Project START:
Increasing STEM Persistence by Supporting Apprentice Research Experiences as a Model for Institutional Change in Community Colleges

Final External Evaluation Report

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Executive Summary

START provides students at Wake Technical Community College, in Raleigh, North Carolina, with the opportunity to do a semester-long mentored research project on a STEM (science, technology, engineering, and math) topic. In 2021, the Wake Tech faculty running START received funding from the National Science Foundation (NSF) to iteratively assess and improve the program over five years. The START team engaged researchers from the Early College Research Center at UNC Greensboro to conduct a randomized controlled trial (RCT) with five study cohorts to understand the impact of participation in START on students as well as to provide formative and other summative evaluation feedback throughout the course of the grant.

The primary activity and purpose of START is providing an opportunity for Wake Tech students to conduct STEM-focused research with STEM mentors. The research activities may be conducted with Wake Tech faculty or with faculty or professionals at partnering institutions or organizations. Each student has a Wake Tech mentor or co-mentor (for students working with a partner organization) who guides the student through the research process. Students are also expected to complete training modules that build their STEM research and career skills and they must share the results of their research; most do so through presenting a poster at a college-wide showcase. Students are considered Wake Tech employees and receive compensation for participating in START activities.

A key goal of the NSF-funded project is to formally and rigorously assess the impact of the program through a randomized controlled trial (RCT) that began with the pilot semester. The five objectives of the NSF project are:

1) Build capacity for undergraduate research at Wake Tech by improving the START program;
2) Develop partnerships with research universities that will build students' transfer capital;
3) Increase student success in transferring to and persistence in STEM bachelor's degree programs;
4) Increase institutional support for undergraduate research at Wake Tech and in the North Carolina Community College System by developing and disseminating a sustainable model; and
5) Test the model with an RCT to increase understanding of potential impacts of undergraduate research opportunities in community college settings.

The NSF-supported version of START was piloted in the Spring 2022 semester. The evaluation studied the pilot cohort and the subsequent four cohorts (from the Fall 2022, Spring 2023, Fall 2023, and Spring 2024 semesters) and the program's implementation during those five semesters. The evaluation team continued to collect outcome data about the study cohorts through the end of the NSF grant. This report covers findings and presents final results from all the data collected by the evaluation team.

The evaluation study has two primary sub-studies: a student-level impact study and an implementation study. The student-level impact study relies on a rigorous random assignment design in which students who applied to START were randomly assigned to the treatment group. The impact of START was assessed via a survey (the Student Survey) and administrative data. The Student Survey, which all applicants took when they applied to START and at the end of their treatment semester, measured students' attitudes and skills related to STEM research and careers. Administrative data provided by Wake Tech allowed for examination of impacts on persistence, degree attainment, and participation in STEM areas. The evaluation collected administrative data for all cohort students throughout the grant period. The implementation study used a variety of data sources to investigate the program's activities, the student experience and the perceived effects of the experience, and the mentor experience and the perceived effects of the experience during the treatment semesters of the study cohorts (the first three years of the grant). The evaluation team interviewed samples of participating students and mentors, conducted focus groups with the program leadership team, and fielded surveys of participating students and mentors. In the final year of the grant, the evaluation team interviewed a small group of program alumni who had transferred to a four-year institution.

The NSF grant provided for scaling up the existing model of START, primarily by increasing the number of internships available and by providing for a more robust student program experience with paid internships, required supplemental training every semester, and optional student activities. The grant also committed the program leadership team to providing more support for mentors, supporting a RCT to determine the impact of the program, garnering institutional support for the program at Wake Tech, and disseminating information about the program to community colleges statewide. For the pilot semester, the program leadership team was largely focused on standing up the foundational elements of the expanded program (such as more extensive student recruitment, recruiting more mentors and partner organizations, and developing the initial student training materials). In subsequent semesters they refined the execution of these elements and implemented other elements of the grant (such as developing mentor training and advanced student training, dissemination, and securing institutional support).

Students who took the Student Survey reported statistically significant higher self-assessments on measures of STEM self-efficacy, STEM career awareness, comfort with STEM research, scientific literacy, and transfer confidence. These results are broadly in line with results from the implementation-focused survey of participating students and student and mentor interviews, in which students reported (and mentors observed students) gaining STEM skills and knowledge, as well as increased confidence, due to their participation in START. Students also said that the program made them more interested in pursuing a STEM degree and career. Mentors who responded to a mentor survey and participated in interviews consistently reported a variety of benefits from their involvement in the program, including the satisfaction of seeing students grow and succeed, improved mentoring and project management skills, and recognition of their service, which can help with promotions.

Program alumni who transferred to a four-year college after attending Wake Tech described several interrelated ways that START had a positive effect on their experience at their new school. Alumni said that their experience in START bolstered their confidence, focused their academic interests, gave them practical STEM and career skills they relied on, inspired them to pursue research, and opened doors to new opportunities.

Results from the analysis of academic and enrollment outcomes are less straightforward. The evaluation found that two years after a student's treatment semester, there is a modest significant positive impact on cumulative curriculum credits for treatment students, but there were no statistically significant differences on persistence or transfer to a four-year institution. There is suggestive evidence that treatment students are delaying their transfer from Wake Tech to a four-year institution in order to take more classes at Wake Tech and to complete additional degree programs. When looking at student subgroups (identified by on program- and policy-relevant characteristics), a few more statistically significant results emerge after two years: treatment students who begin the program with more than 30 credits were more likely to be a STEM concentrator and earn more Wake Tech credits, treatment students with a high-achievement background earned more credits at Wake Tech, and students who were Pell-eligible prior to START were more likely to still be enrolled in higher education, be a STEM concentrator, and earn more credits at Wake Tech.

While the evidence about the impact of START on a student's postsecondary trajectory does not provide a clear picture, other data from the evaluation suggests that START did have a meaningful effect on the quality of a student's postsecondary experience. If students were delaying their intended transfer from Wake Tech to a four-year college, there is evidence that could explain why—students in the program may find their experience at Wake Tech to be meaningful, interesting, and worthwhile due to START.

As the NSF-supported version of START sunsets, the leadership team can point to a number of successes from the five years of the grant. Chief among them may be that they achieved their goal of institutionalizing the program at Wake Tech; with the support of college leadership and new foundation support, START will continue. And a close second may be building a program that gives community college students not just research experience, but a reason to feel engaged with their institution.

I. Introduction

Wake Technical Community College's START (STEM Academic Research and Training)[1] program provided the college's students with opportunities to conduct mentored research and to build their knowledge of and interest in STEM (science, technology, engineering, and math) research. The National Science Foundation (NSF) funded a five-year effort to iteratively assess and improve START; the funding supported 50 students each semester in paid research internships. The NSF funding was leveraged to secure supplemental funding to support five additional students each semester. The evaluation covers the entire program and all participating students, regardless of funding source, as over 90% of the students were covered by NSF funding and the major components of program implementation did not vary by the source of students' support. The results reported here apply to the program as a whole.

The START program began as a faculty-created effort to provide students the opportunity to participate in apprentice-based STEM research. Prior to the grant, the program had individual student success stories, but the START faculty recognized that they would not be able to further develop the program without additional funding and systematic assessment. As a result, the START team submitted a proposal with the long-term goal of developing "a sustainable and scalable undergraduate research program to foster student success in transferring to and persistence in bachelor's degree programs in STEM disciplines" (NSF proposal).

The primary activity and purpose of START is providing an opportunity for Wake Tech students to conduct STEM-focused research with STEM mentors. The research activities may be conducted with Wake Tech faculty or with faculty or professionals at partnering institutions or organizations. Each student has a Wake Tech mentor or co-mentor (for students working with a partner organization) who guides the student through the research process. Students are also expected to complete training modules that build their STEM research and career skills and they must share their research; most do so through presenting a poster at a college-wide showcase. Students are considered Wake Tech employees and receive compensation for participating in START activities.

The grant began in the Fall 2021 semester and the new NSF-funded version of the program was piloted in the Spring 2022 semester. The 2022–2023 school year was the first full year of implementation of the NSF-funded program (Year 2 of the NSF-funded project). The evaluation studied the pilot cohort (from the Spring 2022 semester) and the subsequent four cohorts (from the Fall 2022, Spring 2023, Fall 2023, and Spring 2024 semesters) and the program's implementation during those five semesters. The evaluation team continued to collect outcome data about the study cohorts through the end of the NSF grant. This report covers findings and presents final results from all the data collected by the evaluation team.

[1] The official name of the project is Increasing STEM Persistence by Supporting Apprentice Research Experiences as a Model for Institutional Change in Community Colleges.

A key goal of the NSF-funded project is to formally and rigorously assess the impact of the program through a randomized controlled trial (RCT) that began with the pilot semester. To guide the evaluation design, the evaluation team developed a logic model (Figure 1) that delineates the specific program components, the shorter-term outcomes, and the longer-term impacts of the program. The logic model is guided by five objectives for the NSF project:

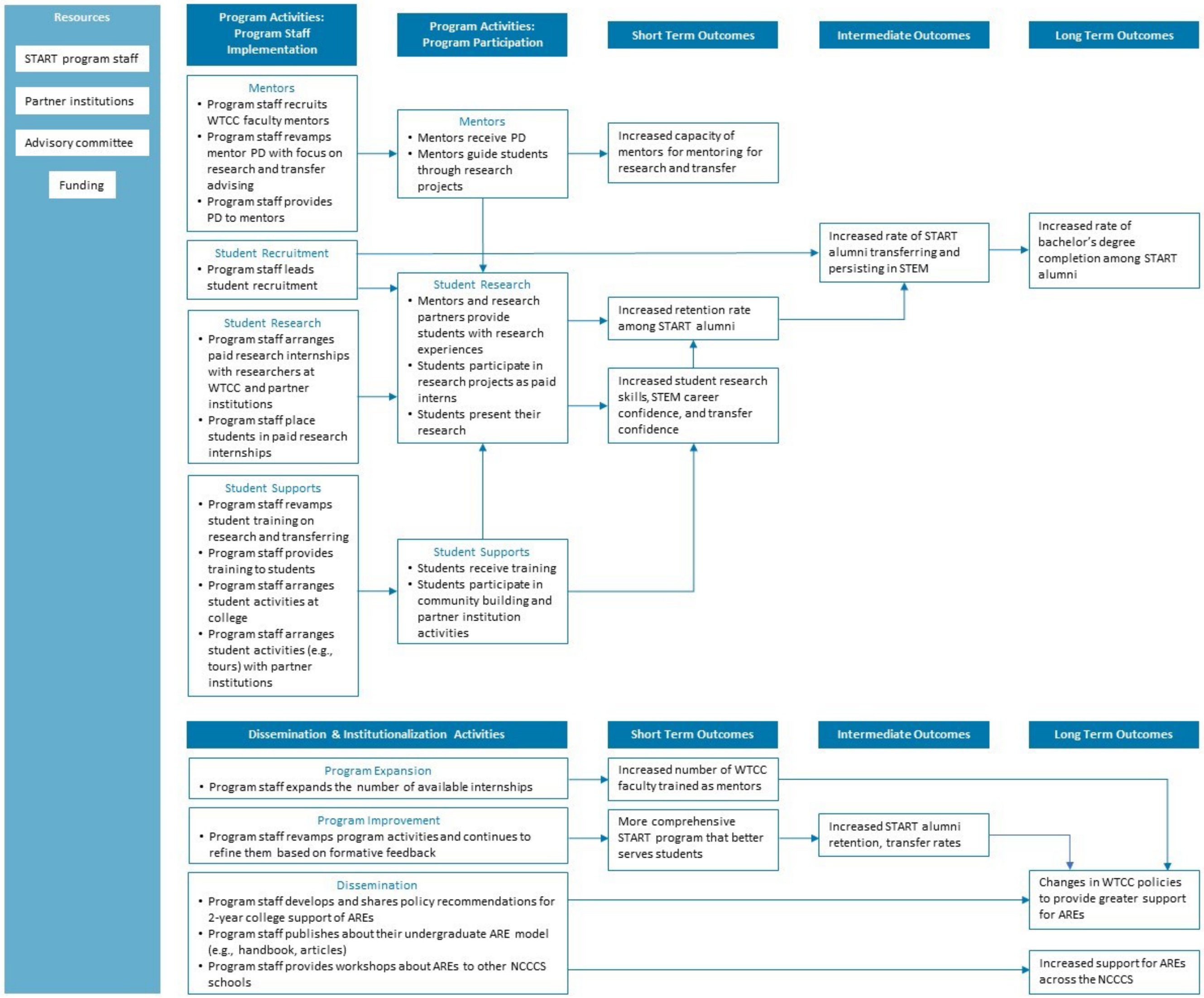
6) Build capacity for undergraduate research at Wake Tech by improving the START program;
7) Develop partnerships with research universities that will build students' transfer capital;
8) Increase student success in transferring to and persistence in STEM bachelor's degree programs;
9) Increase institutional support for undergraduate research at Wake Tech and in the North Carolina Community College System by developing and disseminating a sustainable model; and
10) Test the model with an RCT to increase understanding of potential impacts of undergraduate research opportunities in community college settings.

As shown in the logic model, the design of the program is as follows. Members of the leadership team (referred to as "program staff" in the logic model) recruit and provide training to mentors who then guide students through research projects. The leadership team arranges for the research projects and recruits students to participate each semester. They also provide multiple student supports including research training, student community-building activities, and activities with partner organizations (specifically, tours of or visits to four-year universities). As a result of doing research, being advised by their mentors, and receiving the program's support, students are expected to improve their research skills, build their sense of self-efficacy in STEM, and build their confidence in and understanding of the college transfer process. The expectation is then that students will be more likely to: 1) persist at Wake Tech and in STEM; and 2) successfully transfer to a four-year institution where they will major in a STEM field.

Because the goal of this project was to create a program that can be more widely scaled, the logic model also includes components related to institutionalization and dissemination. The expectation of the grant is that Wake Tech would develop policies to support student research. Through various dissemination activities, the START program model would eventually be adopted by other colleges in the North Carolina Community College System (NCCCS).

The evaluation builds off the logic model. The study's methods and data sources are described in Section II, Methodology. Section III, Program Activities, describes the program's implementation throughout the first three years of the grant. Section IV, Program Impacts and Perceived Program Effects and Experiences, presents estimates of the impact of participation in START on students' self-assessment of their STEM-related attitudes and skills and on academic and enrollment outcomes over time, including by program- and policy-relevant student subgroups. It also describes the effects of the program on students, mentors, program alumni, and the Wake Tech as an institution. The report concludes with Section V, Implications and Future Research, which summarizes the implications of the evaluation's findings and suggests avenues for future research.

Figure 1: START Logic Model



II. Methodology

The 2025–2026 school year, Year 5 of the project, was the final year of the grant and the evaluation. This section describes the methodology for all data collected throughout the evaluation.

Student-Level Impact Study

The student-level impact study was intended to rigorously examine the impact of START on student outcomes targeted by the program. For students in the five study cohorts, outcomes on self-reported measures were collected after their treatment semester; other outcomes were observed over the five years of the project.

Research Questions

The research questions driving the student impact study are:

1) What is the effect of participating in START for at least one semester on the percentage of students who remain enrolled in Wake Tech and/or transfer to a four-year institution compared to the control students?
2) What is the effect of participating in START for at least one semester on the percentage of students who are identified as STEM concentrators at Wake Tech compared to the control students?
3) What is the effect of participating in START for at least one semester on students' scientific literacy and research skills compared to the control students?
4) What is the effect of participating in START for at least one semester on students' academic confidence compared to the control students?
5) What is the effect of participating in START for at least one semester on students' STEM identity and awareness compared to the control students?
6) How does the effect of participating in START for at least one semester differ for students from various program- and policy-relevant subgroups compared to control students in the same subgroups?

Student-level administrative data provided by Wake Tech allows us to address research questions 1, 2, and 6. Evidence for questions 3, 4, and 5 comes from the Student Survey, which was administered to students in the study cohorts when they applied to START and at the completion of their first semester in the program.

Design

The study relies on a randomized controlled trial design in which students applied to START and were then randomly assigned to the treatment group. Treatment students are those students who were offered the opportunity to participate in the START intervention; this group includes both students who accepted the invitation to participate and those who declined the invitation. Control students are those who were not offered a spot and participated in business as usual.

Sample

For each study cohort, the leadership team conducted student recruitment and collected applications for the program. Students applied to the program in the semester before they participated in it. In order to qualify for the program, students had to be planning to be enrolled in Wake Tech in the semester they applied for; there were no academic pre-requisites for program eligibility. Students had to also be 18 or older at the time they applied so that they could consent to be part of the study.

The evaluation team conducted separate randomizations for each of the study cohorts (i.e., the cohorts in the Spring 2022, Fall 2022, Spring 2023, Fall 2023, and Spring 2024 semesters). The leadership team submitted the list of eligible applicants to the evaluation team who assigned each applicant a random number. The list of applicants was reordered based on the random number, with the list sorted from lowest to highest, and returned to the leadership team. The START team then offered spots to students in the order in which they were listed until all available program spots were taken. The applicant pools from each of the five study semesters were combined to create the sample for the student-level impact study.

The study uses an intent-to-treat analysis, in which all students who were offered a spot are considered part of the treatment group even if they did not end up participating, and any students who were not offered a spot remain in the control group. This approach allows for the original randomized ordering to remain intact.

