ASEE AMERICAN SOCIETY FOR ENGINEERING EDUCATION

Paper ID #27877

Inspiring the Next Generation: Lessons Learned from the National Summer Transportation Institute Program

Dr. Yongping Zhang P.E., California State Polytechnic University, Pomona

Dr. Yongping Zhang is an Assistant Professor in the Civil Engineering Department at Cal Poly Pomona. He is also a registered Professional Engineer in Civil Engineering.

Dr. Zhang currently serves on the Transportation Research Board's Committee on Transportation Planning Applications as well as Task Force on Understanding New Directions for the National Household Travel Survey Task Force.

From 2009 to 2015, Dr. Zhang worked as Senior Transportation Modeler and Project Manager for Southern California Association of Governments (SCAG); Prior to that, he was a Senior Transportation Analyst for Wilbur Smith Associates in Chicago from 2007 to 2009.

Dr. Ghada M. Gad, California State Polytechnic University, Pomona

Dr. Ghada Gad is an Assistant Professor in Construction Engineering at Cal Poly Pomona. She received her PhD in Civil Engineering (Construction emphasis), from Iowa State University. Her main areas of research is in construction management focusing on contracts, procurement, project delivery methods, estimating, and risk management, in addition to the cultural aspects of construction projects. She is also an ExCEED fellow; her teaching pedagogy focuses on adopting active learning techniques in her classes, to increase student attainment and motivation beyond the classroom.

Dr. Wen Cheng

Dr. Cheng received his Ph.D. from Arizona State University. His research focuses on highway safety, statistical modeling, traffic operation and management. He won the nationally recognized "2008 Young Researcher Award" presented by TRB Committee on Safety Data, Analysis, and Evaluation due to his research related to safety performance ranking. He also received the 2013 National James M. Robbins Excellence in Teaching Award from the Civil Engineering honor society. Most recently, he received the 2015 Outstanding Research Award and the 2018 Outstanding Teaching Award from Cal Poly Pomona College of Engineering.

Dr. Ahmed Elaksher P.E., Cal Poly State
Dr. Xudong Jia, California State Polytechnic University, Pomona

Inspiring the Next Generation: Lessons Learned from the National Summer Transportation Institute Program

Yongping Zhang*, Ghada Gad, Wen Cheng, Ahmed Elaksher, Xudong Jia

Civil Engineering Department
California State Polytechnic University, Pomona
3801 W Temple Ave, Pomona, CA 91768

Abstract

To address the need for a diverse workforce in the 21st Century, and create awareness of the career choices and opportunities that exist in the transportation industry, the US Department of Transportation (DOT) established various educational initiatives. One of these is the National Summer Transportation Institute (NSTI) that aims at providing middle or high school students the opportunity to spend a few weeks in a prominent accredited college/university, in which they receive a realistic college preview geared at transportation related coursework. In summer 2018, under the theme *"Modern Design Tools in Transportation Engineering: How to Prepare Los Angeles for the 2028 Olympic Games?"*, California State Polytechnic University, Pomona (CPP) was selected as one of the four host sites for the NSTI program. The main goal of the program was to motivate students to study transportation engineering and equip them with the knowledge and capability to come up with creative, systematic, and sustainable solutions. It is intended to provide conclusions to inform other peers in engineering education in the U.S. and other countries. The program included 40 high school students recruited from 30 schools across Southern California, and was designed to include a multi-modal inter-disciplinary curriculum. With detailed description of the pedagogical approach, assessment methods, and learning outcomes, this paper aims to systematically review the successful implementation of the NSTI program at CPP and the lessons learned. In general, the program was very well received by all parties: high school students, parents, CPP faculty, CPP student assistants, guest speakers, the sponsors, and field trip hosts. Through the assessment tools used, it was seen to greatly impact the 40 high school students, as well as the 17 CPP students, both on the knowledge of the subject, as well as their future career decisions.

With detailed description of the pedagogical approach, assessment methods, and learning outcomes, this paper aims to systematically review the successful implementation of the NSTI program at CPP and the lessons learned in the process. It is intended to provide conclusions to inform other peers in engineering education in the U.S. and other countries.

