

# **2016 Mississippi State Summer Transportation Institute**

by

Dennis D. Truax, Ph.D., P.E., BCEE, F.ASCE, F.NSPE

Vemitra White, Ph.D.

Department of Civil and Environmental Engineering

Bagley College of Engineering

Mississippi State University

Mississippi State, MS 39762-9546

NCITEC Project No. 2016-16

Conducted for

NCITEC

July 2016

## DISCLAIMER

*The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. This document is disseminated under the sponsorship of the Department of Transportation University Transportation Centers Program, in the interest of information exchange. The U.S. Government assumes no liability for the contents or use thereof.*

## ABSTRACT

Each year since 2007, the Mississippi State University Department of Civil and Environmental Engineering has hosted a National Summer Transportation Institute. During 2016, this was one of three NSTI programs in the state of Mississippi. The 2016 Mississippi State Summer Transportation Institute (MSTI) was a two-week residence program for rising ninth and tenth grade high school students. With funding from NCITEC, Federal Highway Administration (FHWA) and the Mississippi Department of Transportation (MDOT), 25 students from all reaches of the state were supported to participate in the program.

The grant from NCITEC allowed enrollment to increase by 25 percent because the FHWA and MDOT funding covered all the fixed costs. Hence, these funds principally supported food and lodging for the additional students. It also helped defrayed the cost of transportation to take the students on field trips and provided supplies needed for the various laboratory STEM projects conducted.

The 2016 MSTI was held the last two weeks of June 2016. During this period, participants:

- Visited two UAS design, research and development facilities
- Toured a concrete batching facility
- Saw the air traffic control center and flight line of an Air Force base
- Toured an asphalt research, development and design laboratory
- Walked through a Tennessee-Tombigbee Waterway lock and dam and boated through an operational port and experienced a lockage on a department research vessel
- Visited an MDOT ITS command center
- Did a scavenger hunt through the Mississippi Agricultural (and Transportation) Museum to learn about air, rail, waterway and roadway impacts on state economics
- Experienced a first flight in general aviation aircraft through the EAA Young Eagles program.

A summary of photographs taken during 2016 MSTI are available for review at:  
<http://www.cee.msstate.edu/events/>.



## ACKNOWLEDGMENTS

There were several individuals who supported the program. Dr. V. G. Gude, P.E., BCEE, provided instructional support, program development, and helped escort students on field trips. Supporting our instructional team, including Dr. Gude, were Cayla R. Cook and Kelly L. Truax in all of these areas of program activity.

A significant effort was expended providing counseling for the participants during evenings. This involved guiding a host of evening activities and events, ensuring personal security, and dealing with schedules. Jazetta “Jaz” Anthony served as Head Counselor and coordinated a team consisting of Audrey Aldrige, Jamel Alexander, Kevaughn Charles, Lokia Clark, Marina McGruder, Leslie Pace, Rufus Warren, and Adam Young.

Lastly, a number of companies and agencies opened their doors to allow the students to gain a perspective of various careers in transportation and to gain a better understanding of what they do and how they contribute to the state. These included: Columbus Air Force Base USACE Tennessee-Tombigbee Waterway, MDOT Information Technology Center, Nissan, Aurora Flight Sciences, Ergon’s Paragon Technical Services laboratory, MMC Materials, MSU’s Center for Advanced Vehicular Systems and Raspet Flight Research Center, and the Mississippi Agriculture Museum. We also enlisted the support of the local Experimental Aircraft Association (EAA) chapter (Chapter 1189) to provide students an introduction to the importance of general aviation to the transportation industry as part of their Young Eagles program.



