

Morgan State University Teacher Transportation Institute



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NATIONAL TRANSPORTATION CENTER

2013 TEACHER TRANSPORTATION INSTITUTE
July 22, 2013 – August 2, 2013 & November 2, 2013 – December 14, 2013

2014 FALL TEACHER TRANSPORTATION INSTITUTE
October 4, 2014 – November 22, 2014

2015 SUMMER TEACHER TRANSPORTATION INSTITUTE
May 15, 2013 – July 29, 2015

Summary Report

Prepared for the

**Mid-Atlantic Universities Transportation Center
and
Connected Vehicle/Infrastructure Transportation Center**



NATIONAL TRANSPORTATION CENTER

2013 TEACHER TRANSPORTATION INSTITUTE

Final Report

prepared for the
Mid-Atlantic Universities Transportation Center
and
Connected Vehicle/Infrastructure Transportation Center



Deputy U.S. Secretary of Transportation John Porcari with 2013 TTI and STI Participants

Teacher Transportation Institute

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July 22, 2013 - December 14, 2013

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Introduction

The Teacher Transportation Institute (TTI) at Morgan State University was implemented in two sessions during the summer and fall. The first session took place over a two-week period July 22, 2013-August 2, 2013. The fall session was held on six Saturdays from November 2, 2013-December 14, 2013. During the fall TTI teams were required to meet during the week for 2 hours. The teachers conducted research and planned for the final project presentations. The TTI participants who attended the summer session were not required to have additional meetings. Time was allotted during the two-week program for them to collaborate on research ideas and plan their final presentations.

Prior to both the fall and summer sessions, the teachers were given a pre-program survey to determine their expectations of the TTI professional development. It also determined what the teachers knew about transportation and transportation-related careers. The teachers also completed post-program surveys to determine if their expectations were met and give recommendations that might enhance the TTI.

TTI participants discussed the importance of STEM to their students' success in post-secondary education and their ability to acquire careers in transportation and related fields. The program engaged the teachers in hands-on, inquiry-based lessons that included the use of engineering principles and technology. The teachers visited transportation and transportation-related work sites to become familiar with current trends in transportation. They gained insights into careers and the work environment of engineers, transportation planners, information technology professionals and social scientists in the transportation industry. Guest speakers also discussed opportunities and careers in the transportation industry. Additionally, during a recent visit to the University, John D. Porcari, U.S. Deputy Assistant Secretary of Transportation, spoke to the teachers about current transportation trends, challenges and career opportunities.

Participants were engaged in conversations about the *Modern Traffic Roundabout and Connected Vehicles* and their impact on the environment and safety. Participants conducted traffic feasibility studies and used scientific and mathematical principles to analyze their data. They were taught to construct a scale model of a traffic roundabout. Participants were taught to use engineering rulers to scale the elements of a roundabout. The teachers also became more aware of the hazards of distracted driving when they got behind the wheel of a driving simulator.

The TTI participants received Continuing Education Units (CEUs) from Morgan State University's Center for Professional Development and Continuing Studies. The CEUs will be used by the teachers for recertification of teaching credentials and/or promotion.

Teacher Transportation Institute Partners:

The Maryland Department of Transportation (MDOT) supported the TTI by providing guest speakers. The speakers spoke to the teachers about the construction, location and design of roundabouts in Maryland. The teachers also received presentations from engineers from the Baltimore City Department of Transportation (BCDOT), who spoke to the teachers about the challenges in the development of connected vehicles. Other speakers discussed the time and

safety concepts of modern roundabouts. They reviewed and discussed with the teachers the results of the teachers' traffic studies at a proposed roundabout and at an actual roundabout site. Teachers were told about the process that engineers use to determine the type of roundabout that will be constructed for specific locations.

Each of the presenters spoke to the teachers about their careers and how they prepared for them. Staff from Morgan State University's Department of Transportation and Urban Infrastructure Studies presented to the teachers about preparing their students for post-secondary education and the requirements for careers in the transportation industry. The teachers received a tour of the Center for the Built Environment Infrastructure Studies (CBEIS) building, which houses the National Transportation Center and transportation department at Morgan State University. They saw the latest technology used by transportation professionals and the labs used to conduct transportation research. The tour guide elaborated on the type of instruction and guidance that is provided to develop transportation professionals.

Accomplishments:

TTI provided an opportunity for STEM teachers to use Math, Science, and Technology and Engineering education to emphasize core ideas that support the process of learning in their students. The teachers in both sessions were taught to go beyond the basics of what students need to know into what engineers do to approach a new problem. They were encouraged to allow their students to solve difficult problems using engineering methods and better communicate their ideas to others.

The teachers were placed in project teams to complete assignments. They conducted computer and field research, collaborated and participated in panel discussions with their colleagues about STEM education. Discussions were held about their current teaching methodologies and strategies and the changes that they would make to improve student success in STEM.

During each session teacher teams presented to the members of their cohort on specific topics such as current STEM research, connected vehicles, transportation careers and the modern traffic roundabouts. TTI participants wrote in journals about their experiences daily at the end of each class. Journaling was used to give the teachers an opportunity to reflect on what they had learned and any new transportation and STEM insights. The final project required the teachers to construct a scale model of a modern traffic roundabout and create a PowerPoint presentation on an assigned transportation career or a related career. They also included in their reports how they will assimilate the strategies and new teaching methodologies into their daily lesson plans.

Key Outcomes:

Teachers were able to learn strategies to teach their students using engineering principles in order for their students to become critical thinkers and problem solvers. They became aware that in the 21st century, the ability to master subject matter is not enough for post-secondary and career success. The TTI participants discussed the need for high-functioning skill sets in the higher education programs and in the workplace. They concluded that their students will need to have the ability to apply knowledge and skills across disciplines and understood how critical this will be to the demands of the transportation industry.

The teachers indicated in their final presentations that they will be able to use the activities from the TTI to encourage students to ask questions, and help students explore ways to answer the

questions themselves. Participants were taught to help their students strategically process and synthesize information and be willing share the results with their peers. The teachers also learned how to help their students reflect on their learning experiences through journaling. The teachers were given information about how to have their students connect to careers in transportation and related careers by exploring transportation and engineering websites. The TTI participants stated that they will encourage their students to consider careers in the transportation industry. The teachers have knowledge of current technology and the opportunities available to students in the transportation industry and related fields.