1. Introduction

National Summer Transportation Institute (NSTI) is a transportation focused career awareness initiative. To address the need for a diverse workforce in the 21st Century and to create awareness of the career choices and opportunities that exist in the transportation industry, the US DOT and FHWA established various educational initiatives and NSTI is one of these initiatives. The NSTI program provides the opportunity for middle school or high school students to spend 2-4 weeks receiving a realistic college preview geared at transportation related coursework at prominent accredited college/university campuses across the country. Each year, FHWA solicits proposals from accredited colleges & universities across the country to serve as host sites for the NSTI program. For this year's program, FHWA added additional funding to support some students from each of the four host universities to attend a six-day training provided by the National Flight Academy (NFA) in Pensacola, Florida.

From June 11 to June 29, 2018, a CPP team (7 CPP faculty, 2 consultants, 13 CPP Civil Engineering student volunteers, and 3 CPP Aerospace Engineering student volunteers) provided a well-designed three-week learning experience on transportation related topics for 40 high school students recruited from 30 high schools across Southern California. Under the theme of *"Modern Design Tools in Transportation Engineering: How to Prepare Los Angeles for the 2028 Olympic Games?"*, the program was designed carefully to include 12 field trips, 12 workshops, and 12 hands-on exercises over three weeks. With detailed description of the pedagogical approach, assessment methods, and learning outcomes, this paper aims to systematically review the successful implementation of the NSTI program at CPP and the lessons learned. The following section provides a more detailed description about the NSTI-CPP program's development process, the scope, and the implementation.

2. Program Pedagogical Approach

Time Frame and Target Group. FHWA sent out the request for proposal via Caltrans. Over the course of three months, numerous discussions were held among PI/Co-PIs, instructors, guest speakers and field trip hosts to ensure a well-designed program. The PI also worked with the Office of Research, bus companies, food service, etc. to ensure the proposed budget was reasonable. There were also many other considerations to account for such as classroom capacity, classroom availability, software availability in different lab rooms, temporary log in to engineering labs, instructors/field trip hosts' availability, supplies, time frame, and safety and liability. All costs were to be covered by the program, but students needed to commute to the university. After compiling all the pieces of information necessary, the proposing group decided to recruit up to 40 high school students (9th-12th grade) across five counties in Southern California, to maximize the impact on the region. It was also decided that a three-week program over the summer from June 11 to June 29 would provide the best fit for high schools' calendar as well as CPP faculty's schedule. It is also worth noting that the NSTI program received strong support from the Dean's office (College of Engineering), as well as faculty and staff in the CE department.

Theme. Our next task was to come up with a good theme for this NSTI-CPP program that addresses contemporary issues related to transportation. In 2028, Los Angeles will be hosting the Olympic Games. The games are expected to bring an estimated $18 billion economic impact to the United States, and $11.2 billion to Southern California alone. However, as the nation's most congested urban area, the question was how Los Angeles can be prepared for the additional millions of trips added on top of the ever-growing traffic gridlocks. Meanwhile, ten years from now, some of these high-school students who would be enrolled in the NSTI-CPP program, will be tasked to combat the traffic congestion problems here in Los

Angeles. In line with this issue, the program goal is to motivate middle and high school students to study transportation engineering and equip them with the knowledge and capability to come up with creative, systematic and sustainable solutions. Aligning these ideas and after many discussions between the Co-PIs, the program theme for the NSTI-CPP program was set to be: *Modern Design Tools in Transportation Engineering: How to Prepare Los Angeles for the 2028 Olympic Games?*

Curriculum. The three-week Program Curriculum started from macro-level down to micro-level, from drawing a big picture to gradually introduce various modern design tools. It started from a transportation system overview (day 1) to transportation planning (day 2), to transportation management (day 3), then to each transportation mode (day 4: water; day 5: air; day 6: railway). From day 7, we came back to focus on highway mode and then zoom in to each specific technical area: traffic safety (day 7), highway construction and management (day 8, day 9), Building Information Modeling (BIM) (day 10). From Day 11 to 14, we spent four days looking into the modern technologies offered by geospatial engineering. These modules were designed to help student understand how to collect data to use in transportation planning and engineering design. These tools include: various survey tools (day 11), UAS (day 12), 3D-Scan (day 13), and CAD/GIS (day 14). On day 15, we asked students to form 4-person groups to compile what they have learned over the past three weeks and have a presentation competition. The best three groups (out of 9) were asked to present in front of 120 audience during the closing ceremony.

