STEM Think Tank and Conference: Encouraging K-12 Teachers to Integrate STEM in the Classroom

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STEM Think Tank and Conference: Encouraging K-12 Teachers to Integrate STEM in the Classroom (Research to Practice)

Abstract

Few conferences set out to examine the impact they have on attendees and whether or not they have met their goals and perhaps research questions beyond a simple satisfaction survey. This study uses surveys and interviews to examine the influence of the STEM Think Tank and Conference 2012 (TT&C), hosted by the Center for STEM Education for Girls, on its attendees (i.e. K-12 teachers, K-12 administrators, university faculties, and industry). We set out to define how the TT&C influenced the attendees' professional connections, both in type and number, and how teachers' experiences at the TT&C affected their future use of STEM integration in their classroom. Eighteen teachers participated in a pre-conference survey to establish baseline data, and fourteen of these teachers completed the post-conference survey. The pre-conference surveys addressed attendees' current professional connections and use of STEM integration. The post-conference surveys readdressed attendees' thoughts on professional connections and STEM integration, as well as their TT&C experience. We chose to follow up with six teachers in interviews at the end of the TT&C to pursue some topics in more depth. These interviews, which followed up on the attendees' responses to pre-conference surveys, were categorized into subthemes related to professional connections and STEM integration. The interviews were complimented by the data comparison of the pre and post-conference surveys. In summary, attendees increased their connections at the TT&C. Teachers thought of ways to utilize their new connections in their profession (such as teacher-industry and teacher-university collaborations) and use these connections to help enact STEM into their courses. Participants took STEM integration tools and ideas from the TT&C. Having attended the TT&C the participants were more confident in enacting STEM into their classrooms and within their schools.

Introduction

K-12 students shy away from engineering fields simply because they have a limited understanding of engineering [1]. A primary cause and barrier to improvement is that many K-12 teachers have just as limited an understanding of engineering as the students do [2]. Scientific discoveries, new technologies, and research into the unique learning style of girls have led to major changes in curriculum and teaching standards which STEM teachers must master to remain current[3] and increase the already daunting task of increasing K-12 teachers' knowledge of engineering

This paper describes the results of a three-day long STEM Think Tank and Conference (TT&C) that offers STEM teachers of girls the opportunity to receive essential professional development. Additionally, the Think Tank and Conference aims to provide the opportunity for K-12, university, informal educator and corporate leaders to exchange ideas and knowledge on what works best for women and what keeps them in the STEM "pipeline"[3].

Professional Connections

We define professional connections to be communications made among communities such as K-12 teachers, K-12 administrators, university faculties, and industry. Dodge (1993) reported that successful partnerships are well planned and provide adequate resources for any activity[4]. Part of preparing teachers to implement STEM in the classroom involves exposing students to real world applications[5]. Teacher partnerships with industry and classroom visits by speakers from industry, reveals students have expressed favorable interest in STEM industries[6].

Fullan[7] believes colleges of education and public schools should closely collaborate, benefiting both parties. Many public schools need help integrating STEM into the classroom and partnerships can be a useful method of achieving this goal[5]. Universities are often willing to provide expertise and/or materials to K-12 educators[8]. Williamson (2005) relays that teachers having connections with engineering and sciences graduate students can enhance integrating teaching STEM in their classrooms[9]. With help from graduate students who are knowledgeable and experienced in STEM, teachers feel more comfortable with incorporating subjects like engineering into their lessons. At the same time, the graduate students build communication skills within the K-12 classroom[9].

Symbiotic partnerships among K-12, university, and industry professionals benefit the entire K-16 community, however, such professional connections can be difficult to make[8]. Factors such as communication, support, and timing are key to forming successful partnerships[5]. Therefore, K-12 teachers, university, and members of industry need opportunities such as professional networking that combine such factors for connections to be made.

Teaching STEM in the K-12 Classrooms

To be effective STEM must be introduced as early as possible in the K-12 curriculum. Today, STEM integration in the classroom has become nationwide. Engineering skills and knowledge can now be found in the educational standards of 41 states, mostly in science, technology or vocational standards. Only one state integrates engineering into mathematics, while twelve integrate it into science[10]. At the same time, many schools are only beginning to step into STEM education. Unfortunately for both adept and novice schools, the majority of K-12 science and mathematics teachers lack knowledge and experience of engineering and how to utilize engineering to connect other STEM subjects [11-12]. This makes it difficult for K-12 teachers to implement curriculum that incorporates engineering concepts into their teaching. Such an obstacle may impede the development of STEM literacy in K-12 schools[13].

Louis (2009) reminds us that elementary school teachers are at the head of the STEM education pipeline; at this age, students build their foundation in STEM areas and their succeeding potential for pursuing STEM careers[14]. However, most elementary teachers typically have had to complete only two college level courses in mathematics and two in science to meet the requirements for their certification[15]. Elementary school teachers' limited exposure to STEM curriculum and instruction constrains capability to teach STEM. Therefore, preparing teachers to teach STEM content through professional development may be beneficial[16]. Professional development in STEM content can positively influence all K-12 educators' teaching STEM curriculum[17].