Both the summer and fall cohorts demonstrated their understanding of the interdisciplinary nature of STEM in the field of transportation. The teachers:

- 1) constructed a scale model of a modern traffic roundabout,
- 2) conducted presentations about modern traffic roundabouts and their research,
- 3) reported on the results of their teams' traffic feasibility study,
- 4) explained how strategies and principles learned in the TTI will be implemented into their classrooms using an interdisciplinary approach to learning,
- 5) provided descriptions of new teaching strategies and methodologies gleaned from the TTI and the teachers
- 6) completed a pre- and post-program survey to determine if the TTI met their expectations.

The results of the teachers' pre/post survey results for both the summer and fall sessions can be found in Appendixes B and C. The teachers feel more equipped to teach their students to be successful in STEM areas. The greatest improvement from pre- to post-survey was that the teachers strongly agreed that the TTI improved their skills in lesson plan development in STEM areas. All of the teachers in both sessions agreed that they are more aware of the careers and opportunities that are available to their students in the transportation industry than they were before they attended the TTI.

The teachers know how to use STEM principles to design and construct a scale model of a traffic roundabout. They are able to explain and discuss how STEM areas impact the transportation industry, workforce and the economy. They are knowledgeable about careers in transportation and what is required of the 21st century workforce in STEM area careers. They have become aware of the types of roundabouts in Maryland, and their impact on safety and the environment. The teachers know the impact of connected vehicles on safety and the rising cost of insurance associated with traffic accidents.

Conclusions:

The teachers plan to use the construction of the modern traffic roundabout in their classrooms to inform their students about why STEM is necessary to be successful in post-secondary education environments, transportation and related careers. They want to initiate discussions with their students about distracted driving, the modern traffic roundabout, and safety concepts related to connected vehicles. They plan to continuously emphasize the importance of being efficient in STEM areas. They stated that they will be able to use transportation projects to encourage their students' aptitude in STEM through hands-on inquiry. The teachers felt that that it will be useful to direct their students to transportation websites. Exploring the websites will help students

consider and prepare for transportation and related careers. The teachers came to the following conclusions about STEM and what is needed to improve STEM education in their schools:

- Providing teachers with current technology that is used in the workplace may improve learning outcomes in STEM.
- Speaking to students early in their educational process about career choices will help teachers to identify resources to help students prepare for STEM careers.
- The Common Core Math and Science Standards are an important resource for teachers and students, but the teachers feel like they are not prepared to implement CCSS.
- The teachers think that more programs like TTI should be offered so that they are more informed about the STEM careers available to their students.
- Principals should be more flexible and listen to their teachers and potential employers about what students need to be successful in post-secondary education institutions.
- Parents should be taught why STEM efficiency is important to their students' post-secondary education success.
- The teachers will conduct workshops for parents to learn more about why STEM is important to their children's post-secondary education and career success.

APPENDIX A: Photos of 2013 Fall and Summer TTI Participants and Activities



Summer cohort doing a traffic study



One group having a discussion about their findings



TTI participant receives a Certificate of Completion



Fall cohort receives certificates and CEUs



Mr. Warren Whitlock and Dr. Moges Ayele of FHWA watch as a TTI participant receives his CEU and Certificate of Completion from Mrs. Flamer with the University's Department of Continuing Studies and Professional Development.



Roundabouts and final projects developed by the cohorts



Participants visit the State Operations Center (SOC) in Hanover, Maryland.



Staff at the SOC speak to teachers about careers.



Another member of the Fall cohort receives a Certificate of Completion.



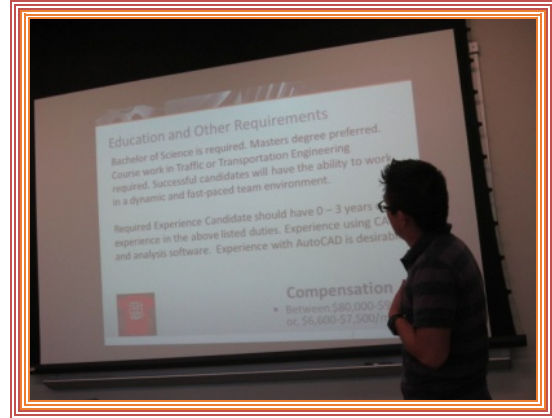
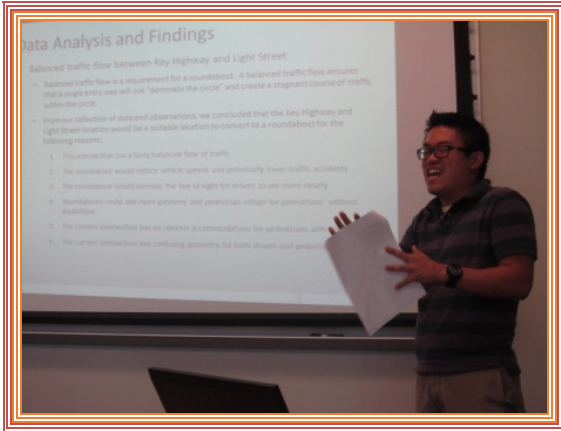
Teacher does her final presentation project



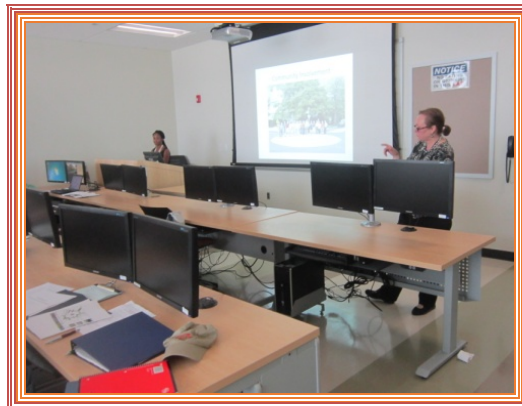
One team presents their project.



Another team presents their final presentation.



TTI participants conduct final presentations.