# TABLE OF CONTENTS

ABSTRACT.....	III
ACKNOWLEDGMENTS .....	V
TABLE OF CONTENTS.....	VII
INTRODUCTION .....	1
OBJECTIVE .....	3
SCOPE .....	5
METHODOLOGY .....	7
Recruitment and Student Selection Procedures .....	7
Recruiting.....	7
Selection.....	7
Program STEM-Focused Curriculum.....	8
Academic .....	8
Enhancement.....	12
Academic Advising.....	12
Sports and Recreation .....	13
24/7 Student Care.....	13
Transportation.....	14
DISCUSSION OF RESULTS.....	15
Survey of Students .....	16
Interest in STEM and Transportation Following MSTI .....	16
Benefit of MSTI Activities to the Students.....	17
Summary .....	18
CONCLUSIONS.....	19
RECOMMENDATIONS.....	21
ACRONYMS, ABBREVIATIONS, AND SYMBOLS .....	23
APPENDIX.....	24









## INTRODUCTION

Each year since 2007, the Department of Civil and Environmental Engineering (CEE) in Bagley College of Engineering (BCoE) of Mississippi State University (MSU) has conducted a two-week residential summer institute for rising high school sophomores and juniors. The program utilizes classroom, laboratory, and field trip exercises to provide participants with:

- an introduction to the myriad of career opportunities in the transportation industry and the educational requirements of these careers with emphasis on high school level education,
- a perspective on the role of transportation in economic growth and development from local through international economies, and
- a stronger sense of social responsibility and leadership as manifest through transportation-related careers.



## **OBJECTIVE**

Entitled the Mississippi State Summer Transportation Institute (MSTI), the program has four overall objectives:

- introduce participants to science, technology, engineering and mathematics (STEM) as they relate to the transportation industry;
- provide an overview of the various professional and technical career opportunities that the transportation industry and the civil engineering profession can provide properly trained individuals;
- present opportunities for students to explore all modes of transportation and the safety issues involved in each; and
- develop student experiences which help participants develop leadership skills, foster self-awareness, and gain skills for greater academic success.



## **SCOPE**

The curriculum includes activities from the AASHTO program TRAC™ as supported by MDOT-identified high school teaching staff involved with the state's seventh grade Transportation Career Discovery program. TRAC is diverse enough that students of all ages benefit from the program, and we adapted activities so students working in teams with other students solved simulations of real-life transportation challenges. The MSTI program also includes hands-on activities that foster the use of the team approach to solve problems, develop communications skills, and utilize the technology and STEM-based skills required into today's workforce.

MSTI incorporates field trips to transportation-related industries, government facilities, and transportation providers expose students to real-world applications of STEM and introduce them to a wide range of careers in transportation. The program addresses the development a workforce and citizenry that can maintain America's competitive edge in STEM fields, leadership training and an awareness of community. The curriculum incorporates service learning and prepares young people for the transition to college and careers. A final piece of the enhancement component, the MSTI students participated in academic strength building that includes oral and writing skill development, computer use and internet reference discernment skills, and coaching in time management and study skills.





## **METHODOLOGY**

The program focuses on engaging students who have demonstrated a strong record of academic performance and who have clearly defined an interest in learning more about the transportation industry. The program provides enrichment using a number of learning methods with the hope of increasing participant knowledge of the STEM areas that support careers in transportation. Subsequently, it is hoped the individuals will also leave the program with a stronger interest in continued pursuit of transportation related careers, particularly those which require continued education following graduation from high school.

### **Recruitment and Student Selection Procedures**

#### **Recruiting**

Students entering the 10th and 11th grade in the coming school year were recruited for the MSTI from all school districts in Mississippi. Students entering the 9th grade who have high academic performance and completed algebra are given secondary consideration. A project information letter, information on how to submit an application, and project brochures are mailed by the BCoE Outreach Office to all mathematics department heads, science department heads, guidance counselors and school administrators, requesting assistance in identifying qualified students interested in applying and participating in MSTI. Additionally, teachers enrolled in BCoE engineering-based classes for secondary educators across the state receive information for their students. MSTI directors visit schools with high percentages of students who are generally considered 'at risk' by accepted standards such as frequency of free or reduced lunch recipients and AYP failure.

Students interested in participating are required to complete an online application at the Bagley College of Engineering Summer Camps website. Supporting information and letters of reference from the student's teacher or school administrator are submitted electronically to support the application. Two weeks after the initial mailing of program information, MSTI project staff follow-up via telephone with school administrators to promote the MSTI program and answer questions.