Students who did a project in a given semester were given the opportunity to remain in the program for another semester.[2] Each semester, all internship spots not taken by students who elected to remain in the program were filled by the randomization process. Students who were in the control group in a given semester were unable to apply to be part of the program in the following semester but could re-apply two semesters later.

Table 1 shows the characteristics of the study sample for the five semesters for which students have been randomized. Because we include the pilot semester, Spring 2022, in the analytic sample for measuring impacts, the pilot cohort is included in this description of the study sample. The semester for which a student applies to participate is their “treatment semester” whether they were randomly selected for that semester’s treatment group or control group. The semester during which they applied to START is their baseline semester. For example, for a student who applied to participate in Spring 2022, Spring 2022 is their treatment semester and Fall 2021 is their baseline semester. We use data from Wake Tech administrative records to look at student characteristics during their baseline semester. If the student was not enrolled at Wake Tech in their baseline semester, we look at data from two semesters prior to treatment. Wake Tech also provided students’ high school GPA when possible.

[2] In Year 3, the leadership team set a limit of four semesters of continuous participation.

Table 1: Baseline Student Characteristics, Study Sample

Characteristic	Treatment *(N=239)* Mean	Treatment *(N=239)* Standard Deviation	Control *(N=425)* Mean	Control *(N=425)* Standard Deviation	Effect Size Difference[a]
Baseline term Wake Tech GPA[b]	3.00	0.99	3.04	0.92	0.04
Cumulative credits	44.42	25.48	41.97	25.71	0.10
% Pell-eligible	35.1%	0.48	36.2%	0.48	-0.03
High school GPA[c]	3.15	0.62	3.13	0.59	0.03
% STEM concentrator	41.4%	0.49	44.9%	0.50	0.07

[a] Effect sizes are calculated using Hedges' *g* for continuous variables and Cox's Index for dichotomous variables.
[b] There are 37 missing values for term GPA in the baseline data.
[c] There are 162 missing values for high school GPA in the baseline data.

Administrative Data and Measures

The primary source of data for the student impact study comes from student administrative records from Wake Tech and the National Student Clearinghouse (NSC), also provided by Wake Tech. The administrative data enables us to examine impacts on persistence, degree attainment, and participation in STEM areas.

We use the administrative data to measure the following outcomes:

- *Enrollment at Wake Tech*. Defined as being enrolled in any credit hours at Wake Tech at the start of the given semester. Summer terms are not counted. We use Wake Tech administrative records to construct this variable.
- *Degree earned at Wake Tech*. Defined as obtaining an associate degree by the end of the given semester. Summer terms are counted toward spring degree attainment. We use Wake Tech administrative records to construct this variable.
- *Any credential earned at Wake Tech*. Defined as completing any program by the end of the given semester. Summer terms are counted toward spring degree attainment. We use Wake Tech administrative records to construct this variable.
- *Multiple credentials earned at Wake Tech*. Defined as completing two or more credentials, including associate degrees, by the end of the given semester. Summer terms are counted toward spring degree attainment. We use Wake Tech administrative records to construct this variable.
- *Enrollment or degree earned at any institution*. Defined as being enrolled in any two- or four-year institution during a given semester or having earned a degree from any two- or four-year institution by the same semester. Students whose status for a given semester is "W" (Withdrawn) or "A" (Approved Leave of Absence) are not counted as enrolled. This variable measures overall persistence in postsecondary education. We use NSC records to construct this variable.
- *Transfer to a four-year institution*. Defined as being enrolled at any four-year institution at any point between the START semester and the given semester. We use NSC records to construct

this variable. For students who were simultaneously enrolled at Wake Tech and a four-year institution, we classify the student as a transfer student if they were enrolled at the four-year institution full-time. Students whose status for a given semester is “W” (Withdrawn) or “A” (Approved Leave of Absence) are not counted as enrolled. We use NSC records to construct this variable.

- *Four-year degree earned*. Defined as obtaining a bachelor’s degree by the end of the given semester. Summer terms are counted toward spring degree attainment. We use NSC data to construct this variable.
- *STEM concentrator status*. Defined as an indicator variable for having completed 12 or more STEM-focused curriculum credits by the end of the semester when the variable is measured. This variable includes transfer credits recorded by Wake Tech. We use Wake Tech administrative data to construct this variable.
- *Term credits earned.* Defined as the number of credits earned at Wake Tech during the given semester. The number of earned credits is 0 for students who were not enrolled at Wake Tech. We use Wake Tech administrative data to construct this variable.
- *Cumulative curriculum credits.* Defined as the total number of curriculum credits awarded by Wake Tech through the end of the semester when the credits are measured. We use Wake Tech administrative data to construct this variable.

Data for all outcomes are available through the Fall 2025 semester. We report impact estimates for all outcomes two and four semesters (one and two years) after a student participated in the START program. The variables based on Wake Tech administrative data are available for all students who applied to START—that is, both treatment group students and control groups students. NSC data are available for all but one treatment group student, who is excluded from these analyses.

Because outcome variables for the last cohort are available only up to three semesters after the treatment semester, the analyses reported here include the Spring 2022, Fall 2022, Spring 2023, and Fall 2023 cohorts for outcomes in the fourth semester following the semester of START participation (the treatment semester). For outcomes measured two semesters after the treatment semester, the analysis sample includes all five cohorts.

The student-level administrative data also includes Pell eligibility status and high school grade point average for both treatment and control students, which we report as part of the baseline student characteristics (see Table 1).

Student Survey Data

The study team developed a survey, referred to in the report as the Student Survey, with the scales listed below, to measure students’ attitudes and skills related to STEM research and careers. A table of the survey scales’ psychometric results can be found in Appendix A.

- *STEM Self-Efficacy.* This scale has 10 questions about whether students could see themselves working in a STEM field, are confident they could do well in STEM, and believe they could transfer to a four-year college STEM program.
- *STEM Career Awareness.* This scale uses three items to assess students' awareness of different STEM careers, the extent to which they have a plan for a STEM career, and their confidence in having a STEM career.
- *Comfort with STEM Research.* This 14-question scale focuses on students' skills with STEM research activities such as collecting and analyzing data, designing studies, research misconduct, and other topics.
- *Science Literacy.* This scale uses seven questions to look at students' self-reported skills in areas such as identifying reliable sources of information and interpreting presentations of scientific results.
- *Grit and Perseverance.* This six-question scale focuses on students' reported ability to finish what they begin, work independently, and continue working.
- *Transfer Confidence.* This five-question scale focuses on students' perceptions of their knowledge and skills relative to transferring to a four-year college.

The Student Survey was developed by the evaluation team collaboratively with the leadership team. It includes items adapted from the validated *Entering Research Learning Assessment* (Butz & Branchaw, 2020), as well as original items that reflect the goals and context of START. The Student Survey was administered twice to each cohort to capture changes in students' attitudes during the treatment semester. For the baseline sample, reliability ranged from 0.76 for the STEM Career Awareness scale to 0.92 for the Comfort with STEM Research Scale. The reliability increased slightly for all scales in the follow-up sample; in the follow-up, it ranged from 0.80 for the STEM Career Awareness Scale to 0.95 for the Comfort with STEM Research Scale.

The baseline survey was part of a student's application to START and all but three students (99% of study participants) completed the survey.[3] The follow-up survey was administered online by the leadership team at the end of each semester. To maximize the sample size for analysis, we combined survey data for all five cohorts, including the pilot (Spring 2022) semester. Table 2 shows the survey response rate for the treatment and control groups. For students who responded to the baseline and follow-up surveys, there were no missing responses to individual questions used to construct each scale. One of the questions from the STEM Self-Efficacy scale was inadvertently omitted in the follow-up survey in Fall 2023, so for that administration, the scale was constructed using the remaining nine questions. Students in the treatment group were 14 percentage points more likely to respond to the follow-up survey (see Table 2).

[3]A small number of students went through randomization without having completed the survey during the initial semesters.

Table 2: Student Survey Response Rates and Attrition (Follow-Up Administration)

	Overall	Treatment	Control	Difference
Response Rates	43% (284 of 664)	52% (124 of 239)	38% (160 of 425)	14%
Response Attrition	57% (380 of 664)	48% (114 of 239)	62% (265 of 425)	-14%

Given the relatively high response attrition and the fact that there was differential attrition between treatment and control groups, we assessed equivalence on baseline measures of the survey for all students who answered both the baseline and follow-up surveys in the same semester. As shown in Table 3, the groups were comparable on baseline measures of all outcomes from the Student Survey.

Table 3: Baseline Equivalence for Student Survey, Key Survey Outcome Measures

	Treatment *(N=124)*		**Control *(N=160)***		**Effect Size Difference**
Scale	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**	
STEM Self-Efficacy	4.39	0.55	4.37	0.59	0.04
STEM Career Awareness	4.37	0.60	4.30	0.72	0.11
Comfort with STEM Research	3.90	0.68	3.88	0.68	0.03
Scientific Literacy	4.02	0.77	4.03	0.74	0.00
Grit & Perseverance	4.46	0.61	4.48	0.57	0.03
Transfer Confidence	4.48	0.57	4.40	0.60	0.12

Analysis

To study the program's impacts on persistence, degree attainment, transfers, and academic performance, we used the administrative data provided by Wake Tech and the NSC. We estimated multiple regression models that included an indicator for treatment group assignment, as well as student-level covariates including Pell eligibility status, baseline achievement, a quadratic in the number of cumulative credit hours earned prior to the START semester, baseline STEM concentrator status, an indicator for Wake Tech credentials earned prior to the START semester, and prior START participation status. Our estimation strategy accounts for the fact that students who were randomized into the control group upon initially applying for START had the opportunity to reapply two semesters later, and thus their participation in START is not random. All models also include cohort-specific indicators.

We also conducted subgroup analyses exploring differences in the program's impacts based on the following student characteristics, which we deemed to be program- and policy-relevant:

- Number of cumulative curriculum credits students had completed at Wake Tech at baseline, comparing students who had 0-30 credits to students who had completed more than 30 credits. Note that with this measure we do not know how many semesters students were enrolled in to complete the number credits they had at baseline.

- Baseline achievement, comparing high-achieving students, defined as those with high school or baseline Wake Tech GPA in the top 50 percent to students with lower baseline achievement. Students who are missing both GPA measures were excluded from this analysis.
- Pell grant eligibility, comparing Pell-eligible students to students who were not Pell-eligible at baseline.

More detail on the analyses, including the statistical models used, is provided in Appendix B.

Implementation Study

The implementation investigation covers three topics: program activities, the student experience and the perceived effects of the experience, and the mentor experience and the perceived effects of the experience during Years 1–3 of the grant.

Research Questions

For each implementation study topic there is a guiding general evaluation question and three or more specific sub-evaluation questions. The implementation evaluation questions are listed by topic below.

Program Activities: What activities constituted the START program and how were they implemented?

1) To what extent were program activities implemented as intended?
2) Which parts of the program were seen as most valuable and most effective?
3) Which recruitment strategies were most effective at reaching mentors?
4) Which recruitment strategies were most effective at reaching students?

Student Experience and Perceived Effects: What were students' experiences in START and after they transferred to a four-year institution?

1) How many students participated? What were their characteristics?
2) What was the student experience like?
3) What types of research projects did students do?
4) To what extent did students experience START as a Community of Inquiry (CoI)?
5) What were students' experiences like when they transferred to a four-year institution?

Mentor Experience and Perceived Effects: What was mentors' experience in START?

1) What were mentors' perceptions about their experiences?
2) To what extent did mentors feel prepared and supported?
3) What is the effect of participating in START on the skills and comfort of mentors in engaging in mentoring activities?

Data Sources and Analyses

The implementation study draws from several different sources to address the questions about how the program was implemented, student and mentor experiences in the program, and their perceptions of the effects of the experiences. Where relevant, data from these sources are presented alongside the results from the student-level impact study to provide more context and the institutional impact study to help address its research questions.

Student Implementation Survey. The Student Implementation Survey was administered online to current START students to learn about their experience participating in the program. The survey focused on the major components of START—the research internship, working with a mentor, the training modules (the PRT), community-building activities—as well their overall impression of their experience. The survey also included questions about their experience of START as a community. The START community questions were adapted from the validated Community of Inquiry Survey (Arbaugh et al., 2008).

The survey was administered once a year, at the end of the spring semester, of the first three study years (i.e., to the Spring 2022, Spring 2023, and Spring 2024 cohorts). In the first year, the survey was administered by the START leadership team; thereafter it was administered by the evaluation team. In Year 1, 29 of 55 students (53%) responded; [4] in Year 2, 18 of 55 students (33%) responded; and Year 3, 22 of 39 students (56%) responded. Summary results by year from key questions on the survey are included throughout the report.

Student Interviews/Focus Groups. The Student Interview protocol was developed to supplement the data from the Student Implementation Survey. Questions asked students to reflect on their research internship, working with their mentor, their sense of community within the program, their perceptions of the program's effects on them, and their recommendations for the program. Students were also asked how they found out about the program and why they applied. A copy of the interview questions can be found in Appendix C.

In Year 1, a member of the evaluation team conducted individual interviews virtually near end of the Spring semester (i.e., with students from the Spring 2022 cohort). In Year 2, the evaluation team switched to a focus group format. One or two members of the team met with a group of students in-person immediately following the fall START Intern Showcase (i.e., with students from the Fall 2022 and Fall 2023 cohorts). Each year, the sample of students was selected by the leadership team who were asked to choose a group representing experiences with START (e.g. new versus returning students, students with projects in different subject areas, students with different levels of engagement with the program). In Year 1, 13 students were invited by email to participate and five did interviews. In each of Years 2 and 3, five students participated in the focus group.[5] All interviews and focus groups were

[4] When the survey was administered in Year 1, two of the questions had errors in the provided response options. The evaluation team kept and recoded responses with the erroneous choices. For Question 7, the provided responses options were *1-Strongly Disagree, 2-Disagree, 3-Agree, 4-Strongly Agree,* and *Option 5; Option 5* was coded as *Strongly Agree.* For Question 9, the provided responses were *1-Strongly Disagree, 2-Disagree, 3-Agree, and 4-Strongly Disagree; 4-Strongly Disagree* was coded as *Strongly Agree.*

[5] In Year 3, one student left the focus group relatively early, so for most questions, up to four students responded.

recorded and transcribed and coded using codes aligned to the interview protocol and components of the program's implementation.

Mentor Survey. The Mentor Survey was administered online to START mentors to learn about their experience with the program. Topics included how they found out about the opportunity, their mode of interaction with mentees (online versus in-person), their level of comfort with the responsibilities of a mentor, potential topics for future mentor trainings, the benefits of mentoring, their perception of the impact of START on students, and their perception Wake Tech support for faculty mentoring student researchers.

The survey was administered once a year by the evaluation team, near the end of the spring semester, of the first three study years (i.e., to mentors and co-mentors for the Spring 2022, Spring 2023, and Spring 2024 cohorts). In Year 1, 14 of 20 mentors (70%) responded; in Year 2, 16 of 19 mentors (84%) responded; in Year 3, 11 of 16 mentors (69%) responded. In Year 2, mentors from partner institutions who played a significant role in working with students were included in the survey invitation. Summary results by year from key questions on the survey are included throughout the report.

Mentor Interviews. The Mentor Interview protocol was developed to supplement the data from the Mentor Survey. Questions asked mentors to reflect on the challenges and benefits of mentoring, the skills and experience required to be successful as a mentor, the training or resources that would support mentor success, their interest in the opportunity, the impact of participation in START on students and on themselves, their perception of Wake Tech's support for research mentors, and their recommendations for the program. A copy of the interview questions can be found in Appendix C.

A member of the evaluation team conducted individual[6] interviews virtually once in each project year, near the end of the semesters in Spring 2022 (Year 1), Fall 2022 (Year 2), and Fall 2023 (Year 3). In each of these semesters, the leadership team provided the evaluation team with a sample of mentors to invite to interviews; they were asked to select a group of mentors representing a variety of experiences with START (e.g., new versus returning mentors, mentors from different departments, few versus many reported challenges with projects or students). In Year 1, seven of 10 invited mentors did an interview; in Year 2, five of nine invited mentors participated; and in Year 3, six of 11 invited mentors, including mentors from partner organizations, did an interview. All interviews were recorded and transcribed and coded using codes aligned to the interview protocol and components of the program's implementation.

Leadership Team Focus Group. Members of the program's leadership team took part in an online focus group with the evaluation team at the end of each of the first three program years (i.e., after the conclusion of the Spring 2022, Spring 2023, and Spring 2024 semesters). The focus group was intended to give members of the leadership team an opportunity to reflect on the implementation of the program in that year and to discuss where or how to make improvements for the next year. The questions asked the team to share what went well and what challenges arose for each component of the program. They

[6] In one case, all of the members of a partner organization mentor team participated in an interview together.

also asked the team to describe the program's management structure, what they did with respect to institutionalization and dissemination in the past year, what they would change about the program in the future, their plans for developing the program, and their perception of the effect of the program on Wake Tech's culture. The focus group was recorded and transcribed, and the transcript was coded using codes aligned to the focus group protocol and components of the program's implementation. A copy of the focus group questions is available in Appendix C.