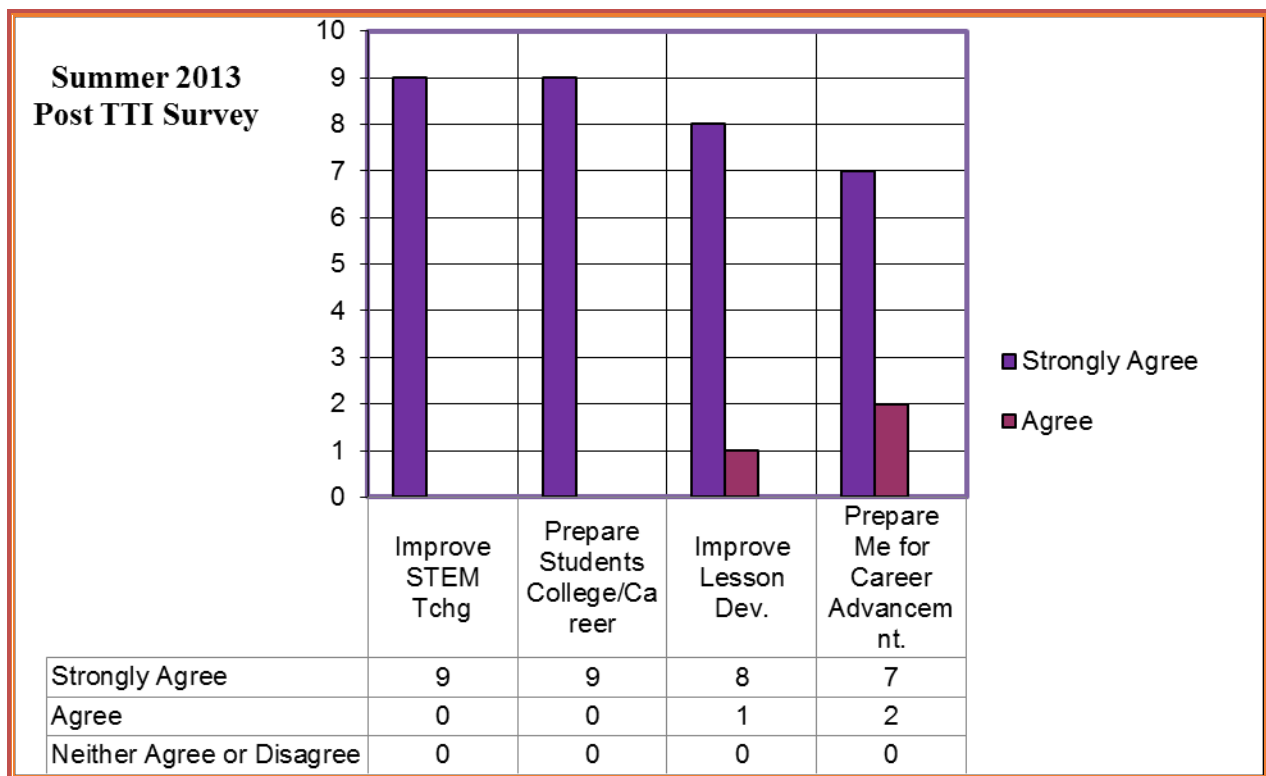
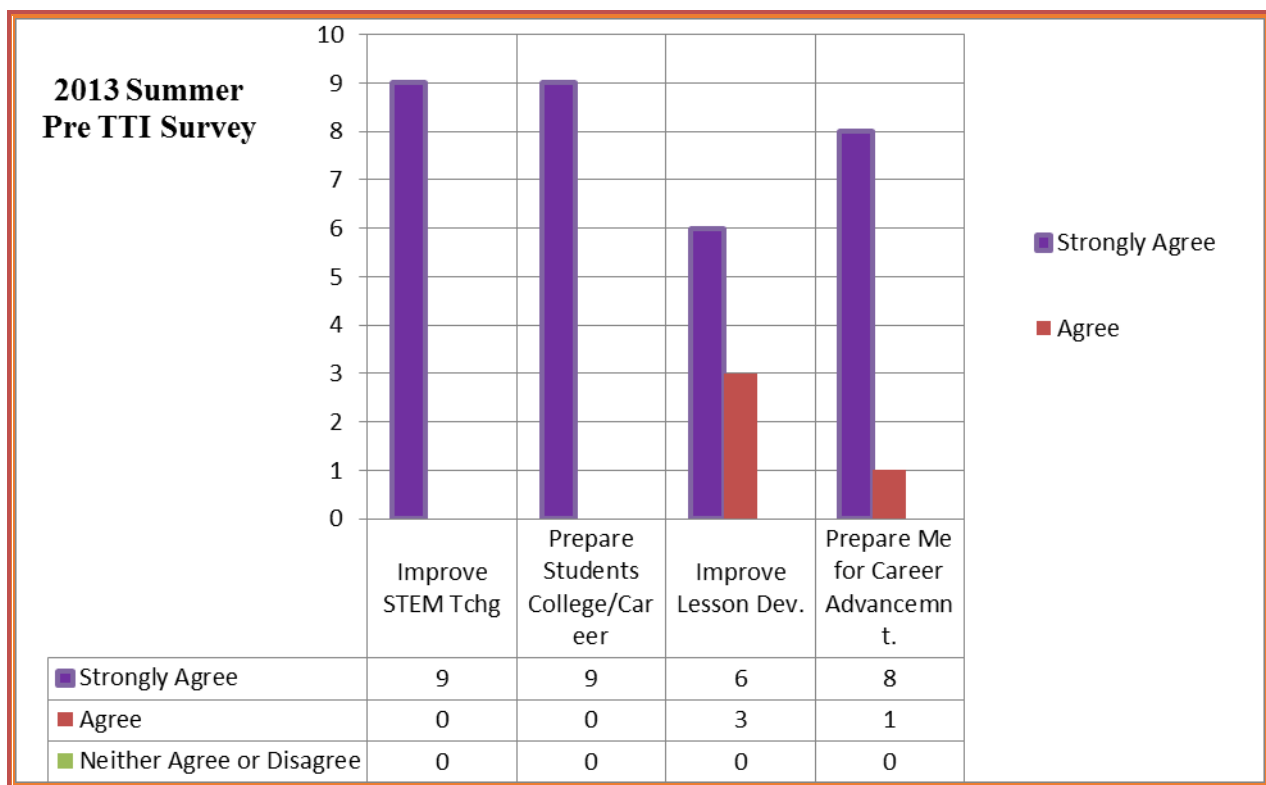


An engineer from the Baltimore City Department of Transportation speaks to the teachers about roundabouts in Maryland and proposed roundabouts in Baltimore City.