It is worth noting that in developing each module, students were challenged with the underlying theme of how to relate what they have learned to solve the traffic congestion problem in Los Angeles area and how to prepare the city/region for the 2028 Olympic Games. In fact, students given the essay topic (which is the same as the program theme) from day 1 so that they could start preparing for the essay throughout the learning process. With this theme in mind, the NSTI-CPP program was based on a multi-modal inter-disciplinary curriculum with the following key components:

- *Field Trips*: The NSTI program provided students with 8 field trips, in addition to 4 learning experience outside the classroom around campus. Students visited Southern California Association of Governments (SCAG, the nation's largest Metropolitan Planning Organization) to learn about the Regional Transportation Plan across Southern California, LA Metro, Transportation Management Center at Caltrans District 7, Port of Long Beach, the Chino Airport, Metrolink train control center, the District Headquarter of Caltrans District 8, and a highway construction site of Caltrans District 8. It is was anticipated that, by giving students direct access to these agencies and facilities, we can encourage them to think about where the traffic congestion problems come from and how the multi-modal system is working towards combating these congestion problems.
- *Seminars and Demonstrations*: Speakers from various transportation organizations and private agencies were invited to talk to the students and/or host tours at their facilities. Instructors for each program module also hosted a workshop to present to students the basic background information and state-of-the-art tools in each subject and facilitate interactive discussions.
- *Projects and Hands-On Activities*: Students worked on hands-on projects that were carefully designed by the NSTI-CPP team. Hands-on activities included: analysis of the transportation planning strategies for a small city, traffic control device analysis and design, site investigation of hazardous traffic spots around campus, earthwork estimating in highway construction, development of a highway construction schedule, simple station design with 4D simulation, stacking out simple horizontal curves using ground surveying tools, use of a UAS equipped with an optical camera to collect geospatial data, 3D laser scanning of a freeway interchange, and analysis of a transportation network with ArcGIS. In

addition, students were involved in activities for trip report preparations, presentation competition, and essay competition. Each student was asked to create and maintain a NSTI portfolio to document his or her activities, and a brief report summarizing what they learned each day. The field trip reports were reviewed by the CPP student volunteers who actively participated in the entire program (field trips, workshops, and hands-on exercises) too. It was our goal that these high school students can use this as a portfolio when applying to universities. At the end of the program, students were asked to assemble each report to create a comprehensive report. Students were trained with our "learn-by-doing" educational philosophy. Workshop participants used the same laboratory facilities used by our undergraduate and graduate civil engineering students, including our transportation and geospatial laboratories.

Implementation. The program started with a formal opening session and closed with a formal ceremony, both attended by over 120 high school students, parents, the CPP team, Dean of College of Engineering, and FHWA representative. From June 21 to June 28, 2018, 12 students selected out of the 40 students from the three-week program to attend the six-day flagship program provided by the NFA in Pensacola, Florida. The flagship program at NFA blends the culture and excitement of aviation with the latest technology and core competencies in an exclusive, entertaining and engaging immersive environment to provide a best in the world learning adventure. These students were selected based on a well-designed grading rubrics, including evaluation of field trip reports (20%), participation (10%), in-class hands-on exercises (10%), and the quality of the essay (60%). The essays were reviewed by CPP faculty carefully to ensure fair grades were assigned to each student.

3. Program Assessment

An important component of the NSTI-CPP program was assessing the students' learning experience. Thus, several pre and post assessments instruments were designed to evaluate the effectiveness of the curriculum in preparing youth for future transportation careers and to improve our program for future years.