#### **Selection**

Based on the applications submitted, funding commitments, and expected costs for the program, 25 individuals were selected to participate in the program. Five alternates were

identified to help insure the design number of participants attend the program. Alternates were identified and invited when initial invitees were unresponsive or declined our invitation.

The MSTI directors and staff sort the applications using a ranking system criteria including completion of application, GPA, essay, and teacher recommendations. Priority is given to students who indicate an interest in transportation or civil engineering. Participant invitations were mailed and include an orientation package outlining the program requirements, legal documents, and detailing institute activities.

### **Program STEM-Focused Curriculum**

The Mississippi State University version of the National Summer Transportation Institute had a diverse instructional platform and curriculum. Using university faculty and students, the program provided a variety of classroom, field trip, and laboratory exercises to present students with the background and application of science, technology, engineering and mathematics as related to the transportation industry. The program included information on life skills (e.g., professionalism, career hunting, resume writing, interviewing, and networking). It exposed students to engineering and technological aspects of the field, but it also introduced them to the public policy and political issues supporting a comprehensive, intermodal US transportation system. This was achieved as summarized below:

#### **Academic**

The MSTI curriculum was designed to provide the participants with a broad range of experiences related to various aspects of the intermodal transportation industry. A combination of presentations, computer simulations, hands-on laboratory-based manipulative activities, and field trips not only introduced them to the scientific, mathematical, and technological aspects of transportation system design and management, but it also exposed them to the engineering and societal aspects of this diverse area. The BCoE faculty and students serving as the academic staff immersed the students in a program that showed the personal rewards and societal benefits of developing and maintaining a viable transportation infrastructure, and what it takes to design and operate such a conductive network. Additionally, the students investigated the safety issues of a variety of various modes of transportation.

The presentation of program information was provided by the MSTI staff through two primary formats; on-campus instructional exercises and off-campus field trips. On-campus instruction routinely utilized a single day to introduce the science, mathematics, and

engineering approaches related to a specific transportation-related topic related to the design, operation, or use of land, air, water transportation vehicle and systems. Off-campus activities primarily consisted of field trips to give the students a real-life application of the content of transportation industry and the diversity of activities and opportunities that it provides in terms of supporting society and as a career.

During the implementation of the program, there were ten days of content instruction that included at several days of off-campus experiences. The closing ceremony included visual presentations by the students of projects and activities for visiting families. This was presented in conjunction with an awards luncheon on the Saturday of the last week.

**On-campus Learning.** Additionally, periodically a competition was devised to foster a sense of learning excitement and to help keep the students' attention throughout the program. Specifically, the projects that the students completed during an on-campus day were judged by staff using objective criteria, usually related to performance of the project. In other instances, the students voted for the best three projects and this resulted in identification of the best overall project.

Each day, students were assigned to a different team. In this manner, exceptional students would not outpace the better students which could have an adverse effect on student moral. Further, students that were struggling would be paired on some projects with students that could enhance their learning. In short, teams were designed in an effort to keep the skill levels of each team comparable and the result of the competition in question until the last day of the Institute.

The MSTI staff, supported by MDOT identified secondary instructors, used a TRAC™ module focused on engineering design tools and urban planning. This laboratory exercise was supported by lectures and multimedia presentations to give the students desired exposure to a myriad of transportation-related topics. Each culminated in a team-orient project activity of an experimental nature. Selected modules from TRAC™ were used for part of the program. Diverse enough that students of many ages may benefit, activities were selected to involve students working in teams to solve simulations of real-life transportation challenges.

In addition, other civil engineering laboratory experiments were modified to provide appropriate STEM activities. These instruction activities provided daily activities based on select topics, possibly including:

- ***Structural Systems (Land)*** – Utilizing West Point Bridge Builder® software and laboratory exercises, students were exposed to the topics of stress, strain and moment in relation to the development of structures. They constructed small

structures and tested them until they failed. The competition centered on getting the best design for a bridge per the West Point Bridge Program.

