12-1-2019

Tracking Outcomes in the National Summer Transportation Institute

Glenn McRae
University of Vermont, glenn.mcrae@uvm.edu

Hannah Ullman

TRACKING OUTCOMES IN THE NATIONAL SUMMER TRANSPORTATION INSTITUTE

Glenn McRae and Hannah Ullman

NORTHEAST TRANSPORTATION WORKFORCE CENTER AT THE UNIVERSITY OF VERMONT TRANSPORTATION RESEARCH CENTER

http://netwc.net/

This material is based upon work supported by the U.S. Department of Transportation under Cooperative Agreement No. DTFH6114H00022. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the Author(s) and do not necessarily reflect the view of the U.S. Department of Transportation.

The Report, "*Tracking Outcomes in the National Summer Transportation Institute*," is submitted in partial fulfillment of grant requirements under Cooperative Agreement #DTFH6114H00022, FHWA Regional Surface Transportation Workforce Centers. This is a 2019 effort of the Northeast Transportation Workforce Center, located at the University of Vermont Transportation Research Center, partnering with the Rutgers University Center for Advanced Infrastructure and Transportation (http://netwc.net/).

Table of Contents

1. Introduction

1.1 Overview of NSTI

> *The transportation industry faces a significant gap between the number of skilled positions needed in the workforce and the number of people qualified to fill those positions… Without enough qualified workers, the industry grapples with a growing challenge to develop, operate, and maintain a safe and efficient transportation system…One way the Federal Highway Administration is working to narrow the workforce gap is by encouraging young people to explore the opportunities awaiting them in transportation... the National Summer Transportation Institute (NSTI) is an FHWA program that expands the awareness of career opportunities in transportation and helps address future needs for a capable and diverse workforce.* (Gottlieb & McClure, 2019)

The National Summer Transportation Institute (NSTI) program was founded at Federal Highway Administration (FHWA) Headquarters' Civil Rights (HCR) Office in 1993, and began in historically black colleges, before expanding across the country. This effort built on the 1991 FHWA Historically Black Colleges and Universities (HBCU) and other Minority Institutions of Higher Education Task Force recommendation that partnerships be established to increase the participation of HBCUs, tribal colleges and universities, and Hispanic serving institutions in the agency's federal and federal aid highway programs. The partnerships were required to have, at a minimum, the active participation of an FHWA Division Office, a state department of transportation (DOT) and a college or university. The FHWA South Carolina Division Office, the South Carolina DOT and the South Carolina State University (SCSU) developed a transportation-focused career awareness initiative entitled "Summer Transportation Institute" (STI). (Sabb et al., 2003).

This USDOT/FHWA educational initiative addressed a crucial transportation workforce issue, as an unprecedented number of transportation employees were identified as, or soon to be, eligible for retirement. This created a need for, and provides a great opportunity to, prepare youth for future transportation careers. The STI program was designed to introduce secondary school students to all modes of transportation and associated careers and encourage them to pursue transportation-related courses in post-secondary programs of study. The program's stated mission is "to promote the Science, Technology, Engineering and Math (STEM) disciplines in transportation – education and career opportunities among middle and high school students, including at-risk youth" (FHWA, 2016).
From the success of the first STI on the SCSU campus in 1993, other FHWA Division Offices, State DOTs and colleges and universities expressed interest in and established STIs. After a six-year pilot program, Congress, in the Transportation Equity Act for the 21st Century, authorized funding for the first transportation career education program for secondary school youth entitled the "National Summer Transportation Institute" (NSTI).

Through NSTI programs, students typically spend between one and four weeks in a program (residential or day) at a host college or university. All US states and territories are eligible to host a program through their USDOT civil rights divisions. The program is currently operated out of FHWA's Center for Transportation Workforce Development. Each host site completes an overall program evaluation to "determine how well the program has accomplished its goals and identify ways to improve the effectiveness of the NSTI" (FHWA, 2017). The host coordinator uses the evaluation forms provided by

the NSTI program for students, speakers, and staff, and includes results in an evaluation report that is then used to complete a post-program questionnaire provided by FHWA.

In 2017 FHWA funded 68 NSTI programs across 48 states and territories. In FY2018 and FY2019 FHWA was reassessing the funding process for NSTI programs, and late announcements and uncertainty resulted in a smaller number of programs being offered in these years. In 2019 FHWA released a memo outlining a new process for fund allocation for On-the-Job Training (OJT/SS) and the NSTI Program with funds made available under 23 USC 140(b) for the specific projects indicated in the State DOT SOW for the FY 2019 OJT/SS and/or NSTI. *See full Memo (May 23, 2019) in Appendix 3.* Table 1, below shows funding levels in FY 16 and FY 17 at $2.6 and $2.75M respectively.

Table 1. NSTI Approved Program Funding FY 2016-2018

NSTI Approved Program Funding FY 2016-2018 through FHWA
• **FY 16 $2,620,293**
• **FY 17 $2,744,620**
In an effort to fund the 2018 NSTI programs, the use of Section 504 (e) and unused OJT/SS funds were options.

Source: Email communication from Camille Robinson, FHWA, on behalf of FHWA Center for Workforce Development, August 6, 2019. State by State expenditures for these years can be found in documents in Appendices 5 and 6, also provided in this communication. The 2018 memo explaining the funding program for NSTI dated May 10, 2018 can be found in Appendix 4.

Starting in 2018, FHWA advised Division Administrators and Civil Rights Specialists that 504(e) funds and unused OJT/SS funds could be used to underwrite NSTI programs. The 2018 memo explaining the funding program for NSTI dated May 10, 2018 can be found in Appendix 4. For 2018 and beyond, FHWA's Center for Workforce Development (CTWD) reported that they did not have data on either total expenditures or number of programs funded. An email memo (August 12, 2019) from the NSTI Manager at CTWD explains that the amounts allocated *are based on the SOWs as reviewed and approved by Division Offices and approved by the Secretary of Transportation.* Program oversite is at the state level but CTWD still reviews and issues concurrence. FHWA works on a reimbursable program so final totals of expended amounts for FY 18 and FY 19 cannot be calculated. For this fiscal year *CTWD allocated the amount of contract authority and an equal amount of obligation limitation to States. States were instructed (per the May 23, 2019 memo, See Appendix 3) to ensure the SOW and associated budget reflect the allocated amount listed in the memo. Those funds are made available under 23 USC 140(b) for the specific projects indicated in the State DOT SOW for the FY 2019 OJT/SS and/or NSTI. This was a significant change. Utilizing 504(e) funds is always an option for State DOTs.* There is still be a requirement for programs to submit responses to an evaluation survey that CTWD will collect. CTWD typically collects information on what programs were implemented and general assessments of each program in the fall following program implementation.

The relevance of this overview is that the NSTI represents a significant annual commitment of FHWA and State DOT funds. NSTI is also a program that has, not only a history of almost 30 years, but also of a continuous and somewhat uniform deployment across most states and territories. There is variety in what curriculum is used and program components emphasized, but FHWA guidelines for the program have remained fairly consistent over the years. It is also a program that has purposely targeted populations that are under-represented in the transportation workforce (e.g., young women and girls, students of color). There is a compelling opportunity to review the program to determine how it is meeting its mission and how these efforts could be enhanced.

Table 2. FY2017 NSTI Host sites & 2019 Host Sites

FY 2017 NSTI Host Site Directory

	State / Territory	Host Site	Program Type (H.S./Mid-Sch)	Residential Program	2019 host site
1	Alabama	Tuskegee University	High School		
2	Alabama	Alabama State University	High School	Yes	X
3	Alabama	University of West Alabama	High School	Yes	X
4	American Samoa	University of Virginia (Host site).	High School	Yes	
5	Arizona	Arizona State University	High School	Yes	
6	Arkansas	University of Arkansas @ Little Rock	High School	Yes	X
7	California	Cal State LA University	Middle School		X
8	California	San Jose State University	High School		X
9	Colorado	Colorado State University- Pueblo	Middle School		
10	Commonwhelth of Northern Mariana Islands (CNMI)	Florida A&M University	High School	Yes	X
11	Connecticut	University of Connecticut	High School	Yes	
12	District of Columbia	Howard University	High School		
13	Florida	Florida International	High School		
14	Florida	Florida Gulf Coast University	High School		
15	Florida	University of Miami	High School		
16	Florida	Florida A&M University	High School	Yes	
17	Georgia	Albany State University	High School		X
18	Georgia	Clark Atlanta University	High School		X
19	Guam	Guam Community College	Middle School		X
20	Idaho	Idaho State University	Middle School		
21	Illinois	University of Illinois @ Chicago	High School		
22	Iowa	Eastern Iowa Community College	High School		X
23	Kansas	Donnelly College	High School		
24	Kentucky	Kentucky State University	High School	Yes	
25	Louisiana	Southern University	High School		X
26	Maine	University of Maine	Middle School		X
27	Maryland	University of Maryland Eastern Shore	Middle School		X
28	Maryland	Morgan State University	High School		X
29	Maryland	Northeastern University	High School		
30	Massachusetts	University of Massachusetts Amherst	High School	Yes	
31	Michigan	Ferris State University	High School	Yes	X
32	Michigan	Michigan Technological University	High School	Yes	X
33	Minnesota	University of Minnesota	Middle School		X
34	Mississippi	Alcorn State University	High School	Yes	X
35	Mississippi	Jackson State University	High School	Yes	
36	Mississippi	Mississippi State University	High School	Yes	X
37	Missouri	St. Louis University	High School		
38	Missouri	University of Missouri-Kansas City	High School		
39	Montana	Montana State University – WTI	High School	Yes	
40	Nebraska	Central Community College	High School		X
41	Nevada	University of Nevada, Las Vegas	High School	Yes	X
42	New Hampshire	University of New Hampshire- 1	Middle School	Yes	X
43	New Hampshire	University of New Hampshire- 2	Middle School	Yes	
44	New Jersey	Rowan University	High School		X
45	New Mexico	University of New Mexico	High School	Yes	X
46	New York	University at Buffalo, SUNY	High School		
47	New York	New York City College of Technology	High School		
48	North Carolina	North Carolina A&T State University	High School		
49	North Carolina	Elizabeth City State University	Middle School		
50	North Dakota	University of North Dakota	High School	Yes	
51	Ohio	Central State University	High School	Yes	X
52	Oklahoma	Oklahoma State University	High School	Yes	
53	Oregon	Portland State University	High School	Yes	XX
54	Pennsylvania	Cheyney University	High School	Yes	
55	Puerto Rico	University of Puerto Rico at	High School		X
56	Rhode Island	University of Rhode Island	Middle School		
57	South Carolina	Benedict College	High School	Yes	X
58	South Dakota	South Dakota University	High School	Yes	
59	Tennessee	Tennessee State University	High School	Yes	X
60	Texas	Texas Southern University	High School		X
61	Texas	Lamar State University	High School		X
62	Utah	University of Utah	High School		X
63	Vermont	Vermont Technical College	High School	Yes	
64	Virginia	Hampton University, School of	High School		
65	Virginia	Virginia State University	High School	Yes	X
66	West Virginina	West Virginia State University	Middle School		
67	Wisconsin	College of Menominee Nation	Middle School		X
68	Wisconsin	Lac Courte Oreilles Ojibwa	Middle School		X

New Programs/Host Sites in 2019: University of Hawaii hosted the program for American Samoa, California State University – Stanislaus, Cuesta College, CA, University of Hawaii-Honolulu Community College, Boise State University (ID), Washburn University (KS), Red Lake Nation College (MN), Oregon Institute of Technology, College of the Mainland (TX), Texas State University

Lists were provided by the FHWA NSTI staff at the Center for Transportation Workforce Development. In 2019 additional programs were reported as funded by some state DOTs and state FHWA Civil Rights program managers that did not show up on the FHWA CTWD lists. No data currently exists to verify how many programs were held in 2019 or how much funding was dedicated to NSTI in 2019.

The new funding structure still relies on FHWA to provide timely notification of funding availability, but provides more direct responsibility for allocation on the state DOT and FHWA state Civil Rights program managers. If FHWA is able to provide notice of funding availability in a timely manner, it may address some of the administrative issues that have been cited in interviews, survey response and communications with NSTI coordinators. These include late notification of funding availability, causing program cancelations in a number of instances for one or more summers. While devolving the program administration to the state level may resolve some administrative issues, it could also have the effect of making on going evaluation of the individual programs and their combined impact even more difficult. It may also distance the individual NSTI programs from networking with one another or sharing resources and best practices.

1.2 Efforts to evaluate success

The USDOT has funded the NSTI summer enrichment programs for more than 25 years (Gottlieb & McClure, 2019), yet there is no in-depth understanding of its longitudinal outcome in influencing students to advance in transportation-related career pathways. Annual program evaluations capture participant impressions at the end of the program, but no program reports a systematic approach to follow students for even several years as they make post-secondary education and training decisions, and select career paths. The 2016 annual survey of NSTI program hosts, administered by FHWA, found that 69% of programs indicated some effort toward tracking students who go into transportation-related studies or careers (J. Gottlieb, personal communication, March 30, 2018). While there is self-reporting of tracking resulting student career choice pathways, there are no details provided on how these follow-up methods are deployed, participation rates, or over what time period the data are collected in the FHWA collected data.

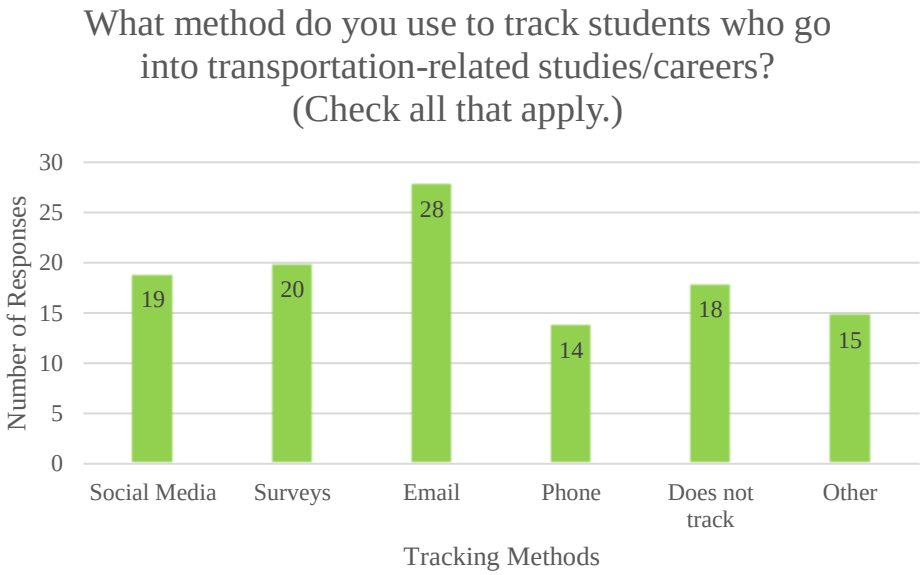


Figure 1. FHWA Student Tracking Survey Results for NSTI Fiscal Year 2016.