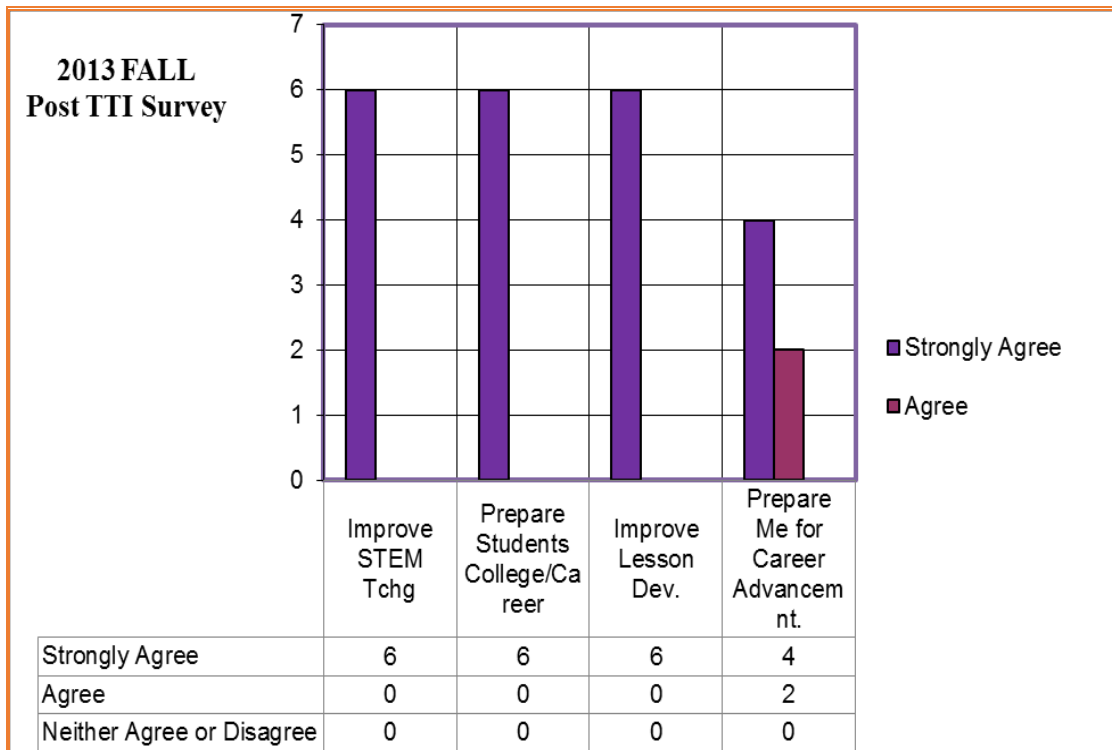
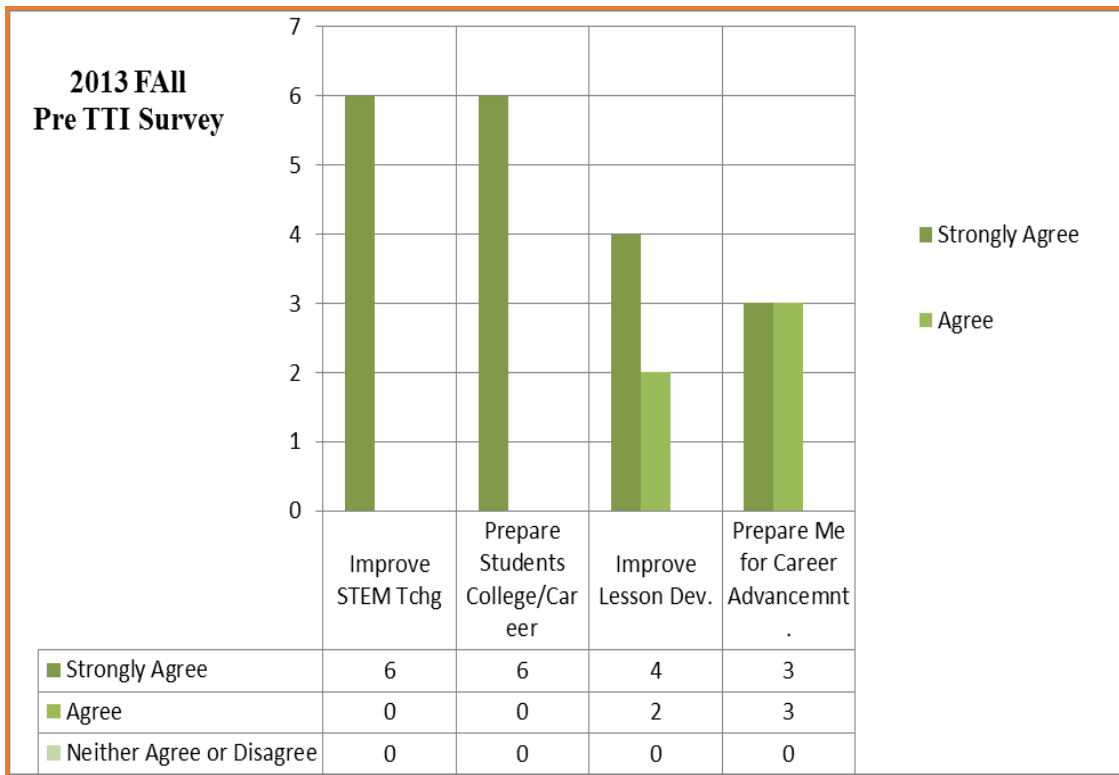
Roundabout models

APPENDIX B: 2013 Summer TTI Survey Results



In both surveys the teachers agreed that the TTI would improve their STEM teaching skills. In the final outcome most of the teachers strongly agreed that the TTI improved their skills in lesson plan development in STEM areas.

APPENDIX C: 2013 Fall TTI Survey Results



In both surveys the teachers strongly agreed that the TTI would improve their STEM teaching skills. In the pre-survey the teachers were evenly split as to whether the TTI would prepare them for career advancement. In the final outcome four of the six teachers strongly agreed that TTI prepared them for career advancement.



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5. Project Duration:
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Introduction

The Fall Teacher Transportation Institute (TTI) at Morgan State University was implemented on Saturdays from October 4, 2014 to November 22, 2014. Seven teachers attended the Saturday sessions. In addition to the Saturday sessions, the teacher teams met during the week for two hours. The two-hour sessions were used by the teachers to conduct research and plan for the final project presentations. The teachers were given a pre-program survey to determine their expectations of the TTI professional development. It also established what the teachers knew about transportation and transportation-related careers.

TTI participants discussed what STEM is and its importance to post-secondary education and successful careers in transportation and related fields. The program engaged the teachers in hands-on, inquiry-based lessons that included the use of engineering principles, design and technology. The teachers visited transportation and transportation-related work sites to become familiar with current trends in transportation. They gained insights into careers and the work environment of engineers, transportation planners, information technology professionals and social scientists in the transportation industry. Guest speakers also discussed opportunities and careers in the transportation industry.

Participants discussed the impact of the traffic roundabout and connected vehicles on the environment and safety. Participants conducted traffic feasibility studies and used scientific and mathematical principles to analyze their data. They were taught to construct a scale of a traffic roundabout. The teachers became more aware of the hazards of distracted driving when they got behind the wheel of a car simulator.