- ***Transportation System Layout (Land)*** – The students were provided with a brief course on surveying for highway planning, design and construction. This involved an introduction to the equipment uses, both land based and remote imagery, for the collection of survey data on proposed roadway site. They were presented with some trigonometry and geometry pertaining to roadway alignment and staking. The competition project was to load data into the CAD software and use it to estimate earthwork volumes.
- ***Waterway Transport Systems and Design (Water)*** – Combining visual information and internet data related to waterway transportation network; students gained historic perspective regarding the use of water-based transports in commerce and industrial growth. Students constructed models of a prototype waterway vehicle to minimize drag while stably carrying a specific load.
- ***Pavement Materials Design (Land and Air)*** – Students were presented with engineering information about the materials that can be used to construct transportation systems. The design of the materials for road systems was emphasized with some testing of materials for basic properties. Students gained an understanding of material design differences between surfaces for land based vehicles as opposed to the materials needed to support air vehicles during take-off and landing. The competition component involved the design and construction of a bench-scale road pavement material and subsequent testing for strength after 7-days of curing.
- ***Air Traffic Management (Air)*** – Students gained an understanding of the role of air traffic controllers and meteorologists in the global air transportation industry. Gaining an understanding of the attributes of Earth’s atmosphere as well as principles of flight including fuel use to cargo mass ratios allow students to gain insight to the industry. They were also introduced to the techniques used to navigate the airways using RNAV and GPS.
- ***Vehicle Adaptation (Land, Air and Water)*** – Students examined the needs of individuals with mobility restrictions and the adaptations that currently exist and are in need of engineering in all three areas of transportation. These included car, van and bicycle adaptations as well as those in the airline and water transport industries.

- ***Transportation Safety (Land, Air and Water)*** – Students explored safety concerns and needs in the realms of transportation. This included pedestrian, motorized and non-motorized vehicles used in water, air and land transportation. Also included was urban planning with mass transit as a central need. Students talked about what approach could be used to develop PSA's or other presentations to educate the general public about these topics.
- ***Miscellaneous Topics*** – A variety of short topics were presented in the time remaining. These could involve the students doing internet-based research and the development of a power point presentation for a competition component, or may involve visiting representatives from MSTI sponsors making short presentations. Topics that might be covered during these 60 to 75 minute presentations could include: innovative and alternative transportation systems (e.g., magnetic levitation, fuel efficient vehicles, mass transit, HOV, telecommuting), transportation safety, urban planning, interfacing intermodal systems, application of graphic information systems (GIS) for navigation, and transportation needs.

**Off Campus Learning.** Field trips were conducted with consideration given to weather, when possible. Examples of the types of transportation-related activities that would be observed during a field trip might include: visiting a concrete batching operation, the pouring of a bridge deck or driving of foundation piles, the construction of embankment and retaining systems, operations at an airport, and operation of a lock and dam system. The cooperation of federal, state, and corporate sponsors were integral to what activities are ultimately presented. Opportunities for these visits were identified through contacts with a number of groups. Working with MDOT and these other agencies allowed our visit to these facilities and construction sites. Other opportunities were developed by working with the Public Affairs Office and the base civil engineers at Columbus Air Force Base and the engineering and lock operations staff of the USACE Tennessee-Tombigbee Waterway.

Industrial visits were incorporated when possible. Industrial partners were engaged for this activity and included Nissan (cars and light commercial vehicles), Aurora Flight Sciences (unmanned aerial vehicles), Ergon (asphaltic binders), and MMC Materials Corporation (concrete). These were augmented with presentations by or visits to Mississippi State's research centers housing transportation-related activities; e.g., Center for Advanced Vehicular Systems and Raspet Flight Research Center. We also enlist the support of the local Experimental Aircraft Association (EAA) chapter (Chapter 1189) to provide students an introduction to the importance of general aviation to the transportation industry as part of

their Young Eagles program. The Director is a pilot, a member of the chapter, and coordinated YE events for MSTI in the past.