There are positive anecdotal accounts of individuals who credit NSTI in directing them to transportation careers (Gottlieb & McClure, 2019), which creates a loose correlation between career or educational path and attending an informational program such as NSTI (Jasek, 2010). However, evidence that provides a clear correlation between program participation and later choices is absent. Given the limited literature that specifically examines transportation career choice and promotion in an out-of-school setting, this review has incorporated the broader growing STEM career choice literature. With the popularity of STEM curriculum rising in schools, and the urgency of replacing retiring workers (Hall et al., 2011), there have been a number of studies of STEM enrichment programs including those that review their effectiveness. Many of these reports describe a program and its successes and challenges, but do not have longitudinal data to support long-term change observed in student choice of future education, training or career path. Researchers have found that K-12 summer programs have helped increase interest in engineering disciplines (Yilmaz et al., 2010), but there has been sparse research to determine the specific aspects of programs that may contribute to STEM interest (Dabney et al., 2011). A complete literature review, conducted as a preliminary step in this research effort, is available in Appendix I of this report.

1.3 Goal of this study and report

The NSTI initiative was created to address future workforce needs by **ensuring that the transportation industry has a well-trained, qualified, and diversified workforce**. Since the beginning of the NSTI program, the stated rationale for the program was that the industry was facing an unprecedented wave of retirements and there was a need to ensure that a new generation of workers would be attracted to and prepared for the challenges facing our transportation systems. This theme has continued to be echoed in every major transportation workforce publication and initiative since. It is one of the challenges that NSTI consciously addresses each year, as in the 2019 Request for Proposals to universities from the Missouri DOT:

> *An unprecedented number of transportation employees are or will soon become eligible for retirement. This creates a need for and provides a great opportunity to prepare youth for future transportation careers. The STI program is designed to introduce secondary school students to all modes of transportation careers and encourage them to pursue transportation-related courses of study at the college or university level.*
>
> *https://www.modot.org/sites/default/files/documents/Request%20for%20Proposal-National%20Summer%20Transportation%20Institute%20%28NSTI%29%202019.pdf (accessed 4/29/2019)*

The questions this effort sets out to address includes:

- How have these programs meet their stated mission, introducing and orienting significant numbers of youth, motivating them to pursue post-secondary educational and training programs and career paths that address the ever-present need for new workers at all levels in the transportation industry?
- How do we measure that impact?
- What are the best practices for tracking what choices students make and career paths they follow once they graduate from an NSTI program?
- What are the most important factors in the various program approaches from NSTI initiatives that are linked to actual success?
- How can NSTI as both a national program and as a network of program providers enhance the resources, network, and opportunities to increase the impact of the program?

2. Aligning Goals and Outcomes in NSTI Programs

2.1 Tracking Outcomes

There have been several documented efforts at a longer-term assessment approach to measure the impact of NSTI participation. Aleong and Aleong (2008) in their evaluation of outcomes from two NSTI programs (Delaware and Vermont) state that the goals of the funder must be considered in evaluation; do students go on to pursue studies related to transportation at the post-secondary level? They conclude that while there is a need to develop measurements to determine if the programs are having any long-term impact in line with the funding intent, it is not feasible on the individual program level. Outside the literature, Montana State, Prairie View A&M University, and Hampton University have shared examples of their attempts to track outcomes and create more regular contact with students who participated in the NSTI program upon or after graduation from high school to determine how NSTI might have influenced them, and what choices they were making for their continuing education and careers.

Montana State University - Bozeman

The program at Montana State has conducted and reported on a survey of NSTI graduates in their senior year. In order to gauge the impact that the NSTI had on participants' career and college choices after high school, a survey was emailed and mailed to former NSTI participants the summer following the completion of their senior year in high school. In total, 130 participants from the 2007-2017 programs had graduated high school by summer 2017. Of the 130 graduates, 49 students responded to the survey (a 38% survey success rate) (Gallagher 2015, 2019).

Table 3. Montana NSTI survey of graduates at the conclusion of their senior year in High School.

A. Post-Secondary Enrollment Choice		
2-yr School	2	
4-yr school	40	
Employed	2	

B. NSTI Influence		
Did you apply to college?	47	Yes
	2	No
Are you currently enrolled in college?	46	Yes
	3	No
Did the STI experience impact your decision to attend college?	23	Yes
	23	No
Did your STI experience help you in choosing a major?	33	Yes
	9	No
Did your STI experience help prepare you for college entrance?	28	Yes
	14	No

C. Reported Area of Study	
Eng-gen	3
Civil Eng	5
Electrical Eng	6
Mech Eng	12
Chem Eng	2
Industrial Eng	1
Mining Eng	1
Aerospace Eng	1
Transport Com – rail (AA)	1
Computer Science	2
Wildlife Biology	1
Chemistry	1
Business	1
Accounting	1
Physics	1
Sociology	1
History	1
Pre-med	1
Gen Studies	1

Prairie View A&M University (PVAMU) (TX)
PVAMU had the goal of creating a database of all the STI participants who graduated in the last 10 years and establish communication links. The program was able to track former graduates as part of its goal to monitor their education and careers beyond the program and found that 100 percent of the STI Scholars program graduates that could be tracked (seven out of eight) are pursuing higher education and more than 70 percent are pursuing higher education in science, technology, engineering, and mathematics (STEM)-related fields. The eight students graduated from the 2008, 2009, and 2010 programs. One student was a senior in the Civil Engineering Program at PVAMU and has a 4.0 CGPA. Of the two students who are in non-STEM fields, one is pursuing finance and the other, broadcast journalism.

Hampton University (VA)
A survey was mailed to former NSTI participants to ascertain the perceived educational value of the program. A total of 37 participants that responded to the survey reported improvement in various skills sets. The exposure to key personnel in the FHWA and VDOT coupled with mentoring and academic enhancement provided by the program's staff was found to be effective for the students that participated in the NSTI Program. Over 60% of the respondents selected science, technology, engineering and mathematics (STEM) related majors in the college. The exposure to key personnel in the FHWA and VDOT coupled with mentoring and academic enhancement provided by the program's staff was found effective in enhancing math and technology scores for participants in pursuing higher education including in transportation related fields.

Table 4. Hampton University NSTI graduates choice of post-secondary study field.

HU NSTI graduates choice of post-secondary study field					
Engineering	32%	Business	14%	Bio-Chem	5%
Other	19%	Liberal Arts	8%	Biology	3%
Computer Science	14%	Transportation	5%		

2.2 Issues with Long-term tracking of NSTI graduates & Opportunities

Tracking student choices from their middle school and high school years into post-secondary education and training, and then career paths is beset with a number of difficulties. Among those most commonly cited by NSTI program directors were limited time, staffing, and funding to support any rigorous program of long-term engagement with the students, who may or may not be from local communities, and who may or may not chose to attend the NSTI host institution for their post-secondary pursuits. Long term tracking to determine student post-secondary choices requires funding that would support a multi-year engagement and communications effort. NSTI funding is committed annually and while some NSTI hosts have conducted programs for the past 20 years there is no guarantee that the program will be awarded to the same institution year to year. Even if there were a long-term commitment to a host site, the funding traditionally awarded is not adequate to conduct individual tracking efforts.

There are also logistical difficulties with the NSTI participant demographic. Students do not always have physical or email addresses or phone numbers, or social media accounts that are consistent through high school or after graduation. NSTI programs often engage a relatively small group of students on an annual basis (20-30). These small numbers contribute to difficulties of maintaining broad enough contact to have a meaningful sample from which to derive conclusions.

Other difficulties reported was lack of appropriate data management and/or collection. For some programs, data was not collected that would later enable them to contact students. For others, data was in an inaccessible format, or stored multiple different ways that would make it labor intensive to combine. With program directors changing over the years, and with some programs running for almost two decades, data storage has changed from written to digital for some programs and from one software to another. Most of the programs do not have the staff or time available to organize and clean their contact lists and data. This is the current challenge for the UNH NSTI program that has been running for over a decade as there has been a change in documenting and storing old rosters. As program coordinators change, the organization of data often also changes. This can be an extensive and demanding task for a part time director to sort through and organize.

Two of the tracking exercises noted in section 2.1 were conducted as part of a wider University Transportation Center supported research initiative. In Montana, additional staff capacity was afforded by the Western Transportation Institute to conduct the annual survey of NSTI participants graduating from High School. Many NSTI programs are serving from 15-25 students a year so the total population of any single program will be small, even over a number of years. Even a good survey return, such as achieved by Montana only provide for 45 data points over 8 program years. While directionally the results appear to be positive in students moving on to post-secondary study, and choosing STEM fields that can be beneficial to future transportation related careers this does not provide us with a consistent or clear set of results.

3. Research Methods

3.1 Program Interviews

During the initial phase of this study, ten program directors in organizations with out-of-school transportation STEM programs were interviewed to gather insight about their tracking and engagement methods. Interview was chosen as the preliminary data-gathering method because no other study of NSTI or similar programs has examined student tracking. Initial exploration was needed in order to craft more targeted data collection for the following phases of the project. Program coordinators or directors were most often the interviewee, with others in the organization sometimes participating. An effort was made to select a variety of programs to gather a range of engagement and tracking methods and promising practices. Programs were diverse in location, years run, target age group, and more. NSTI programs served as the primary target for investigation as they focus on transportation and occur across most states, have a common goal, guidelines on program design and reporting, as well as a 25-year history. A two-year period in which NSTI funding (FY17, FY18) communication was interrupted created a high level of uncertainty and concern among university partners who traditionally implement the programs. Outreach to past NSTI programs was challenging due to this hiatus in funding, even though some host schools found different resources to maintain some aspect of their former NSTI programming. As program funding was advanced again in FY19, a focus on these programs is timely. This report focuses primarily on NSTI survey results, discussed in the following section.

3.2 NSTI Survey

With the renewed clarity of a funding process for NSTI programs, the decision was made to gather a wider range of responses by surveying the directory list of FY17 and FY19 programs. Survey questions (See Appendix 2) were developed using insight from the previous program interviews. Four NSTI program directors volunteered to pre-test the survey. Recruitment was done via direct email contact using email addresses obtained from the directories provided by FHWA. Responses were gathered from June to the beginning of September 2019 using SurveyMonkey. In total, 53 unique responses were collected, each representing a single NSTI program. Duplicate responses or incomplete survey responses were removed from the sample. 81 programs were initially contacted using the directory information and one program of these had its email returned due to incorrect contact information. Of these 81 contacts, 12 were new programs; an additional 3 new programs that were not in the initial directory contact list responded to the survey. Thus, the response rate was approximately 63 percent (53 responses/84 contacts).

3.3 NSTI Survey Follow-Up

Survey respondents were asked if they would like to participate further. 41 of the 53 respondents gave consent for further participation. A follow-up communication was sent to the emails provided by participants and six responded with written answers to the following questions that were posed to them; those who did not indicate that they tracked students were only given question two to answer:

1. In the survey we asked about current tracking methods and how you might ideally track students. We would like you to further expand on this.
    a. What resources would help you to track students?
    b. What metrics do you use to track students?
    c. What tracking methods were most effective? And, which were not so effective?

    d. Do you have results from your tracking activities? What are they? Can you share them with us in aggregate?
2. What activities, curriculum, field trips, etc. have been most beneficial for directing students to further education, training, or career opportunities in transportation? We welcome you to include attachments and links to your materials (program schedules, curriculum/activities, field trip agendas, presentations, hands-on or other innovative methods).

The option was given to provide a written response or have a phone conversation; one of the six follow-up participants chose the latter. As the survey focused primarily on tracking methods, the follow-up conversations served to also gather information on engagement methods.

3.4 NSTI Focused Conversation

The final method for analysis involved gathering together a small but diverse group of NSTI program directors to discuss tracking and engagement. Programs involved in this conversation were chosen based on survey results regarding tracking, their own enthusiasm for improving NSTI, and respondent engagement with study follow-up. This brain-storming session was intended to provide additional content for a future webinar series and was focused on answering the following questions:

- How can NSTI programs direct students to further education, training, and career opportunities in transportation?
- What are ideas for implementable tracking practices including metrics and methods?
- What program elements are most effective in guiding students to the transportation field?
- How can the practices, metrics, and methods of the NSTI programs be used to align FHWA and transportation career development for middle and high school students?

The conversation lasted about one hour and permitted the three programs to give a quick introduction and program overview to others. The remainder of this time was spent on discussing the questions previously referenced.

4. Preliminary Findings

4.1 The NSTI Survey Sample

Survey responses were composed of respondents from 35 states and 1 U.S. territory. Of these programs, 22 ran middle school programs (two which were residential) and all ran high school programs (12 high school programs were residential). Forty-four of the 53 respondents had programs operating during the summer of 2019, though nine did not continue to operate after FY17 funding. While the NSTI program has been operating across the nation for over 20 years, the average years of operation was about 9, with a minimum of 1 year and a maximum of 27. Most programs tended to serve 40 students or less each summer (Table 5).

Table 5. Number of students served annually during an NSTI program.

Students Served	Frequency	Percent
0 to 20	28	53%
21 to 40	18	34%
41 to 60	5	9%
More than 60	2	4%
Total	53	100%

Many of the programs also run similar or related programing (Table 6). Twenty programs focus solely on their NSTI programs, but others organized a variety of other STEM or transportation-related events throughout the year.

Table 6. Other types of programming run by NSTI program directors.

Program Type	Frequency	Percent
After School	6	11%
Single Event (e.g. career fair)	15	28%
Reoccurring Event (e.g. seminar series)	12	23%
Other Non-NSTI Summer Program	23	43%

As for overall program goals, respondents were asked to rank several focus areas from 1 to 6 with 1 signifying the most important item. In order of most focus to least these included: STEM skills (average score of 2.21), engineering (2.9), career awareness (2.33), college prep (4.15), intelligent transportation systems (ITS) (4.2), and construction (4.65). Additionally, about 35 percent of respondents rated STEM skills as the number one focus of their NSTI program and 30 percent of respondents ranked STEM skills as the 2nd most important focus. In order to get a better understanding of the focus of each program, respondents were asked to list their top three program objectives. Responses for each of the top three objectives were coded and divided into two categories: subjects and actions. Table 7 shows the number of mentions for each of the different program subjects and actions.

Table 7. Number of mentions from top three program objectives.

Subjects	Number of Mentions
Active Transportation	1
Bridges	1
Coastal Transportation	1
Communication & Teamwork	5
Engineering (any type)	19
General Aviation	4
Geographic Information Systems	2
Highway Construction	5
Interpersonal & Soft Skills	2
Life Skills	1
Personal Development & Enrichment	2
Transportation Safety	1
SAT Prep	1
STEM Skills	57
Study Skills	2
Traffic Management	1
Transportation Industry (general)	45
Unmanned Aerial Systems (UAS)	1
Workforce Development	1
Actions	Number of Mentions
Attract and encourage participants to specific careers; build or increase specific career interest	27
Career exposure and awareness of opportunities	50
Career readiness (overall)	5
Hands-on Learning	9
Impact underrepresented students	8
Motivate participants to continue to higher education	19
Pass a college level class	1

As expected, STEM skills, the transportation industry overall, and engineering were the top three subject areas of focus for NSTI programs. The top goals of NSTI programs that were surveyed were providing transportation career exposure and an awareness of related opportunities, attracting and encouraging participants to specific careers or career interests (e.g. engineering or highway construction), and motivating students to continue on to higher education. With this third goal, some programs seemed to deem the program a success if the student continued on to any higher education, though most programs aimed to have a student enroll in college with a transportation-related major.

4.2 Engagement of Students

Engagement methods were not directly examined using the survey, but follow-up emails with participants showed a common theme. These items were in agreement with findings from the initial set of interviews with NSTI program directors and other non-NSTI programs. These included:

- Hands-on projects
- Field trips (overnight and day trips)

- Career exploration with transportation professionals (including any one-on-one interaction and career path "interviewing")
- Simulation lessons (flying, driving, etc.)