Alumni Interviews. The Alumni Interview protocol was developed to learn about how participating in START affected students' experiences with respect to transferring to a four-year institution. Questions covered how START influenced their decision to transfer, their transfer experience, how START prepared them for their new college, faculty and mentor relationships at their new college, and their involvement with STEM research at their new college. At the beginning of the Spring 2026 semester, the START leadership team contacted former START students who had transferred to a four-year institution and kept in touch with the program, providing them with an invitation to sign up for an interview with a member of the evaluation team. Six students participated in an interview, five of whom were students during the study cohort semesters. All interviews were conducted virtually and recorded and transcribed. Themes corresponding to the protocol were identified with assistance from Copilot and verified manually.[7] A copy of the focus group questions is available in Appendix C.

Institutional Impact Study

The institutional impact study takes a descriptive approach to understanding the extent to which implementing START for several years has the intended effects on Wake Tech's institutional culture. Indicators for perceptions of the culture come from data collected in Years 1–3; other indicators come from data covering the five years of the grant.

Research Questions

The research questions guiding the institutional impact study are:

1) What is the impact of implementing START on student participation in STEM fields targeted by START at Wake Tech?
2) What is the impact of START on Wake Tech's support for mentors and research?

Data Sources and Analyses

To address the first research question, Wake Tech provided student enrollment data for the college overall and for the academic divisions that house the departments for the STEM fields targeted by START: Advanced Manufacturing, Engineering, and Design; Biotechnologies; Health Sciences; Information Technology; and Mathematics and Sciences. The data covers Fall and Spring semester enrollments from Fall 2021 (the semester before the grant-funded version of START launched) through

[7] UNC Greensboro has an enterprise license for Copilot so no interview data were made available to the program's training corpus.

Fall 2025. We compiled the data to look descriptively at changes in enrollment over time for the divisions and the college overall.

Research question 2 is addressed primarily through data collected in the Mentor Survey and interviews with mentors (described in the previous section).

III. Program Activities

This section describes the various activities that the program leadership team undertook to implement the START program model: the programming for students and mentors and the efforts to institutionalize the program and disseminate information about the program model. It also includes information about the project management required to implement the activities. It covers Years 1–3 of the NSF grant, the period during which the five study cohorts participated.

During the first three years of the program, major program implementation developments included launching the START Ambassador program for student and mentor recruitment, streamlining the student hiring process to hire as many students as possible before the beginning of the semester, creating student and mentor handbooks, learning how to minimize the number of students who do not meet program expectations and processes for managing those who do struggle with them, developing trainings appropriate for returning students, developing a mentor training program, garnering the support of college leadership, and sharing information about the program model and impacts at conferences and with other North Carolina community colleges.

Student Recruitment

A key goal of the project was to increase the number of students who participate in the program; the grant funding allowed the program to increase the number of research projects available and to pay the student interns. The hope was that more students would be interested in, and able to commit to, the START internship if it was a paid opportunity. Additionally, each semester, the START leadership team needed to overrecruit for the program in order to support the randomized control trial; therefore, many more students needed to apply for START than there were internships available to allow for a sizable comparison group. Table 4 provides details about the number of available spots (internship spots not filled by returning START students) and the number of applicants for those spots each semester.

Table 4: Number of Applicants and Number of Internships Available Each Semester

	Year 1	Year 2		Year 3	
	Spring 2022	Fall 2022	Spring 2023	Fall 2023	Spring 2024
Applicants	144	124	135	125	138
Internships Available via Random Assignment	43	55	28	29	25

The leadership team used a multi-pronged approach to attract new applicants each semester. During the first three years of the project, recruitment strategies included broad outreach to the campus community, such as through posts on social media, promotional announcements on screens in campus buildings, and posters and flyers around campus, as well as more targeted outreach to students interested in STEM, such as posts in the Virtual STEM Center Teams channel and providing STEM faculty with a short text description of the program that they could share in course announcements. They also made sure student advisors and success coaches were aware of the program, so they could share information with their students. In the second year, the team began using the “I am a STEM Researcher” tagline, paired with a picture of and quote from a START student, in recruitment materials.

Also in the second year, the team launched the START Ambassador program, which became an important recruitment strategy for the program. START Ambassadors were former START students who received training on presentation skills and about the program. They helped disseminate information to the general public on the campus as well as to fellow students. They spoke about START in classes and at student club meetings and participated in various STEM events around campus. In an interview in Year 3, a member of the leadership team described the valuable role the START Ambassadors play in generating awareness of START at Wake Tech:

> It's been really great because these are all students who want to talk and are great communicators and really want to share their story. And so they're just excellent spokespeople for our program whether it's recruiting new students or just letting the broader community of Wake Tech know, “This is what we're doing, this is why it's important, this is how it's meaningful.”

Student Onboarding

Across Years 1–3, Student Onboarding consisted of two primary steps: matching selected students to research projects and hiring students as Wake Tech employees so they could get paid for their internship. These were both new activities for the program and the leadership team modified their processes each year in response to the challenges they encountered in the prior semester or year.

During the pilot semester (Year 1), the team encountered delays with both onboarding phases. The START application asked students to identify their top two projects and the team found that this was not enough options to accommodate every student’s preferences. The follow-up communication with students to get their third or fourth preference extended the time it took to match students. In addition, it took longer than anticipated for many students to complete the hiring paperwork and the college to process it, which meant that many students were unable to begin their internships until several weeks into the semester. This, in turn, reduced the time that they had to complete their projects.

In Year 2, the leadership team implemented several improvements to streamline onboarding and reduce delays. Changes included modifying the application to ask students to select four options for projects, asking students to fill out hiring paperwork prior to the semester’s start, processing the paperwork for returning students during the end of the prior semester, assigning returning students to projects first and removing their assigned projects from the website so that new applicants did not select them, and securing a dedicated contact in the college’s HR department for START hiring. These changes resulted in a quicker matching process and more students being ready to begin their internship at the beginning of the semester. However, in Year 2, the team noticed that the relatively few students who only completed onboarding requirements with significant help from the leadership team often exhibited lower engagement later in the program.

In Year 3, onboarding responsibilities were consolidated under a single leadership team member who was trained to process hiring paperwork internally, significantly reducing delays and improving communication with students. The team member explained the benefit of this arrangement:

> It took away the barrier of [students] not knowing who to ask because it was always just me. And so that way, if they were asking about the application or any part of HR, they could just send it to that one email rather than going, “Well, I didn't know who to ask.” Or it's sitting around in an inbox that didn't get checked or something. So that was nice, and that definitely helped get the students through faster so that they could start working. We'll keep doing that.

Nearly all students were hired before the semester began, and the team held firm to hiring deadlines, which helped with placing students in internships who were more likely to follow-through and complete their projects.

Research Internship

The research internship—the opportunity for students to do authentic original scientific research under the guidance of a mentor—is the core activity of the START program. Some of the research projects were led by Wake Tech faculty and some were led by researchers at partner institutions; in Years 1–3, partner organizations included Appalachian State University, Fayetteville State University, the North Carolina Department of Transportation, North Carolina State University, Piedmont Health, and University of North Carolina at Chapel Hill. The leadership team strove to offer projects in a wide variety of STEM disciplines: students had options in biology, chemistry, data analysis, geology, math, physics, science communication, science education, and technology. At the end of each semester, students in the program had the opportunity to “continue on” in START in the following semester without going through the random selection process; in Year 3, the leadership team set a limit of four semesters of continuous participation.

Students engaged in the research projects in a variety of ways. Some projects were virtual and could be done online while others required students to conduct research in the lab or out in the field. For their part, mentors took a variety of approaches to guiding students through the research process. For example, one mentor had all of their students begin with literature reviews and then choose a project based on their interests; this, in turn, informed the type of work students did. In a single semester, this mentor had one student doing lab work, another analyzing extant data, and a third creating a pamphlet on the project. Most mentors set up regular meetings with students, usually on a weekly basis, to guide them through the process of conducting research and developing their final project. Mentors with projects that required field work or lab work for data collection typically met in-person with students for those portions of the project. Those mentoring more than one student usually attempted to meet with their students in groups if students’ schedules allowed.

An important part of the research experience was the communications requirement, which asked students to summarize their research process and findings, either through a poster presentation or through a paper, at the end of the semester. Most students chose to present a poster at the START Intern Showcase held at the end of each semester. In Years 1–3, some students were also given the opportunity to present at other venues, such as the North Carolina Undergraduate Research and Creativity Symposium, the NC Space Symposium, and the International Forum on Research Excellence.

The Intern Showcase was considered a program highlight by START leadership and many students and mentors. In addition to giving students a concrete goal, with a defined final product, to conclude their semester-long internship, it was an opportunity to practice their communication skills and share their work publicly. Attendees often included high-level college administrators and funders—which increased the visibility of START and highlighted the importance of undergraduate research generally—as well as mentors and other Wake Tech students. Many students enjoyed the opportunity to share their work with others; one student said it made them "feel like an expert" and another said that it demystified the process of presenting research. On the Student Survey, almost all students (95% or more) consistently reported that it was valuable to share the results of their research (see Table 5). A mentor said that it was rewarding to see their mentees' pride in their work at the Showcase when "people looked at their work and admired it and saw value in it."

Table 5: Students' Perceptions of Their Research Internship

	Year 1 *N=28*	**Year 2** *N=18*	**Year 3** *N=22*
I found it easy to interact with my mentor(s) about my research.	100.0%	77.8%	90.9%
It was valuable to share the results of my research.	96.4%	94.4%	95.5%
It was easy for me to schedule time to do my research internship.	89.3%	94.4%	90.9%
I enjoyed my research internship.	96.4%	88.9%	95.5%
My research internship was a valuable part of my experience as a Wake Tech student.	96.4%	100.0%	95.5%

Note: Each item had 4 possible response options on a scale ranging from *Strongly Disagree* to *Strongly Agree*. The results here are the percentage that chose one of the top two options, *Agree* or *Strongly Agree.*

Students surveyed and interviewed during the first three years felt positively about their research internship overall (see Table 5). Students appreciated that they had more freedom to explore their interests and that the projects were hands-on and had real-world applications. Notably, some students who were disappointed when they did not get assigned to one of top choice projects reported being pleasantly surprised to find that they enjoyed their internship anyway. One of these students described this, saying,

> I got a project that I, no offense, just don't really care about. I got something in geology, and I do not care about trees or rocks or anything like that. So, at the beginning it was kind of hard to be interested in doing the research, but then as I learned more, … going out in the field and doing

> that made me kind of interested... I learned more than I could ever imagine. I did something with statistics, and I didn't know that was a thing in science.

An ongoing concern for the leadership team in the first three years of the program was how to handle students who did not fulfill their commitment to do a research project. While most students participated in the internship without problems, mentors raised concerns to the leadership team about a few students each semester related to things like missing meetings, failing to complete research tasks, and their communication (or lack thereof) with their mentor. After the first year, the leadership team added more information to the program orientation about the internship being a paid position with Wake Tech and the expectations that come with that. In subsequent years, the leadership team formally removed students from the program (and employment) for job abandonment when they stopped doing work and stopped responding to communication from the leadership team or their mentor. And they applied HR policy to any students who remained technically active but did not do sufficient work by putting them on performance improvement plans.

Mentoring

Central to the START model is providing students with a mentor who can help guide students through their research project but can also help students develop related skills. Each student had at least one Wake Tech mentor or co-mentor; students may also have had a mentor from a partner institution, in most cases, a four-year university but sometimes a governmental or private institution. Over the first three years of the project, external mentors came from North Carolina universities—Appalachian State University, Fayetteville State University, North Carolina State University, University of North Carolina at Chapel Hill—as well as public or non-profit organizations, including the North Carolina Department of Transportation and Piedmont Health. In some cases, Wake Tech instructors partnered with an instructor from another department on a project. This section describes how mentors were recruited, the skills that mentors needed to be successful, how they were supported in building or improving those skills, and key mentor activities.

Mentor Recruitment

Many of the faculty who served as mentors at the beginning of START had been with the project prior to the NSF grant. Over the course of the project, there was turnover among mentors. The leadership team recognized that mentors may not be able to serve each semester and that there might be some ebb and flow in a mentor’s commitment depending on other demands on their time. The staff recruited new mentors through a variety of ways, including through departmental email lists and a mentor information session; however, the majority were recruited personally and via word of mouth. In the later years of the program, the project team also started using the START Ambassadors for mentor recruitment. For example, two new math mentors joined the program because of a presentation by the Ambassadors at a virtual faculty meeting where they shared their STEM story and talked about their experiences. When asked on the mentor survey how they learned about being a mentor, the most common recruitment methods across the three years were 1) an email from their division (44%), 2) a personal request from a member of the START leadership team (34%), and 3) a colleague serving as a START mentor (22%).

When asked in interviews about why they became mentors, instructors mentioned both student-related and personal reasons. For the student-related reasons, mentors wanted to work with students and help them do research and build related skills as well as help them envision their future. For example, one mentor described wanting to help students explore the range of career opportunities available to them, explaining, “I wanted my students to have an opportunity to figure out [what they like], not just go through and take these classes that everyone else is taking, but just to take those little chances when it's low stakes to figure out who you are before you're stuck in a career for the rest of your life.” Another really valued the opportunity to help students from a range of backgrounds understand they could be researchers. They wanted “to get more people involved in STEM-related careers and help them to just believe that they can be researchers, they can do this.” One mentor said that one of her motivations was providing a positive research experience of the type that she had as a student:

> I really enjoy teaching, but I wanted to bring a little bit of research experience to my students. … I really just enjoyed teaching them how to go out in the field and doing research [with them]. And it just reminded me of me as an undergrad, because that's how I got my start and I wanted to give them that experience too. [I] felt like it helped me a lot [to] develop who I was scientifically and academically. And this program I think has that opportunity to do that [for students] too.

Mentors at the partner organizations generally saw the START mentoring as a very natural extension of the mentoring and teaching work that they did with their undergraduates. “I love teaching and mentoring students, that's my passion,” one partner mentor said.

In terms of personal reasons for becoming a mentor, interviewees commented on how being a START mentor helped them grow professionally. Some described that this allowed them to pursue an interest that they might otherwise not have a chance to spend time on at a teaching-focused institution. Two mentors shared that they chose to join START to help them make progress towards their own career goals related to undergraduate research: one had a project that they used in their classes that they wanted to develop for use in other instructors’ classes, the other wanted to apply the experience to leading their own undergraduate research grant in the future.

Mentor Skills

In the interviews conducted across the first three project years, mentors were asked to identify the types of skills that were needed to be an effective mentor. Mentors saw the need for subject matter and research expertise as well as other skills, such as effective communication and interpersonal skills, and organizational skills.

Several interviewees believed that prior experience with conducting research on their own and/or with the topic of the research was essential, and that prior experience leading students through the research process was very helpful. Some interviewees noted that the role required someone who was adept at teaching students about scientific writing and who could guide them through creating a poster and/or writing a paper.

Multiple mentors noted that the role required interpersonal skills that facilitated a good working relationship with their students. Specific skills mentioned included communication skills; patience; humility; listening skills, that is, "actually hearing what students are telling you rather than hearing what they want you to hear;" and the ability to consider "your students as whole human beings that you can learn from." Another frequently mentioned set of skills was flexibility and the ability to work with many different kinds of students and adapt to changing circumstances. A member of the project team explained that mentors had to be able to "meet each individual student where they are because they're all coming in with such a wide range of abilities."

Mentors also commented on the need for organizational skills—"being organized and staying on top of things," in the words of one. Related to this was the need to be able to help students become more organized and break down the tasks needed to complete their project and prepare a presentation. One mentor described their approach:

> If it seems like they're completely lost at the idea of, 'Where do I start making this poster?', [it is important to] be able to lay out the steps of, 'Do this thing and this thing and then this thing and bring it back to us next week,' and helping the student to understand how to take something very big and amorphous and break it down into discrete steps. Like, 'Yes, I can do this. Yes, I can do step two. Yes, I can do step three.'

In general, across the three years, mentors perceived themselves as comfortable overall with the responsibilities of a START mentor. Across all three administrations of the Mentor Survey, over 80% said that they were either comfortable or extremely comfortable providing mentorship to students about their research projects, transferring to a four-year university, and their future STEM education and career options (see Table 6).

Table 6: Mentors' Comfort With Mentoring

	Year 1 *N=14*	**Year 2** *N=16*	**Year 3** *N=11*
How comfortable are you providing mentorship to students on their START research project?	92.9%	93.8%	100.0%
How comfortable are you providing mentorship to students about transferring to a four-year college?	85.7%	81.3%	90.9%
How comfortable are you providing mentorship to students about their education and career options in STEM?	85.7%	100.0%	90.9%

Note: Each item had 4 possible response options on a scale ranging from *Uncomfortable* to *Extremely Comfortable*. The results here are the percentage that chose one of the top two options, *Comfortable* or *Extremely Comfortable*.

Mentor Training and Supports

One of the goals of the START project was to create a set of supports to help mentors become more effective and to help them gain or improve the necessary skills. During the pilot year, the project staff focused on building the student-facing activities; starting in the second year, they were able to also focus on supports for mentors.