### **Enhancement**

There are a number of enhancements that were added to the program. While they were not directly relate to the topic of transportation, they helped develop the participating students' educational focus, team skills, and promoted a strong network between the students and with the MSTI staff. In this way, the learning was enhanced and the students would leave with interpersonal skills that will serve them during their high school career and thereafter.

Because of the many challenges that confront Mississippi, our citizens often fail to see the opportunities of shared community investments yielding shared community growth. Although the timeframe for overcoming these challenges is long, the formula for success is simple: enhancing the leadership skills of our emerging adults likely to remain in Mississippi which yielded shared social and economic growth. Drawing on multiple leadership development theories, students were offered daily opportunities for leadership experience as well as opportunities for personal leadership growth. Under the tutelage of MSTI staff, students explored the qualities of leaders and ways these qualities can enhance in their lives.

The program overviewed the role of transportation leadership in economic emergence, which included industry recruitment and infrastructure development. The program included a case studies for students that centers around leadership and the previously mentioned economic development topics. This allowed for the program to frame the concept of public policy and political process as it relates to the development of transportation infrastructure, support for operation of such systems, and the careers related to the industry.

MSTI Counselors used study skills development curricula to coach students in ACT preparation, time management, research skills and the application of content to practice. We incorporate these skills in the academics outlined above and reinforce them by requiring the students to work in teams on projects summarizing what they have learned about transportation as a result of their participation in MSTI.

### **Academic Advising**

University faculty and university staff engaged the students in explaining the need to focus on STEM and STEM-related classes while in high school to be prepared for entrance in to college. Improving learning skills and study habits was presented in conjunction with this program. All of this was framed in the context of college entrance requirements, the opportunities and requirements to obtain scholarships, and the success that can be achieved in

college with proper preparation while in high school. The college application process was discussed including completing FASFA, essay writing, and taking advanced placement classes.

### **Sports and Recreation**

In effort to build healthy living attitudes, MSTI students participated in daily physical recreation that may include outdoor sports and games. Students swam, played basketball, and a variety board and video games. MSTI counselors and staff encouraged students to try new physical activities such as wall-climbing, racquetball and other sports they may not be familiar with in order to encourage learning. Extreme Frisbee, yard golf, volleyball, and other outside sports were infused throughout their visit to campus.

Evening and weekend activities included games of intellect and a variety of positive entertainment opportunities. Should parents desire to visit with their students, they were encouraged to do so on the weekends. Students were allowed to be signed out by their parents for the weekends if they desire, but only one did. Students remaining on-site participated in supervised activities and extended learning opportunities.

Further, taking the students to local movies, theatre productions, and concerts are options depending on community activities. Many of these are free or of low cost and expose students to the culture of a university community.

### **24/7 Student Care**

The MSTI staff has developed a program to insure the safety and security of MSTI residents while providing an enjoyable, supportive resident experience. This requires address of several issues, as summarized below:

- **Lodging** - Students participating in MSTI was housed in a residence hall on the campus of Mississippi State University. Students lived in double rooms for the duration of the program. Roommates were randomly assigned so that students may get to know those not from their own schools. Males and females were on different wings. Male and female counselors resided on these halls and patrolled the floors during the evenings.
- **Meals** - All meals were provided for students with drinks and snacks available throughout the day and evening. We used MSU's dining services for the majority of the program, depending on availability. However, local eating establishments were occasionally used in the evenings to provide variety and as a reward for good behavior. For field trips, box lunches were generally provided by MSU Dining



Services unless logics dictate a lower cost, food-safe options at an area restaurant is better. All payments were made in accordance with MSU and state procurement policies (including tax exception).

- ***Supervision and Security*** - Along with the Project Coordinator, at least two counselors were with the students at all times. After hours, six counselors were with the students. All residence halls have card access, and can only be accessed with the card. MSTI students were the only ones on the hall and were the only ones with access. Students were not be allowed out of the residence hall after 9 p.m. and before 7 a.m., and then, only with a counselor. Males were not be allowed to enter female halls and vice versa.