Assessment instruments. The assessment tools used included two forms of surveys that were composed of both open-ended and close-ended (Likert-scale type) questions. The first was a *Pre-assessment Survey* that was conducted before the program started. This survey aimed at getting a better understanding of what the students' knowledge is of the transportation topics being discussed and gearing the curriculum to serve the students. Students were asked questions on the reason they selected to join the program, what they thought civil engineers do, how much they knew about various topics/terms such as Caltrans, transportation planning, plan reading, and CAD, why they thought civil and transportation engineering is important, expectations of the program, and finally what they would like to learn most in the program.

The second was a series *of Daily Surveys* that were administered at the end of each day to offer the opportunity for students to evaluate their daily activities. Questions included their opinions of how well the topics were introduced and presented, if it encouraged them to pursue a career in civil engineering, whether the time allocated for the topic was adequate, what they thought of the field trip or the hands-on activities, major take-away points, and improvement suggestions.

Assessment results. Based on the data collected, the following discussion provides some of the major findings from the assessment tools administered to the students. As for the *Pre-assessment Survey*, as shown in table 1, most students reported that they joined the program to learn about engineering and

civil engineering specifically (76% and 66% respectively). The least reported reason by the students was to meet experts in the civil engineering field (34%). In terms of what they though civil engineers do, as shown in table 2, 82% of the students selected “Design bridges and tunnels”, followed by a 68% selecting “prepare and develop construction project schedules and project cost estimates to determine project feasibility”. The least two selected options were “Eliminate wastefulness in production processes” and “design vehicles” (34% and 32% respectively).

Table 1: Why students joined the program?

ANSWER CHOICES	RESPONSES
I didn’t have plans for this summer and it sounded like a nice way to spend some of my summer	36.84%
I wanted to learn about engineering	76.32%
I wanted to learn about civil engineering	65.79%
I wanted to learn about university education in general	42.11%
I wanted to meet experts in the civil engineering field	34.21%
I wanted to make a decision whether engineering is a good career for me	65.79%
Other (please specify)	15.79%

Table 2: What do you think Civil Engineers do? (Select all that apply)

ANSWER CHOICES	RESPONSES
Design bridges and tunnels	81.58%
Prepare and develop construction project schedules and project cost estimates to determine project feasibility	68.42%
Manage and direct construction operations	68.42%
Construct projects	65.79%
Design buildings	65.79%
Design dams and water supply	65.79%
Determine number of lanes in roads	65.79%
Determine length of airport runways	65.79%
Design sewage systems	63.16%
Determine highways speed limit	60.53%
Design and develop new electrical systems	50.00%
Design power-producing machines	50.00%
Survey earth profile	44.74%
Design aircraft, spacecraft, satellites, and missiles	42.11%
Test soils or materials	42.11%
Develop and design chemical manufacturing processes	34.21%
Eliminate wastefulness in production processes	34.21%
Design vehicles	31.58%

Table 3: How much students thought they knew about various topics?

Term	NEVER HEARD THIS TERM BEFORE–1	MIGHT HAVE HEARD THE TERM BEFORE BUT NOT SURE WHAT IT ENTAILS–2	HEARD THIS TERM AND HAD A DISCUSSION ABOUT IT–3	FAMILIAR WITH THE TERM AND WHAT IT ENTAILS–4	VERY FAMILIAR WITH THE TERM AND WHAT IT ENTAILS–5	WEIGHTED AVERAGE–(1-5)
Air Transportation	0.00%	15.79%	42.11%	34.21%	7.89%	3.34
Safety Management	0.00%	23.68%	39.47%	31.58%	5.26%	3.18
Cost Estimating	2.63%	26.32%	34.21%	26.32%	10.53%	3.16
Water Transportation	5.26%	23.68%	42.11%	23.68%	5.26%	3
Railway Engineering	0.00%	39.47%	36.84%	21.05%	2.63%	2.87
Site management and work zone traffic safety	5.26%	36.84%	36.84%	13.16%	7.89%	2.82
Construction project management	5.26%	39.47%	28.95%	26.32%	0.00%	2.76
Transportation Planning	2.63%	52.63%	26.32%	15.79%	2.63%	2.63
Caltrans	26.32%	34.21%	21.05%	18.42%	0.00%	2.32
Plan Reading	24.32%	56.76%	16.22%	2.70%	0.00%	1.97
Earthwork Estimating	36.84%	42.11%	21.05%	0.00%	0.00%	1.84
Southern California Association of Governments (SCAG)	47.37%	44.74%	5.26%	2.63%	0.00%	1.63