The TTI participants received Continuing Education Units (CEUs) from Morgan State University's Center for Professional Development and Continuing Studies for attending the TTI. The CEUs will be used by the teachers for recertification of teaching credentials and/or promotion.

Goals and Objectives

STEM and Workforce Development:

- Provide teachers an opportunity to become aware of the connection between STEM, transportation and related careers.
- Research and explore STEM careers associated with transportation
- Underscore the importance of STEM education to students and parents
- Develop teachers' awareness of transportation as an option for post-secondary education and career path

- Conduct research on transportation careers, modern traffic roundabouts and connected vehicles

Distracted Driving

- Provide an opportunity for TTI participants to use the Car Simulator at Morgan State University's transportation department. It provided a virtual environment and simulation demonstration that features roadways complete with safety hazards
- Discuss statistics associated with distracted driving
- Discuss if connected vehicles will help drivers to be less or more distracted
- Teams will develop a distracted driver PowerPoint presentation that emphasizes the danger of a distracted driver

TTI Partnerships

The Maryland Department of Transportation (MDOT) supported the TTI by providing guest speakers. The speakers spoke to the teachers about the construction, location and design of roundabouts in Maryland. The teachers also received presentations from engineers from the Baltimore City Department of Transportation (BCDOT). They spoke to the teachers about proposed roundabouts in the city and they reviewed the results of the teachers' traffic studies with them. Teachers were told about the process that engineers use to determine the type of roundabout that will be constructed for specific locations.

Each of the presenters spoke to the teachers about their own careers and how they prepared for them. Staff from Morgan State University's Department of Transportation and Urban Infrastructure Studies presented to the teachers about preparing their students for post-secondary education and the requirements for careers in the transportation industry. The teachers received a tour of the Center for the Built Environment Infrastructure Studies (CBEIS) which houses the transportation department at Morgan State University. They saw the latest technology used by transportation professionals and the labs used to conduct transportation research. The tour guide elaborated on the type of instruction and guidance that is provided to develop transportation professionals.

Accomplishments

The Common Core State Standards (CCSS) in Math, Science and Engineering education emphasize core disciplinary ideas and interdisciplinary approaches to learning. TTI provided an opportunity for STEM teachers to use Math, Science, and Technology and Engineering education to emphasize core ideas that support the process of learning in their students. The teachers were taught to go beyond the basics of what students need to know into what engineers do to approach a new problem. They were encouraged to allow their students to solve difficult problems using engineering methods and better communicate their ideas to others.

The teachers were placed in project teams to complete assignments. They conducted computer and field research, collaborated and participated in panel discussions with their colleagues about STEM education. Discussions were held about their current teaching methodologies and strategies and the changes that they would make to improve student success in STEM.

During each session teacher teams presented to the cohort on specific topics such as current STEM research, connected vehicles, transportation careers and the modern traffic roundabouts. TTI participants wrote in journals about their experiences at the end of each class session. Journaling was used to give the teachers an opportunity to reflect on what they learned and any new transportation and STEM insights. The final project required the teachers to construct a scale of a modern traffic roundabout and create a PowerPoint presentation on an assigned transportation career or a related career. The teachers included in their reports how they will assimilate the strategies and new teaching methodologies into their daily lesson plans.

The teachers completed post program surveys, and the results indicated that the teachers feel more equipped to teach their students to be successful in STEM areas through hands-on, inquiry-based learning. Most of the teachers agreed that they are more aware of the careers and opportunities that are available to their students in the transportation industry than they were before they attended the TTI.

Outcomes

Teachers were able to learn strategies using engineering principles to teach their students to become critical thinkers and problem solvers. They became aware that in the 21st century the ability to master subject matter is not enough for post-secondary and career success. The TTI participants discussed the need for high-functioning skill sets in the higher education programs and in the workplace. They concluded that their students will need to have the ability to apply knowledge and skills across disciplines and realized how critical this will be to the demands of the transportation industry.

The teachers will use the activities from the TTI to encourage students to ask questions, and help students explore ways to answer them. Participants were taught to help their students strategically process and synthesize information and be willing to share the results with their peers. The teachers also learned how to help their students reflect on their learning experiences through journaling. The teachers were given information about how to connect their students to information about careers in transportation and related careers by exploring transportation and engineering websites such as <http://fastforward.unl.edu/index.html>, which highlights careers in transportation. The TTI participants stated that they will encourage their students to consider careers in the transportation industry. The teachers have knowledge of current technology and the opportunities available to students in the transportation industry and related fields. The teachers demonstrated their understanding of the interdisciplinary nature of STEM. The teachers:

- 1) constructed a scale model of a modern traffic roundabout,

- 2) conducted presentations about modern traffic roundabouts and their research,
- 3) reported on the results of their teams' traffic feasibility study,
- 4) explained how strategies and principles learned in the TTI will be implemented into their classrooms using an interdisciplinary approach to learning,
- 5) provided descriptions of new teaching strategies and methodologies gleaned from the TTI and the teachers
- 6) completed a post program survey to determine if the TTI met their expectations.

The teachers know how to use STEM principles to design and construct a scale model of a traffic roundabout. They are able to explain and discuss how STEM areas impact the transportation industry, workforce and the economy. They are knowledgeable about careers in transportation and what is required of the 21st-century workforce in STEM-area careers. They have become aware of the types of roundabouts in Maryland, and their impact on safety and the environment. The teachers know the impact of connected vehicles on safety and the rising cost of insurance.

Conclusions

The teachers plan to use the construction of the modern traffic roundabout in their classrooms to inform their students about why STEM is necessary to be successful in post-secondary institutions, transportation and related careers. They want to initiate discussions with their students about the driving simulator, modern traffic roundabouts, and connected vehicles to emphasize safe driving and STEM efficiency. They emphasized that they will be able to use transportation projects to encourage their students' aptitude in STEM through hands-on inquiry. The teachers indicated that they will use a variety of transportation websites to introduce their students to transportation and related careers. The teachers came to the following conclusions about STEM and what is needed to improve STEM education in their schools:

- Providing teachers with current technology that is used in the workplace may improve learning outcomes in STEM.
- Speaking to students early in their educational process about career choices will help teachers identify resources to help students prepare for STEM careers.
- Plan to add transportation as a separate focus in STEM seminars/fairs at their schools.
- The teachers think that more programs like TTI should be offered so that they are more informed about the STEM careers available to their students.
- Principals should be more flexible and listen to their teachers and potential employers about what students need to be successful in post-secondary education institutions.
- Plan to dedicate a professional development activity to professional development meetings to enhance their colleagues' awareness of career and education opportunities in transportation.