### **Transportation**

For local tours, vans operated by the Civil and Environmental Engineering Department were used. The cost of using these vehicles was recovered per MDOT prescribed procedures. If these vehicles are not available or are not sufficient to carry all of the students, vans were rented in accordance with state and university procurement procedures. The program staff drove vans.



## DISCUSSION OF RESULTS

The 2016 edition of Mississippi State University's National Summer Transportation Institute was one of three NSTI programs in the state of Mississippi. Nevertheless, MSTI has 64 applicants for the 25 positions eventually filled for the program this year. Unfortunately, funding for the program from FHWA, MDOT, and NCITEC was limited as we could not engage the 30 to 35 students we could easily accommodate. However, the grant from NCITEC did allow us to invite 20 percent of the students participating this year. These funds supported food and lodging for the students, defrayed the cost of transportation to take the students on field trips, and provided supplies needed for the various STEM laboratory projects that were conducted.

The selection process focused on the academics of the applicants. All candidates considered must have completed high school algebra with a grade of B or higher. Qualifying students were then ranked based on their overall academic performance as indicated by grade point average. After ranking students based on their academic record, a review of their statement of interest was used to provide a secondary ranking of the students with those expressing a "sincere interest in learning more about the transportation industry." Finally, while diversity did not play a predominate role in the decision as to who to invite to the program, some acknowledgement of our desire to have a diverse group was incorporated into the selection process.

Of the 25 participants that ultimately attended, one was an alternate replacing a person who was only willing to participate for a few days. Ultimately we had 15 young women and 10 young men who participated. We had one young man voluntarily withdraw from the program after the first week due to personal commitments that were not indicated in the application and which would have excluded him initially. Eleven of the students would be entering 11<sup>th</sup> grade in the fall, nine would be 10<sup>th</sup> graders, and five would be starting 9<sup>th</sup> grade. Ten self-identified as "African American" and five indicated "Asian" as their ethnicity. One student was identified as "Native American, Hispanic, White" and the other nine indicated they were "White, Non-Hispanic."

We were supported by several organizations and agencies which organized tours of their facilities by the students, with a prerequisite number of chaperones. Those working with us this year included:

- Aurora Flight Sciences
- Columbus Air Force Base
- Ergon, Inc.

- Experimental Aircraft Association, Chapter 1189
- MMC Materials,
- Mississippi Agricultural and Transportation Museum
- Mississippi Department of Transportation,
- Mississippi Transportation Institute,
- Nissan
- Paragon Technical Services, Inc.,
- Starkville-MSU Area Rapid Transit (SMART) Authority,
- MSU's Raspet Flight Research Laboratory
- Tennessee-Tombigbee Waterway Authority, and
- US Army Corps of Engineers

### **Survey of Students**

A survey was used to assess the effectiveness and impact of the program. All student participants were surveyed upon entrance to and completion of MSTI. Surveys were conducted to gather information regarding program components including, but not limited to recruitment efforts, changes in career awareness, role of STEM in transportation, importance of developing leadership skills, strengths and weaknesses of the project, and recommendations for project improvement. Additionally, student participants were asked to evaluate the program.

A copy of the survey is included in the Appendix. A Likert Scale was used to provide a foundation for the responses. The negative option was used as lead to lend a sense of conservatism to the results. The data from surveys were compiled and are summarized below.

### **Interest in STEM and Transportation Following MSTI**

The survey indicated that none of the students were disinterested in Mathematics, Science, or Engineering following MSTI. To the contrary, 89 percent indicated strong interest (i.e., either very interested or interested) in Science and Mathematics with a slightly higher interest in the latter. Engineering interest was strong at 78 percent of the respondents. As for Transportation as an areas of interest, this was weaker than the other two. Only 41 percent indicated a strong interest in this field following MSTI. All but one indicated some level of interest with that one stating they were not interested in the field in any way.

Hence, it would appear the program strengthened student interest in STEM and careers based on a strong science and mathematics background. It is hoped that this interest will translate into course completed while in high school; a goal of this program which appears to have

been achieved. Further, while the interest in transportation is lower than some might hope, we consider it a positive as most of the student indicated upon arriving at MSTI during our orientation briefing that a very small fraction were considering a career in this area. Therefore, the program is also considered successful in developing student interest in this area.