Table 4: How much students thought they knew about various acronyms?

Acronyms	NEVER HEARD THIS TERM BEFORE–1	MIGHT HAVE HEARD THE TERM BEFORE BUT NOT SURE WHAT IT ENTAILS–2	HEARD THIS TERM AND HAD A DISCUSSION ABOUT IT–3	FAMILIAR WITH THE TERM AND WHAT IT ENTAILS–4	VERY FAMILIAR WITH THE TERM AND WHAT IT ENTAILS–5	WEIGHTED AVERAGE–(1-5)
STEM	2.63%	2.63%	10.53%	34.21%	50.00%	4.26
CAD	39.47%	23.68%	18.42%	10.53%	7.89%	2.24
Caltrans	34.21%	28.95%	18.42%	18.42%	0.00%	2.21
FAA	42.11%	31.58%	18.42%	7.89%	0.00%	1.92
DOT	55.26%	21.05%	15.79%	5.26%	2.63%	1.79
NFA	44.74%	42.11%	10.53%	0.00%	2.63%	1.74
GIS	63.16%	21.05%	10.53%	2.63%	2.63%	1.61
FTA	59.46%	32.43%	8.11%	0.00%	0.00%	1.49
BIM	60.53%	36.84%	2.63%	0.00%	0.00%	1.42
ITS	68.42%	26.32%	2.63%	0.00%	2.63%	1.42
FHWA	71.05%	21.05%	7.89%	0.00%	0.00%	1.37
UASs	73.68%	21.05%	5.26%	0.00%	0.00%	1.32
AADT	72.97%	27.03%	0.00%	0.00%	0.00%	1.27
VMT	78.95%	21.05%	0.00%	0.00%	0.00%	1.21

Table 3 and Table 4 show how students responded in terms of how much they thought they knew about various topics and acronyms, from 1 being 'never heard about this term before' to 5 being 'very familiar with this topic'. The topics that students reported having most knowledge of included Air transportation (3.34 out of 5) and Safety Management (3.8 out of 5), while the topics they reported knowing least about were Earthwork estimating (1.63 out of 5) and plan reading (1.84 out of 5). The acronym that students reported having most knowledge was STEM (4.26 out of 5). This was followed with a significant drop by CAD (2.24 out of 5), while the acronyms they reported knowing least about were VMT (1.21 out of 5) and AADT (1.27 out of 5).

On being asked why they think civil engineering is important, common themes included ones related to transportation infrastructure, economy stimulation, better buildings, and its effect on our everyday lives. As for why they think transportation engineering is important, common themes included ways to move people and goods efficiently, economic growth stimulation, improved productivity, and safety. In terms of the students' expectations from the program, most students wanted to learn more about engineering and transportation topics such as traffic flow analysis, investigate future career paths in engineering, do hands-on work related to transportation, understand how departments of transportation work, and applications of technology in engineering.

As for the *Daily Surveys* results, Table 5 shows that students, in general reported positively on the statements asking for their daily experience, with all the average scores ranging 4 being agree to 5 being strongly agree. Major takeaway from the topics covered included Caltrans project initiation steps, surveying tools, environmental constraints, runways design, Metro link, air traffic control, and BIM use in communication.

