McNemar tests pinpoint where any specific differences between groups occur. No significant differences were found.*

[c] *Analysis excludes Hispanic and American Indian participants due to insufficient numbers in each group.*

[d] *Note that with smaller sample sizes, there may not be enough power to detect a statistically significant difference.*

Note. Student pairs were not required to match on every demographic characteristic. These analyses exclude pairs that did not match on the specific characteristic of interest. For example, the analysis based on free or reduced-price lunch status excludes 16 pairs that did not match on this variable.

A84. College enrollment: Cohort 1 by college characteristic

		Percentage enrolling in each type of college		N[a]	Significance
		STARBASE	Comparison		
Public vs. private	Public	88%	82%	34	ns
	Private	12%	18%		
2-year vs. 4-year	2-year	50%	44%	34	ns
	4-year	50%	56%		
Minnesota vs. outstate	Minnesota	97%	94%	34	ns
	Outstate	3%	6%		

ns not statistically significant

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 34 STARBASE students were compared to 34 comparison students).*

Note. In cases where a student attended more than one college, these analyses reflect the first college the student attended.

A85. College enrollment: Cohort 2 by college characteristic

		Percentage enrolling in each type of college		N[a]	Significance
		STARBASE	Comparison		
Public vs. private	Public	67%	63%	51	ns
	Private	33%	37%		
2-year vs. 4-year	2-year	31%	35%	51	ns
	4-year	69%	65%		
Minnesota vs. outstate	Minnesota	84%	92%	51	ns
	Outstate	16%	8%		

ns not statistically significant

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 51 STARBASE students were compared to 51 comparison students).*

Note. In cases where a student attended more than one college, these analyses reflect the first college the student attended.

A86. College enrollment: Cohort 3 by college characteristic

		Percentage enrolling in each type of college		N[a]	Significance
		STARBASE	Comparison		
Public vs. private	Public	62%	81%	63	*
	Private	38%	19%		
2-year vs. 4-year	2-year	29%	40%	63	ns
	4-year	71%	60%		
Minnesota vs. outstate	Minnesota	95%	92%	63	ns
	Outstate	5%	8%		

* *p<.05*

ns not statistically significant

[a] *Refers to the number in each group of the matched pairs comparison (e.g., 63 STARBASE students were compared to 63 comparison students).*

Note. In cases where a student attended more than one college, these analyses reflect the first college the student attended.

A87. College enrollment of perfect matches[a]: Cohorts 1-3 overall, by cohort, and by dosage

			Percentage enrolling in college		
		N[b]	STARBASE	Comparison	Significance
All perfect matches[a]		297	60%	56%	ns
Cohort	Cohort 1	55	67%	65%	ns
	Cohort 2	84	70%	61%	ns
	Cohort 3	158	51%	49%	ns
Dosage	Higher	241	59%	56%	ns
	Lower	56	64%	54%	ns

ns not statistically significant

[a] *Analysis reflects only the 297 pairs (594 study participants) who matched on all nine characteristics of interest. These included the four characteristics on which pairs were required to match: grade level in 2008-09, high school attended in 2008-09, third-grade math achievement test level score, and third-grade reading achievement test level score. Pairs included in this analysis also matched on each of the following five characteristics in fourth grade, although they were required to match on only one for inclusion in the study: free or reduced-price lunch eligibility, English Language Learner status, special education status, gender, and race or ethnicity.*

[b] *Refers to the number in each group of the matched pairs comparison (e.g., 297 STARBASE students were compared to 297 comparison students).*

Note. Data reflect enrollment as of fall 2011. If they graduated from high school on time, this would be the fall after high school graduation for Cohort 3, just over a year after high school graduation for Cohort 2, and just over two years after high school graduation for Cohort 1. Differences in percentages enrolled across cohorts are likely at least partially due to varying lengths of time since high school graduation.

Phase I high school student survey

STARBASE survey

Advisory: _____

Name: _____ ***ID number:*** _____ ***Grade:*** _____

High school: _____ ***High school number:*** _____ ***Group:*** ____

Please take a few moments to complete this survey. The information you provide will help us learn more about students' interests in science, math, technology and engineering as well as the impact of the STARBASE program. Your answers will be kept confidential. Your name will not be attached to the answers you give in the report of survey results. Please check only one box per question and complete both sides of the survey.

1. In elementary school, did you participate in STARBASE, a 5-day science, math, technology, and engineering program? (STARBASE is at the MN Air Guard military base. Students get "call signs" and do activities such as build rockets to see how science, math, technology, and engineering are used in aerospace).

   ❒[1] Yes ❒[2] No

If Yes, continue with question 2. If No, SKIP ahead to question 9 on the back.