After the first semester, the leadership team created a handbook for mentors that included detailed descriptions of project activities; a team member described it as containing “what they need to do and how they need to do it and when it is due by.” The team also created a Teams channel, where the project staff would post regular reminders, and a common calendar in Outlook that the mentors could access, which would provide more up-to-date information on dates and activities. At the beginning of each semester, the START team held a meeting for new and returning mentors to allow them to get together and get questions answered. One mentor noted that those meetings were run really well, providing key information efficiently and also giving the mentors time to connect with each other. Another noted that it allowed them to meet other mentors that they could reach out to.

During the Fall 2022 semester, the team developed a formal mentor training program, which was launched at the beginning of Spring 2023. The program included three online modules that focused on: 1) introduction to mentoring START students, 2) research ethics and research misconduct, and 3) ethical research practices and data management. All mentors were expected to participate, and they received three professional development credits from the college for their participation. In the spring of 2023, the team also began offering “coffee chats” for the mentors, in which leadership team members would rotate to be available in an open online session to answer questions. Mentors joined as needed to ask questions.

Additionally, in Year 3, to recognize the commitment that mentors made, the college began allowing mentorship to count as part of an instructors’ normal workload if they worked with five or more students in a semester. The leadership team also provided more logistical supports that were appreciated by the mentors. For example, the team noticed that ordering supplies was a challenge and developed a more streamlined and transparent process so that mentors knew the status of any supply orders.

Overall mentors agreed that START provided them with the resources to be a strong mentor. On the Mentor Survey, in a question asked only in Year 3, all or almost all of the responding mentors agreed (selected *Agree* or *Strongly Agree*) that START provided them with the help and resources to be successful. One mentor shared that, in particular, the leadership team was great with communication and responding quickly to their questions, saying that was “super helpful for me as a mentor.”

Mentor Activities
Mentors’ main role was to help students clarify the goals and questions of their project, to understand the content, and to identify steps to get to the end product of the poster or article. One mentor described the role as like a tour guide, saying, “We kind of walk next to the student through their semester-long project and have an end point in mind, but are also very keyed into what's happening this week. What are the things that you need to bring back next week so that you stay on track to help us have enough data for your poster at the end of the semester?” Many mentors also engaged students in conversations about future careers.

Mentors played different roles depending on whether they were primarily responsible for the research project or whether they were partnering with another mentor who was leading the research. One mentor, who preferred to partner with others to jointly mentor students, said that they and their collaborating mentor would each frame the project differently for students and review their posters for different criteria, complementing each other and giving students more perspectives on their work. In the cases where Wake Tech mentors worked with mentors at partner organizations, the Wake Tech co-mentors generally served as a "connector," handling logistics and coordination and communication with the START leadership team.

On the Implementation Survey, students were asked to provide feedback on the mentoring experience. Table 7 below summarizes their perceptions across the three years. As the table shows, students generally reported positive responses relative to interactions with their mentors.

Table 7: Students' Perceptions of Their Mentoring Experience

	Year 1 *N=29*	**Year 2** *N=18*	**Year 3** *N=22*
My mentor(s) provided guidance about the skills and knowledge needed for my research internship.	93.1%	83.3%	90.9%
My mentor(s) provided information or advice about my academic career (e.g., choosing classes, choosing a major, transferring to a four-year college).	69.0%	72.2%	72.7%
It was easy to schedule meetings with mentor(s).	93.1%	83.3%	90.9%
My meetings with my mentor(s) were a valuable part of my experience in START.	96.6%	88.9%	86.4%

Note: Each item had 4 possible response options on a scale ranging from *Strongly Disagree* to *Strongly Agree*. The results here are the percentage that chose one of the top two options, *Agree* or *Strongly Agree.* In Year 1, the survey asked students about their Wake Tech mentor. The Years 2 and 3 version, shown here, asked students about all of their mentors, if they had more than one.

Principles of Research Training (PRT)

The hands-on experience of the START research internship was supplemented by the program's requirement that students do Principles of Research Training (PRT) each semester. The original training (the 10 modules for first-semester students described below) was intended to ensure that all students got direct instruction on topics or in skills related to scholarship and careers in STEM that may arise through their internship. In Year 1, all students were required to do the same 10 online modules for their PRT; beginning in Year 2, the topics and format of the PRT a student was required to do was determined by how many semesters a student had participated in the program. First-semester students were required to do the 10 online modules, which covered topics related to STEM academic skills and knowledge, such as research ethics, scientific communication, data analysis, researcher confidence, as well as STEM careers and transferring to a four-year university. Three of the modules met the NSF training requirements for Responsible Conduct of Research. Throughout Years 1 through 3, students who took the Implementation Survey overwhelmingly found the information in the ten-module course to be useful and relevant (see Table 8). In the interviews, three students commented on the value of the

PRT. One Year 1 student said the modules opened their eyes to STEM careers: “It started with the training modules because that opened my eyes up more for what this START internship could offer me or help me pursue as towards skills. … It opened my eyes to STEM careers.”

Table 8: Students’ Perceptions of the PRT

	Year 1 *N=27*	**Year 2** *N=10*	**Year 3** *N=12*
The information about communicating research covered in the PRT was applicable to my research internship.	96.3%	100.0%	100.0%
The information about data collection and data analysis covered in the PRT will be applicable to my future STEM classes or future STEM jobs.	96.3%	100.0%	100.0%
The information about research ethics covered in the PRT will be applicable to my future STEM classes or future STEM jobs.	100.0%	100.0%	100.0%
The PRT provided useful guidance about transferring to a four-year college.	92.6%	80.0%	75.0%
The PRT provided useful guidance about how to explore and pursue a career in STEM.	92.6%	100.0%	100.0%
The PRT modules were a valuable part of my experience in START.	81.5%	90.0%	91.7%

Note: Each item had 4 possible response options on a scale ranging from *Strongly Disagree* to *Strongly Agree*. The results here are the percentage that chose one of the top two options, *Agree* or *Strongly Agree*. In Years 2 and 3, these items were only shown to respondents who were participating in START for the first time.

Because students could participate in START for multiple semesters, the program staff developed PRT modules that were appropriate for returning students. Beginning in Year 2, students in their second semester of the program were required to do three online modules devoted to career development and scientific misrepresentation and ethics. For students who had already completed two semesters of START (and the two sets of online PRTs), the leadership team brought students together for a series of meetings. In each session, students gave short updates on their projects and discussed assigned STEM journal articles and how to read scientific literature. Students were also able to ask questions, so they ended up also discussing topics such as graduate school and the peer review process. The team scheduled eight sessions and students were required to attend four of them. In Year 3, the program director invited speakers to some of the sessions—a START mentor from Appalachian State who is also a Wake Tech graduate, a transfer advisor for an NC State STEM program, and a representative from the nearby National Institute of Environmental Health Sciences Scholars Connect program—to share information about education and career opportunities in STEM. The director also began using the career-readiness competencies framework from the National Association of College and Employers in Year 3 as a way to guide reflection discussions about students’ experiences with START.

In Year 1, most students (more than 75%) did not complete all 10 modules, which program leadership attributed to the late start many students had in the program. In Year 2, the team made two adjustments to help students complete more of the modules: they gave students access to the online platform as soon as their hiring paperwork was processed, meaning many had access before the semester began, and along with this, encouraged them to begin working on the modules before they started their internship; they also added an interim due date to keep students from waiting until the end of the semester to complete all of them. PRT completion rates jumped up in Years 2 and 3, with 85% or more of first-semester students completing all of the required modules every semester. Completion of the second semester 3-module sequence was also greater than 85% most semesters. Attendance rates for the four sessions for long-time students was more variable, but fewer students had this requirement most semesters. Across all students each semester, more than 85% met 100% of their PRT requirements in Years 2 and 3. See Table 9 for more details.

Table 9: Percent and Number of Student Completing 100% of Their PRT Requirements

# of Required Modules/Sessions	Year 1	Year 2		Year 3	
	Spring 2022	Fall 2022	Spring 2023	Fall 2023	Spring 2024
10 modules	23.6%	97.5%	92.3%	84.6%	90.5%
	13	39	24	22	21
3 modules	-	100.0%	86.4%	85.7%	69.2%
	-	6	19	12	9
4 sessions	-	-	50.0%	91.7%	80.0%
	-	-	2	11	4
All Students	23.6%	97.8%	86.5%	86.5%	87.2%
	13	45	45	45	34

Community-Building and Other Student Activities

The START program model includes optional activities designed to build community among participants and to build their familiarity with local four-year higher education institutions. The extent to which the activities were offered and the leadership team's approach to offering them evolved over Years 1–3 of the project. In Year 1, student activities were largely limited to those directly related to students' research internship: the orientation at the beginning of the semester and the Intern Showcase at the end of the semester. Due to the demands of launching the scaled-up program plus the complications of the COVID protocols and restrictions that were still in place in 2022, the leadership team did not arrange visits to four-year universities. To attempt to build community, the team did host ice cream socials on the Wake Tech Southern and Northern campuses during the final week of the semester, but students were given little notice and the events were sparsely attended.

The leadership team went into Year 2 with the goal of creating a sense of community among students. At the orientations at the beginning of each semester, they included opportunities for students to get to know each other, familiarize themselves with Wake Tech's STEM Lab, and see the new "I am a STEM Researcher" posters. In the spring semester, they piloted a "coffee chat" activity for students, a drop-in online session open to all START students in which a START team member was available to answer any questions. Approximately 10 students attended. The team also led trips to three universities—NC A&T, NC State, and UNC-Chapel Hill—that served dual purposes of building student community as well as providing students information about transferring to a four-year university.

In Year 3, the leadership team aimed to have a handful of opportunities for students to meet each other and socialize outside of their research groups and the main START events (i.e., the orientation and the Intern Showcase). In the fall semester, they held a mini pumpkin decorating activity. They planned a coffee-and-donuts social for the spring semester, but very few students RSVP'd so they cancelled the event. However, a spring semester visit to NC State was attended by eight students who got to tour a biological sciences lab and speak with students who transferred from community colleges. The leadership team also continued the coffee chat events, with one each semester. And at the end of each semester, they hosted pizza parties, one on the Northern campus and one on the Southern campus, a week after the Showcase, to celebrate students' completion of their projects. For the in-person on-campus events, generally 10 or fewer students attended each one.

At the end of Year 3, the leadership team came to the conclusion that many students were interested in activities with other students, but that more exploration was needed to figure out what students were interested in attending and when to schedule events to maximize attendance from those interested. Indeed, one student in Year 1 said they were interested in meeting other START students, saying, "I was actually looking forward to being able to meet other people in the program and learning about what they did. So if they had planned more events or even some regular thing where we could just share what we've learned or something, I definitely would've gone to all of those, if I could." And while the attendance at in-person events was small, the members of the leadership team were pleasantly surprised to realize that START Ambassadors could be a valuable asset for developing community among students. Although the Ambassador program was created to help with recruitment, the leadership team found that when Ambassadors attended community building events they were also effective at facilitating connections between current students.

In addition to scheduling "live" in-person or online events, from the beginning, the leadership team made use of a START Teams site as a forum for asynchronous connections. They set up a channel for interactions between students and touch-points with the leadership team. Throughout each semester, they seeded the chat with conversation starters and requests for students to provide a brief update to check in on their project.

On the Implementation Survey, most of the students (85% or more) who attended a community building activity (which, on the survey, was defined as the orientation, discussions on the START Teams site, social activities, and office hours with the leadership team) or a campus visit in Years 2 and 3 reported that they found the activities valuable. (See Table 10).

Table 10: Students' Perceptions of Community-Building Activities and Campus Visits

	Year 2	Year 3
Community Building Activities	*N=15*	*N=13*
The community building activities helped me get to know other START students better.	80.0%	100.0%
The community building activities helped me feel like I was part of a community.	93.3%	100.0%
I enjoyed the community building activities.	93.3%	100.0%
It was easy and convenient to participate in community building activities.	100.0%	100.0%
The community building activities were a valuable part of my experience in START.	93.3%	100.0%
Campus Visits to Four-Year Universities	*N=4*	*N=8*
Because of the campus visit(s) I attended, I know more about what it's like to be a student at a four-year university.	100.0%	100.0%
Because of the campus visit(s) I attended, I feel more confident about applying to transfer to a four-year university.	75.0%	87.5%
Because of the campus visit(s) I attended, I am more likely to apply to a four-year university.	100.0%	87.5%
I enjoyed the campus visit(s) I attended.	100.0%	100.0%
It was easy and convenient to participate in the campus visit(s).	100.0%	100.0%
The campus visit(s) were a valuable part of my experience in START.	100.0%	87.5%

Note: These questions were only on the survey in Years 2 and 3. Each item had 4 possible response options on a scale ranging from *Strongly Disagree* to *Strongly Agree*. The results here are the percentage that chose one of the top two options, *Agree* or *Strongly Agree*.

Dissemination and Institutionalization

The long-term goal of the grant, creating a scalable model for community college undergraduate research in North Carolina, depended upon institutionalizing the program at Wake Tech while also disseminating the model to other colleges in the North Carolina Community College System (NCCCS). The program began to gain the attention of the college administration early on, and in Year 2, the administration showed its support of the program by highlighting it as a success story in college-wide meetings and by asking program leadership to speak with important campus visitors. By Year 3, the program had achieved some degree of informal institutionalization due to its increased visibility among staff, faculty, and students. It also had made strides towards formal institutionalization by securing the support of college leadership: the college provided a multi-course release for one member of the leadership team to serve as an associate director for START, and in response to a proposal submitted by the leadership team, provided assurances that START would become a permanent program at Wake Tech after the NSF grant ended, as long as they could find a sponsor.

Also in Year 3, the START program director joined a college-wide high impact practices group where START was held up as an exemplar for other programs at the college. Elements of the program's implementation practices that have been cited as noteworthy or a model for other programs include: 1) collecting student outcome data, 2) not requiring a minimum GPA for participation (and thus being accessible to students who have not had academic success in the past), 3) developing a students' sense of belonging by building community and a connection to the program, 4) requiring training on research practices and differentiating that training by level of experience in the program, 5) following grant requirements, and 6) engaging in formative evaluation for program improvement. In addition, as the program became more well-known at Wake Tech, members of the leadership team became a resource for other programs and departments around the college. Other Wake Tech staff and faculty sought out their advice to get help on their own problems, to learn from their expertise in undergraduate research programming generally, or to hear about successful aspects of their program implementation and operations, such as building a relationship with HR in order to hire a large group of students at once and creating an Ambassador program.

As with their institutionalization goal, START began to make progress towards their dissemination goals in Year 2 of the project and made considerable gains in Year 3. In Year 2, the leadership team did a presentation about the program model at the 2022 NCCCS Conference. In Year 3, the team presented about the model and/or preliminary outcome results at several statewide and nationwide conferences, including the 2023 SPARC Conference at Gaston College, the 2024 Achieving the Dream Conference, and the 2024 Council on Undergraduate Research Conference. They also published a peer-reviewed article with preliminary outcome results in the Winter 2023 issue of *Scholarship and Practice of Undergraduate Research.*[8]

In addition to the conference presentations and publications, the team began sharing information about START directly with other community colleges in North Carolina in Year 3. In the spring semester, they hosted a free day-long workshop about START and how to develop similar programs; 20 people from other colleges attended. They also built a relationship with someone at the NCCCS office who had taken up the cause of undergraduate research. Members of the START leadership joined a working group investigating how to develop and support undergraduate research at community colleges of all sizes in North Carolina and were invited to share their PRT modules for first-semester students on the NCCCS Virtual Learning Community website so that the modules will be available to all colleges statewide.

Project Management

Over the first three years of the START project, the program leadership team developed and improved their management strategies such that, at the end of Year 3, one of the mentors remarked, unprompted, that START had been running “like a well-oiled machine.”

The project management responsibilities were divided by interest and skills, which allowed team members to do tasks they were most comfortable with. The team reported that while each led an area of work, they also communicated regularly to coordinate their efforts, collaborate, and, when needed, cover responsibilities for teammates. In the summer before each program year, the team held a retreat,

[8] Swanik, J., Rollins, S., Horstman, S., Hoffman, C., & Fishback, K. (2023). Mentored undergraduate research at community colleges. *Scholarship and Practice of Undergraduate Research, 7*(2), 25-29. https://doi.org/10.18833/spur/7/2/7

which allowed them to clarify roles and do program planning. During the first two project years, team communication was largely facilitated by weekly team meetings. They were able to hold fewer meetings in the third year as the team members had developed the expertise to manage the project.

The leadership team addressed a series of management challenges over the course of the grant, including refining the student hiring process (see the Student Onboarding section for more details), communicating with mentors and students, and specific logistical challenges such as tracking student and mentor hours, purchasing materials, and reimbursing students.

To address communication with mentors and students, after the pilot semester, the leadership team developed a calendar of important dates that they shared at the beginning of the semester. They also developed handbooks for both the students and the mentors that clearly laid out the timeline and the expectations for the year.

Mentors were responsible for tracking students' hours to pay the students for their work, which posed significant challenges in the first year at least partly because mentors were not aware that this would be one of their responsibilities. In the following year, the leadership team provided more explicit guidance about the time tracking process in mentor orientation materials and a project team member followed up with students throughout the year to make sure they were on track in completing their hours and other required program components.

Finally, the team addressed some challenges related to reimbursement and supply ordering. For example, students needed to travel for conferences and for their research projects. The team worked with the college to get gift cards to cover the cost of the travel. They also developed a system to clearly track supplies that the mentors were ordering to help make it more transparent where their requests were in the process.