Table 5: Students rating of their daily experiences

Questions	STRONGLY DISAGREE-1	DISAGREE-2	NEITHER AGREE NOR DISAGREE-3	AGREE-4	STRONGLY AGREE-5	WEIGHTED AVERAGE (1-5)
Overall, I feel I learned a lot from today's session(s)	2.00%	0.00%	3.00%	28.00%	67.00%	4.58
The instructors were good communicators	2.00%	0.00%	5.00%	31.00%	62.00%	4.51
Today's topic was very well introduced	2.00%	1.00%	6.00%	27.00%	64.00%	4.5
The material covered was very well presented	2.00%	1.00%	6.00%	33.00%	58.00%	4.44
The hands on session(s)/field trip helped me understand the material covered more	2.02%	0.00%	9.09%	29.29%	59.60%	4.44
The hands on session(s)/field trip was well organized	2.00%	2.00%	10.00%	31.00%	55.00%	4.35
Time allocated for today's topic was adequate	2.00%	4.00%	11.00%	40.00%	43.00%	4.18
Today's topic encouraged me more to pursue an engineering career	5.00%	0.00%	11.00%	45.00%	39.00%	4.13

4. Program Outcomes

Based on the general faculty observations, the assessment results, and the informal discussions that the faculty had with the students and their parents, it was evident that the students were exposed to a very thorough transportation curriculum for the first time. They acknowledged transportation engineering as a career path and some showed interest to pursue transportation engineering as their future field of study. Some have applied for other engineering majors, though. During the program students learned about different parts of the transportation infrastructure and the role of different local, state, and federal agencies in the LA metropolitan area and the state. It was interesting to see this young generation know about the history of the 1984 LA Olympic Games. In this project, they had the opportunity to understand how various transportation technologies and policies were implemented to facilitate this event successfully. Students were also able to apply the knowledge and tools presented in this three-week program to come up with reasonable ideas to help LA cope with its ever-growing traffic congestion problems and prepare LA for the 2028 Olympic Games. Students were very enthusiastic, collegial, and built good friendship among themselves.

Other participants in our project included CPP student volunteers, faculty and host agencies. CPP Student volunteers were very active and passionate to help the high school students. They also benefited from the event and learned about our transportation curriculum and career path. They learned how such event was organized and were deeply involved in organization, scheduling, and transportation. Additionally, CPP students and the NSTI high school students formed very good connections. Faculty got to know more about the high school students and their potentials. Faculty were impressed by students' skills using the new technology, computers and video/audio tools to present what they have learned. The event was a good opportunity to collaborate with different agencies that were all very helpful, eager to teach students, and present the cutting edge technologies they use. This created a potential to attract some of these students to work for these agencies in the future.

5. Lessons Learned

This section highlights the major lessons learned from implementing this program in CPP.

Design the program carefully. One of the main points to address when designing the program is to try to maximize the learning experience within a short three-week program. A successful program relies heavily on the careful design of the program, with a mix of field trips, seminars, and hands-on experience grouped by a theme: how to prepare L.A. for the 2028 Olympic Games. Students were drawn to the theme because it is interesting, realistic, and challenging. With many different topics covered in the program, it is important to have a theme to group the topics together, and to remind students to relate what they learned to that theme; how can I apply what I have learned to solve the problem? Also, it is important to ask students to write a brief report on each field trip. It keeps students focused and responsible. It is also worth mentioning that the additional National Flight Academy program in Pensacola, Florida after the three-week program was a big incentive, as it motivated students to perform better to get selected.

Grouping the students into teams of 2 to 4, to present what they have learned through a presentation (multimedia) is beneficial and crucial in enhancing their learning process. It provides them a great opportunity to reflect on what they have learned and improve their presentation skills. Students can have peer evaluation to select the best presentations, which can be presented again to all parents and participants in the closing ceremony, as parents love to see their kids present what they learned. It is also

crucial to have all documents uploaded online via cloud (eg. Google drive), so all participants have access to all documents/photos/videos/presentations for a long time.