### **Benefit of MSTI Activities to the Students**

Benefit was not explicitly defined in asking the students about the MSTI program activities and their benefit to the individuals participating in them. However, overall average response for the twenty learning modules indicated that 59 percent felt the activities were beneficial or very beneficial. Only four percent of all respondents felt that average of all program activities was not of any benefit.

The activity deemed as most beneficial was the EAA Young Eagles activity on the weekend of the program. This activity garnered a 94 percent “beneficial or very beneficial” rating from the group, with the lowest evaluation coming from one student indicating it was “somewhat beneficial.” It is noted that one of the students did not participate in the event fully; did not go flying in one of the airplanes but only participated in the ground school activity.

The Marble Rollercoaster Project was second with an 89 percent strong positive response. This activity was a “running” project in which students spent free time each day working on construction a “rollercoaster” out of paper which would have a marble travel down a pathway of their design. The process and concepts demonstrated through this project included conservation of energy, conservation of momentum, friction, and stress and strain in structural design. Two students found this activity “somewhat beneficial” to them.

The activities which were deemed to have the least benefit to the students were those which have very limited physical engagement. Tours were well received if a variety of activities were included, but standing and looking at something for long periods did not seem to be received well. Hence, the visits to construction sites, construction materials facilities, the museum, and MDOT ITS received the lowest support.

In summary, program activities which mentally and physically engage the students had a greater positive impact on the students. The corollary is that activities which simply present information are generally now as well received. However, there was one exception to this overview. The college preparation session was given a 78% positive response. In review, this might be attributed to several factors, including: the presenters were demographically diverse and unique presenters in the program. Their presentation was multi-media and

students were drawn into conversations with the presenters. Finally, the activity was kept to one hour, while most other activities took several hours, if not most of a day. So, it is concluded that if a “lecture” on a topic is to be provided, it should be kept to a shorter period, presumably due to the attention span of the students. It should be multi-media and include audience participation. It should also be flexible and tailored to meet the interest of the audience.

## **Summary**

Reviewing the other survey data reaffirms that students felt they had developed stronger learning skills and interests. A few examples include asking if MSTI:

- Encouraged the student to take more science courses – 61 percent agreed or strongly agreed, with 66 percent indicating the program increased their confidence to participate in science class;
- Motivated the student to take more mathematics courses – 66 percent agreed or strongly agreed, with the same percent indicating the program increased their confidence to participate in science class;
- Positively impacted a student’s consideration of engineering as a college major – 61 percent agreed or strongly agreed, with a similar percentage saying they would consider a career in the transportation area;

Finally as noted on the survey, the last two questions asked if the program would benefit them in school the following year and if they would want to participate in MSTI again, if allowed. To both questions, 100 percent of the respondents replied, “Yes.” Therefore, we feel that the 2016 MSTI program achieved its goals and was an overall success with the students.

## CONCLUSIONS

By most indications, the 2016 Mississippi State Summer Transportation Institute achieved the goals set forth. The students has a positive experience even though they were, for the most part, all kept away from home and family for two weeks and had to live and work with a group of people they knew little about before the program started. An increased interest in STEM learning and careers by the participants was perceived based on the conversations and survey. At this point, students are still contacting the Director with questions about their future and parents are still corresponding about educational benefits gained by the participants based on changes in student interest. Therefore, it is strongly suggested from the data collected, anecdotally and through the survey, that the program provided a positive outcome for the participants.



## RECOMMENDATIONS

There are a few recommendations that come from the version of the National Summer Transportation Institute program held at Mississippi State University during this past year, and the other nine which preceded it. These are:

- The program should be continued each year as a way of increasing the interest of high school students to take STEM classes and pursue STEM-related careers.
- The number of students involved in the program should be increased through the additional of funding and program options. With sufficient recourses, this program could have a positive impact on students' value of education.
- The program may have a positive impact on the number of individuals who enter transportation-related careers. However, an equally important result will be that these future citizens will have a clearer understanding of the role transportation infrastructure and those working in the field have on economic development
- The program models must maximize engagement of students both mentally and physically. At the middle high school level, attention spans are much shorter than energy levels, and a considered approach of activity-based learning is needed for optimum benefit.