Implementation Lessons Learned

The NSF grant for START provided for scaling up the program both in terms of the number of internships and by offering a fuller program experience for students (i.e., paying students for their internship, requiring supplemental training every semester a student participated, and offering optional activities) as well as by providing more support for mentors. This expansion of the program—which required more mentors and partnerships—plus the addition of using randomization to assign students to internships, meant that the START leadership team's operations had to evolve to accommodate the more complex implementation. Over the first three years of the grant, the team made several changes to program implementation to set students and mentors up for success and to amplify their recruitment and community-building efforts. These changes provided lessons related to *making onboarding more efficient*, *improving communication through documentation*, and *using former interns to represent the program*.

Making onboarding more efficient: Perhaps the biggest lesson learned was related to onboarding—specifically, how to do it efficiently. The team made a number of changes so that as many students as possible were approved to begin their internship as soon as the semester began and did not lose valuable time to work on their project. These changes included beginning the hiring process before the start of the semester, expediting the matching process by asking students to provide their top four project choices on their application, assigning students who were continuing on to their projects first and removing options from the website that were no longer available to new students, and working with the college's HR department—first securing a dedicated HR contact and ultimately getting approval for a member of the leadership team to process paperwork. They also learned that holding firm to paperwork deadlines and dropping students who did not meet them made room for students who were more likely to follow through on the internship experience. Getting students hired prior to beginning of the semester also allowed the leadership team to give students access to the online PRT modules earlier, which gave students a better chance of completing them by the end of the semester.

Improving communication through documentation: Another lesson learned about implementation was the importance of early and regular communication. At the beginning of the grant, both mentors and students reported not being completely clear about program expectations or deadlines. The team responded to this by creating student and mentor handbooks that laid out program expectations, processes, and also included a calendar for program activities and deadlines.

Using interns to represent the program: The development of the "I am a STEM Researcher" recruitment materials and the START Ambassadors program quickly demonstrated that interns were a powerful way to attract new applicants. Students' personal stories about their experiences in the program, told in their authentic voice, made the program seem like an accessible opportunity. In addition, START Ambassadors could represent START at campus events, such as the college's STEM Day Open House, or present to student groups or in classes, in lieu of a member of the leadership team, thus extending the reach of team's in-person recruiting efforts. In addition, the team found that Ambassadors could also be useful for recruiting mentors and building community within current START cohorts.

IV. Program Impacts and Perceived Program Effects and Experiences

This section presents analyses of short-term and long-term outcomes for students in the study cohorts. These analyses make use of the RCT study design to provide estimates of the program's impact on treatment students. The section also provides descriptive results from the first three years of the grant about the perceived effects of program participation on students and mentors as well as the perceived effects on program alumni. Finally, it descriptively considers the broader effects of having the START program at Wake Tech on elements of the institution's culture. Key findings include:

- Compared to the control students, START students reported statistically significant higher self-assessments on measures on the Student Survey of STEM self-efficacy, STEM career awareness, comfort with STEM research, scientific literacy, and transfer confidence.
- Each year, on the Implementation Survey, the vast majority of students consistently reported that their START internship gave them skills and/or knowledge that they will use in future STEM classes and that it increased their interest in majoring in STEM. In interviews, students said that their START experience gave them valuable STEM skills and knowledge, made them more confident, and reinforced their interest in pursuing a STEM degree and career. Mentors responding to the Mentor Survey and reflecting in interviews also noticed the same growth and development in students' skills and attitudes.
- Impacts on academic and enrollment outcomes observed one year after a student's first semester in START were not statistically significant. Two years after START, there was a modest significant positive impact on the cumulative curriculum credits for treatment students; all other outcomes were not significant. There is suggestive evidence that treatment students were delaying their transfer from Wake Tech to a four-year institution in order to take more classes at Wake Tech and to complete additional degree programs.
- Two years after START, treated students who entered with more than 30 credits were statistically significantly more likely to be a STEM concentrator and earned more credits at Wake Tech than their similar control group counterparts. Treatment students who entered the program with a high-achievement background earned more credits at Wake Tech. And treatment students who were Pell-eligible before START were more likely to still be enrolled in higher education, be a STEM concentrator, and earn more credits at Wake Tech.
- Program alumni who transferred to a four-year institution after Wake Tech reported several interrelated ways that START positively influenced their experience at their new school. Alumni said that their experience in START bolstered their confidence, focused their academic interests, gave them practical STEM and career skills they relied on, inspired them to pursue research, and opened doors to new opportunities.
- In interviews and on the Mentor Survey, mentors consistently reported a variety of benefits from participating in the program, including the satisfaction of seeing students grow and succeed, improved mentoring and project management skills, and recognition of their service, which can help with promotions.

- Enrollment data does not indicate that START had an effect on student enrollment in the academic divisions that house the departments aligned to the fields targeted by START during the five years of the grant.
- While mentors' assessment of college's support of mentorship and mentored research during the first three years of the grant remained lukewarm, the administrative burden for faculty involvement in mentorship and research appears to have been reduced.

Impacts and Perceived Effects on Students' Attitudes and Skills

The START logic model posits that a positive change in students' STEM attitudes and skills will lead to improved academic and enrollment outcomes. Data from the Student Survey, combined across all five study semesters, indicates that participation in START had positive effects on students' self-reported assessments of their STEM research, education, and career skills and attitudes (see Table 11). The program had positive and statistically significant impacts (p-values less than 0.05) on all but two of the survey scales. Of the remaining two scales, the impact on scientific literacy was positive and statistically significant at the 10 percent level but the impact on grit and perseverance was also positive but not statistically significant.

Table 11: Impact on Students' Attitudes and Skills (Student Survey)

Scale	Treatment *(N=124)*		Control *(N=160)*		Impact Estimate	Effect Size	P-Value
	Adjusted Mean	Standard Deviation	Mean	Standard Deviation			
STEM Self-Efficacy	4.44	0.62	4.28	0.77	0.15	0.21	0.045**
STEM Career Awareness	4.43	0.63	4.22	0.81	0.21	0.29	0.012**
Comfort with STEM Research	4.20	0.58	3.95	0.81	0.25	0.34	0.002**
Scientific Literacy	4.25	0.76	4.08	0.87	0.16	0.20	0.074*
Grit & Perseverance	4.35	0.73	4.23	0.85	0.12	0.14	0.180
Transfer Confidence	4.44	0.60	4.24	0.83	0.20	0.26	0.026**

*p<0.1; **p<0.05; ***p<0.01

Evidence from students and mentors about the impact of START on students, recorded in the Implementation Survey and Mentor Survey results and captured in the student interviews/focus groups and mentor interviews, descriptively confirm that students' STEM skills and attitudes did change as a result of participating in the program. On the Implementation Survey, year-over-year, the vast majority of respondents (over 90%) reported that their START internship gave them skills and/or knowledge that they will use in future STEM classes and that it increased their interest in majoring in STEM. In addition, almost all respondents in Years 2 and 3, when this item was included on the survey, said that START gave them a better understanding of professionalism. See Table 12.

Table 12: Students' Perceptions of the START's Effects

	Year 1 *N=29*	Year 2 *N=18*	Year 3 *N=22*
Participating in START gave me an idea of what it is like to have a job in a STEM field.	89.7%	94.4%	95.5%
Participating in START provided me with skills and/or knowledge that I will use in future STEM classes.	93.1%	100.0%	95.5%
Participating in START increased my interest in majoring in a STEM field at Wake Tech.	93.1%	100.0%	95.5%
I enjoyed participating in START.	82.8%	100.0%	95.5%
I would recommend START to other students majoring in, or considering majoring in, a STEM field.	96.6%	100.0%	100.0%
The opportunity to get paid made START an attractive opportunity.	93.1%	100.0%	100.0%
I feel better prepared for applying to another job after participating in START.	82.8%	100.0%	100.0%
Being paid for my participation in START meant that I didn't have work as many hours at another job or I didn't have to work at all at another job this semester.	-	72.2%	72.7%
Participating in START gave me a better understanding of professionalism (for example, timeliness, completing paperwork, responding to emails in a timely manner, dressing appropriately for the situation).	-	100.0%	95.5%

Note: Each item had 4 possible response options on a scale ranging from *Strongly Disagree* to *Strongly Agree*. The results here are the percentage that chose one of the top two options, *Agree* or *Strongly Agree*. Two items were added to the survey for the Years 2 and 3 administrations.

In the annual interviews and focus groups, several themes about the impact of the program on students aligned with the survey results came up each year. Most students said that they learned or practiced skills that they considered valuable for conducting and communicating about STEM research, such as coding and developing presentations. They also spoke about the scientific knowledge and reasoning skills they acquired through their internship. A student in Year 1 working on an entomology project described learning how to identify and classify insects, saying, "I learned how to identify different insects and bugs with dichotomous keys, so now I feel really comfortable just going to the lab and just saying, 'Oh, well this falls in this category because of blank, blank, and blank. Oh, it must be this.' It feels much more natural to look at a flying or crawling creature and then say, 'Oh, it must be this because of these traits.'" And in Year 2, a student said that the internship gave them the opportunity to apply and synthesize knowledge from their classes. They explained,

> I just feel like this internship kind of gave us the opportunity to put everything together, everything that we know from different aspects that we know of and put it together. It's not just a regular class where you are focusing on that one class and doing it. In this research, you're able to put many things together. You put statistics on it...I also learned how to use a 3D printer, something that I didn't know before, and of course do extra research about filaments, different types of filaments, and doing research of measurements and other softwares that I never heard of. So, it is definitely putting everything that you know and adding new ones along the way that

> you go to your goal, which is [to] finalize or at least get to the point that you get a result. You just grab from a little bit from everywhere.

A mentor in Year 2, noting that students entering the program had never read a scientific article or encountered scientific research before, described their students' acquisition and application of scientific skills as going "from zero to 60" over the course of the internship semester and went on to say that they "made a lot of progress in a pretty short amount of time."

Participating in START also made students feel more confident. Some students connected this to the skills they learned or improved through START or meeting the challenge of designing, conducting, and presenting research. One Year 1 student said, "I feel a lot better about my capabilities. ... I have proven to myself now that I can do a bunch of different things at once and still learn what I need to learn." Mentors also consistently shared how they saw the confidence of their students increase as they became more comfortable with the research process generally and felt like they were successfully mastering specific research skills. A mentor in Year 1 said,

> I see students grow more confident just in research in general and speaking skills. Having presented twice, I think by the end of it, my students were much more confident talking to peers and to other mentors about their research. They grow with their research skills. They learn new skills and get more confident in working with those skills, everything from pinning insects to collecting them and learning how to talk about that in a written fashion as well.

And a partner mentor in Year 3 described students' development over the course of the internship, saying,

> There's some amount of intimidation at the start. Here I am a community college student and I'm going to be working on a project at [university]. So, there's some amount of intimidation at the start, but slowly and methodically you can…see the student blossoming, becoming very confident, becoming comfortable in asking questions they don't know. Because we make sure to create that safe space context. So, it's okay to ask if you don't know. We probably don't have all the answers either, but we'll find out and tell you or we'll tell you where to look. And that creates some amount of comfort. So, it takes that stress and anxiety out of it. And so over time you can see the student becoming very confident and starting to share their opinion, how they see things. … And you just see them come full circle and take ownership of that project.

For some students, the experience of building skills through START confirmed their interest in pursuing a STEM degree and helped them envision themselves in a science career. Many of them attributed this to the hands-on, real-world nature of the internships. One Year 2 student explained, "I feel like this is the first time ever where I actually felt like I could actually be a scientist and do research, because doing it in class is not anywhere close to what we did for this internship. Without this, I don't think I would ever truly believe that I could do it until I was physically doing it at a company." For another student, in Year 3, START opened them up to the idea that STEM research was a path they wanted to pursue. "It's made me use that exposure that I got and really think of how, is this something that I could actually make into a career? So just, in general, this program has not only exposed me but has made me even more interested in finding a way to make research a real career for me," the student explained.

Responses on the Mentor Survey confirmed that most mentors noticed the same changes in students' skills and attitudes after participating in START. In all three administrations, the vast majority of respondents (greater than 90%) agreed that students improved their research skills and are more confident about their STEM research skills. And in Years 2 and 3, the vast majority said that their START students had a better understanding of STEM career options, were more interested in continuing to study STEM subjects, and had improved their presentation skills. In addition, the vast majority of responding mentors in Years 2 and 3 said that START students displayed increased persistence and a greater capacity to learn from errors and failure. See Table 13.

Table 13: Mentors' Perceptions of the Impact of START on Students

Since I began working with them this semester, my START students…	**Year 1** *N=12–13*	**Year 2** *N=16*	**Year 3** *N=11*
Have improved their research skills.	92.3%	100.0%	100.0%
Have a better understanding of STEM career options.	69.2%	93.8%	90.9%
Have a better understanding of STEM education options (e.g., classes to take at Wake Tech, four-year colleges to transfer to, majors to pursue).	53.8%	62.5%	90.9%
Have an increased interest in continuing to study STEM subjects.	61.5%	93.8%	100.0%
Are more comfortable interacting with college faculty.	84.6%	93.8%	81.8%
Have improved their presentation skills.	84.6%	100.0%	100.0%
Know more about financial aid and other funding options for their education.	0.0%	18.8%	27.3%
Are more confident about their STEM research skills.	91.7%	100.0%	90.9%
Display increased persistence and a greater capacity to learn from errors and failure.	61.5%	100.0%	90.9%
Demonstrate increased professionalism (e.g., showing up on time, appropriate communication).	46.2%	87.5%	81.8%

Note: Each item had 5 possible response options on a scale ranging from *Strongly Disagree* to *Strongly Agree*. The results here are the percentage that chose one of the top two options, *Agree* or *Strongly Agree.*

Impacts on Student Academic and Enrollment Outcomes

All Students

Table 14 provides the impact estimates one year (two semesters) following the treatment semester for all five study cohorts. We do not see statistically significant impacts for any of the outcomes, and effect sizes for each outcome are modest. There is suggestive evidence that at one year after START, treatment students were slightly more likely to remain enrolled at Wake Tech and to pursue multiple credentials there and less likely to transfer to a four-year institution in their first year after the initial semester of START participation. It is possible that treatment students were more likely to remain enrolled at Wake Tech in order to continue participating in START.

Table 14: Post-Intervention Outcomes and Estimated Impacts: 2 Semesters After Treatment Semester (All Cohorts)

	Treatment *(N=239)*		Control *(N=425)*		Impact Estimate	Effect Size	P-Value
	Adjusted Mean	Standard Deviation	Mean	Standard Deviation			
Enrolled at WTCC	48.8%	0.50	46.8%	0.50	0.02	0.04	0.62
Associate degree earned from WTCC	34.7%	0.48	37.9%	0.49	-0.03	-0.07	0.37
Any credential earned from WTCC	40.2%	0.49	42.1%	0.49	-0.02	-0.04	0.60
Earned multiple credentials from WTCC	11.7%	0.29	8.9%	0.29	0.03	0.10	0.26
Enrolled OR degree earned anywhere	86.0%	0.36	86.4%	0.34	0.00	-0.01	0.89
Enrolled OR degree earned at 4-year	35.1%	0.48	39.1%	0.49	-0.04	-0.08	0.30
STEM concentrator	73.9%	0.45	75.5%	0.43	-0.02	-0.04	0.60
Earned credits at WTCC	4.3	5.24	4.0	5.47	0.29	0.05	0.51
Cumulative curriculum credits at WTCC	62.8	29.75	62.4	28.26	0.47	0.02	0.63

*p<0.1; **p<0.05; ***p<0.01

Impacts two years (four semesters) after START are shown in Table 15. These results are based on a smaller sample consisting of the first four study cohorts (the Spring 2022, Fall 2022, Spring 2023, and Fall 2023 semester cohorts). We see a modest positive impact, statistically significant at the 5 percent level, of participation in START on cumulative curriculum credits, with treatment students earning on average 2.8 more credits than control students. None of the other impact estimates are statistically significant. The impact on cumulative credits provides some suggestive evidence of small positive impacts of START on remaining enrolled at Wake Tech and earning multiple credentials there and corresponding negative but not statistically significant impacts on transfers to four-year institutions. We observe essentially identical rates of overall postsecondary persistence, four-year degree attainment, and STEM concentrator status for the treatment and control groups.

Combined, these results may indicate that treatment students are delaying their transfer from Wake Tech to a four-year institution in order to take more classes at Wake Tech and to complete additional degree programs.