Coordination. Since there were so many people and so many activities involved, it is critical to have good coordination between faculty, college student volunteers, NSTI students, parents, and host agencies. It is a good practice to inform all participants of the activities in the entire program with details. Meanwhile, make an announcement in class at the end of the each day's activity and email all students and copy their parents the night before to remind everyone of the next day's activities and items to bring, especially for each field trip. Students' safety is always the top priority, and thus assigning each NSTI student to a specific college student and have them exchange cellphone number so it is easier to keep track of all students is a good practice. The coordinator, however, needs to keep a checklist for each field trip and count the number of students before bus leaves.

Get college students involved as much as possible. NSTI program provided a great opportunity for college student to learn and contribute. Since there were as many as 40 high school students, it is really hard for the faculty member to keep track of everyone. However, it is much easier for college student volunteers to observe and help out. Faculty can seek feedbacks from college students on various aspects. For example, the evaluation of field trip reports (20%) was completely done by college student volunteers. Usually faculty members were assigned only to a particular field trip, but most college students went to all field trips. By assigning each college student to be in charge of reviewing a specific field trip report for all NSTI students, it provided a great motivation for college student to learn and contribute.

Outreach. An important aspect of the program is how to attract underrepresented student population (i.e., underrepresented ethnicity groups, female, low-income students, etc.). The 2018 STI was not able to attract enough underrepresented students to apply, despite the fact that the program flyer was emailed to almost all public and private schools in the four-county area. Moving forward, there are many ways to improve the outreach efforts. Organizations that have worked with students in the previously mentioned demographics will be contacted for targeted advertisement. Furthermore, the ITE and WTS student chapters will initiate an STI referral campaign to engage their respective undergraduate students in the recruitment of high school students. The team can also contact and partner with Maximizing Engineering Potential (MEP) program, National Society of Black Engineers (NSBE), and Society of Hispanic Professional Engineers (SHPE). For example, MEP program has extensive experience in reaching out to disadvantaged high school students. In addition, both National Society of Black Engineers (NSBE) and Society of Hispanic Professional Engineers (SHPE) have extensive professional networks in the region which will greatly help reach out to more disadvantaged high school students who are interested in pursuing STEM fields. The team can also create a list of high schools with a higher percentage of disadvantaged students, then contact these schools to make presentations to students and showcase the 2018 STI program and recruit students for the 2019 STI program.

Add more components to the STI program. An enhancement program, if added, can expose students to a variety of workshops/presentations including: Career Opportunities in the Transportation Industry; How to Learn Effectively; How to Use Library/On-line Resources; How to Apply for College; and How MEP Program Can Help You Succeed. These workshops will help improve students' study habits and time management skills, communication skills, and computer skills. It is intended to foster students' self-awareness and provide students with useful resources and skills to succeed.

5. Conclusions

To address the need for a diverse workforce in the 21st Century and to create awareness of the career choices and opportunities that exist in the transportation industry, the US DOT and FHWA established various educational initiatives and NSTI is one of these initiatives. The objective of this paper was to systematically review the successful implementation of the NSTI program at CPP from proposal development all the way to assessment, as well as the lessons learned. The three-week Program Curriculum started from macro-level down to micro-level, from drawing a big picture to gradually introduce various modern design tools that could be used to address contemporary issues related to transportation. The program was based on a multi-modal inter-disciplinary curriculum including 12 field trips, 12 workshops, and 12 hands-on exercises over three weeks.

In general, the program was very well received by all parties: high school students, parents, CPP faculty, CPP student assistants, guest speakers, the sponsors, and field trip hosts. The program was seen to greatly impact the 40 high school students, as well as the 17 CPP students, both on the knowledge of the subject, as well as their future career decisions. In short, through a great teamwork and a well-designed curriculum, the program successfully created a win-win situation for everyone who was involved and the feedback received from all parties involved was very positive. It has certainly made great impacts on these 40 high school students as well as the 17 CPP student volunteers. It has also helped promote the Civil Engineering department, the College of Engineering, and the University among prospective students and the community. In the future, the project team intends to follow-up with the program participants to see how the program might have affected their career path decisions.

ACKNOWLEDGEMENT

The authors would like to acknowledge the Federal Highway Administration, and California Department of Transportation for funding this project through the National Summer Transportation Institute.