Lectures and presentations tended to be the least interesting to students based on program director feedback. However, if the speakers knew how to engage their audience with age-appropriate content, then this was a case where bringing in speakers could also engage students.

4.3 Tracking Student career and study choices

Tracking was the focus of the survey as this is one of the ways we can understand how the program affects students. Although NSTI is an FHWA program, tracking students and program results is not centralized, and there is only a minimal requirement for program feedback. In the survey, participants were asked whether they tracked students after the program has ended (Table 8)

Table 8. Programs that track students after conclusion of program

Do you track?	Frequency	Percent
No, and we do not plan to	2	4%
No, but we would like to in the future	22	41%
No, but we have in the past	9	17%
Yes	19	36%
Missing Response	1	2%

A majority of respondents were not currently tracking but that was something they wanted to do in the future. Only about 36 percent of the programs were currently tracking their students to some degree. Those who tracked were asked to rate their tracking methods on a scale of 0 (completely ineffective) to 10 (extremely effective). The average self-reported success rating was almost 6 and the median was 5. The maximum score given was 9 and the minimum was 3 (n=19). When these individual respondents' answers were examined, there did not seem to be a clear difference between those who rated their tracking at 3 and those who rating their tracking at 9.

Tracking methods were also solicited from those who answered "yes" to currently tracking (Table 9). A category for "Other" was provided and several respondents entered written responses that included tracking students through university records (1), through the National Student Clearinghouse (2), and using a messaging app (1).

Table 9. Number of respondents who used the following tracking methods (percentage)

Facebook	LinkedIn	Email	Call	Text Message	Postal Mail
8 (15%)	2 (4%)	17 (32%)	9 (17%)	2 (4%)	6 (11%)

N=53; Note: question was "check all that apply"

Finally, respondents were asked how they would *ideally* track students post program if resources (financial, time, or otherwise) were not an issue. All respondents, whether they were currently tracking or not, responded (n=53). The answers are summarized below:

- Survey: through email, social media, phone, or postal mail. One specific strategy mentioned was teaming up with another NSTI program to share resources; another idea suggested using parent emails to send a survey

- In-person check-ins at students' schools; this could be in the form of alumni events or meet-ups
- Continued academic year programming and interactions; this could include a welcome back session for students
- Assign specific outreach staff tasked with tracking (instead of placing this duty on program directors)
- In-person or phone interviews with students
- Provide college scholarship information that would encourage students to stay in touch
- Follow-up summer programs or NSTI alumni-specific programs
- Utilize university recruitment tools; partner with host university admissions department
- Utilize the National Student Clearinghouse
- Create dedicated website with individual student login
- Text students for updates (e.g. use of remind 101 messenger app at remind.com)
- Guidance counselor follow-ups

4.4 Focused Conversations with NSTI Program Directors

A follow-up focused conversation with NSTI program managers who shared interest and availability from the survey was conducted as a group by phone on September 19, 2019. Programs represented included Elizabeth City State University, NC, San Jose University, CA, and Michigan Tech University. The conversation focused on four areas and responses are summarized below.

1. Key group to attract are possible first-generation college bound student
    - NSTI can give them a college live experience
    - In the case of SJU they offer NSTI as a 3-week intensive that can translate to a 3-credit required college course acceptable at any CA state U
    - NSTI format offers a flexible, hands-on, learning experience through field trips and activities that provide for wide interaction with professionals from a number of transportation disciplines, providing different stories and approaches to careers in transportation from a variety of folks, some of which they can identify with directly.
    - Expanding the idea of what transportation is as a discipline/career and what the outcomes are for the communities where they live
    - Expands the idea of the somewhat circuitous nature that career paths can take, as opposed to simple linear paths with clear outcomes.

2. NSTI can be part of an important trajectory of extra-curricular exploration for students
    - Students participating in an NSTI, especially in middle school, can be pointed to other summer STEM oriented summer programs, and in the case of ECSU can apply to participate in the High School NSTI as a follow-up.
    - Participation in other summer or after-school informal STEM programs is one metric that could be applied to a tracking rubric to indicate a positive outcome for NSTI.

3. Tracking students after NSTI
    - When NSTI participants apply to and attend the host college they can be easily tracked. In some cases (SJU) when participating in NSTI they are assigned a college ID number.
    - When tracked into the host college students can be called together of reunions or other common gatherings.
    - In tracking them at other colleges, the Nation Clearinghouse can be used, but NSTI student cohorts are small and this can be difficult and expensive to pursue.

- One method is to keep parent contact information for each cohort and follow up through that. Can communicate when the cohort is in their senior year, to determine what post-secondary choices are being made. One program (Elizabeth City State University) uses Remind.com to keep in touch with parents during the program. This is also used for occasional post-program contact with parents.
- Students can come from anywhere in a large state, or from around the country to some programs, so they are scattered and the tools to follow-up with them are limited.
- At some colleges, many different summer high school/middle school STEM programs are offered so NSTI gets mixed into a larger cohort that is not always easy to separate out.
- In many cases "tracking" is institutionally specific

4. Helpful NSTI networking tools to develop:
    - Listing of all programs and contacts annually
    - Database of
        - Curricular ideas
        - Activity guides
        - Field trip guides
        - Ideas for competitions
        - Partner networks
        - Ideas for tracking and evaluation
    - Specific Middle School program network and resources (Middle school students have different needs and interests and approaches to them through NSTI requires different strategies if their interests are to develop through High School and into post-secondary choices)
    - Occasional webinar on promising practices
    - Additional funding ideas for supplemental activity funding

5. Findings: Increasing Program Capacities

5.1 Tracking Student Future Choices

Tracking students after a program has ended not only has value to the FHWA CTWD but also has value to program directors and host institutions. While there is a shared perception of value most programs are not conducting rigorous outreach to students to understand what choices they are making as they continue in secondary education, or move to post-secondary programs.

Through the NSTI survey, interviews, and conversations, all program directors thought that it was important to track students to understand if their program was truly getting students interested in STEM and transportation careers, though many had reservations about doing so. In general, the reasons programs reported that tracking was important include:

- Understanding if the experience was meaningful enough to affect a student's trajectory;
- Understanding how a program impacts a student's awareness of STEM or transportation fields;
- Understanding how a program may affect their self-perception (e.g. engineering identity)

For some program directors, not only were they curious where students would end up, even if it were not college, but they found it beneficial to have this information to report back to industry and private sponsors who contributed time, and in some cases funding, for student activities. Only 36% of NSTI survey respondents indicated that they were in some what actively seeking to track student actions and choices after the program. Those who tracked were asked to rate their tracking methods on a scale of 0 (completely ineffective) to 10 (extremely effective). The average self-reported success rating was almost 6 and the median was 5. The maximum score given was 9 and the minimum was 3 (n=19). When these individual respondents' answers were examined, there did not seem to be a clear difference between those who rated their tracking at 3 and those who rating their tracking at 9.

Finally, respondents were asked how they would *ideally* track students post program if resources (financial, time, or otherwise) were not an issue. All respondents, whether they were currently tracking or not, responded (n=53). The answers are summarized below:

- Survey: through email, social media, phone, or postal mail. One specific strategy mentioned was teaming up with another NSTI program to share resources; another idea suggested using parent emails to send a survey
- In-person check-ins at students' schools; this could be in the form of alumni events or meet-ups
- Continued academic year programming and interactions; this could include a welcome back session for students
- Assign specific outreach staff tasked with tracking (instead of placing this duty on program directors)
- In-person or phone interviews with students
- Provide college scholarship information that would encourage students to stay in touch
- Follow-up summer programs or NSTI alumni-specific programs
- Utilize university recruitment tools; partner with host university admissions department
- Utilize the National Student Clearinghouse
- Create dedicated website with individual student login
- Text students for updates (e.g. use of remind 101 messenger app at remind.com)
- Guidance counselor follow-ups

5.2 Barriers to evaluation outcomes and Challenges to tracking Students

Among the most common barriers to program evaluation were **limited staffing**, **time**, and **funding** for more thorough evaluation and setting longer term tracking and metrics**.** These issues compound one another as there are often few staff who also do not have the time to seek out additional funding sources.

For one NSTI program, organizing the summer institutes is a continuous process. The program director here is only technically paid for 6 weeks of planning time, but does far more than that. The program director has tried out different program management models including hiring a part-time administrative assistant. This year they hired a part time assistant director, and this method has been working much better. The assistant director not only manages the day-to-day operations but also helps in brainstorming program ideas. The previous administrative assistant also did not have a STEM background. In order to evaluate program success long-term, the program director said they would need to hire someone part-time to do this, therefore resources are the biggest barrier. The director stressed that the program has the ideas and energy to do the evaluation and tracking, but they would need to hire someone with expertise in evaluation, which could be very expensive. This is a difficult situation when trying to keep the program cost down for the students. (Note, this program host, like others, runs a number of summer programs including NSTI. This arrangement allows the limited NSTI funding to be stretched, offering those students a free program, but there is still a shortfall at most institutions to take evaluation past the summer months).

Another NSTI program director said that the program gets regular positive feedback from both parents and participants, and especially industry partners who participate in the program. In order to look at long-term impact, the program would need significantly more resources, both in funding and staffing. With no long-term or stable funding source or commitment, there is little incentive for program directors to invest in any type of tracking other than very short- term evaluation required by FHWA (for NSTI programs).

NSTI, and most other programs, are funded and planned on an annual basis. There is no guarantee that programs will receive funding for the next year, or the year after, so establishing a program that would require additional expenditure and staffing for tracking student results and decisions over time does not make programmatic or financial sense.

Throughout the survey results, interviews, and discussions it was clear that tracking students was difficult for programs to do and this was further compounded as programs were not required to do so, therefore often relegating it to the back burner. The common challenge of staying in touch with students after the program ends was echoed across all programs. One workaround several programs mentioned, has been contacting the parents of former participants. Most of the parents have shared a positive opinion of the program, and are more than willing to share their student's new email address.

Other difficulties noted was lack of appropriate data management and/or collection. For some programs, data was not collected that would later enable them to contact students. For others, data was in an inaccessible format, or stored multiple different ways that would make it labor intensive to combine. With program directors changing over the years, and with some programs running for almost two decades, data storage has changed from written to digital for some programs and from one software to another. Most of the programs do not have the staff or time available to organize and clean their contact lists and data. One NSTI program that has been running for more than a decade noted that there have been several changes in documenting and storing old student rosters at the program and

university levels. Also, as program coordinators change, the organization of data often also changes. This can be an extensive and demanding task for a part time director to sort through and organize.

Program directors also shared that requirements for tracking and overall evaluation have become less rigorous. Long-time program directors reported that fewer metrics are required for collection and some view the survey, from FHWA's NSTI program manager, only as a way to gain approval for continued participation in the program.

Key Points:

1. Just as NSTI programs employ a diversity of methods to engage students, so too is it likely that a more rigorous and widespread effort to evaluate the effectiveness of NSTI and document future choices by NSTI grads will be a result of deploying a mixed methods approach that will allow programs to make appropriate choices relevant to their local situation and resource base.
2. Programs lack adequate and stable funding sources to be able to conduct evaluations.
3. Program staff typically do not have expertise in program evaluation.
4. Even if program staff conduct student evaluations, there is limited time to analyze the data to examine outcomes; most program coordinators and staff are part-time.
5. Tracking students longitudinally is difficult for programs that lack the appropriate time, staff, and funding.
6. Challenges with data occur when program directors and software or data organization change.

5.3 Implementable practices to track student choices and career paths

Below are some of the methods either employed by programs reviewed, or in development by them. This is the first level of review of possible methods for further development.

Direct Survey or Interviews of past students
Identifying students 6 month, 1, 2, or 3 years post-program has been cited as a desired tracking tactic by many of the program directors. It has the advantage of engaging students directly and acquiring more specific information and unmediated impressions. Few programs engage in this though for many reasons (lack of funding to pursue; lack of good student contact information post-graduation; problematic nature of researching a "vulnerable population." One proposal was to use direct follow-up with the students either by phone call or email around the time of their graduation. They would like to get more detailed information about their post high school intentions such as what major they are considering.

Social Media Avenues
Using social media platforms to stay in contact with past participants. Setting up an alumni Facebook group as a method for follow-up is a common method. The effectiveness of this approach can be limited (as high school students reported to program directors, they now consider Facebook as a social media platform for "old people"). Helping students set up and use a LinkedIn account and creating a group LinkedIn Page for programs has been considered but no examples were identified. Connecting students to a list serve or notice service that can provide information on post-secondary opportunities, e.g., a scholarship foundation provides an incentive for students to stay in touch.

University Registration Systems
Host universities can sign up NSTI students in their "future student" registry as a way of reaching out to them about future educational opportunities. At minimum, they can look back to compare who currently attends the university or college who also participated in the NSTI.

Alumni Support Programs
Universities and colleges who host NSTI can develop a welcome program for former NSTI students attending the school and set up a system so that they can stay in contact and the students will hopefully persist through the entire degree. An alumni group or reunion events for both NSTI alum who attend as students and others who did not end up attending the school is another idea under consideration.

Parental Contact
Students, under the age of 18 are difficult to track for many reasons, and any academic program seeking to do this will have to adhere to strict Human Subject Research standards which can be onerous, especially for a lightly funded program without year-round staff, or funding to support evaluation and planning. Parents often have to sign permissions for students to participate in programs and provide contact information that might be more stable than the students. No program that was reviewed used parents as a primary source of information for tracking students in their further academic and career pursuits, but parents could be a stable source of future contact information.

National Student Clearinghouse
The National Student Clearinghouse, a company with a host of services available to universities that can produce reports that contain information about high school graduates such as what college or university they attended, their major, and year of graduation, is national service that could be used to help inform on student choices. A large percentage of universities and colleges across the United States use and participate in this service, as they contribute their own data. Unfortunately, there does not seem to be a central communication point at most universities between admissions, who would have access to the Clearinghouse, and the various outreach programs on campus.

Create a centralized NSTI student tracking system within FHWA
A centralized function would eliminate the program by program problem with funding and continuity, and lead to standardized information/data collected from students for programs across the country. This would provide a national "average" for all NSTI programs to work towards, whether that is including a certain percentage of female or minority students, increasing STEM interest to a certain level, or improving base-knowledge of college and career options related to STEM and transportation. It could best answer some key questions, such as: What parts of NSTI are similar between all of the programs, and what are programs doing that differ among one another? Understanding the answers to these questions may help future NSTI programs collaborate better.

Some initial guidance includes:

1. High school graduates can be transient and difficult to track using traditional methods such as emailing. Social media may be one way to relate to students and encourage remaining in contact with the program, however, platforms such as Facebook may not be effective and alternative platforms, such as LinkedIn, while it may align with future career goals and sustain consistent usage over time, may be hard to effectively set up within the confines of these programs.
2. Programs may find it beneficial to partner with their on-campus resources, such as admissions, which may be able to better reach students and their information.

3. It is likely that a mixed methods approach will be needed to maintain contact with as many students as possible.
4. All of these methods require financial resource expenditures that are currently not available under the NSTI program.

5.4 Program elements most effective in guiding students to the transportation field

NSTI and other informal career education programs at the middle and high school level employ a mixed methods approach with various program elements.