Table 15: Post-Intervention Outcomes and Estimated Impacts: 4 Semesters After Treatment Semester (Spring 2022, Fall 2022, Spring 2023, Fall 2023 Cohorts)

	Treatment *(N=195)*		Control *(N=331)*		Impact Estimate	Effect Size	P-Value
	Adjusted Mean	Standard Deviation	Mean	Standard Deviation			
Enrolled at WTCC	22.3%	0.41	19.6%	0.40	0.03	0.07	0.49
Associate degree earned from WTCC	51.0%	0.50	52.6%	0.50	-0.02	-0.03	0.70
Any credential earned from WTCC	57.7%	0.50	58.3%	0.49	-0.01	-0.01	0.88
Earned multiple credentials from WTCC	20.5%	0.40	15.4%	0.36	0.05	0.13	0.17
Enrolled OR degree earned anywhere	82.5%	0.39	82.8%	0.38	0.00	-0.01	0.92
Enrolled OR degree earned at 4-year	51.2%	0.50	56.8%	0.50	-0.06	-0.11	0.20
4-year degree earned	4.7%	0.19	5.4%	0.23	-0.01	-0.04	0.68
STEM concentrator	77.9%	0.43	77.9%	0.42	0.00	0.00	1.00
Earned credits at WTCC	1.4	3.28	1.0	2.90	0.36	0.12	0.22
Cumulative curriculum credits at WTCC	71.6	30.82	68.8	29.13	2.81	0.09	0.04**

*p<0.1; **p<0.05; ***p<0.01

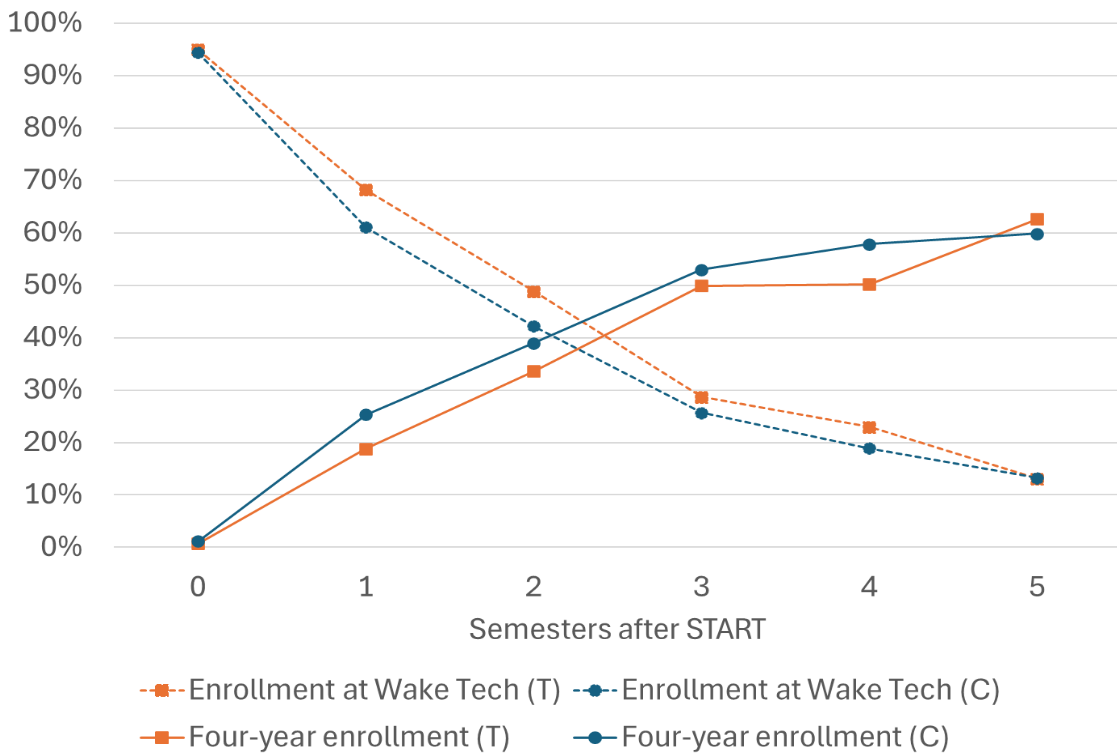
To examine this potential trend further, we looked at the first three cohorts (Spring 2022, Fall 2022, and Spring 2023), for five semesters after START participation. Figure 2 compares the Wake Tech enrollment and four-year enrollment rates of these three cohorts for each of the five semesters after a student's first semester in START. The graph shows covariate-adjusted shares of treatment students (in orange) and shares of control students (in blue) enrolled at Wake Tech (dashed lines) or in any four-year institution (solid lines). The semester labeled as 0 corresponds to the START treatment semester or the one control students would have participated in if they had been assigned to the treatment group. For example, in the first semester after START (1 on the x-axis), 61 percent of control students were enrolled at Wake Tech and 25 percent were enrolled in a four-year institution. The corresponding shares for treatment students were 68 percent and 13 percent.

In the graph, the Wake Tech and four-year enrollment rates started off equal for the treatment and control groups.[9] Right after the treatment semester, the Wake Tech enrollment rate for the treatment group surpassed the Wake Tech enrollment rate for the control group. While the Wake Tech enrollment rates for both groups decline over time (as expected, as students graduate from or otherwise leave the institution), the treatment group Wake Tech enrollment rate remained higher than the control group rate through the fourth semester after START. During the same period, there was a corresponding

[9] Students apply for START in the semester prior to the one labeled as 0 on the graph. Since not all students who applied remained enrolled at Wake Tech in what would have been their treatment semester, the enrollment rate starts off slightly below 100%.

difference of a similar magnitude in four-year enrollment for the treatment group relative to the control group (with the treatment group enrolling in a four-year institution at a lower rate). This suggests that of the treatment students who remained enrolled in any postsecondary institution during this time, more of them chose to stay enrolled at Wake Tech instead of a four-year institution, as compared to the control students. However, in the fifth semester after participating in START, the Wake Tech enrollment rate was equal again for both groups (13 percent), and four-year enrollment was slightly higher for the treatment group (63 versus 60 percent). This indicates that eventually, the treatment students "catch up" to control students in enrolling in a four-year institution, suggesting that their preference for remaining at Wake Tech after START was temporary and dissipated over time. However, none of the differences in enrollment rates are statistically significant, possibly because the sample size for these analyses is considerably smaller than that for the full analytic sample, so the findings are only suggestive.

Figure 2: Enrollment at WTCC and Four-Year Institutions (Spring 2022, Fall 2022, Spring 2023 Cohorts)



Note: The graph shows the shares of treatment (in orange) and control (in blue) students enrolled at Wake Tech (dashed lines) or in any four-year institution (solid lines). The treatment means are covariate-adjusted. Semester 0 corresponds to the treatment semester.

Student Subgroups

The next table provides estimates of the impacts four semesters (two years) after START for different program- and policy-relevant groups of students based on their status on various measures at baseline to understand how the program might impact these groups differently. We group students based on 1) how many curriculum credits they completed before START (comparing students who had completed 0–30 credits to those who had more than 30 credits); 2) students' academic achievement prior to START (comparing students with above-median GPAs and those with lower GPAs); and 3) Pell grant eligibility prior to START (comparing Pell-eligible students to those who were ineligible).

In each column in Table 16, the results we present show the impact estimate for treatment students in that group relative to control students in the same group. For each subgroup, the outcome variable means for control students are provided in Appendix D. Covariate-adjusted means for the treatment group can be calculated as the sum of the control mean and the impact estimate.

Table 16: Subgroup Analyses: Impact Estimates 4 Semesters after Treatment (Spring 2022, Fall 2022, Spring 2023, Fall 2023 Cohorts)

	Treated vs. Control students with 0–30 credits	Treated vs. Control students with >30 credits	Treated vs. Control high-achievement students	Treated vs. Control low or average achievement students	Treated vs. Control Pell-eligible students	Treated vs. Control non-Pell eligible students
Enrolled at WTCC	1.0%	3.3%	4.3%	0.8%	5.8%	1.0%
Associate degree earned from WTCC	2.5%	-3.2%	-2.5%	-2.2%	-6.2%	0.8%
Any credential earned from WTCC	3.0%	1.5%	3.0%	0.4%	8.9%	-1.7%
Earned multiple credentials from WTCC	-3.1%	0.3%	-0.5%	-1.1%	-5.2%	1.7%
Enrolled OR degree earned anywhere	0.5%	6.8%	7.5%	3.0%	14%**	0.5%
Enrolled OR degree earned at 4-year	-2.4%	0.2%	4.2%	-2.6%	-1.6%	0.4%
4-year degree earned	-5.7%	-5.7%	-8.0%	-1.3%	-9.6%	-3.6%
STEM concentrator	-0.18	0.58**	0.51	0.25	1.21**	-0.066
Earned credits at WTCC	-1.66	4.37***	3.27*	2.26	4.95**	1.72
Cumulative curriculum credits at WTCC	-9.9%	3.0%	-4.3%	5.7%	5.6%	-2.9%
Number of observations	143	384	253	265	180	347

*p<0.1; **p<0.05; ***p<0.01

We observe statistically significant positive impacts on cumulative credits earned at Wake Tech for several groups, including students who entered START with more than 30 credits (4.4 more cumulative credits, significant at the 1 percent level); higher-achieving students (3.3 more credits, significant at the 10 percent level); and Pell-eligible students (5 more credits, significant at the 5 percent level). Pell-eligible treatment students were also 14 percentage points more likely to earn multiple credentials from Wake Tech between their treatment semester and their fourth semester after treatment, relative to Pell-eligible control students. Treatment students with more curriculum credits at baseline and Pell-eligible treatment students continued to earn more semester credits than comparable control students in their fourth semester after treatment. The rest of the estimated impacts are not statistically significant, but for Pell-eligible students, the increased likelihood of earning multiple credentials at Wake

Tech is offset by a 9.6 percentage point decrease in the probability of transferring to a four-year institution.

Perceived Effects on Program Alumni

The program's ultimate goal for START students is that they will transfer to a four-year institution and earn a bachelor's degree, preferably in a STEM field; therefore, in the final year of the evaluation, the evaluators interviewed five START program alumni who participated in the program during the NSF grant period. All five alumni had graduated from Wake Tech and matriculated at a four-year institution the following semester. Four were still enrolled in their transfer institution and one had already graduated. The interviews focused on the participants' experiences as new transfer students and how START impacted their experience at their new college.

All of the alumni were clear that START did not influence their decision to transfer to a four-year institution and earn a bachelor's degree. Furthermore, most of them already had their transfer school in mind when they started at Wake Tech. However, once they arrived at their new school, all of them found that having participated in START positively influenced their experience there in several interrelated ways.

Alumni shared that they entered their university with a general sense of confidence about their ability to succeed at their new school because of what they learned and accomplished in START. One alum said that having done START made them feel generally prepared for their new classes because, "It really feels like I've got something behind me that says, 'Yeah, I can definitely do this because I've done it before.'" Another said that when they mentally compared their academic preparation to that of their new peers, they reminded themselves that "you might've been here longer and have more [University] classes, but I've worked in a lab." For a third alum, the confidence they gained from their START internship, as well as from being a START Ambassador, gave them the self-assurance to actively participate in classes and engage with faculty at their new school, an evolution which surprised even them. They explained the change, saying, "If you had told me in middle or high school that I would be standing up in front of the class talking to people about stuff once a week, I would've laughed in your face. … Never in a million years would I have expected my confidence and overall presentation skills to skyrocket the way they have but START definitely got me out of my box." Later in the interview, they said that because of START, it had become "bare minimum" for them to sit in the front row in class, answer questions, and go to office hours. "I want my teachers to know me," they said.

START also allowed many of the interviewed alumni to enter their new school feeling certain about what they would study. While all of the alumni had known, from the time they started at Wake Tech, that they wanted to transfer and earn a STEM bachelor's degree, most them had been uncertain about the specific major they wanted to pursue. For four of the alumni, their START experience affirmed their interest in STEM broadly and for three, it helped them narrow down their field of study. (The fifth alum said that they knew what they wanted to major in prior to START and that the experience did not change their choice.) One alum explained that START confirmed for them what they enjoy and are interested in, which reassured them that they had chosen the right field of study. They went on to say, "I came to [University] from START with a lot of confirmed confidence... It really just gave me that boost that I needed that I was going down the right path and in a field that really interested me as well."

The START alumni also described specific ways in which they used STEM and career skills they learned in START in their new academic endeavors. Having experience in a lab gave students both comfort in the setting and practical skills. One alum said that they were the only person in their organic chemistry lab group "that felt comfortable enough to actually do the lab work." They explained, "I was one of the only ones that actually knew what I was doing despite the fact that they give us all the videos and experiments before we go to lab. But I would come to lab and I would just get started on the experiment and the rest of my group would just stand there." Another alum said that in one of their START internships they learned a trick for preparing Petri plates quickly, which they were grateful for because they got a job in lab which requires them to make about 200 plates a day. Outside of the lab, alums found that their experience with things like reading scientific research, writing literature reviews, and writing up research findings was helpful for their classes, and in some cases, greater than their native-student peers had experience with. And one of the alums credited START's interview training with helping them earn a scholarship and the program's lessons on creating a resume for getting them ahead on a resume assignment and allowing them to help other students.

With their positive experiences with research in START, all of the interviewed alumni were inspired to continue working on research projects. Not all of them had yet to get involved in research at the time of the interviews, but for some, START gave them the confidence to seek out opportunities as well as the experience that helped them get selected for those opportunities. "[START] definitely gave me a lot of excitement to look for research opportunities at [University]," said one of the alumni. At the time of interviews, two of the alumni were beginning their second semester at their university and were currently working on joining a lab that term. One of these alumni said that because of START, they felt comfortable asking their professors if they had active research projects that needed students. "With my past experience, I'm qualified to help in a lab, so I feel more inclined to ask that," they said. This was another area in which some of the START alumni found they had a leg up on non-transfer students. Interviewees who attended NC State, in particular, said it was difficult for an undergraduate to join a lab without any prior lab experience. A third alum, who attended NC State, joined three different labs and attributed their success in part to having worked in labs through START. For the alum who had already graduated from their university, their START project both motivated them to seek out research opportunities and opened the door to career opportunities. While in school, they asked their department head about opportunities for contributing to research and eventually arranged for an independent study project. They also drew a direct line between START and landing their current job. They explained that when they applied for summer internships as an undergraduate, they put START on their resume and talked about the "practical, in-field experience" it provided during their interviews. Their internship led to a part-time job during the school year and after graduation, a full-time position.

Finally, for the alumni that transferred to NC State, START gave them a peer network at their new school. Indeed, two of the interviewees had roommates they had met through START. START alumni at

NC State said that they often studied and attended events together and that knowing a handful of familiar faces at their new school eased the transition to the larger institution. One alum said that academically, they did not have any challenges at NC State, but that “the social aspect” of the transition was more difficult for them. However, “It helped a lot to have friends from Wake Tech that also transferred in at the same time, and they were also in START,” they said. “So compared to some of the horror stories I have heard, I probably had a smoother transfer process than most people.” Another alum got assistance settling in to their new school from friends from START who had transferred the semester before. “It was nice to have those guides. … They helped me the most through it, through how to study for my classes, because you have to study differently at a four-year, and how to explore the campus and other little silly things like how to use a meal card, or do I need a meal card as a commuter?” they explained.

Perceived Effects on Mentors

START can have an impact not only on the students, but also on the mentors themselves. Across the three years of the Mentor Survey administration, mentors were asked to identify the extent to which they received specific benefits from their START experience. As Table 17 below shows, in Year 3, nine out of 11 mentors reported that START improved their relationships with START students, their ability to explain research practices, and their mentoring skills. Ninety percent of mentors also reported professional benefits and an increase in job satisfaction. Very high proportions also reported that they were able to do STEM research and that they had an increased connection to Wake Tech and to the broader STEM community. The percentage of respondents identifying specific benefits generally increased over time, which could have been partly due to the mentor supports introduced by START or it could be because new mentors joined the project in the last two years.

The interviews supported the survey findings. One of the most common responses about the benefits of mentoring was the ability to interact with students and the satisfaction the mentors had in seeing students grow. One mentor said, “I like watching the wheels spin, and I like them following through and then presenting their work and having that ownership." Another mentor said,

> I think a big part of what brings me satisfaction and joy is helping students to see their potential. It is priceless just to see how students can go from being “lost” to seeing all the possibilities that are open to them career-wise. I think that's been my commitment, to take students to the point where they can see value in what they're doing and possibilities as they move forward in their career.

Mentors also highlighted professional benefits including recognition for their mentoring work that can assist with promotions, connections with external partners, and increased skills in project management. One mentor highlighted how participating in research alongside students improved their attitude toward their job: “It's easy to, when you're teaching the same classes every semester, to get in a rut. But with undergraduate research, I feel like that pulls you out of the rut pretty well.”

Table 17: Mentors' Perceptions of the Effects of START on Themselves

This semester, because of my participation in START as a mentor…	**Year 1** *N=13*	**Year 2** *N=14–16*	**Year 3** *N=11*
I have a better understanding of how students think.	61.5%	93.8%	81.8%
My classroom instruction has improved.	15.4%	13.3%	27.3%
I have better relationships with my START students.	84.6%	93.3%	90.9%
I have better relationships with all of my students, not just START students.	15.4%	35.7%	27.3%
I have a better understanding of the questions and concerns Wake Tech students have about continuing their education.	61.5%	73.3%	63.6%
My ability to explain research practices has improved.	69.2%	86.7%	90.9%
My knowledge of Wake Tech's resources has increased.	61.5%	56.3%	72.7%
I feel a greater sense of belonging to Wake Tech.	53.8%	73.3%	81.8%
I feel more connected to the greater STEM community.	61.5%	85.7%	72.7%
My mentoring skills have improved	-	-	90.9%
I was able to do STEM research I would not have otherwise been able to do.	-	-	81.8%
I feel a greater sense of job satisfaction.	-	-	90.9%
I gained experience or knowledge that will lead to professional gains or have a long-term impact on my career.	-	-	90.9%

Note: Each item had 4 possible response options on a scale ranging from *This Did Not Occur to This Occurred, Entirely Because of START*. The results here are the percentage of respondents that chose one of the top two options, *This Occurred, Partially Because of START* or *This Occurred, Entirely Because of START*. Four items were added to the survey for the Year 3 administration.