Appendix A: 2014 Fall TTI PHOTOGRAPHS

Teachers conducting traffic feasibility studies at a roundabout site.



The teachers visit the site of an existing roundabout.



The teachers tour the Smithsonian's America on the Move exhibit.



Final touches on roundabouts



The Teachers prepare for final project presentations of their roundabouts



Project presentations are conducted on the last day of the TTI



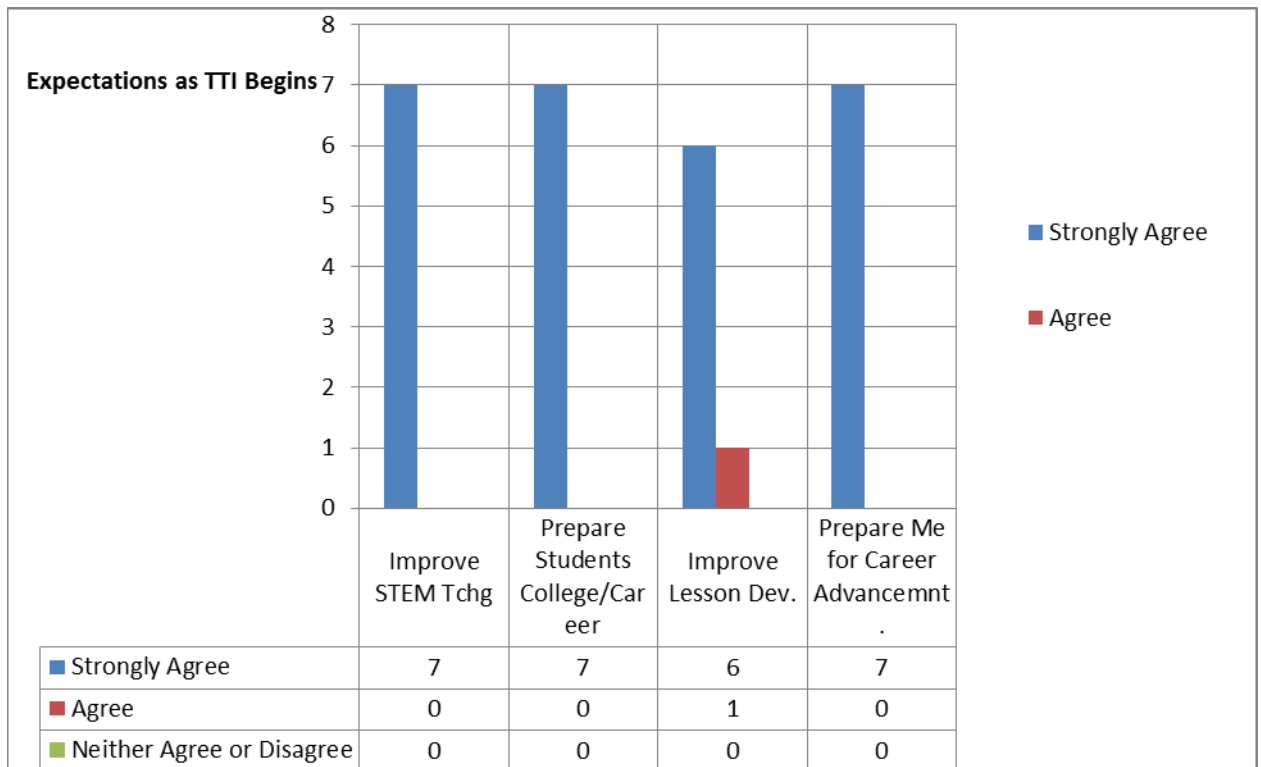


On the last day of the program, one of the teachers surprised the cohort with a roundabout cake.

Appendix B: Pre/Post Survey Results

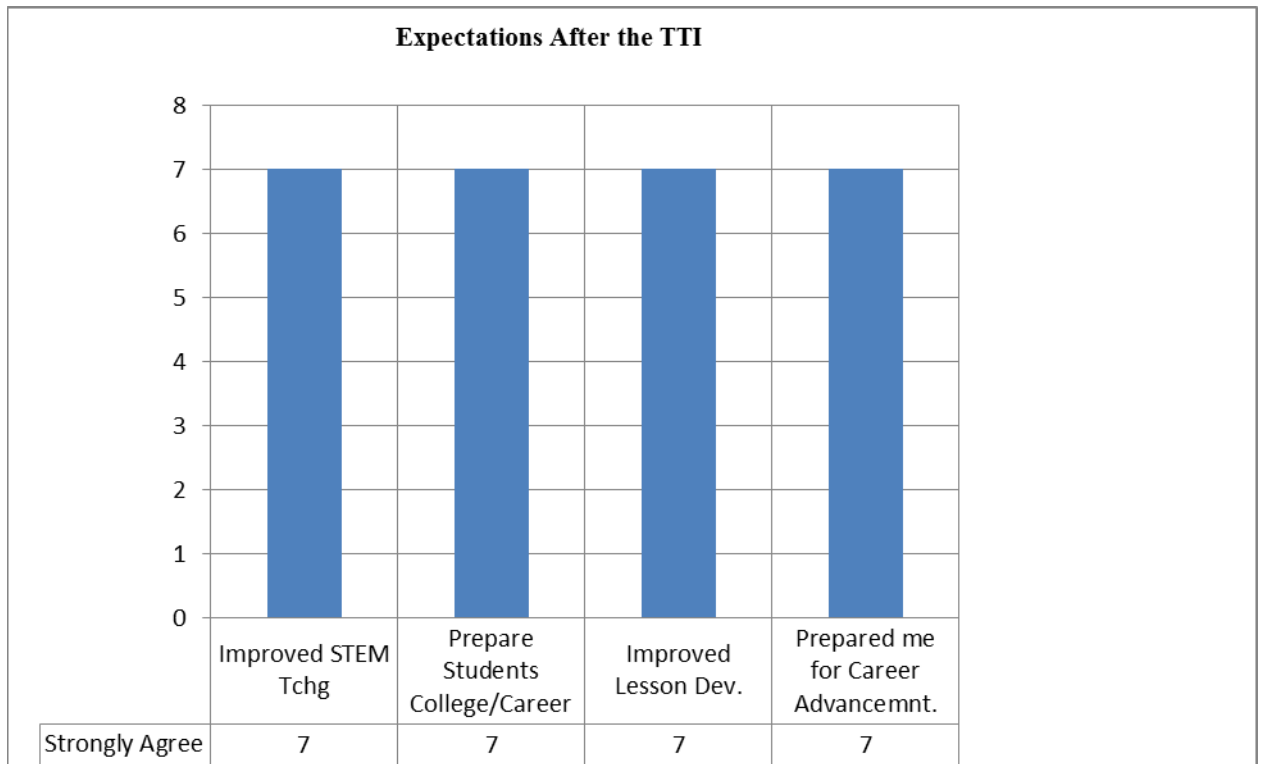
Pre Survey Results

A majority of the teachers felt that the TTI program would help to improve their ability to teach STEM and make their students aware of career and educational opportunities in transportation.