Field Trips: Field trips, as a method of engagement, are regularly cited as having a significant impact on students. In many cases, NSTI students are exposed to new transportation modes and technologies (e.g., aviation, aerospace, transit, rail) that may not be part of their experience at home. Field trips with a tour guide are very popular with students. Students can get a behind-the-scenes look at facilities and meet transportation workers in their work environment. Being on-site can stimulate the students' interest and provides a chance to speak with professionals about their jobs on their actual job site, which may be more impactful than listening to presentations in an auditorium or classroom.

Presentations: The use of lectures by skilled presenters can be an asset to programs. The best presentation still needs to provide an element of engagement to be effective., demonstrating real-world scenarios and problem-solving approaches to students. Hearing the "career story" from professionals in different transportation fields, and being exposed to the various, and sometimes less conventional, paths that individuals follow to land in their current career is an effective method to help students feel that they too can enter STEM or transportation-related fields.

Projects and Activities: All programs note that their curriculum is rich in projects and activities as a key piece in helping students learn about STEM and transportation-related careers. Capstone projects were one device used to engage high school students especially, as they have the chance to focus on a single area in depth. Students develop their ideas while practicing teamwork and using creativity. Topics are usually assigned (due to the short timeframe of the program), but students are encouraged to be as creative as they can when developing their final presentation. In the classroom, hands-on activities are cited as key learning elements to keep students active and let them be in the driver's seat.

Engagement was frequently mentioned as a process that needed to extend beyond the end of the NSTI program for students, and this related back to many of the methods employed for some kind of tracking of student choices at the secondary and post-secondary level. Connecting students to a variety of activities and opportunities was an important way to reinforce learning and interest at the NSTI. Some of the reported post NSTI engagement options included:

- Job shadowing with the state DOT or local roads department, or one of the private employers who participated as a field trip site or guest speaker;
- Connection to internship or service learning projects at their high school related to transportation;
- Introduction to a school club or program sponsored by a national organization (e.g., ASCE, ITE, NABE);
- Recommendation to attend a different but related STEM summer program the next year;
- College choice guidance programs.

An effective NSTI learning program can also draw on a number of studies that are relevant to this education and career orientation program. Some of these studies include:

- Glitman (2009) identified strategies for creating cross-organization and program partnerships that enabled the STI to serve a diverse student population, meeting the dual objectives of exposing students to career opportunities within the transportation industry and, to provide students with a college experience.
- Nezamuddin & Pande (2014) tested the framework for executing near-peer facilitated activities to enhance the learning process and outcomes.
- Pollard-Mitchell, Talor, and Martin (2012) explore the role of mentors, assigned to students over a 4-week summer program, acted as an effective strategy to better prepare and encourage consideration of post-secondary education and training in the various fields of transportation.
- Aleong and Aleong (2011) discuss the different problem-based learning methods that can be effective.
- Kommalapati, Ramalingam & Stockton (2012) developed a bridge program between the NSTI, high schools and post-secondary institutions, and multiple partnerships to craft a streamlined academic pathway for students to follow starting with their junior year in high school and extending through their graduate education.

5.5 Aligning with other resources for more effective future programs

A set of findings not within the original scope but that have surfaced in multiple conversations and responses from NSTI managers are import to share as part of this process as they relate to building a sustainable and mutually reinforcing program community that will be necessary for ongoing reliable tracking of program effectiveness and future choices of students who have attended NSTI.

a. **Community of practice**

   There is no active engagement between program managers and their institutions, with other program managers and institutions that host NSTI. The creation of a virtual community of practice could be as simple as sharing out the contact information and websites of all programs after they have been selected to encourage contact between programs; hosting of semi-annual webinars for all NSTI program managers, one in the fall focused on program evaluation, and one in the spring focused on innovations in curriculum and new resources would be low cost, high value activities. Other strategies could be generated through engagement with the NSTI managers.

b. **Data base of shared resources**

   Curriculum, activities, student recruitment practices, student outcomes tracking, and other program elements have been developed program-by-program. There are currently no sharing resources for NSTI programs to see what other programs offer, or have created, affording the chance to share and learn from each other. This would involve working with program directors to gather material and permission to share with other programs. Programs may have a lot to learn from one another. This repository may also include a forum of tried and “not so true” methods or activities – things that didn’t go as planned but that with collective input and improvement, could prove to be a valuable new activity, resource, etc.

c. **Playbook for using existing resources**

   In addition to the resources developed in NSTI programs, a number of other relevant resources have been created, many of which grew out of other FHWA sponsored programs, including Fast Forward and Transportationcarees.org. While some of these

are linked to the FHWA CTWD web site they are not directly linked to NSTI resources. University Transportation Centers (UTCs) have also developed a number of resources at the K-12 level that are appropriate for deployment in NSTI programs (e.g., STRIDE). Making access to, and promoting, these resources may encourage NSTI programs to help evaluate those resources and improve them and share out their own resources.

d. Ongoing programming for students

Develop and field a set of monthly webinars during the school year, continuing the conversations and learning started in NSTI. Offer participation to NSTI alum and the teachers from the schools who wrote their recommendations. Keeping students engaged after the program increases the likelihood that awareness and interest generated during NSTI will be sustained and grow, and offers a way to have students voluntarily keep connected to the program allowing for tracking of their future direction and outcomes with a minimal effort at longer term evaluation of the program.

6. Conclusions and next steps

A number of recommendation and conclusions emerging from the research and engagement findings have been laid out in each of the sections. The following is a summary of those items to provide a quick reference and resource for the development of a future action plan.

How have these programs meet their stated mission, introducing and orienting significant numbers of youth, motivating them to pursue post-secondary educational and training programs and career paths that address the ever-present need for new workers at all levels in the transportation industry?

The simple answer is that the NSTI program has not been able to surface definitive evidence indicating that it is meeting its mission. That being said, this conclusion is largely shared by numerous other STEM programs offered outside of the school setter. There are a number of barriers that were documented, many of which can be addressed.

- Tracking student choices from their middle school and high school years into post-secondary education and training, and then career paths is beset with a number of difficulties. Among those most commonly cited by NSTI program directors were limited time, staffing, and funding to support any rigorous program of long-term engagement with the students to determine post-secondary choices.
- NSTI funding is committed annually and while some NSTI hosts have conducted programs for the past 20 years there is no guarantee for program continuity, and even if there were a long-term commitment to a host site, the funding traditionally awarded is not adequate to conduct individual tracking efforts.
- Logistical difficulties with the NSTI participant demographics include the fact that students do not always have physical or email addresses or phone numbers, or social media accounts that are consistent through high school or after graduation; NSTI programs often engage a relatively small group of students on an annual basis (20-30), contributing to difficulties of maintaining broad enough contact to have a meaningful sample from which to derive conclusions.
- There is a lack of appropriate data management and/or collection. For some programs, data was not collected that would later enable them to contact students. For others, data was in an inaccessible format, or stored multiple different ways that would make it labor intensive to combine. With program directors changing over the years, and with some programs running for almost two decades, data storage has changed from written to digital for some programs and from one software to another.
- Most of the programs do not have the staff or time available to organize and clean their contact lists and data.
- As program coordinators change, the organization of data often also changes. This can be an extensive and demanding task for a part time director to sort through and organize.

How do we measure that impact? What are the best practices for tracking what choices students make and career paths they follow once they graduate from an NSTI program?

Using current resources, the following practices have been cited by program managers (see Section 5.2):

1. *Direct Survey or Interviews of past students, for example,* one proposal was to use direct follow-up with the students either by phone call or email around the time of their graduation. They would like to get more detailed information about their post high school intentions such as what major they are considering.

2. *Social Media Avenues.* Using social media platforms to stay in contact with past participants. This requires some level of incentives to be effective.

3. *University Registration Systems.* Host universities can sign up NSTI students in their "future student" registry as a way of reaching out to them about future educational opportunities.

4. *Alumni Support Programs.* Universities and colleges who host NSTI can develop a welcome program for former NSTI students that choose to attend the school and set up a system so that they can stay in contact.
5. *Parental Contact.* Students, under the age of 18 are difficult to track for many reasons, and parents could be a stable source of future contact information.

6. *National Student Clearinghouse.* The National Student Clearinghouse, a company with a host of services available to universities that can produce reports that contain information about high school graduates such as what college or university they attended, their major, and year of graduation, is national service that could be used to help inform on student choices.

How can NSTI as both a national program and as a network of program providers enhance the resources, network, and opportunities to increase the impact of the program?

1. Align NSTI funding with Regional UTCs – Long term funding; evaluation teams built in; multiple partner institutions to maintain broad geographic reach; align workforce and education efforts across the educational continuum; research-based curriculum and career paths; multiple post-secondary education and training partners; higher level of partnership between DOTs and universities…
2. National recognition of NSTI participants; national registry
3. Regional and National network of NSTI institution to share resources, experience, curriculum and practices – a learning community

4. Compile national resource center of resources and practices that can be catalogued from NSTI and existing related resource that NSTI programs should have access to (e.g., Transportationcareers.org and other curriculum, videos, Fast Forward, etc.)
5. Align program emphasis and resources with other FHWA initiatives and priorities (Highway Constructions; ITS PCB)

6. Create a centralized NSTI student tracking system within FHWA. A centralized function would eliminate the program by program problem with funding and continuity, and lead to standardized information/data collected from students for programs across the country. This would provide a national "average" for all NSTI programs to work towards, whether that is including a certain percentage of female or minority students, increasing STEM interest to a certain level, or improving base-knowledge of college and career options related to STEM and transportation. It could best answer some key questions, such as: What parts of NSTI are similar between all of the programs, and what are programs doing that differ among one another? Understanding the answers to these questions may help future NSTI programs collaborate better.

7. Create a national "advisory" group for the benefit of all STEM/transportation-related extra-curricular programs that works to establish best practices in effective evaluation and tracking.
8. Facilitate a dialogue to use within universities to help to establish a relationship between outreach and admissions departments.
9. National recognition of NSTI participants (with a national registry).
10. Connect to follow-up activities (e.g. AASHTO TRAC) and collaborate on evaluation and tracking.
11. Align program emphasis and resources with other FHWA Center for Transportation Workforce Development initiatives and priorities
12. Align NSTI funding with Regional UTCs, connecting with long term funding; evaluation teams; multiple partner institutions to maintain broad geographic reach.
13. Build a shared repository of curriculum, activities, schedules, and best practices for transportation-related out-of-school programs.
14. Build a Community of Practice among NSTI and other practitioners

7. References

Aleong, C., & Aleong, J. (2008). Are Summer Institutes Funded by FHWA And State Departments of Transportation Effective? Case Studies of Evaluation and Learning Strategies. *College Teaching Methods & Styles Journal (CTMS)*, *4*(5), 41-50. https://doi.org/10.19030/ctms.v4i5.5552

D'Souza K.A., Maheshwari S.K. 2014. Interdisciplinary Transportation Education and Workforce Development Modules (ITEWDM). Report for the National Center for Intermodal Transportation for Economic Competitiveness (NCITEC), Mississippi State University (MSU). Available at: http://www.ncitec.msstate.edu/wp-content/uploads/2012-30FR.pdf

Dabney, K. P., Tai, R. H., Almarode, J. T., Miller-Friedmann, J. L., Sonnert, G., Sadler, P. M., & Hazari, Z. (2012). Out-of-school time science activities and their association with career interest in STEM. International Journal of Science Education, Part B, 2(1), 63-79.

FHWA-NSTI Desk Reference (2016). https://www.fhwa.dot.gov/innovativeprograms/pdfs/centers/workforce_dev/nsti_desk_reference_2016.pdf (Accessed 5/23/2019)

FHWA presentation on NSTI (FY17). https://www.fhwa.dot.gov/innovativeprograms/pdfs/centers/workforce_dev/nsti_program_presentation_2016.pdf (accessed 5/23/2019

Gallagher, S. 2019, Personal Correspondence, 9-30-2019) re: Montana Summer Transportation Institute 2016 and 2017 reports to the Montana Department of Transportation. Susan Gallagher, Western Transportation Institute. Montana State University-Bozeman.

Gallagher, S. 2015 Montana Summer Transportation Institute. Report to Montana Department of Transportation. October 2015. Western Transportation Institute. Montana State University-Bozeman. https://www.mdt.mt.gov/other/webdata/external/research/docs/research_proj/summer/FINAL_REPORT_15.pdf

Glitman K. 2009. Summer Transportation Institutes: Increasing Diversity Through Partnerships. Transportation Research Board 88th Annual Meeting. Available from: http://trid.trb.org/view.aspx?id=881427

Gottlieb, Joyce, & McClure, Will. (2019). Recruiting Tomorrow's Workforce. Public Roads, FHWA-HRT-19-002, Vol.82 No. 4, Winter 2019). *https://www.fhwa.dot.gov/publications/publicroads/19winter/02.cfm* (Accessed 5/23/19)

Hall, C., Dickerson, J., Batts, D., Kauffmann, P., & Bosse, M. (2011). Are we missing opportunities to encourage interest in STEM fields? *Journal of Technology Education*, v23 n1 p32-46 Fall 2011

Jasek, D. (2010). Assessment of Programs That Encourage Students from Diverse Populations to Consider Transportation Careers. Report SWUTC/10/167175-1, Texas Transportation Institute, College Station, TX. https://rosap.ntl.bts.gov/view/dot/17806

Kommalapati R., Ramalingam R., Stockton W. Transportation Workforce Development: Sustaining and Expanding High School Outreach Programs and Multi-agency Partnerships. 2012. Final Report to University Transportation Center for Mobility, Texas A&M Transportation Institute. Available at: https://rosap.ntl.bts.gov/view/dot/24785.

Nezamuddi, N., Pande A., Nuworsoo, C. Workforce of the Future: Ideas for Improving 1 K-12 Outreach by Transportation Engineering Educators through Near-Peer Involvement and Leveraging Contextual Exposure. Paper ID#10514. Manuscript Prepared for the 121st American Society for Engineering Education (ASEE) Annual Conference, June 2014, Indianapolis, USA. Available at: https://www.asee.org/public/conferences/32/papers/10514/download

Pollard-Mitchell S., Taylor S., Martin M.D. National Summer Transportation Institute Program: Role of Educators and Mentors in the Post-Secondary Achievement of Participants. October 2012. Proceedings of the 1st National Conference on Intermodal Transportation: Problems, Practices, and Policies. Hampton University, Hampton, VA. Available at: https://trid.trb.org/view/1264109

Valdes-Diaz D., Hill C., Gonzalez-Quevedo A, Sabb V, and Toledo-Feria F. (2003, June). The National Summer Transportation Institute (NSTI): 10 Years Motivating Minority Students Toward Professions in The Transportation Industry. In Proceedings of the 2003 American Society for Engineering Education Annual Conference & Exposition (Session 2793) pp. 8.1153.1 – 8.1153.9. Accessed at https://peer.asee.org/the-national-summer-transportation-institute-nsti-10-years-motivating-minority-students-toward-professions-in-the-transportation-industry.pdf (October 8, 2019).

Yilmaz, M., Ren, J., Custer, S., & Coleman, J. (2010). Hands-on summer camp to attract K–12 students to engineering fields. IEEE Transactions on Education, 53(1), 144-151.