Perceived Effects on Student Community of Inquiry

The START model is partially based on the Community of Inquiry model, which identifies the characteristics of high-quality online instruction. The Community of Inquiry model consists of three elements: a Social Presence, a Cognitive Presence, and a Teaching Presence. The START team sought to create a program that developed the first two presences. A strong Social Presence requires that students work with each other and with mentors to learn together. A strong Cognitive Presence emphasizes students' active learning and engagement with the content.

The Student Implementation Survey asked students questions from the Community of Inquiry survey (Arbaugh et al., 2008), adapted to the features of the START program. Throughout the first three years of START, students consistently reported very high levels of agreement (more than 80% of respondents agreeing) with almost all the statements about Social Presence (see Table 18) and all of the statements about Cognitive Presence (see Table 19).

Table 18: Students' Perceptions of START as a Community of Inquiry, Social Presence

	Year 1 *N=28*	Year 2 *N=18*	Year 3 *N=21–22*
Getting to know other START participants gave me a sense of belonging in the program.	89.3%	100.0%	95.5%
I was able to form distinct impressions of some of the other START participants.	89.3%	94.4%	95.2%
Microsoft TEAMS is an excellent medium for social interaction.	71.4%	83.3%	77.3%
I felt comfortable conversing with my mentor.	96.4%	83.3%	90.9%
I felt comfortable participating in online and in-person discussions as part of START.	96.4%	100.0%	95.5%
I felt comfortable interacting with other START participants.	96.4%	94.4%	90.9%
I felt comfortable having collegial disagreements with my mentor/co-mentor and other START participants.	82.1%	83.3%	81.0%
I felt that my point of view or opinions were acknowledged by my mentor/co-mentor and other START participants.	100.0%	88.9%	95.5%
START activities helped me to better understand the importance of collaboration.	96.4%	94.4%	90.9%

Note: Each item had 4 possible response options on a scale ranging from *Strongly Disagree* to *Strongly Agree*. The results here are the percentage of respondents that chose one of the top two options, *Agree* or *Strongly Agree*.

Table 19: Students' Perceptions of START as a Community of Inquiry, Cognitive Presence

	Year 1 N=28–29	Year 2 N=18	Year 3 N=22
Because of my participation in START, I feel motivated to explore STEM-related topics.	89.7%	94.4%	95.5%
Brainstorming and finding relevant information helped me resolve content related questions.	93.1%	100.0%	95.5%
Discussions with members of the START community were valuable in helping me appreciate different perspectives.	96.6%	88.9%	95.5%
Interpreting new information helped me answer questions raised in START activities.	89.7%	100.0%	95.5%
START learning activities, including the research project, helped me construct explanations/solutions.	93.1%	94.4%	95.5%
Reflection on START activities helped me understand fundamental research concepts.	89.7%	100.0%	95.5%
I can describe ways to apply the knowledge I have gained through START.	89.3%	100.0%	95.5%
I have developed solutions to STEM problems that can be applied in practice.	86.2%	94.4%	95.5%
I can apply the knowledge I gained from START to my future classes, future jobs, or other activities.	89.7%	100.0%	95.5%

Note: Each item had 4 possible response options on a scale ranging from *Strongly Disagree* to *Strongly Agree*. The results here are the percentage of respondents that chose one of the top two options, *Agree* or *Strongly Agree.*

Institutional Impacts

Through institutionalizing START at Wake Tech, the grant seeks to have broader impacts on the college and its culture. The evaluation looked specifically at the impact of implementing this grant-funded version of START on student participation in the STEM fields targeted by START and on the impact of implementing START on Wake Tech's general support of mentors and undergraduate research.

Institution-level administrative data provided by Wake Tech, student enrollment data for the academic divisions that house the departments aligned to the STEM fields targeted by START, do not clearly indicate that START had an impact on student participation in classes in these fields (or at least, in those departments), as shown in Table 20. Note that the enrollment data alone cannot support any causal claims about the impact of START, but a comparison of the changes in the divisions' enrollment to overall college enrollment does not suggest an impact from the program. While enrollment increased in all of the divisions from before the new version of START (the Fall 2021 semester) to the most recent semester for which data was available (Fall 2025), total enrollment at Wake Tech also increased during this time. Furthermore, most divisions' growth tracked total enrollment growth relatively closely during this time (and some grew less than enrollment overall). The exception is the Biotechnologies division, which saw much higher growth, but began with many fewer students: in Spring 2021, there were 104 students in the Biotechnologies division; in Fall 2025, enrollment had increased 79% by adding 82 students. In contrast, the Information Technology division grew by 16% during this time, by adding 397 students for an enrollment of 2,862 in Fall 2025. The by-semester percent change in enrollment from Fall 2021 to Fall 2025 (i.e., the percentage by which each semester's enrollment differs from Fall 2021's enrollment) for each division and for the college overall is illustrated in Figure 3. Even though no impact in STEM participation can be detected with these data, the growth in enrollment in these divisions affirms the continued need for START with more students taking STEM classes and thus more students likely to benefit from the program.

To provide an indication of the institutional support for mentored undergraduate research at Wake Tech outside of the START program, the evaluation asked mentors about their perceptions. The Mentor Survey asked respondents about the extent of support provided to faculty who want to mentor students doing research and the extent of support for student opportunities for mentored research, aside from START. Table 21 shows the percentage of mentors in each administration of the survey who believed that Wake Tech offered each kind of support. Only slightly more than one-third of mentors reported support for faculty taking on mentorship in Year 1; this nearly doubled to approximately two-thirds in Years 2 and 3, suggesting that mentorship was being valued more as START gained campus-wide visibility. More than half of mentors (57%) reported general support for mentored student research in Year 1; this jumped to 75% in Year 2 and dropped a little to 64% in Year 3. The second-year increase may be a reflection of the new spotlight on START during that year.

Table 20: Wake Tech Enrollment by Academic Division

	Fall 2021	Spring 2022	Fall 2022	Spring 2023	Fall 2023	Spring 2024	Fall 2024	Spring 2025	Fall 2025
Wake Tech overall	18,569	16,531	18,613	17,425	19,759	19,022	20,696	20,285	22,327
Advanced Manufacturing, Engineering & Design	1,276	1,152	1,226	1,200	1,425	1,331	1,477	1,422	1,588
Biotechnologies	104	93	134	140	169	174	198	182	186
Health Sciences	645	606	681	637	652	614	697	697	719
Information Technology	2,465	2,355	2,714	2,606	2,876	2,876	2,950	2,803	2,862
Mathematics & Sciences	2,595	2,254	2,646	2,398	2,703	2,459	2,668	2,547	2,691

Figure 3: Percent Change in Enrollment from Fall 2021, by Fall Semesters

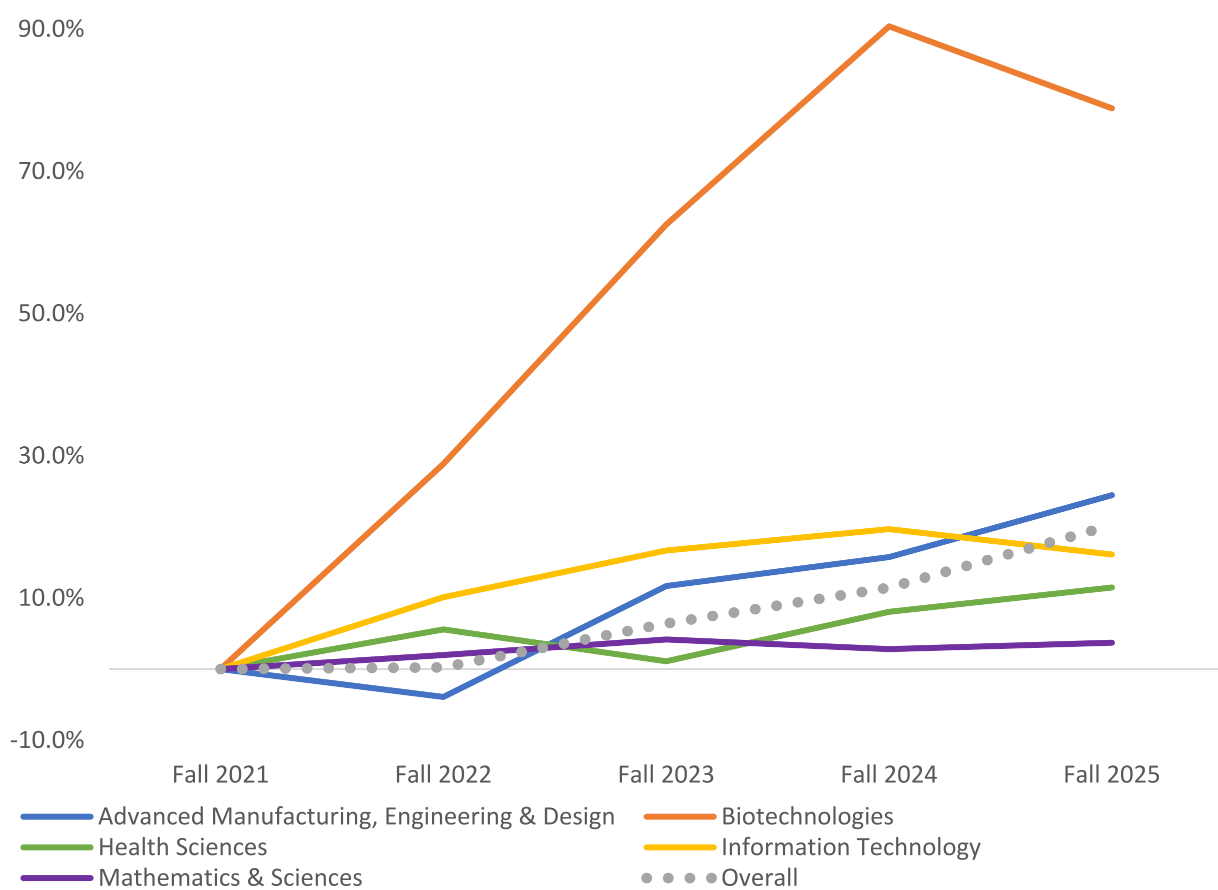


Table 21: Mentors' Perception of Institutional Support for Mentored Student Research

	Year 1 *N=14*	**Year 2** *N=16*	**Year 3** *N=11*
Aside from the START program, do you feel that Wake Tech is generally supportive of opportunities for mentored undergraduate research?	57.1%	75.0%	63.6%
Aside from the START program, do you feel that Wake Tech provides support (e.g., training, structured programming, recognition) for faculty who want to mentor students doing research?	35.7%	68.8%	63.6%

Note: Each item had 4 possible response options: *Yes, definitely*; *Yes, somewhat*; *No*; and *I'm not sure*. The results here are the percentage of respondents that chose either Yes, somewhat or Yes, definitely.

Interviews with mentors reflected the mostly-but-not-entirely positive view of institutional support for mentorship and mentored research. Many held the view that mentored research was supported in the sense that there was nothing to stop faculty from taking on the work but that it wasn't valued or rewarded as much as teaching. One mentor, in Year 1, explained, "Faculty are allowed [to mentor students], there's nothing standing in their way, but I wouldn't say that [mentoring students is] necessarily supported actively. You can use it for faculty rank and you'll get a pat on the back from your immediate supervisor, but if you were to ask the reverse question, I don't know I would say that Wake Tech actively encourages faculty to do this." Even after the college administration took notice of START and offered some support for mentors (as noted in the Mentoring section, in Year 3, mentors with five or more students were able to count the time in their normal workload), some mentors felt they did not get recognized for their efforts.

One related aspect that appears to have improved over this time is the administrative burden for faculty involvement in students activities, including mentorship and research. A mentor commented on this in Year 1, saying, "[The administration] supports us in a number of ways, but boy, they make it hard to do good things." In Year 3, a different mentor said that in the past, they had encountered roadblocks and resistence to working with students on grants simply because the college's operations were not set up to support it. They felt that because of START's efforts to work through many of the operational challenges associated with student research, the experience of mentoring students, at least throught START, was much easier.

IV. Implications and Future Research

As the NSF-supported version of START sunsets, the leadership team can point to a number of successes from the five years of the grant. Chief among them may be that they achieved their goal of institutionalizing the program at Wake Tech; with the support of college leadership and new foundation support, START will continue. The program continues to evolve—in the newest iteration, START students will commit to two semesters, with an initial semester focused on building professional skills before being assigned to a research internship the following semester—as the leadership team has responded to formative feedback from the evaluation and their own observations about the needs of students and mentors, but the core elements of the program, and its goal, remain the same.

The three years of the program implementation study offer consistent evidence of a variety of positive effects for students from participating in the program. In each year we fielded the Implementation Survey, 90% or more of students said that START gave them an idea of what it is like to have a job in a STEM field and that START gave them skills and/or knowledge that they would use in future STEM classes. Over 95% of students in Years 2 and 3, when this question was asked, said that START gave them a better understanding of professionalism. In interviews, students said that participating in START increased their confidence, which the program leadership and interviewed mentors also remarked on. Students also spoke about learning valuable STEM-related skills and knowledge, becoming more comfortable with communicating about their work, the satisfaction of applying and synthesizing knowledge from their courses, and feeling more certain that they wanted to pursue a STEM career, all because of their time in START. Results from the Student Survey, which was administered to both treatment and control students, provides more rigorous evidence of the positive effects on students because of the random assignment to treatment. On this survey, START students reported statistically significant greater levels, relative to their control group peers, of STEM self-efficacy, STEM career awareness, comfort with STEM research, scientific literacy, and transfer confidence.

New to the pile of evidence about the START experience this year are the interviews with program alumni. Although we spoke with just a handful of former START students, the group was notable for being unanimous in their appreciation for the opportunity to participate in START and for the variety of ways it positively affected their experience at the four-year institution they transferred to. Add to this the finding from the Implementation Survey that each year, over 95% of respondents agreed that their START research internship was a valuable part of their experience at Wake Tech, and we can conclude that for many students, START was a meaningfully positive and important component of their time at Wake Tech.

The five years of student impact data offers a more complex picture of the impact of participating in START. Two years after students' first semester in START, there are no statistically significant positive impacts on students' persistence at Wake Tech, degree attainment (either from Wake Tech or a four-year institution) or enrollment at a four-institution. There is suggestive evidence, however, that students in the program are staying at Wake Tech longer and thus delaying transferring to a four-year institution, relative to their control group counterparts. To be clear, it appears that they are still transferring, just not as soon.

Taken with the evidence from the implementation study and alumni—who also all said that START did not influence their decision to get a bachelor's degree as they entered Wake Tech intending to transfer— this is not an unreasonable theory. If START is making a student's experience at Wake Tech more meaningful in some way, perhaps more interesting or worthwhile, and it makes them feel more confident and competent, then it is reasonable to imagine that a student who planned to earn a bachelor's degree eventually would continue to take advantage of the opportunity to participate in START as long as they could continue to take classes at Wake Tech for that eventual degree. In this scenario, a student's time at Wake Tech becomes less a steppingstone on the path to a goal and more an important waypoint on the journey.

For more conclusive evidence about the potential transfer delay and long-term outcomes for START students, the evaluation team would need to continue to follow the trajectories of the study cohort students in coming semesters. The evaluation team will continue to seek financial support to allow us to do this work. Although the post-NSF grant version of START is different, the longer commitment in the new iteration makes it even more plausible that students would develop a strong connection with the program, and thus Wake Tech, and choose to delay an eventual transfer. Getting a firmer understanding about the long-term outcomes for the NSF study cohorts would help the program anticipate the long-term outcomes for future cohorts. Future research could also address questions about the impacts of delaying transfer and workforce outcomes for START students.

Taking a step back and considering what we do know about START and its effects, it is important to recognize that with this grant, START has created something unusual in the two-year college world: a program that gives students research experience, fosters student community, and facilitates meaningful extra-curricular student relationships with faculty or other mentors. And, it would seem, it fosters genuine student engagement with the college. As the program's evaluators, we would be remiss not to point out that if START continues to administer pre-and-post surveys to students (and better yet, if the leadership continues to use randomization to allocate program spots and gives the follow-up survey both to accepted and non-accepted students), changes in college engagement due to START could be investigated simply by including a question asking students about the extent to which they feel connected to Wake Tech. But suggestions for research aside, if the primary achievement of NSF-funded START is building a program that has taken root at Wake Tech then the secondary achievement may be building a program that has rooted students at Wake Tech—or at least, improved the quality of their time there.