Post Survey Results

All of the teachers indicated that overall the TTI has helped them to improve their teaching skills in STEM areas. They also felt that the TTI made them aware of career opportunities for their students.





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Introduction

The Teacher Transportation Institute (TTI) at Morgan State University was implemented from July 13, 2015 to July 29, 2015. The professional development took place over a two-week period. The session was used by the teachers to conduct research and plan for the final project development and presentations. The teachers were given a pre-program survey to determine their expectations of the TTI professional development. It also established what the teachers knew about transportation and transportation-related careers. One participant, a school counselor, registered for the TTI to become more informed of career and educational opportunities in the transportation industry for her students. Teachers who are more informed about the connection between STEM and the transportation industry and are aware of the trends in transportation and safety developments can communicate career opportunities available to their students.

TTI participants discussed what STEM is and its importance to post-secondary education and successful careers in transportation and related fields. The program engaged the teachers in hands-on, inquiry-based lessons that included the use of engineering principles and technology. The teachers visited transportation and transportation-related work sites to become familiar with current trends in transportation. They gained insights into careers and the work environment of engineers, transportation planners, information technology professionals and social scientists in the transportation industry. Guest speakers also discussed opportunities and careers in the transportation industry.

Participants discussed the impact of the traffic roundabout and connected vehicles on the environment and safety. Participants conducted traffic feasibility studies and used scientific and mathematical principles to analyze their data. They were taught to construct a scale of a traffic roundabout. The teachers also experienced driving scenarios behind the wheel of a driving simulator and became more aware of the hazards of distracted driving.

The TTI participants received Continuing Education Units (CEUs) from Morgan State University's Center for Professional Development and Continuing Studies for attending the entire program. The CEUs will be used by the teachers for recertification of teaching credentials and/or promotion.

Goals and Objectives

STEM and Workforce Development:

- Provide teachers an opportunity to become aware of the connections between STEM, transportation and related careers.
- Research and explore STEM careers associated with transportation
- Underscore the importance of STEM education to students and parents

- Develop teachers' awareness of transportation as an option for post-secondary education and career path
- Conduct research on transportation careers, modern traffic roundabouts and connected vehicles

Distracted Driving:

- Provide an opportunity for TTI participants to use the Driving Simulator at Morgan State University's transportation department. It provided a virtual environment and simulation demonstration that features roadways complete with safety hazards
- Discuss statistics associated with distracted driving
- Discuss if connected vehicles will help drivers to be less or more distracted
- Develop a distracted driver PowerPoint presentation that emphasizes the danger of a distracted driver

TTI Partnerships

The Maryland Department of Transportation (MDOT) supported the TTI by providing guest speakers. The speakers spoke to the teachers about the construction, location and design of roundabouts in Maryland. The teachers also received presentations from Baltimore City Department of Transportation (BCDOT) engineers. They spoke to the teachers about proposed roundabouts in the city and they reviewed the results of the teachers' traffic studies with them. Teachers were told about the process that engineers use to determine the type of roundabout that will be constructed for specific locations.

Each of the presenters spoke to the teachers about their own careers and how they prepared for them. Staff from Morgan State University's Department of Transportation and Urban Infrastructure Studies presented to the teachers about preparing their students for post-secondary education and the requirements for careers in the transportation industry. The teachers received a tour of the Center for the Built Environment Infrastructure Studies (CBEIS) which houses the transportation department at Morgan State University. They saw the latest technology used by transportation professionals and the labs used to conduct transportation research. The tour guide elaborated on the instruction and guidance that are provided to develop transportation professionals.

Accomplishments

The Common Core State Standards (CCSS) in Math, Science and Engineering education emphasize core disciplinary ideas and interdisciplinary approaches to learning. TTI provided an opportunity for STEM teachers to use Math, Science, and Technology and Engineering education to emphasize core ideas that support the process of learning for their students. The teachers were taught to go beyond the basics of what students need to know into what engineers do to approach a new problem. They were encouraged to allow their students to solve difficult problems using engineering methods and better communicate their ideas to others.

The teachers were placed in project teams to complete assignments. They conducted computer and field research, collaborated, and participated in panel discussions with their colleagues about STEM education. Discussions were held about their current teaching methodologies and strategies and the changes that they would make to improve student success in STEM.

During each session teacher teams presented to their colleagues on specific topics, such as current STEM research, connected vehicles, transportation careers, and modern traffic roundabouts. TTI participants wrote in journals about their experiences at the end of each class session. Journaling was used to give the teachers an opportunity to reflect on what they learned and any new transportation and STEM insights. The final project required the teachers to construct a scale of a modern traffic roundabout and create a PowerPoint presentation on an assigned transportation career or a related career. To construct the roundabouts the teachers used tools such as Computer Aided Design (CAD) software and triangular rulers. They also included in their reports how they will incorporate strategies and new teaching methodologies into their daily lesson plans. The journals and reports were relied upon to provide the information on outcomes and conclusions reported here.

The teachers completed post program surveys (page 16), and the results indicated that the teachers feel more equipped to teach their students to be successful in STEM areas through hands-on, inquiry-based learning. Most of the teachers agreed that they are more aware of the careers and opportunities that are available to their students in the transportation industry than they were before they attended the TTI.

Outcomes

Teachers were able to learn strategies using engineering principles to teach their students to become critical thinkers and problem solvers. They became aware that in the 21st century the ability to master subject matter is not enough for post-secondary and career success. The TTI participants discussed the need for high-functioning skill sets in higher education programs and in the workplace. They concluded that their students must have the ability to apply knowledge and skills across disciplines and realized how critical this will be to the demands of the transportation industry.

The teachers will use the activities from the TTI to encourage students to ask questions and help students explore ways to answer them. Participants were taught to help their students strategically process and synthesize information and be willing to share the results with their peers. The teachers also learned how to help their students reflect on their learning experiences through journaling. The teachers were given information about how to connect their students to information about careers in transportation and related careers by exploring transportation and engineering websites such as <http://fastforward.unl.edu/index.html>, which highlights careers in transportation. The TTI participants stated that they will encourage their students to consider careers in the transportation industry. The teachers have knowledge of current technology and the opportunities available to students in the transportation industry and related fields.