Appendices

APPENDIX 1: What does the Literature Say
NSTI and Transportation STEM Literature review
(June 2019)

Given the limited literature on transportation career choice and promotion in K-12 settings, this review will incorporate the growing STEM career choice literature as well as references to civil engineering, but only where the case can be made that it applies to the research question. Many NSTI programs specifically reference STEM-related educational outcomes. While this program focus provides an in-depth overview, STEM is broader than the fields encompassed by transportation, but subsequently leaves out critical occupations aligned more in career technical education (CTE) and skilled trades that are essential and in demand. Though studies focused on career choice in civil engineering are referenced, this field is much broader than transportation and not at all encompassing of the many essential fields and occupations that need to be prioritized for future workforce growth. There are emerging focused studies looking more closely at just transportation, and those will be referenced, but they are still limited.

With the popularity of STEM curriculum rising, and the urgency of replacing retiring workers (Hall et al., 2011), there has been a number of studies of STEM enrichment programs including those that review their effectiveness. Many of these reports describe a program and its successes and challenges, but do not have longitudinal data to support long-term change. Researchers have found that K-12 summer programs have helped increase interest in engineering disciplines (Yilmaz et al., 2010). However, few have examined the long-term impact of programs on pursuance of STEM majors or careers, and sparse research has been conducted to determine the specific aspects of programs that may contribute to STEM interest (Dabney et al., 2011). This literature review attempts to provide an overview of the factors that may play a role in student career interests, different methods used for engagement, challenges with program evaluation and methods for longitudinal tracking studies, and the actual impacts of out-of-school STEM enrichment programs. This review focuses on STEM generally as there is little literature with a focus into just transportation career programs. Later we will look to translating these lessons to address transportation career enrichment programs specifically, such as the NSTI.

Factors in Student Career Choice

In order for career enrichment programs to make an impact on secondary student career and post-secondary education and training choices, we must first understand how students make decisions about their future career paths. Programs must be tailored to account for these factors, as participating in any single program is likely not the sole reason for the final choice of a particular career or major.

Table 1. Factors in Student Career Choice

Factor	Reference
Personal interests	Hall et al., 2011; Sadler et al., 2012
Parental influence	Hall et al., 2011; Harackiewicz et al., 2012
Potential earnings	Hall et al., 2011
Teacher Influence	Hall et al., 2011; Mitchell, 1993
Perceived Gender Stereotypes	Shapiro & Williams, 2011; Sadler et al., 2012; Cantrell & Ewing-Taylor, 2009

Current STEM vs. non-STEM aptitude and perceived ability	Wang et al., 2013; Graham et al., 2013; Gasiewski et al., 2012
URM Disadvantages	Hurtado et al., 2016; Estrada et al., 2016; Culotta, 1992; Peske & Haycock, 2006
School preparation & focus on STEM	Hossain, 2012; Morgan et al., 2016; Robinson, 2003; Griffith, 2010

In the 2011 study, *Are we Missing Opportunities to Encourage Interest in STEM Fields*, (Hall et al., 2011), the findings indicate that the four highest rated factors influencing a high school student's career choice are *their personal interests, their parent's influence, potential earnings*, and *the influence of a teacher*, in that order. Additionally, the study points out that the teacher and the parent, while critical influencers, are often woefully under informed as to STEM fields and STEM related career opportunities. In a national study on educator preparedness to teach core STEM concepts (life science, earth science, physical science), only about one third of K-5 teachers had taken at least one college course in each of the three areas (Trygstad et al., 2013). The same survey also found that more than 60 percent of teachers in grades K-12 participated in less than six hours of professional development focused on science from 2010 to 2013. Another study used brochures about science and math as an intervention to help parents teach their children about the importance of those fields (Harackiewicz et al., 2012). While students who had parents with STEM careers were more likely to enroll in more STEM-related high school classes, the intervention had a similar effect with other students who did not have parents in STEM fields. In combination this results in students with less informed parents being less likely to end up in STEM majors.

Maintaining interest in a STEM field may also have to do with a student's interest at the beginning of high school. A study tracking STEM interest levels over a 4-year high school career found that while male students maintained the same level of interest from freshmen to senior year, the percentage of female students sustaining interest declined (Sadler et al., 2012). Male students tended to begin high school with higher levels of interest in STEM fields than females, a trend that extends into other traditionally male dominated fields as well. This may signify a biased presentation of STEM careers to students starting at a younger age, as well as a lack of visible female representation and role models. One study claims that not only are girls affected by teacher and parent "gender-related math attitudes" which contribute to anxiety and stereotyping, but this is compounded by girls believing their own poor performance or that of other girls confirms the stereotypes as true (Shapiro & Williams, 2011). Another study found that overall, when students have high levels of verbal *and* mathematical skills, these students tended to choose non-STEM education paths (Wang et al., 2013). This may begin to explain the gender difference in STEM fields as 63% of participants with high math and verbal skill levels were women (n=1,490).

Disparities by race, ethnicity, socioeconomic status, and gender are common in STEM education in relation to access to opportunities that have an effect on these students' career choices. Underrepresented minority students (URM) who show characteristics related to future achievement in a science career still face challenges. These challenges include "lower high school grade point averages, fewer years of high school math and science course work, and concerns about financing their education." (Hurtado et al., 2016) Additionally, URM students work more hours at jobs while in high school than non-URM students, and research has shown that future financial concerns may affect job choice, especially if science careers are perceived to be lower paying than other fields (Hurtado et al.,

2016). The Joint Working Group on URMs' Persistence in STEM has worked to identify why URMs in particular fall out of the STEM pipeline more often when compared to white or Asian students. Their suggested methods for increasing diversity in undergraduate STEM disciplines include (Estrada et al., 2016):

- Increasing institutional accountability
- Creating partnerships that can elevate STEM programs by looking at literature evaluating successful or similar programs
- Use inquiry-based learning approaches
- Address student resource disparities at the local, statewide, regional, and federal levels
- Bring creativity into STEM fields by connecting them to personal and culturally significant future outcomes

In order to participate in STEM careers, and the programs that lead to them, students must attain certain math and science levels early on in their schooling, many years before they understand the significance of this for future choices. Furthermore, many elementary and middle schools do not adequately prepare students to meet expectations in science and mathematics (Hossain, 2012). Parents play an important role and must have the foresight necessary to equip their child with educational opportunities that leave STEM avenues open to them until they are able to be more active decision-makers as to the path they would like to take (Shapiro & Williams, 2011). Students may be boxed in from a very young age, as early as kindergarten, when knowledge gaps between different sociodemographic groups are vast. A study on children entering kindergarten between 1998 and 1999 found that below proficiency knowledge in kindergarten was a predictor of science achievement by the 3rd grade (Morgan et al., 2016). The potential for STEM learning later in life may depend on being set up to succeed early on, among other variables.

Knowledge gaps may be further exacerbated when students enter high school. Exposure to college-level high school STEM courses such as Advanced Placement (AP) classes has been correlated with increased likelihood to pursue STEM-related college programs as opposed to students who did not take college-level courses (Robinson, 2003). It is important to note that the direction of causality cannot be determined here as we do not know whether those who take AP classes take these classes *because* they intend to pursue STEM-related studies. Women and minority college students who took more STEM-related AP classes in high school, relative to total number of AP classes taken, are more likely to persist in a STEM major (Griffith, 2010). School socioeconomic status also impacts the availability of AP courses for students, and potentially the quality and quantity of non-college-level STEM-related courses. One older study (1990) study that high schools with a high percentage of minority students offered fewer challenging science and math classes (Culotta, 1992). Often districts made up of predominantly minority or low-income students include a greater share of their state's teachers who are underqualified, uncertified, or have less experienced overall (Peske & Haycock, 2006).

With achievement in STEM hinging in some part on early childhood education, it seems that out-of-school career awareness programs may temporarily increase interest in high school students, though students cumulatively lacking in STEM knowledge are at a vast disadvantage by the time they enter college. As many students experience boredom in school, especially in middle and high school years, out-of-school programs may benefit engagement, though interest can wane again if classroom lessons lack meaningfulness (Mitchell, 1993). Situational interest can result from non-routine and engaging learning explorations (e.g. projects that involve teamwork, novel ways to examine a concept) (Schraw et al., 2001). Thus, out-of-school programs must carefully craft their evaluations to avoid a false sense of newly gained interest in STEM subjects.

Interest in STEM may not persist past high school if students do not feel adequately prepared for these college level classes, as persistence largely has to do with self-confidence, or "belief in one's own ability" (Graham et al., 2013). One study concluded that most students who pursue STEM majors in college make the decision to do so while in high school (Maltese & Tai, 2011). Their choice is due to an interest in STEM, not necessarily for the status of completing a difficult major. Furthermore, shame and feelings of inadequacy stemming from comparative difficulty in these classes may discourage students from persisting through difficult STEM majors such as mechanical engineering (Gasiewski et al., 2012). Persistence in STEM requires self-efficacy, or the belief that one can achieve their goals, but introductory STEM college courses often discourage students from pursing a related major (Graham et al., 2013), partly due to the difficulty of the class and boredom. One study examined factors that contribute to a student enrolling in a STEM major in college. Of the most important were "12th grade math achievement, exposure to math and science courses, and math self-efficacy beliefs," though the effect was seen more with white students than minorities (Wang, 2013). This may be evidence that the effects of uneven opportunity between white and minority students is felt well into post-secondary education.

Outside the classroom, more formal efforts appear to help generate and sustain interest. One study examined how high school STEM seminars might change 11th and 12th grade students' career interests. The seminars ran once a week for eight weeks and targeted women who were undecided in their career choice, influencing them to want to switch it to engineering (Cantrell & Ewing-Taylor, 2009). The seminars contained research presentations by University of Nevada Reno faculty and graduate students, and also touched on possible career paths in engineering. Thus, engagement may go hand-in-hand with career field awareness, as it is difficult to become interested in something without significant prompting and demonstration of relevance.

Formal and Informal K-12 Program Engagement Methods to Enrich and Guide Career Choice

Engagement is more than just keeping students interested over a period of time. The previous section discussed factors affecting interest, but engagement programs create experience with a subject, allowing students to "touch" the work, not just simply learn about it. One study proclaims that "school engagement is seen as an antidote to such signs of student alienation" (Fredricks et al., 2004), as feelings of belonging are also important for maintaining engagement. The authors note that the literature commonly divides engagement into three categories:

- Behavioral engagement – includes academic and social extracurricular activities during which a student is cooperative and follows directions associated with the task at hand. This is essential for ensuring educational continuation and positive educational outcomes.
- Emotional engagement – relates to one's mood while engaging in an activity, such as boredom, happiness, sadness, anxiety, et cetera.
- Cognitive engagement – may be viewed as intrinsic motivation to learn, and at the very least, a desire to learn something.

In order to make a lasting impact on students' career interests, enrichment programs must, at a minimum, provide engaging material and activities. Summer transportation and STEM programs across the U.S. have used various engagement methods. For some states, such as Texas, there are an abundance of STEM "academies" – middle and high schools that focus specifically on STEM learning. States with notable STEM schools include North Carolina, Ohio, Massachusetts, and Texas (Kennedy & Odell, 2014). However, most school boards across the U.S. lack comprehensive STEM education, making out-of-school STEM experiences even more important.

Studies have shown that after school programs, a form of informal learning, have a positive effect on students, though the full extent is not known. One study defines engagement as being "characterized by relatively high amounts of attention, interest, effort, and enjoyment that occur during the process of learning and acquiring skills (Mahoney et al., 2007)." Thus, it is not enough to merely attend an activity, but there must be elements that draw the student in to actively *participate* in some way. The study found that the most engaging elementary level afterschool programs were organized and well-thought out, and contained more time on skill-building enrichment activities than on homework or non-skill building activities (e.g. clean-up, snack breaks) (Mahoney et al., 2007). Another study on middle school students in after school programs produced similar findings in that students preferred sport and art-focused activities over homework-based programs (Shernoff & Vandell, 2007). The difference in these activities is that the after school homework help sessions were not enjoyed by students (seen as an extension of school work) and the sessions did not require interaction amongst peers. Shernoff and Vandell (2007) found that activities which were positively rated by students, such as sports and art, "support autonomy and facilitate group involvement with peers and adults." The article continues to suggest that choice and feedback are aspects of engaging or successful programs.

In a review of the state of Texas' successful high school STEM-specific educational model, "T-STEM," several things were noted to have an impact on engagement. These include rigorous and high-quality curriculum that include inquiry, design, and problem solving; use of technology to enhance learning; and offering a combination of both formal and informal learning (Kennedy & Odell, 2014). The report emphasized the need for teachers to use problem- and project-based techniques, and to use partnerships and professional development to remain current and relevant in teaching. An emphasis was placed on presenting real-world, applicable lessons, as students often struggle to understand why something is important or how it relates to them personally. While Kennedy and Odell's (2014) recommendations for engagement were intended for in-school teaching, they explain that STEM teaching is interdisciplinary and differs from traditional approaches, e.g. the barriers between disciplines are broken down. They recommend the following:

- Employ instructional strategies that require students to "innovate and invent"
- Use problem- and project-based lessons with specific learning goals
- Use applied and collaborative learning whenever possible
- Require knowledge attainment to be demonstrated through avenues that mimic real-world contexts
- Use "interdisciplinary, multicultural, and multi-perspective viewpoints" to give students a global perspective (especially noting the existence of a global workforce and economy)

Summer and After-School programs tend to emphasize engagement through hands-on activities and experiential learning. A program hosted at Texas A&M University-Kingsville (TAMUK) focused on hands-on activities that aimed not only to help students develop an interest in STEM, but to "decrease their anxiety levels associated with entering these fields (Yilmaz et al., 2010)." The activities were 1-hour in length and included lessons such as air pollutant measurements, "mysteries" of nanoparticles, and desalination. The 3-hour long projects were bridge building, computer technology and Bluetooth, river pollution, and computer-controlled manufacturing. In the program evaluation survey, a majority of the students reported that the hands-on experiences of the camp were the most enjoyable part of it.

Out-of-school time (OST) in general in the form of clubs and competitions were effective to the development of student's STEM career interest, using activities to engage them in direct learning (Dabney et al., 2011). Summer out-of-school programs are also widely popular throughout the U.S.

Many elementary and middle schools have limited time to cover STEM topics, and high schools often have few required science classes, let alone engineering or technology. Transportation-specific teaching is even rarer in schools, making summer programs in many cases the only option to learn about this field for many students. Few studies explicitly address how and whether engagement techniques in summer camp settings differ from in-school and other types of out-of-school learning environments. Most studies on STEM summer programs focus on how to attract women and minorities or test out innovative program structures and topics. The original goal of NSTI was to promote STEM disciplines through transportation, to inform middle and high school students of educational and career opportunities, especially for at-risk youth. Though after school and STEM-focused high schools were discussed in this section, the basic concepts of student engagement can also be used within summer programs such as NSTI.

Challenges with Program Evaluation and STEM Career Interests

Program evaluation can be very beneficial when done in a way that is suitable and tailored to the program, though it is an aspect of program development that can be challenging. There are two types of evaluations that may be incorporated into summer programs: formative evaluations which help steer program improvements, and summative which determine whether a program is meeting its goals or objectives (Wilkerson & Haden, 2014). Most transportation career development programs reviewed focused on summative evaluations. This tends to be what is required by the sponsor. Formative evaluations are more difficult to design and implement, and require significantly more staff time, resources, and cannot necessarily be carried out within the time frame that programs operate in, or that is covered by the funding period for programs. This investigation will address both types of evaluation and will seek to identify practices and strategies to move beyond summative evaluation and support more formative approaches.