## ACRONYMS, ABBREVIATIONS, AND SYMBOLS

AASHTO	American Association of State Highway Transportation Officials
AYP	Adequate Yearly Progress
BCoE	Bagley College of Engineering
EAA	Experimental Aircraft Association
FHWA	Federal Highway Administration
ITS	Intelligent Traffic System
MDOT	Mississippi Department of Transportation
MSTI	Mississippi State Summer Transportation Institute
MSU	Mississippi State University
NCITEC	National Center for intermodal Transportation for Economic Competitiveness
NSTI	National Summer Transportation Institute
STEM	Science, Technology, Engineering and Mathematics
TRAC	Transportation and Civil Engineering Program
UAS	Unmanned Aerial System
USACE	U.S. Army Corps of Engineers
YE	Young Eagles

# APPENDIX

## Student Survey

**2016 Mississippi State Summer Transportation Institute  
Survey**

**Basic Demographic Questions**

1. Gender  Male  Female
2. Rising classification:  Ninth Grade  Tenth Grade  Eleventh Grade
3. Race:  African American  Asian  Caucasian  Hispanic  Native American  Other (Please Specify) \_\_\_\_\_
4. Home Town and State: \_\_\_\_\_

**Summer Transportation Institute Questions**

5. Now that you have participated in the Mississippi Summer Transportation Institute, how would you describe your general interest in the following subjects?

Area	Not at all interested	Very little interest	Somewhat interested	Interested	Very Interested
Science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mathematics	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Engineering	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Transportation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. How beneficial were the following components of the Mississippi Summer Transportation Institute?

Activity	Not at all beneficial	Very little benefit	Somewhat beneficial	Beneficial	Very Beneficial
Raspet Flight Lab Visit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aurora Flight Sciences Visit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MMC Concrete Batch Plant Visit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Water Transportation Experiment Session	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nissan Tour	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Paragon Technical Services Tour	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Columbus Air Force Base Visit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
South Entrance Construction Site Visit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PACCAR Visit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bridge Design Experiment Session	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EAA Young Eagles Event	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SimCity (TRACS) Activities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
College Preparation Session	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Traffic Management Session	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Stennis L&D and Tenn-Tom Waterway Tour	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Biofuels Laboratory Project Session	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SMART Urban Bus Trip	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MDOT ITS Visit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MS Agriculture Museum Visit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Marble Rollercoaster Project Sessions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7. To what extent did the Mississippi Summer Transportation Institute affect you?

	Did not affect me	Affected me a little	Somewhat affected me	Affected me	Affected me very much
General interest in science.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Increased my confidence to participate in science class.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Encouraged me to take more science courses.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
General interest in math.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Increased my confidence to participate in math class.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Encouraged me to take more math courses.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
General interest in engineering.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Encouraged me to consider majoring in engineering.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
General interest in transportation careers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Encouraged me to consider a career in transportation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. Now that you have participated in the Mississippi Summer Transportation Institute, how would you describe your general knowledge of the following?

	Not at all knowledgeable	Very little knowledge	Somewhat knowledgeable	knowledgeable	Very knowledgeable
STEM roles in transportation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Careers available in transportation industry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Civil engineering profession	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Opportunities for students to develop leadership skills	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

9. What part(s) of the Mississippi Summer Transportation Institute were MOST interesting to you personally?

---

---

---

---

---

10. What part(s) of the Mississippi Summer Transportation Institute were LEAST interesting to you personally?

---

---

---

---

---

11. Do you think your experiences in the Mississippi Summer Transportation Institute will benefit you in school next year?

- Yes
- No

12. If you could attend the Mississippi Summer Transportation Institute next year, would you?

- Yes
- No