During the final week of the TTI, the teachers demonstrated their understanding of the interdisciplinary nature of STEM. The teachers:

- 1) constructed a scale model of a modern traffic roundabout,
- 2) conducted presentations about modern traffic roundabouts and their research,
- 3) reported on the results of their teams' traffic feasibility study,
- 4) explained how strategies and principles learned in the TTI will be implemented into their classrooms using an interdisciplinary approach to learning,
- 5) provided descriptions of new teaching strategies and methodologies gleaned from the TTI.

The teachers know how to use STEM principles to design and construct a scale model of a traffic roundabout. They are able to explain and discuss how STEM areas impact the transportation industry, workforce and the economy. They are knowledgeable about careers in transportation and what is required of the 21st-century workforce in STEM-related careers. They have become aware of the types of roundabouts in Maryland and their impact on safety and the environment. The teachers know the impact of connected vehicles on safety.

Conclusions

The teachers stated that they will be able to use transportation projects to encourage their students' aptitude in STEM through hands-on inquiry. The teachers indicated that they will use a variety of transportation websites to introduce their students to transportation and related careers. They plan to initiate discussions with their students about the driving simulator, modern traffic roundabouts, and connected vehicles to emphasize safe driving and STEM. One teacher thought that he might consider an after-school activity with a transportation focus. The teachers came to the following conclusions about STEM and what is needed to improve STEM education in their schools:

- Speaking to students early in their educational process about career choices will help teachers identify resources for students to prepare for STEM careers.
- The teachers think that more programs such as TTI should be offered so that they are more informed about various STEM careers available to their students.
- School administrators should be more flexible and listen to their teachers and potential employers about what students need to be successful in post-secondary education institutions.
- Parents should be taught why STEM exposure is important to their students' post-secondary education success.
- Post school activities should focus on career goals for students.

Appendix A: 2015 TTI Photographs



The teachers discuss their findings at the site of a proposed roundabout.



The teachers' instructor discussed some of the traffic patterns that can be found during the traffic feasibility study.



The teachers begin the process of designing the roundabout according to the scale provided by the instructor.



Teams work on their roundabout designs.



Team A – Roundabout Design



Team B – Roundabout Design





The teachers visited the Maryland Department of Transportation (MDOT) to learn about roundabout signage and other, traffic signs in Maryland. They also spoke with staff about career opportunities.

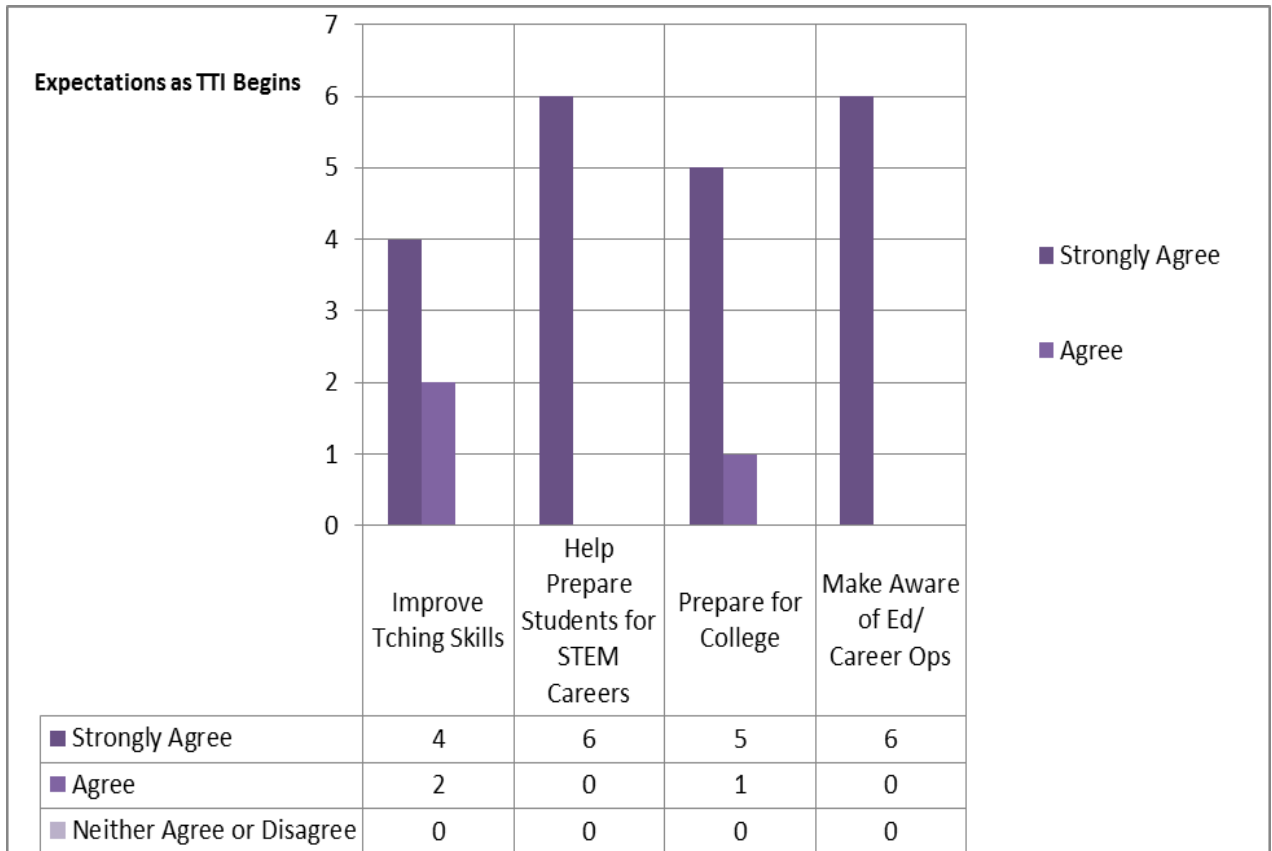


On the final day of the TTI the teachers shared their PowerPoint presentations with invited guests.

APPENDIX B: PRE/POST SURVEYS

PRE-SURVEY

On the first day of the TTI the teachers took a survey to express their expectations for the outcome of the program. Four out of six teachers strongly agreed that the program will improve their teaching skills.



POST SURVEY

The results of the post survey indicate that one more teacher strongly agreed that the TTI helped them to improve their teaching skills in STEM areas. All of the teachers indicated that they are more aware of educational and career opportunities in the transportation industry.