Wilkerson and Haden (2014) suggest setting SMART goals for programs – one's that are Specific, Measurable, Attainable, Realistic, and Time-bound. Some program goals will be short term, such as providing new STEM knowledge to participants, and others will be longer-term, such as encouraging students to pursue STEM careers. Most of the NSTI and STEM program evaluations reviewed focus on short-term, immediate changes, and do not follow up to determine whether any long-term changes have occurred for reasons noted above. Additionally, only short-term success typically needs to be presented for continued program funding from the sponsors of the programs reviewed.

Wilkerson and Haden (2014) outline reasonable goals that programs can strive for (and attempt to measure in evaluations) based on the number of instructional hours. Longer programs may potentially lead to an outcome that many programs desire to have: influencing students to pursue a STEM major or career. They suggest that the longer the program, the more likely it will have the effect of steering students towards STEM studies and careers, though individual programs should consider their own goals and whether the duration and utilization of time helps them accomplish their mission.

Program evaluation for out-of-school programs is more difficult due to lack of standardized assessments, which is compounded by less funding for informal teaching, and sometimes inexperienced teachers. One study points out that because of these factors, there can be a disconnect between program design and implementation, or program fidelity (Barker et al., 2014). This disconnect can make it difficult to effectively evaluate whether a program meets its objectives.

Many things may influence one's career choice and interests. Evaluation methods for summer programs may not be very effective at demonstrating causation. For example, it is difficult to control for all other

factors and assess that a particular program's content and structure resulted in a student deciding to pursue a STEM major in college. Moreover, many programs enroll small groups of students, making their sample sizes too small for rigorous analysis, or requiring consistent data collection over several years to amass an appropriate sample. Evaluating programs collectively is also a challenge and can be open to bias. Bias can result from the lack of "large-scale, randomized, multiyear evaluations of each of several educational programs (Slavin, 2008)." Out-of-school STEM programs vary widely, and the evaluation methods used by program coordinators varies even more so. As any one program likely has only a small sample, results can produce misleading conclusions.

Additional studies also demonstrate that program evaluations may not actually portray the success of a program well, as many students who enroll already have a strong interest or aptitude for STEM areas of study. One study found that there was no statistically significant difference in students pursing STEM majors when compared to those who participated in science fairs with those who did not (Sahin, 2013). However, high school students who had participated in three years or more of the science fairs were more likely to choose a STEM major. These students may be more self-aware and invested in their future at an earlier age. Evaluations of Sponsor a Scholar (SAS) showed that students who had attended the program had slightly higher GPA's than those who did not attend, and had greater post-secondary school attendance in the two years following high school (Gullatt & Jan, 2003). The follow-up method with students was via interview. Other studies have also remained skeptical of program impacts as there is a chance that students who attend programs such as these self-select to participate. Analysis of the Camp Reach program showed that many participants who applied but were not selected still went on to pursue STEM opportunities later on (Demetry et al., 2009).

In general, it can be very difficult to determine how programs impact career interest. One camp for middle school students called the See Blue STEM Camp reported an overall increase in STEM interest and interest in STEM careers (Mohr-Schroeder et al., 2014). While the long-term impact will not be known for some time, the key to the camp's success may be attributed to engagement methods that included quality hands-on activities taught by STEM faculty, getting to experience a college campus, working in teams, and using technology. With such limited resources for program staff, directors, and instructors, organizers are often left to choose and develop the evaluation method themselves, although they may not have a research or evaluation background. Hiring a professional evaluator can be cost prohibitive for many programs. Additionally, with so much necessary preparation and planning, program coordinators may need to lower the priority of creating or implementing a valid and reliable evaluation method.

One of the most popular types of program evaluation methods used, especially for programs that do not have the time, funding, or expertise to conduct larger studies, are pre- and post-surveys or tests. These are surveys that measure a student's knowledge of certain topics, attitude towards certain fields of study or careers, and perceptions of themselves in relation to their desire or interest in pursuing a particular career path before and after an "intervention." These surveys are often used as a way to show positive change, especially when funders require evaluation data and results. The surveys also sometimes serve as data for marketing material for a program. However, this method is imperfect if its intended use is for demonstrating program effectiveness beyond new knowledge attainment for several reasons:

- First, many students who attend these educational programs are already primed to want to attend. Students may have encouragement from teachers that view them as interested or gifted, or from parents. Students may be "self-selecting" in that they may have a predisposition

to attending a program because they already have a level of personal interest in the subject area. The Camp Reach program for girls found that about one third of attendees never had an initial interest in pursuing a STEM career, but attended the camp anyway as they thought it would be enjoyable (Demetry et al., 2009). The same camp also found success in that approximately 20 percent of the students gained an interest in STEM because of the camp. Nearly 35 percent of attendees who had either moderate or high interest in STEM by the end of the camp also decided to pursue a STEM major in college. It is difficult to determine whether the same students who *became* interested in STEM because of the camp were also the ones who decided on a STEM major. Further follow-up post high school is needed to determine the lasting impacts.

- Second, the questions in these types of surveys only demonstrate whether there was an immediate impact, and cannot necessarily demonstrate long-lasting impact. One study aiming to increase science interest in middle school students found that a 2-week program (SSEP) was too short of a time to increase interest from middle to high school (Gibson & Chase, 2002), although interest for middle school students who already had a high interest in science was maintained. The study noted that the transition from middle to high school is often a time when interest in STEM is lost. Programs can be strategically developed to help prevent loss of interest during that time period. The loss of interest between high school and college transition remains an open question.

Pre and post surveys primarily reflect the short-term program results, but indicate little about whether the effects of the program will carry on long-term (Brody, 2006). In order to understand long-term effects, Brody (2006) reports that evaluation must investigate outcome variables such as participation in other STEM-related classes or opportunities, high achievement in STEM-related courses, having a positive attitude in the future towards STEM subjects, confidence one will succeed in a STEM field, and enrolling with a STEM major or entering a STEM career.

For many programs, evaluations may only occur immediately after the program ends, often creating a false sense of effectiveness. One summer bridge program found that 89% of its students felt more prepared and positive about their ability to learn math, however, when students were interviewed following their first semester of college, the percentage dropped (Raines, 2012). In one study of a 2-week summer camp using pre and post surveys, most students indicated in the pre-survey that they would either probably or definitely take STEM courses once in college. Thus, there was little statistically significant change between the two surveys (Miller et al., 2007). Results of pre and post surveys can be unreliable if effective survey methods are not used.

A further challenge with program evaluation lies in the difficulty in obtaining longitudinal survey responses. These are expensive as they require more planning time, on-going maintenance, and testing (Wilkenson & Haden, 2014). Ultimately the appropriate evaluation design will depend on the individual program including its length, budget, staff expertise, and number of students enrolled.

Methods in Tracking Students

Depending on the program goal, a simple summative evaluation, answering such questions as whether or not specific new knowledge was gained, or interest increased may be sufficient for the sponsor and meeting the objective. However, if the goal is to build a broader, more sustainable pool of future workers in a field, then such an evaluation will not provide any guidance or results-based assurances that the program functioned effectively.

There are a number of STEM-related out-of-school learning programs that have been on-going for 20 or more years (NSTI being the one we are most concerned with addressing in this report). With the continuing STEM worker shortage, it is necessary to understand how, or whether, these programs contributed to the STEM workforce. Numerous papers (Kuenzi, 2008; Raju & Clayson, 2010; Johnson, 2012) on the transportation and STEM workforce cite that the U.S. school system is behind other countries in many ways, including providing quality STEM education. However, efforts to track students longitudinally, and the accompanying research, are limited. Unlike longitudinal studies in other fields, tracking K-12 students is made more difficult because most are minors requiring special research techniques and approvals. Moreover, most are going through several new life milestones (e.g. attending college, starting a career) which could impact retention and response rate.

One program which used methods to track participants longitudinally is Camp Reach, hosted by Worchester Polytechnic Institute (WPI) since 1997, which has worked to promote long-term contact with students (Demetry, et al., 2009). Alumni are invited to two annual reunions per year, and are encouraged to participate again in the program as student staff members. Semiannual newsletters are used to keep in contact with alumni. The authors report that part of the success of this program, and the number of participants who have stayed engaged after the end of the program, can be qualitatively attributed to its empowering nature of being an all-girls camp. This program uses a commonality to unite participants and create a sense of belonging to a group, which may be beneficial in obtaining participation in tracking activities.

The high school Summer Science Academy held at the University of Rochester completed a study of the long-term impact of the program on students' interest in science (Marowitz, 2004). The program was held for six years from 1996 to 2002. The study used a follow-up survey which was mailed during July 2003 in hopes of maximizing the number of students reached as the researchers thought students might be home from college during the summer. Approximately 44 percent of students responded (n=96). The survey also included an option for researchers to contact them for a follow-up interview. This method of mailing surveys may have been more successful in the early 2000s when internet, social media, and cell phone usage was much less common and communication was more centralized (physical mail and home phone). The study found that approximately 87% of students who became science majors say the program contributed to their interest in science. Only 13 students who attended the camps and were surveyed did not become science majors, though 6 of them agreed that the program contributed to their interest in science. These results can be problematic to interpret because students who attended the camp may be self-selecting. Today, programs are encouraged to utilize social media as an avenue for staying in touch with past participants, especially due to its cost effectiveness (Wilkenson & Haden, 2014). This method may help with obtaining a larger sample of students for future study, which is necessary to gain a deeper understanding of motivation to pursue STEM careers and self-selection tendencies.

The Governor's Institute of Vermont (GIV) is one program that has run for over 30 years, and thus had to ability to conduct a longitudinal study. The organization released a 30th anniversary 2013 report detailing the lessons learned, and part of that involved contacting past students who attended the various STEM-related institutes between 1983 and 2006 (Brydolf-Horwitz et al., 2013). The program sought to understand the longer-term impacts of the program via a survey (n=382), which was administered to graduates 6-29 years following participation. While the organization had a large contact database, most information was outdated, and thus outreach to alumni was the primary method for gathering the participant sample. An online survey was used to collect the data, and paper mailings were sent out (though few made it to the intended recipient). The most effective strategy for tracking down former

students was individually searching for them using “email, phone, social media, parents, social network, a postcard, or some combination.” Some respondents were also obtained using online survey promotion through owned media (e.g. Facebook page, website). Overwhelmingly, results of the survey indicated that GIV made a difference in students’ interests, with 93% of respondents agreeing that GIV influenced their future decisions, and 88% claiming it was the most important academic experience prior to college. Much of this was attributed to the rural setting of Vermont not granting many opportunities for extracurricular or supplemental programs, and a poorer population attending the program, with little emphasis on certain topics in school (such as STEM learning). While the GIV Institutes undoubtedly influenced some graduates to pursue post-secondary education, the institute that seemed to most directly affect students’ major choice was the Engineering Institute (40% of students who attended this Institute in particular responded this way). A next step in this analysis would be to determine what aspects of this institute in particular resulted in these findings. While the GIV report is comprehensive, and data collection was done in partnership with an independent evaluation firm, the report could be inherently biased as three of the four authors are high level GIV employees. Additionally, the report has not been peer-reviewed.

In a recent report on national indicators of K-12 STEM success, 14 indicators were identified and prioritized that might be used as measurements to spur nation-wide improvements (Means et al., 2016). The majority of these indicators focus on in-school learning, including teacher qualifications, funding investments, and alignment with NGSS science standards and integration of these into national and state standards. Data collection for each indicator was recommended. The most pertinent indicator to this report was Indicator 14: Federal Funding for STEM Education Research. This was designated a high priority item and looks to “fill critical gaps in knowledge about programs and practices that contribute to student learning and to the other goals of STEM education.” One large piece of this strategy is to conduct longitudinal assessments of student outcomes. The report explicitly states that the operational definition for this indicator should not exclude exploratory work. In general, this indicator is one of the more open-ended ones, as it poses a great challenge.

References

Aschbacher, P. R., Li, E., & Roth, E. J. (2010). Is science me? High school students' identities, participation and aspirations in science, engineering, and medicine. Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching, 47(5), 564-582.

Barker, B. S., Nugent, G., & Grandgenett, N. F. (2014). Examining fidelity of program implementation in a STEM-oriented out-of-school setting. *International Journal of Technology and Design Education, 24*(1), 39-52.

Breiner, J. M., Harkness, S. S., Johnson, C. C., & Koehler, C. M. (2012). What is STEM? A discussion about conceptions of STEM in education and partnerships. School Science and Mathematics, 112(1), 3-11.

Brody, L. (2006). Measuring the effectiveness of STEM talent initiatives for middle and high school students. In annual meeting of the National Academies Center for Education, Washington, DC.

Bronzini, M. S., Mason Jr., J. M., Tarris, J. P., & Zaki, E. (1995). Choosing a civil engineering career: Some market research findings. *Journal of professional issues in engineering education and practice, 121*(3), 170-176.

Brydolf-Horwitz, R., Mitchel, K. T., Kocherlakota, K., & Char, C. (2013). GIV@30: A long-term look at how a little-known Vermont educational program is changing young lives. From http://www.vermontsummerprograms.org/GIV2/wp-content/uploads/2014/01/GIV-AT-30-color.pdf (Accessed 7/16/2019).

Bybee, R. W. (2010). Advancing STEM education: A 2020 vision. Technology and Engineering Teacher, 70(1), 30.

Cohen, C., Patterson, D. G., Kovarik, D. N., & Chowning, J. T. (2013). Fostering STEM career awareness: emerging opportunities for teachers. WA State Kappan, 6, 1-17.

Culotta, E. (1992). Scientists of the future: Jumping high hurdles. Science, 258(5085), 1209-1212.

Dabney, K. P., Tai, R. H., Almarode, J. T., Miller-Friedmann, J. L., Sonnert, G., Sadler, P. M., & Hazari, Z. (2012). Out-of-school time science activities and their association with career interest in STEM. International Journal of Science Education, Part B, 2(1), 63-79.

DeJarnette, N. (2012). America's children: Providing early exposure to STEM (science, technology, engineering and math) initiatives. *Education, 133*(1), 77-84.

Demetry, C., Hubelbank, J., Blaisdell, S. L., Sontgerath, S., Nicholson, M. E., Rosenthal, L., & Quinn, P. (2009). Supporting young women to enter engineering: Long-term effects of a middle school engineering outreach program for girls. Journal of Women and Minorities in Science and Engineering, 15(2).

Estrada, M., Burnett, M., Campbell, A. G., Campbell, P. B., Denetclaw, W. F., Gutiérrez, C. G., ... & Okpodu, C. M. (2016). Improving underrepresented minority student persistence in STEM. CBE—Life Sciences Education, 15(3), es5.

Flores, A. (2007). Examining disparities in mathematics education: Achievement gap or opportunity gap? *The High School Journal, 91*(1), 29-42.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. Review of educational research, 74(1), 59-109.

Gasiewski, J. A., Eagan, M. K., Garcia, G. A., Hurtado, S., & Chang, M. J. (2012). From gatekeeping to engagement: A multicontextual, mixed method study of student academic engagement in introductory STEM courses. *Research in higher education, 53*(2), 229-261.

Gibson, H. L., & Chase, C. (2002). Longitudinal impact of an inquiry-based science program on middle school students' attitudes toward science. Science education, 86(5), 693-705.

Gonzalez, H. B., & Kuenzi, J. J. (2012, August). Science, technology, engineering, and mathematics (STEM) education: A primer. Congressional Research Service, Library of Congress.