2. What do you remember most about participating in STARBASE? _____

   _____

3. Did STARBASE increase your <u>interest</u> in…

	A lot	Some	A little	None
a. science?	❒[4]	❒[3]	❒[2]	❒[1]
b. math?	❒[4]	❒[3]	❒[2]	❒[1]
c. technology? (e.g., computers)	❒[4]	❒[3]	❒[2]	❒[1]
d. engineering?	❒[4]	❒[3]	❒[2]	❒[1]

4. Did you get involved in science, math, technology or engineering activities or programs because of STARBASE?

   ❒[1] Yes ❒[2] No

   If Yes, what activities/programs were these? _____

   _____

5. Did STARBASE help you <u>understand</u> science, math, technology or engineering better?

   ❒[4] A lot ❒[3] Some ❒[2] A little ❒[1] None

6. Did STARBASE help you learn about careers related to science, math, technology or engineering?

   ❒[4] A lot ❒[3] Some ❒[2] A little ❒[1] None

7. Was STARBASE a valuable learning experience?

   ❒[1] Yes ❒[2] No ❒[8] Don't know

8. Do you think your participation in STARBASE continues to impact you today?

   ❒[1] Yes ❒[2] No ❒[8] Don't know

   If Yes, how so? _____

   _____

OVER

9. Do you currently participate in any activities, clubs, or programs related to science, math, technology or engineering?
   ❒1 Yes ❒2 No
   If Yes, which one(s)? _____
   _____

10. Do you currently participate in any activities, clubs, or programs related to the military (e.g., JROTC)?
   ❒1 Yes ❒2 No
   If Yes, which one(s)? _____
   _____

11. Have any past experiences or activities (besides STARBASE) increased your interest in science, math, technology or engineering?
   ❒1 Yes ❒2 No
   If Yes, what activities/experiences were these? _____
   _____

12. How much <u>interest</u> do you have in…

	A lot	Some	A little	None
a. science?	❒4	❒3	❒2	❒1
b. math?	❒4	❒3	❒2	❒1
c. technology? (e.g., computers)	❒4	❒3	❒2	❒1
d. engineering?	❒4	❒3	❒2	❒1

13. What is your favorite <u>core</u> subject in school? (Check one)
   ❒1 English/Language Arts ❒3 Science
   ❒2 Math ❒4 Social Studies

14. Do you plan on taking more science, math, computer or engineering classes in high school?
   ❒1 Yes, only what's required ❒3 No
   ❒2 Yes, more than what's required ❒8 Don't know

15. How much interest do you have in joining the military?
   ❒4 A lot ❒3 Some ❒2 A little ❒1 None ❒8 Don't know

16. Do you plan on going to college (2 year or 4 year)?
   ❒1 Yes ❒2 No ❒8 Don't know

17. Do you plan on getting a job related to science, math, technology or engineering?
   ❒1 Yes ❒2 No ❒8 Don't know

18. Do you have an older brother or sister who participated in the STARBASE program?
   ❒1 Yes ❒2 No ❒8 Don't know

If Yes, continue with question 19. If No, you have completed the survey.

19. Did this older brother or sister who participated in STARBASE major in science, math, technology or engineering in college, or do they now have a job in one of these areas?
   ❒1 Yes ❒2 No ❒8 Don't know

Thank you!

Note. *The actual survey layout differed from that presented here because the survey was administered in a Web-based format.*

Phase III college student survey

STARBASE survey

We are working with STARBASE Minnesota to look at former participants' interests and future plans. STARBASE is the 5-day science, technology, engineering, and math (STEM) program at the Minnesota Air National Guard base. You may have participated in the program in 4th grade or both 4th and 6th grades.

Please take a few moments to complete this survey. The information you provide will help us learn more about the impact of the STARBASE program as well as what other opportunities are available for students interested in science, technology, engineering, or math. Your answers will be kept confidential. At the end of the survey, you will be given the opportunity to have a $20 gift card to Target or Walmart mailed as thanks for your participation.

1. Did you participate in the STARBASE program at the Minnesota Air National Guard base? You may have participated in 4th grade, 6th grade, or both.
   ❒1 Yes
   ❒2 No [If no, respondent has completed survey and should be thanked for their participation.]

Experience with STARBASE

2. What do you remember most about participating in STARBASE? _____
   _____
   _____

3. Do you think STARBASE was a valuable learning experience?
   ❒1 Yes ❒2 No ❒8 Don't know

4. Do you think STARBASE helped you <u>understand</u> science, technology, engineering, or math better?
   ❒1 Yes ❒2 No ❒8 Don't know

5. Do you think STARBASE increased your <u>interest</u> in science, technology, engineering, or math?
   ❒1 Yes ❒2 No (Skip to question 7.) ❒8 Don't know (Skip to question 7.)