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Appendix A: Student Survey Scales

Table A-1: Student Survey Scales

Scale ***Baseline Survey Reliability Estimate*** **(Number of items)**	**Scale Topic** • **Sample Items**
STEM Self-Efficacy *α = 0.88* (10)	Perceptions of your current and future involvement with STEM: • I have STEM career goals. • I am confident I can master the content in my STEM classes and in STEM research projects. • I am comfortable asking questions of professors and STEM professionals.
STEM Career Awareness *α = 0.76* (3)	Awareness of careers in STEM: • I am aware of different careers in STEM. • I am developing a plan to pursue further education for a STEM career. • I am confident that I can have a STEM career.
Comfort with STEM Research *α = 0.92* (14)	Comfort with research: • I know how to analyze data. • I know how to use the tools, materials, and equipment needed to conduct research in the field I am interested in. • I understand the consequences of unethical practices and research misconduct.
Scientific Literacy *α = 0.90* (7)	Comfort with scientific literacy skills: • I know how to identify reliable sources for scientific information. • I can identify when scientific evidence does and does not support a hypothesis. • I am familiar with how STEM research is communicated in the written form (i.e., scientific papers, scientific reports).
Grit & Perseverance *α = 0.88* (6)	Perceptions of how you work: • I am confident in my ability to stay motivated and committed to my projects or assignments when things do not go as planned. • I try very hard even after experiencing failure. • I stay committed to my goals.
Transfer Confidence *α = 0.80* (5)	Confidence in transferring to a four-year college: • I feel like I have the tools or resources to tackle the obstacles or challenges that may come up as I work towards my education goals. • I know how to find the resources or support I need at a four-year college. • I feel confident that I will be successful at a four-year college.

All sets of items for a scale began with a statement about the topic of the statements that follow. For example, the STEM Career Awareness items began with, “The next set of items asks you about your awareness of careers in STEM (science, technology, engineering, and math).” For each set, the statement was followed by the question, “On a scale of 1-5, how well does each of these statements reflect you, your skills, and your attitudes or beliefs?” All sets of items had the same set of response options: *1 – Not at all true of me*, *2 – Slightly true of me*, *3 – Somewhat true of me*, *4 – Very true of me*, and *5 – Completely true of me.*

Appendix B: Technical Methodology Report

To study the program's impacts on enrollment, degree attainment, and academic performance, we used the administrative data provided by Wake Tech and data from the National Student Clearinghouse to estimate the following regression model for student *i* who participated in the study in semester *t*:

$$Y_{it} = \beta_0 + \beta_1 Treatment_{it} + X_{it}\delta + \gamma_t + \varepsilon_{it}, \qquad (1)$$

where $Treatment_{it}$ is an indicator variable for student *i* being randomized into the treatment group in semester *t* and to 0 otherwise. The vector of student-level covariates in X_{it} included:

- Time-invariant student characteristics and baseline Pell eligibility (imputed to 0 when missing);
- Baseline achievement measure constructed as standardized high school GPA or Wake Tech cumulative GPA at baseline when high school GPA is missing;
- Indicators for missing demographic information and high school GPA;
- An indicator for having STEM concentrator status in the baseline semester;
- An indicator for having earned a credential from Wake Tech prior to the START semester;
- Cumulative credits earned through the baseline semester and a quadratic in cumulative credits at baseline; and
- An indicator for having participated in START in a previous semester.

In addition, cohort indicators were included in the vector γ_t.

Students who were randomized into the control group upon initially applying for START had the opportunity to reapply two semesters later. Some students took advantage of this opportunity and were randomized into the treatment group in a later semester. Under these circumstances, their participation in START was not random, so our estimation approach had to account for this. We used the fact that a student's initial assignment the first time they applied to START was random, so the results we report are for the following modified equation:

$$Y_{it} = \beta_0 + \beta_1 Treatment_{i0} + X_{it}\delta + \gamma_t + \varepsilon_{it}, \qquad (2)$$

where $Treatment_{i0}$ is an indicator for treatment assignment the first time a student applies to START. We also allowed for within-student correlation in the errors in equation (2).

We verified the robustness of the results to an instrumental variable (IV) approach, in which we used a student's initial assignment, which was random, as an instrument for their treatment assignment at time *t*:

$$Treatment_{it} = \alpha_0 + \alpha_1 Treatment_{i0} + X_{it}\alpha_2 + \eta_t + e_{it}. \qquad (3)$$

There were 27 students whose treatment status changed between randomizations. For the rest of the sample, the IV approach, equation (1) and equation (2) are equivalent, so the results are not very sensitive to the estimation method.

To measure differential effects of START participation by student characteristics, we estimated the regression model in (2) adding interactions between the treatment indicator and indicators for subgroup membership:

$$Y_{it} = \beta_0 + \beta_1^0 Treatment_{i0} \times Z_{i0} + \beta_1^1 Treatment_{i0} \times Z_{i1} + \beta_2 Z_i + X_{it}\delta + +\gamma_t + \varepsilon_{it},$$

where Z_{i0} and Z_{i1} indicate membership in each of the respective subgroups (e.g. non-Pell eligible versus Pell-eligible).

Appendix C: Interview and Focus Group Instruments

Student Focus Group Questions

1. Is this your first semester in the program, or did you do START before?
2. How did you hear about START?
   What made you want to apply to START?
3. How was your experience with your research internship?
   What did you learn from the experience?
4. How was your experience with sharing your research in the Showcase?
5. How was your experience working with your mentor or co-mentor?
   Did you have any challenges or concerns with working with a mentor?
6. Did you do other activities with START besides the research internship that you found valuable?
   Do you feel like those activities added to your experience in START? In what way?
7. How do you think you have changed as a result of your participation in START? Do you have new skills or a new perspective?
8. Has participating in START changed how you feel about Wake Tech or about being a student at Wake Tech? If so, how?
   What do you think your experience at Wake Tech would have been like if you had not participated in START?
9. Do you have any suggestions for how to improve START in the future?
10. Are you planning on continuing on with START next semester? Why or why not?

Mentor Interview Questions: Wake Tech Mentors

1. How many semesters have you been a START mentor?
2. How many START students are you mentoring or co-mentoring this semester?
3. Are all of those students working on research projects that you're leading?
   Are any of those students working on a research project lead by someone else?
4. When you met with students, what topics did you generally talk about?
5. What challenges did you encounter with students' work on their research projects?
6. Why did you sign up to be a START mentor?
   What did you think you would gain or learn from the experience?
   Did you get what you expected from the experience?
7. Did you find there were benefits of being a mentor that you didn't anticipate?
8. What skills are important to being successful as a START mentor?
9. Have you done the mentor training? If so, was it helpful? How?
   What other supports have you received from START to help you be successful as a mentor?
   Are there other supports or resources you could use?
10. How have you interacted with other mentors this semester?
    Are you interested in building a community among mentors? If so, what would be helpful for building a community among mentors?
11. What were the biggest challenges you faced as a mentor?
12. Is there anything the START program can do to help with these types of challenges in the future?

13. From your perspective, how have the students you worked with grown and developed over the past semester as a result of START?
14. Was there anything else the students needed so that they could fully take advantage of the START experience?
15. How has your approach to mentoring changed over the semesters you've been a START mentor?
    Is there anything you did differently this semester that you didn't do before or any lessons that you've learned?
16. In general, outside of the START program, do you think Wake Tech provides support for faculty to mentor students doing research?
17. Do you feel that your department or division values or supports undergraduate research?
    To what extent do they support or value your mentoring students?
18. How has participating in START changed you or how you approach your work at Wake Tech?
19. Do you believe that mentoring will lead to professional gains or have a long-term impact on your career?
20. Is there anything else that you would like to share that I have not asked about?

Mentor Interview Questions: Partner Mentors

1. How many semesters have you been a START mentor?
2. How many START students are you co-mentoring this semester?
   Did your student(s) have a Wake Tech co-mentor?
   How did you divide up responsibilities with the Wake Tech co-mentor?
   What is your area of study, and what topic did your student(s) do their project on?
3. When you met with students, what topics did you generally talk about?
4. What challenges did you encounter with students' work on their research projects?
5. How did you learn about the START program and the opportunity to be a mentor?
   Why did you sign up to be a START mentor?
   What did you think you would gain or learn from the experience?
   Did you get what you expected from the experience?
6. Did you find there were benefits of being a START mentor that you didn't anticipate?
7. What skills are important to being successful as a START mentor?
8. What other supports have you received from START to help you be successful as a mentor?
   Are there other supports or resources you could use?
9. Do you mentor other students, from your own school? How is it different working with a START student compared with students from your school?
10. What were the biggest challenges you faced as a mentor?
11. Is there anything the START program can do to help with these types of challenges in the future?
12. From your perspective, how have the students you worked with grown and developed over the past semester as a result of START?
13. Was there anything else the students needed so that they could fully take advantage of the START experience?

14. How has your approach to mentoring changed over the semesters you've been a START mentor?
    Is there anything you did differently this semester that you didn't do before or any lessons that you've learned?
15. Do you feel that your department or division values or supports your working with a student from outside your institution?
    Do you think they see value in your involvement in START?
16. How has participating in START changed you or how you approach your work?
17. Do you believe that mentoring will lead to professional gains or have a long-term impact on your career?
18. Is there anything else that you would like to share that I have not asked about?

Leadership Team Focus Group Questions

1. Describe the management structure of the program this year. How do you divide responsibilities?
    a. How is the management structure different this year compared to last year?
    b. How well do you think this year's management structure worked?
    c. Is there anything you would do differently next year?
2. Describe how you recruited students this year. What changes have you made since last spring?
    a. What did you learn about recruiting students this year? Were there notable challenges or successes?
    b. One of the goals of START is to increase the diversity of students getting STEM degrees. What did you do to recruit a diverse group of students to START?
    c. Is there anything you would do differently next year?
3. This year, did you make any changes to either the process of matching students to projects or the hiring process for students? What were the changes?
    a. What did you learn about matching students or hiring students this year? Were there notable challenges or successes?
    b. Is there anything you would do differently next year?
4. Did you learn anything new this year about what makes for a good research project or internship? That is, what provides the best experience for students, or facilitates a strong research project?
    a. Are you planning on making any changes to the program based on what you have learned?
5. Students who struggle to be successful in START is always a concern. Did you learn anything from the issues that came up this year? Are there changes to policies or procedures or the program structure that you want to make based on what you learned?
    a. Briefly describe the issue that came up in the spring semester with international students. What did you learn from this issue? Are there any changes you are going to make from what you learned?
6. This year, did you make any changes to the PRT requirements or their content? What were the changes?

    a. What did you learn about the PRT requirement this year? Were there notable challenges or successes?
    b. Is there anything you would do differently next year?
7. Briefly describe the community building activities offered this year. How were they different than last year?
    a. What did you learn about the community building component this year? Were there notable challenges or successes?
    b. Is there anything you would do differently next year?
8. Briefly describe the visits to four-year colleges you organized this year. How many did you have each semester? How did they compare to last year's visits?
    a. What did you learn about the college visit component this year? Were there notable challenges or successes?
    b. Is there anything you would do differently next year?
    c. Were there other activities that you did this year to build transfer capital? Are there other activities you would like to offer in the future?
9. From your perspective, what did you see as the most common ways START had an impact on students?
    a. Did you notice anything different this year compared to last year?
    b. Have any of the changes you made to the program this year changed how the program impacted students?
    c. Have there been any unintended impacts on students?
    d. What do you think have been the impacts on students after they left START?
10. This year, did you do anything new or different to recruit new mentors? How did you find new mentors for the program this year?
    a. Mentor retention was a challenge this year. Describe the challenges you encountered. How did they impact the program?
    b. What is your current thinking about recruiting new mentors? About retaining current mentors?
11. Describe what you provided for mentors this year in terms of support, such as training and community building. How was it different than last year?
    a. What did you learn about mentor support this year? Were there notable challenges or successes?
    b. Is there anything you would do differently this year?
    c. How has participating in START impacted mentors? Have you noticed any unintended impacts?
12. What other plans do you have for developing the program in the future?
    a. Are you planning on making any changes to START to accommodate the long-term sustainability of the program? What changes or resources are needed to sustain the program?
13. Now that the RCT phase of the grant has ended, are you making any changes to the program implementation since you won't have to accommodate the study?

    a. How are you going to select students for future cohorts? Why do you want to select students that way?
    b. Are you going to continue to survey students or collect data about the program? What do you want to continue to learn or track?
14. One of the goals of START is to have an impact on the culture at Wake Tech when it comes to support for undergrad research. Have you noticed any changes in the institutional culture this year?
    a. When it comes to Wake Tech supporting and sustaining START after the end of the NSF grant, what is the current thinking?
    b. Have there been unintended impacts on the institution because of START this year?
15. One of the intended outcomes of the NSF grant is to share best practices for undergraduate research programs with other institutions, especially other North Carolina Community Colleges. Describe what you did this year to disseminate what you have learned from START.
    a. What are your upcoming plans for disseminating best practices?
    b. What would another institution need in order to replicate the program? What do you think is important to provide to other institutions who want to replicate the program? That is, what information or advice or documentation do you think you could provide?
16. Is there anything else that you would like to share that we have not asked about?

START Alumni Interview Questions

1. What college do you go to now?
    a. When did you start there?
    b. Did you start the semester after you graduated from Wake Tech?
2. How many semesters did you participate in START?
    a. *If more than one semester:* Did you work on the same project and with the same mentor each semester?
    b. What project *(or projects)* did you work on?
3. What are you majoring in at your college?
    a. Was your choice of major influenced by your START project?
4. How did participating in START affect your decision to transfer to a four-year college?
    a. Before START, were you planning on transferring?
    b. Did you change your mind about what colleges to apply to for transfer because of your experience in START?
    c. What did you learn about transferring to a four-year college from START?
5. Can you describe your overall experience transitioning from Wake Tech to your current college?
    a. What were some of the biggest academic or social adjustments you had to make?
    b. What parts of the transition were easy or did not require a big adjustment?
    c. How did your expectations about what it would be like at your current college compare to the reality? Did anything surprise you?
6. How do you think participating in START prepared you to be a student at your current college?
    a. Were there specific skills, knowledge, resources, or connections from START that you have found useful?

    b. Did participating in START help you feel more confident about or prepared for being a student at your current college?
    c. Can you share a moment since you transferred when you realized the value of what you learned in START?
7. Have you made connections with faculty or mentors since you transferred?
    a. Have you worked on a mentored research project or in a lab since you transferred?
    b. *If yes:* Did your experience in START help with making the connection?
8. If you could change or add anything to the START program to better support students to transfer to a four-year college, what would it be?
9. How did START fit in to your time as a student at Wake Tech – did you participate in it during your first semester(s), your last semester(s), or in the middle? We find that students who participate in START early in their time at Wake Tech are more likely to transfer to a four-year college, compared to students who participate later. Why do you think that might be happening?
10. Is there anything else you'd like to tell us about START and transferring to a four-year college?

Appendix D: Additional Results for Subgroup Analyses

Table D-1: Control Group Means for the Subgroup Analyses, 4 Semesters After Treatment: Credits at Baseline

	0–30 credits *(N=93)*		**>30 credits *(N=238)***	
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**
Enrolled at WTCC	31.2%	0.47	15.1%	0.36
Associate degree earned from WTCC	18.3%	0.39	66.0%	0.47
Any credential earned from WTCC	24.7%	0.43	71.4%	0.45
Earned multiple credentials from WTCC	3.2%	0.18	20.2%	0.40
Enrolled OR degree earned anywhere	64.5%	0.48	89.9%	0.30
Enrolled OR degree earned at 4-year	33.3%	0.47	66.0%	0.47
4-year degree earned	1.1%	0.10	7.1%	0.26
STEM concentrator	50.5%	0.50	88.7%	0.32
Earned credits at WTCC	2.13	4.42	0.61	1.87
Cumulative curriculum credits at WTCC	35.97	22.72	81.64	19.80

Table D-2: Control Group Means for the Subgroup Analyses, 4 Semesters After Treatment: Achievement at Baseline

	High baseline achievement *(N=150)*		**Lower baseline achievement *(N=174)***	
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**
Enrolled at WTCC	16.7%	0.37	22.4%	0.42
Associate degree earned from WTCC	63.3%	0.48	45.4%	0.50
Any credential earned from WTCC	66.7%	0.47	52.9%	0.50
Earned multiple credentials from WTCC	17.3%	0.38	13.8%	0.35
Enrolled OR degree earned anywhere	84.0%	0.37	82.8%	0.38
Enrolled OR degree earned at 4-year	64.7%	0.48	50.6%	0.50
4-year degree earned	6.0%	0.24	4.6%	0.21
STEM concentrator	87.3%	0.33	71.3%	0.45
Earned credits at WTCC	0.89	2.71	1.12	2.98
Cumulative curriculum credits at WTCC	70.81	27.30	69.14	29.30

Table D-3: Control Group Means for the Subgroup Analyses, 4 Semesters After Treatment: Pell Grant Eligibility at Baseline

	Pell eligible *(N=115)*		**Non-Pell eligible *(N=216)***	
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**
Enrolled at WTCC	17.4%	0.38	20.8%	0.41
Associate degree earned from WTCC	53.0%	0.50	52.3%	0.50
Any credential earned from WTCC	61.7%	0.49	56.5%	0.50
Earned multiple credentials from WTCC	16.5%	0.37	14.8%	0.36
Enrolled OR degree earned anywhere	86.1%	0.35	81.0%	0.39
Enrolled OR degree earned at 4-year	59.1%	0.49	55.6%	0.50
4-year degree earned	4.3%	0.20	6.0%	0.24
STEM concentrator	75.7%	0.43	79.2%	0.41
Earned credits at WTCC	0.75	2.41	1.19	3.13
Cumulative curriculum credits at WTCC	73.26	27.31	66.44	29.84