Gottlieb, Joyce, & McClure, Will. (2019). Recruiting Tomorrow's Workforce. Public Roads, FHWA-HRT-19-002, Vol.82 No. 4, Winter 2019). https://www.fhwa.dot.gov/publications/publicroads/19winter/02.cfm (Accessed 5/23/19)

Graham, M. J., Frederick, J., Byars-Winston, A., Hunter, A. B., & Handelsman, J. (2013). Increasing persistence of college students in STEM. *Science, 341*(6153), 1455-1456.

Griffith, A. L. (2010). Persistence of women and minorities in STEM field majors: Is it the school that matters?. *Economics of Education Review, 29*(6), 911-922.

Gullatt, Y., & Jan, W. (2003). How do pre-collegiate academic outreach programs impact college-going among underrepresented students? Washington, DC: Pathways to College Network Clearinghouse.

Hall, C., Dickerson, J., Batts, D., Kauffmann, P., & Bosse, M. (2011). Are we missing opportunities to encourage interest in STEM fields?

Harackiewicz, J. M., Rozek, C. S., Hulleman, C. S., & Hyde, J. S. (2012). Helping parents to motivate adolescents in mathematics and science: An experimental test of a utility-value intervention. Psychological Science, 23(8), 899-906.

Helwig, A.A. (2004). A ten-year longitudinal study of the career development of students: Summary findings. *Journal of Counseling & Development, 82*(1), 49-57.

Hossain, M. (2012). How to motivate US students to pursue STEM (science, technology, engineering and mathematics) careers. Online Submission.

Hurtado, S., Newman, C. B., Tran, M. C., & Chang, M. J. (2010). Improving the rate of success for underrepresented racial minorities in STEM fields: Insights from a national project. *New Directions for Institutional Research, 2010*(148), 5-15.

Ivey, S.S., Powers, M., & Clark, A. (2018). A business case for increasing diversity in the transportation workforce.

Ivey, S. S. (2019). Inspiring the Next Generation Mobility Workforce through Innovative Industry-Academia Partnerships. In T. Reeb (Ed.), *Empowering the New Mobility Workforce* (In Press). Elsevier.

Jasek, D. (2010). Assessment of Programs That Encourage Students from Diverse

Populations to Consider Transportation Careers. Report SWUTC/10/167175-1, Texas Transportation Institute, College Station, TX. https://rosap.ntl.bts.gov/view/dot/17806

Johnson, C. C. (2012). Implementation of STEM education policy: Challenges, progress, and lessons learned. School Science and Mathematics, 112(1), 45-55.

Kennedy, T. J., & Odell, M. R. L. (2014). Engaging students in STEM education. Science Education International, 25(3), 246-258.

Kuenzi, J. J. (2008). Science, technology, engineering, and mathematics (STEM) education: Background, federal policy, and legislative action.

Mahoney, J. L., Parente, M. E., & Lord, H. (2007). After-school program engagement: Links to child competence and program quality and content. The Elementary School Journal, 107(4), 385-404.

Maltese, A. V., & Tai, R. H. (2011). Pipeline persistence: Examining the association of educational experiences with earned degrees in STEM among US students. *Science education, 95*(5), 877-907.

Markowitz, D. G. (2004). Evaluation of the long-term impact of a university high school summer science program on students' interest and perceived abilities in science. Journal of Science Education and Technology, 13(3), 395-407.

Means, B., Mislevy, J., Smith, T., Peters, V., & Gerard, S. (2016). Measuring the Monitoring Progress K-12 STEM Education Indicators: A Road Map.

Miller, K. C., Carrick, T., Martínez-Sussmann, C., Levine, R., Andronicos, C. L., & Langford, R. P. (2007). Effectiveness of a summer experience for inspiring interest in geoscience among Hispanic-American high school students. Journal of Geoscience Education, 55(6), 596-603.

McClure, E. R., Guernsey, L., Clements, D. H., Bales, S. N., Nichols, J., Kendall-Taylor, N., & Levine, M. H. (2017). STEM Starts Early: Grounding Science, Technology, Engineering, and Math Education in Early Childhood. In Joan Ganz Cooney Center at Sesame Workshop. Joan Ganz Cooney Center at Sesame Workshop. 1900 Broadway, New York, NY 10023.

Mitchell, M. (1993). Situational interest: Its multifaceted structure in the secondary school mathematics classroom. Journal of educational psychology, 85(3), 424.

Mohr-Schroeder, M. J., Jackson, C., Miller, M., Walcott, B., Little, D. L., Speler, L., ... & Schroeder, D. C. (2014). Developing Middle School Students' Interests in STEM via Summer Learning Experiences: See Blue STEM Camp. School Science and Mathematics, 114(6), 291-301.

Morgan, P. L., Farkas, G., Hillemeier, M. M., & Maczuga, S. (2016). Science achievement gaps begin very early, persist, and are largely explained by modifiable factors. Educational Researcher, 45(1), 18-35.

Peske, H. G., & Haycock, K. (2006). Teaching Inequality: How Poor and Minority Students Are Shortchanged on Teacher Quality: A Report and Recommendations by the Education Trust. Education Trust.

Raines, J. M. (2012). FirstSTEP: A preliminary review of the effects of a summer bridge program on pre-college STEM majors. Journal of STEM Education: Innovations and Research, 13(1), 22-29.

Raju, P. K., & Clayson, A. (2010). The future of STEM education: An analysis of two national reports. Journal of STEM Education: Innovations and Research, 11(5/6), 25.

Robinson, M. (2003). Student enrollment in high school AP sciences and calculus: How does it correlate with STEM careers? Bulletin of Science, Technology & Society, 23(4), 265-273.

Sabb, V., Hill, C., Gonzalez, A., Toledo, F., & Valdes-Diaz, D. (2003, June). The National Summer Transportation Institute (NSTI): 10 Years Motivating Minority Students Toward Professions In The Transportation Industry. In 2003 Annual Conference (pp. 8-1153).

Sahin, A. (2013). STEM clubs and science fair competitions: Effects on post-secondary matriculation. Journal of STEM Education: Innovations and Research, 14(1), 5-11.

Sanders, M. E. (2009). Stem, stem education, stemmania. The technology teacher. December/January Ed.

Schraw, G., Flowerday, T., & Lehman, S. (2001). Increasing situational interest in the classroom. Educational Psychology Review, 13(3), 211-224.

Shapiro, J. R., & Williams, A. M. (2012). The role of stereotype threats in undermining girls' and women's performance and interest in STEM fields. Sex Roles, 66(3-4), 175-183.

Shernoff, D. J., & Vandell, D. L. (2007). Engagement in after-school program activities: Quality of experience from the perspective of participants. Journal of Youth & Adolescence, 36(7), 891-903.

Slavin, R. E. (2008). Perspectives on evidence-based research in education—What works? Issues in synthesizing educational program evaluations. Educational researcher, 37(1), 5-14.

Subotnik, R. F., Tai, R. H., Rickoff, R., & Almarode, J. (2009). Specialized public high schools of science, mathematics, and technology and the STEM pipeline: What do we know now and what will we know in 5 years?. Roeper Review, 32(1), 7-16.

Tai, R. H., Liu, C. Q., Maltese, A. V., & Fan, X. (2006). Planning early for careers in science. Science, 312, 1143-1144.

Tec, C. (2000). K-12 career awareness & development sequence [with appendices, executive and implementation guide]. *ED450219. Springfield, Il: Tec.*

Torpey, E. (2015). Moving and storage: Careers in transportation and warehousing. *Career Outlook, U.S. Bureau of Labor Statistics.*

Trygstad, P. J., Smith, P. S., Banilower, E. R., & Nelson, M. M. (2013). The status of elementary science education: Are we ready for the Next Generation Science Standards? Horizon Research, Inc.

Wang, M.-T., Eccles, J. S., & Kenny, S. (2013). Not Lack of Ability but More Choice: Individual and Gender Differences in Choice of Careers in Science, Technology, Engineering, and Mathematics. Psychological Science, 24(5), 770–775. https://doi.org/10.1177/0956797612458937

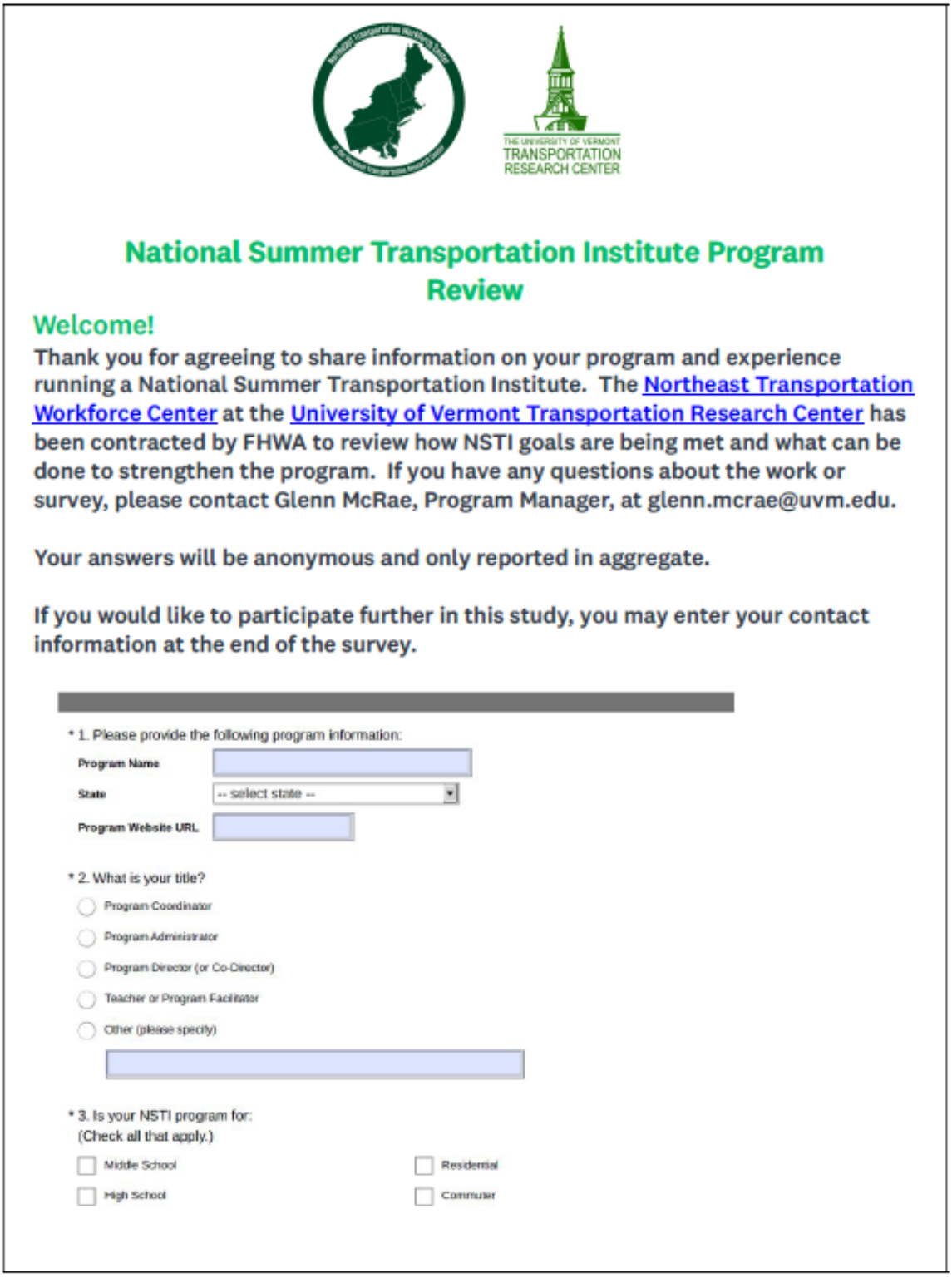
Wang, X. (2013). Why students choose STEM majors: Motivation, high school learning, and postsecondary context of support. American Educational Research Journal, 50(5), 1081-1121.

Wilkerson, S. B., & Haden, C. M. (2014). Effective Practices for Evaluating STEM Out-of-School Time Programs. *Afterschool Matters, 19*, 10-19.

Xue, Y., & Larson, R. C. (2015). STEM crisis or STEM surplus? Yes and yes. *Monthly labor review*.

Yilmaz, M., Ren, J., Custer, S., & Coleman, J. (2010). Hands-on summer camp to attract K–12 students to engineering fields. IEEE Transactions on Education, 53(1), 144-151.

APPENDIX 2 – NSTI Survey of Programs



National Summer Transportation Institute Program Review

Welcome!

Thank you for agreeing to share information on your program and experience running a National Summer Transportation Institute. The Northeast Transportation Workforce Center at the University of Vermont Transportation Research Center has been contracted by FHWA to review how NSTI goals are being met and what can be done to strengthen the program. If you have any questions about the work or survey, please contact Glenn McRae, Program Manager, at glenn.mcrae@uvm.edu.

Your answers will be anonymous and only reported in aggregate.

If you would like to participate further in this study, you may enter your contact information at the end of the survey.

* 1. Please provide the following program information:

Program Name

State -- select state --

Program Website URL

* 2. What is your title?

- Program Coordinator
- Program Administrator
- Program Director (or Co-Director)
- Teacher or Program Facilitator
- Other (please specify)

* 3. Is your NSTI program for:
(Check all that apply.)

- Middle School
- High School
- Residential
- Commuter

* 4. Is your program operating during the summer of 2019?

- ◯ Yes
- ◯ No

5. How many years has your institution run an NSTI program?

1 30

* 6. On average, how many students does your annual NSTI program(s) serve?

- ◯ 0 to 20
- ◯ 21 to 40
- ◯ 41 to 60
- ◯ More than 60

* 7. Do you run other programs with related goals, either during the summer or the school year? (Check all that apply).

- ☐ Yes, after-school program(s)
- ☐ Yes, single event (annually or one-off)
- ☐ Yes, reoccurring event(s) (i.e. monthly, weekly, etc.)
- ☐ Yes, other summer programs in related fields
- ☐ No

8. Rank the focus of your NSTI program from 1 (most focus) to 6 (least focus).

≡	STEM Skills	☐ N/A
≡	Career Awareness	☐ N/A
≡	College Prep	☐ N/A
≡	Engineering	☐ N/A
≡	Construction	☐ N/A
≡	Intelligent Transportation Systems	☐ N/A

9. Please list the top three program objectives.

1

2

3

* 10. Do you have evidence that students participating in NSTI programs also go on to participate in other related summer or informal education programs?

- ◯ Yes
- ◯ No

11. Please explain the reason(s) why you believe students go on to participate in other related summer or informal programs. Please list specific evidence if you have it.

* 12. What types of partners does your NSTI program work with?
(Check all that apply.)

- ☐ State DOT
- ☐ Public Transit Agency
- ☐ Local Department of Public Works (DPW), or Roads/Streets Department
- ☐ Privately Operating Companies (e.g. transit, rail, pipeline, logistics, delivery, trucking, etc.)
- ☐ Professional Organizations (e.g. ASCE, ITE, APWA)
- ☐ Private Engineering or Construction Firm(s)
- ☐ Other (please specify)

* 13. Do you track student progress AFTER the program has concluded to determine whether they continue on to secondary or post-secondary education and/or training that is related to transportation careers?