6. Specifically, do you think STARBASE increased your <u>interest</u> in…

	Yes	No	Don't know
a. science?	❒1	❒2	❒8
b. technology? (e.g., computers)	❒1	❒2	❒8
c. engineering?	❒1	❒2	❒8
d. math?	❒1	❒2	❒8

7. Do you think STARBASE helped you learn about careers related to science, technology, engineering, or math?
   ❒1 Yes ❒2 No ❒8 Don't know

8. What was the most important thing you gained from your participation in STARBASE? _____

_____

_____

9. Do you think your participation in STARBASE continues to impact you today?
   ❒[1] Yes ❒[2] No ❒[8] Don't know

   If Yes, how so? _____

   _____

   _____

Current interest in STEM

10. How much interest do you currently have in…

	A lot	Some	Very little/None
a. science?	❒[3]	❒[2]	❒[1]
b. technology? (e.g., computers)	❒[3]	❒[2]	❒[1]
c. engineering?	❒[3]	❒[2]	❒[1]
d. math?	❒[3]	❒[2]	❒[1]

11. Have you decided on a major or field of study in college?
    ❒[1] Yes
    ❒[2] No (Skip to question 13.)
    ❒[8] Don't know (Skip to question 13.)
    ❒[9] Not applicable (Skip to question 13.)

12. What is your major or field of study? _____ (Skip to question 14.)

13. Are you considering a major or field of study related to science, technology, engineering, or math? This would include any field that emphasizes skills in one of these areas. For example, accounting would be considered a math field, and nutrition a science field.
    ❒[1] Yes ❒[2] No ❒[8] Don't know ❒[9] Not applicable

14. Have you taken or are you planning to take any additional science, technology, engineering, or math classes in college beyond what is required?
    ❒[1] Yes, more than what's required ❒[2] No, only what's required ❒[8] Don't know ❒[9] Not applicable

15. How much interest do you have in getting a job <u>related to</u> science, technology, engineering, or math?
    ❒[3] A lot ❒[2] Some ❒[1] Very little/None

16. How much interest do you have in getting a job <u>teaching</u> science, technology, engineering, or math?
    ❒[3] A lot ❒[2] Some ❒[1] Very little/None

17. Do you think STARBASE has had any influence on your career plans or choices?
❒[1] Yes ❒[2] No ❒[8] Don't know
If yes, please explain: _____

18. At your college or university, have you participated in any activities, clubs, or programs related to science, technology, engineering, or math?
❒[1] Yes ❒[2] No

If Yes, please indicate the types of activities, clubs, or programs in which you have participated:_____

_____

19. Have you participated in any activities, clubs, or programs related to the military since STARBASE, either in junior high, high school, or at your college or university (e.g., Junior ROTC or ROTC)?
❒[1] Yes ❒[2]No
If Yes, please indicate the types of activities, clubs, or programs in which you have participated:_____

_____

Current interest in the military

At STARBASE Minnesota students learn how science, technology, engineering, and math are used in various careers. The program takes place on the Military Air National Guard base, and you likely saw members of the military around the facility, heard stories of ways they use these subjects in their jobs, and had a member from the Guard speak at graduation. In addition to learning about your interest in other science-, technology-, engineering-, or math-related areas, we are also interested in learning about any military interest.

20. Are you currently enrolled in any form of the military?
❒[1] Yes. What branch are you in? _____ What is your rank? _____ (Skip to question 22.)
❒[2]No

21. How much interest do you have in pursuing a civilian or uniform military career?
❒[3] A lot ❒[2] Some ❒[1] Very little/None

22. Do you think STARBASE increased your interest in the military? This could include interest in the military in general as well as interest in joining the military.
❒[1] Yes ❒[2] No ❒[8] Don't know

Final questions

23. After participating in STARBASE, did you participate in any other activities, clubs, or programs related to science, technology, engineering, or math when you were in elementary, junior high, or high school?
❒[1] Yes ❒[2] No (Skip to question 26.) ❒[8] Don't know (Skip to question 26.)
If Yes, please indicate the types of activities, clubs, or programs in which you participated:_____

_____

24. Which of these activities, clubs, or programs did you find most helpful?
_____

_____

25. Did you get involved in any of these science, technology, engineering, or math activities or programs because of STARBASE?

❒[1] Yes ❒[2] No ❒[8] Don't know

If Yes, which activities/programs were these? _____

_____

26. Did you face any challenges to participating in other science, technology, engineering, or math activities, clubs, or programs when you were in elementary, junior high, or high school?

❒[1] Yes ❒[2] No (Skip to question 28.) ❒[8] Don't know (Skip to question 28.)

27. Which challenges did you face? (Check all that apply.)

❒[1] I was not aware of what other opportunities were available to me.

❒[2] My parents or caregivers were not aware of other opportunities.

❒[3] There were not enough opportunities available to me.

❒[4] Available opportunities were too expensive.

❒[5] I was too busy with other activities.

❒[6] Transportation would have been difficult.

❒[7] I needed to be home to care for my sibling(s).

❒[8] Opportunities did not fit my specific interests. Please explain: _____

❒[9] Opportunities were not applicable to me based on my age, gender, or other factors. Please explain:

_____

❒[10] Other challenges. Please explain: _____

28. Were there any science, technology, engineering, or math opportunities you would have liked to participate in but that were not available to you in elementary, junior high, or high school?

❒[1] Yes ❒[2] No ❒[8] Don't know

If Yes, what types of opportunities would you like to have had? _____

_____

29. Are there any final comments you would like to share with the STARBASE program? _____

_____[respondents are not required to respond to this question]_____

_____

Thank you for your participation in the survey!