- ◯ Yes
- ◯ No, but we have in the past
- ◯ No, but I would like to in the future
- ◯ No, and we do not plan to

14. Please select all the method(s) you CURRENTLY use to track students.

- [ ] Facebook
- [ ] Phone calls
- [ ] LinkedIn
- [ ] Mobile text messages
- [ ] Email
- [ ] Postal mailings
- [ ] Other method (please specify)

15. How would you rate the success of your CURRENT tracking method(s)?
(Move slider or type number in box).

0 - Completely Ineffective 5 10 - Extremely Effective

16. Is this method(s) different than methods the program has used in the PAST?

- ( ) Yes
- ( ) No

17. Which methods has your program used in the PAST?

- [ ] Facebook
- [ ] Phone Calls
- [ ] Linkedin
- [ ] Mobile Text Messages
- [ ] Email
- [ ] Postal Mailings
- [ ] Other Method (please specify)

* 18. If resources were not an issue, how might you IDEALLY track students after they complete the program to determine how it influenced their future options and choices?

* 19. As part of this study, we are also conducting phone interviews to gain a deeper understanding of the successes and challenges in delivering an NSTI program and meeting the goals that the program aspires to.

Are you willing to be contacted for further participation in the study?

- ◯ Yes
- ◯ No

* 20. Please enter your contact information.

If you would like to provide additional program information such as brochures, agendas, or other materials, please email Program Manager, Glenn McRae, at glenn.mcrae@uvm.edu.

Name	
Organization	
City/Town	
State	-- select state --
Email Address	
Phone Number	

Thank you!

Thank you for participating in our survey! We appreciate your time.

Appendix 3 – FHWA Memo (May 23, 2019)
Allocation of Funds for Fiscal Year (FY) 2019 On-the-Job Training Supportive Services (OJT/SS) and National Summer Transportation Institute (NSTI) Program

U.S. Department of Transportation
Federal Highway Administration

Memorandum

Subject: **ACTION:** Allocation of Funds for Fiscal Year (FY) 2019 On-the-Job Training Supportive Services (OJT/SS) and National Summer Transportation Institute (NSTI) Program

Date: May 23, 2019

From: Ewa Flom *Ewa Flom*
Acting Director
Center for Transportation Workforce Development

In Reply Refer To: HIN-CWD

To: Division Administrators
Civil Rights Specialists
Directors of Field Services

The Federal Highway Administration (FHWA) Center for Transportation Workforce Development (CTWD) concurs with the FHWA Division Office recommendations to approve the Statement of Work (SOW) from State departments of transportation (State DOT) for the FY 2019 On-the-Job Training Supportive Services (OJT/SS) and/or National Summer Transportation Institute (NSTI) programs.

Through this memo, we are allocating the amount of contract authority and an equal amount of obligation limitation to States. Please work with your State to ensure the SOW and associated budget reflect the allocated amount listed in the Attachment. These funds are made available under 23 USC 140(b) for the specific projects indicated in the State DOT SOW for the FY 2019 OJT/SS and/or NSTI.

State	Program Code	FY	CFDA	Project	Contract Authority (CA)	Obligation Limitation Authority (OA)
	DELPHI Code: 15X0R49050-0000-028					
Details in Attachment	Z49A	2019	20.205	OJT/SS	Details in Attachment	Details in Attachment
Details in Attachment	Z49B	2019	20.205	NSTI	Details in Attachment	Details in Attachment
	Total				**$8,124,674.93**	**$8,124,674.93**

These funds are to be used to support the implementation of activities as set forth in the State DOT SOW for the FY 2019 OJT/SS and/or NSTI. The maximum Federal share for these funds is 100 percent and the funds are to be used in accordance with 23 USC 140

(b) and 23 USC 230.113.

These funds are available until expended, but are subject to August Redistribution. If it is determined that the funds will not be obligated by the end of FY 2019, please contact this office. Additionally, please contact this office in writing to notify that 1) the related project has closed; 2) if the remaining balance has been deobligated from the project; and 3) to request a deallocation of funds.

If there are questions, please contact

- OJT/SS Program Manager, Michael Caliendo, at 208-334-9180 ext. 131, or by e-mail at michael.caliendo@dot.gov,
- NSTI Program Manager, Joyce Gottlieb, at 202-366-9495 or by e-mail at joyce.gottlieb@dot.gov, and
- Funds Certifier, Cindy Owens, at 202-809-4771 or at cindy.owens@dot.gov

By copy of this memorandum, we request that the Office of Budget - FMIS Team, Office of the Chief Financial Officer process this allocation.

Attachment

CC:
FMIS Team
Cindy Owens, Program Analyst, HIF-20
Michael Caliendo, Equal Opportunity Specialist, Idaho Division
Joyce Gottlieb, NSTI Program Manager, HIN-CWD
Division Financial Managers

Funding for FY 19 OJT/SS and/or NSTI Programs

States/Territory	OJT/SS Z49A	Equal CA/OA Z49A	NSTI Z49B	Equal CA/OA Z49B	Total
Alabama	$111,825.00	$111,825.00	$49,958.00	$49,958.00	$161,783.00
Alaska	$88,202.00	$88,202.00	$0.00	$0.00	$88,202.00
Arizona	$117,842.00	$117,842.00	$40,000.00	$40,000.00	$157,842.00
Arkansas	$76,312.00	$76,312.00	$50,000.00	$50,000.00	$126,312.00
California	$300,000.00	$300,000.00	$259,479.00	$259,479.00	$559,479.00
Colorado	$78,817.00	$78,817.00	$50,000.00	$50,000.00	$128,817.00
Connecticut	$74,030.00	$74,030.00	$50,000.00	$50,000.00	$124,030.00
Delaware	$19,933.00	$19,933.00	$55,000.00	$55,000.00	$74,933.00
District of Columbia	$50,720.00	$50,720.00	$22,798.00	$22,798.00	$73,518.00
Florida	$329,261.00	$329,261.00	$0.00	$0.00	$329,261.00
Georgia	$190,315.00	$190,315.00	$50,000.00	$50,000.00	$240,315.00
Guam	$41,447.00	$41,447.00	$21,053.00	$21,053.00	$62,500.00
Hawaii	$22,929.00	$22,929.00	$50,000.00	$50,000.00	$72,929.00
Idaho	$46,158.00	$46,158.00	$46,000.00	$46,000.00	$92,158.00
Illinois	$259,556.00	$259,556.00	$0.00	$0.00	$259,556.00
Indiana	$190,444.00	$190,444.00	$0.00	$0.00	$190,444.00
Iowa	$90,604.00	$90,604.00	$31,384.00	$31,384.00	$121,988.00
Kansas	$55,700.00	$55,700.00	$49,933.00	$49,933.00	$105,633.00
Kentucky	$147,933.00	$147,933.00	$0.00	$0.00	$147,933.00
Louisiana	$103,588.00	$103,588.00	$49,860.94	$49,860.94	$153,448.94
Maine	$28,050.00	$28,050.00	$48,332.00	$48,332.00	$76,382.00
Maryland	$83,574.00	$83,574.00	$55,000.00	$55,000.00	$138,574.00
Massachusetts	$139,519.00	$139,519.00	$0.00	$0.00	$139,519.00
Michigan	$205,187.00	$205,187.00	$0.00	$0.00	$205,187.00
Minnesota	$60,578.00	$60,578.00	$85,533.00	$85,533.00	$146,111.00
Mississippi	$0.00	$0.00	$120,000.00	$120,000.00	$120,000.00
Missouri	$139,535.00	$139,535.00	$49,984.74	$49,984.74	$189,519.74
Montana	$90,475.00	$90,475.00	$20,000.00	$20,000.00	$110,475.00
Nebraska	$77,548.00	$77,548.00	$15,054.36	$15,054.36	$92,602.36
Nevada	$53,521.00	$53,521.00	$0.00	$0.00	$53,521.00
New Hampshire	$24,353.00	$24,353.00	$50,000.00	$50,000.00	$74,353.00
New Jersey	$50,627.00	$50,627.00	$59,797.48	$59,797.48	$110,424.48
New Mexico	$0.00	$0.00	$61,999.47	$61,999.47	$61,999.47
New York	$247,408.00	$247,408.00	$50,000.00	$50,000.00	$297,408.00
North Carolina	$203,724.00	$203,724.00	$0.00	$0.00	$203,724.00
North Dakota	$37,244.00	$37,244.00	$49,349.00	$49,349.00	$86,593.00
Northern Mariana Islands	$26,791.90	$26,791.90	$21,299.00	$21,299.00	$48,090.90
Ohio	$197,569.00	$197,569.00	$50,000.00	$50,000.00	$247,569.00

Oklahoma	$93,479.00	$93,479.00	$50,000.00	$50,000.00	$143,479.00
Oregon	$0.00	$0.00	$123,672.00	$123,672.00	$123,672.00
Pennsylvania	$291,835.00	$291,835.00	$0.00	$0.00	$291,835.00
Puerto Rico	$34,000.00	$34,000.00	$50,000.00	$50,000.00	$84,000.00
Rhode Island	$82,235.00	$82,235.00	$0.00	$0.00	$82,235.00
South Dakota	$91,567.00	$91,567.00	$0.00	$0.00	$91,567.00
Tennessee	$109,552.00	$109,552.00	$65,000.00	$65,000.00	$174,552.00
Texas	$412,846.00	$412,846.00	$173,727.89	$173,727.89	$586,573.89
Utah	$0.00	$0.00	$20,000.00	$20,000.00	$20,000.00
Vermont	$29,930.45	$29,930.45	$49,983.55	$49,983.55	$79,914.00
Virgin Islands	$60,735.00	$60,735.00	$0.00	$0.00	$60,735.00
Virginia	$141,072.00	$141,072.00	$58,918.00	$58,918.00	$199,990.00
Washington	$149,920.00	$149,920.00	$0.00	$0.00	$149,920.00
West Virginia	$63,320.00	$63,320.00	$51,084.15	$51,084.15	$114,404.15
Wisconsin	$100,903.00	$100,903.00	$60,000.00	$60,000.00	$160,903.00
Wyoming	$87,760.00	$87,760.00	$0.00	$0.00	$87,760.00
Total	**$5,810,474.35**	**$5,810,474.35**	**$2,314,200.58**	**$2,314,200.58**	**$8,124,674.93**

Note: Allocation for South Carolina and American Samoa may be provided by separate memorandum.

Appendix 4- FHWA Memo (May 10, 2018)

Update: Fiscal Year (FY) 2018 National Summer Transportation Institute Funding

U.S. Department of Transportation
Federal Highway Administration

Memorandum

Subject: **UPDATE**: Fiscal Year (FY) 2018 National Summer Transportation Institute Funding

Date: May 10, 2018

From: Virginia Tsu, Director Yolanda Jordan for Virginia Tsu
Center for Transportation Workforce Development
Office of Innovative Program Delivery

In Reply Refer To: HIN

To: Division Administrators
Civil Rights Specialists

On April 19, 2018, the Center for Transportation Workforce Development (CTWD) provided an update on the status of funding for the National Summer Transportation Institute (NSTI) program. In an effort to fund the 2018 NSTI programs, the use of Section 504(e) and unused OJT//SS funds were discussed as options.

These options were based, in part, on the past practice of using unobligated/unused OJT/SS funds to support NSTI activities and other activities such as construction career days. This was typically done by modifying an existing OJT Statement of Work (SOW) by adding a component to address the activity. However, after further analysis by CTWD and the Office of Chief Counsel regarding the use of the unobligated/unused OJT/SS funds, these funds can only be used for their initial purpose and may not be used to fund NSTI or other activities. Unused OJT/SS funds must be handled in accordance with the regulations at 23 CFR 230.117(2)(b):

> Where a State highway agency does not obligate all its funds within the time specified in the year's allocation directive, the funds shall revert to the FHWA Headquarters Office to be made available for use by other State highway agencies, taking into consideration each State's need for and ability to use such funds.

CTWD will be working with you over the next couple of weeks to de-obligate any unused OJT/SS funds.

A State DOT may use Section 504(e) funds to support NSTI activities; however, NSTI funds cannot be used to reimburse State DOTs that choose to use Section 504(e) funds for NSTI purposes.

If you have questions, do not hesitate to contact to me at (703) 235-1263. Thanks.

Appendix 5-

NSTI State by State Expenditures FY 16 (provided by FHWA)

NSTI FY 2016 STATE ALLOCATION	
PARTICIPATING STATE	AVERAGE ALLOCATION
ALABAMA	$97,755
ARIZONA	$46,955
ARKANSAS	$25,104
CALIFORNIA	$109,224
COLORADO	$34,519
CONNECTICUT	$20,000
DELAWARE	$53,958
DISTRICT OF COLUMBIA	$47,776
FLORIDA	$81,626
GEORGIA	$89,982
IDAHO	$72,611
ILLINOIS	$51,128
IOWA	$24,822
KANSAS	$51,691
KENTUCKY	$51,128
LOUSIANA	$47,962
MAINE	$33,520
MARYLAND	$67,588
MASSACHUETTS	$99,734
MICHIGAN	$79,000
MINNESOTA	$29,310
MISSISSIPPI	$86,257
MISSOURI	$65,065
MONTANA	$39,253
NEBRASKA	$20,000
NEVADA	$51,082
NEW HAMPSHIRE	$19,997
NEW MEXICO	$46,447
NEW YORK	$14,554
NORTH CAROLINA	$116,898
NORTH DAKOTA	$20,000
OHIO	$50,807
OKLAHOMA	$55,000
OREGON	$54,952
PENNSYLVANIA	$75,000
PUERTO RICO	$55,000
RHODE ISLAND	$30,384
SOUTH CAROLINA	$84,889
TENNESSEE	$55,000
TEXAS	$104,000
UTAH	$20,000
VERMONT	$55,904
VIRGINIA	$95,421
WEST VIRGINA	$38,907
WISCONSIN	$90,000
*AMERICAN SAMOA	$20,000
*GUAM	$20,083
NORTHERN MARIANA ISLANDS	$20,000
Total	$2,620,293

Appendix 6-
NSTI State by State Expenditure FY 17 (provided by FHWA)

FY 17 NSTI Approved Program Funding

State/U.S. Territory	FY17/Program Code: Z49B
Alabama	$95,197
American-Samoa	$20,000
Arizona	$51,206
Arkansas	$20,000
California	$101,979
Colorado	$35,690
Connecticut	$20,000
District of Columbia	$48,583
Florida	$87,277
Georgia	$95,000
Guam	$20,069
Idaho	$75,362
Illinois	$49,447
Iowa	$25,715
Kansas	$50,264
Kentucky	$55,516
Louisiana	$49,409
Maine	$33,916
Maryland	$68,220
Massachusetts	$95,026
Michigan	$82,684
Minnesota	$44,990
Mississippi	$113,757
Missouri	$58,247
Montana	$39,684
Nebraska	$20,000
Nevada	$55,000
New Hampshire	$20,000
New Jersey	$50,682
New Mexico	$40,510
New York	$67,972
North Carolina	$112,193
North Dakota	$20,000
Northern Mariana Islands	$20,000
Ohio	$55,000
Oklahoma	$55,064
Oregon	$55,000
Pennsylvania	$85,990
Puerto Rico	$55,159
Rhode Island	$29,093
South Carolina	$89,998
South Dakota	$20,000
Tennessee	$56,361
Texas	$87,066
Utah	$20,000
Vermont	$53,598
Virginia	$93,696
West Virginia	$55,000
Wisconsin	$90,000
Total	**$2,744,620**