The STEM Think Tank and Conference (TT&C)

The 2012 Think Tank and Conference focused on drawing on the best ideas in girls' education around the country. The conference itself is set to occur annually for five summers at the Harpeth Hall School in Nashville , Tennessee. The 2012 conference theme was "Changing the Paradigm: Lessons Up & Down the Pipeline – K-12 to university to corporate". The members of the STEM Consortium, which is comprised of leading K12 schools, university researchers and STEM program leaders, corporate members, and informal educators, developed the program. Conference strands included:

- Best Practices in Curriculum & Teaching for Girls
- Girls in Coed Schools
- Getting Started in STEM – What do we mean? How is it different? How do you do it?
- Changing the Conversation – What message do we send to girls about STEM?
- Community Outreach - How can schools use local museums, universities, science centers, and businesses to give girls hands-on experiences and access to STEM careers?

With over 60 high quality presentations, workshops, and Think Tank discussions, the conference allowed participants to discuss and learn more from each of these groups, translating lessons learned across the lives of females. Additionally, the Think Tank and Conference produced new connections and conversations among these groups. Our focus is to assess the effectiveness of the TT&C through answering the following underlying questions:

1. How does attending the STEM Think Tank and Conference affect communication across communities – K12 to informal to university to corporate?
2. How does attending the STEM Think Tank and Conference encourage classroom teachers to enact STEM integrated lessons in their own classrooms or to start new STEM integrated courses?

The STEM Think Tank and Conference

The 2012 STEM TT&C ran July 18-20 at The Harpeth Hall School. Lunch and snacks were included for participants. Transportation assistance from hotels to Harpeth Hall was provided as needed for participants. Below is a summary of the day-to-day content.

Day 1-Optional - July 18, 2012
Registration took place between 12:00-4:00pm. From 1:00-4:00, the attendees could attend one of the four Optional Pre-Conference Workshops:

1) Nissan Leaf/ Elementary School
   The attendees traveled to the Smyrna plant of Nissan North America. Nissan shared with their curriculum for grades 3-5 and 6-8 called ChooseZero, which focuses on making positive personal choices for the environment and is aligned to the national science standards.
2) Vanderbilt University STEM Admissions and STEM Lab Tours
   Attendees took part in a conversation about highly selective university admissions

practices, particularly in the STEM fields. Tours were held on the Vanderbilt campus and in their STEM laboratories. Attendees were encouraged to return to their classrooms with stories of how their subject areas are used in real research.

3) Strategic Technical Experiences and Mentoring with University Partners
Attendees learned about successful partnerships as well as brainstorm projects and programs on which to build a long-term partnership between their school and near-by higher education and professional entities. They also developed strategies for working with scientists and engineers toward empowering young women to be STEM literate citizens or to pursue STEM careers.

4) Research Experiences for Teachers (RET) Fair
Attendees learned about specific programs that allow the teacher participant to do actual engineering research and create instructional materials based on those research experiences.

Day 2-July 19, 2012
Registration took place between 7:00-8:00am. The day consisted of four hour-long Concurrent Sessions A-D (See Appendix A and B). Attendees were able to pick one presentation to attend for each particular session. Between the sessions was Welcome and Keynote Speaker Professor Chris Rogers of Tufts University: "Engineering from Kindergarten to College." (9:15–10:15am); Break (10:15–10:45am); Lunch (11:45–1:00pm); Ice Cream Sandwiches, RET Fair, and Focus on Exhibits (2:00–3:00pm); and Reception (4:00–5:30pm) .

Day 3-July 20, 2012
The day consisted of two hour-long Concurrent Sessions E and F (See Appendix C). Attendees were able to pick one presentation to attend for each particular session. The final event of the conference was the Focus on Schools Closing Session (10:30–11:45). Attendees were divided into groups of six to ten, where they discussed STEM education topics and how to translate what they had learned back into their every day jobs.

Participants

The STEM TT&C brings together national leaders in K12 education for girls and young women (independent, public, charter, and parochial), university K12 outreach coordinators and researchers, leaders of successful university STEM programs, girls' informal educators, and members of industry. Individuals were informed about the TT&C by the Center for STEM Education for Girls' Web Page (http://stemefg.org), an email from the Center for STEM Education for Girls, or from their school administration. Potential attendees were assured that they were not required to have previous experience with STEM education in order to attend the TT&C. They were told that the TT&C was open to those who wanted to discuss and learn about translating STEM across the lives of females. A total of 201 registered for the conference. As shown in Figure 1, the attendees represented the following professions: 60% teachers, 10% school administration, 13% university, 7% industry, 5% informal educators, and 5% educational administrators (i.e., College Board). The TT&C attracted participants from 28 states and Quebec.

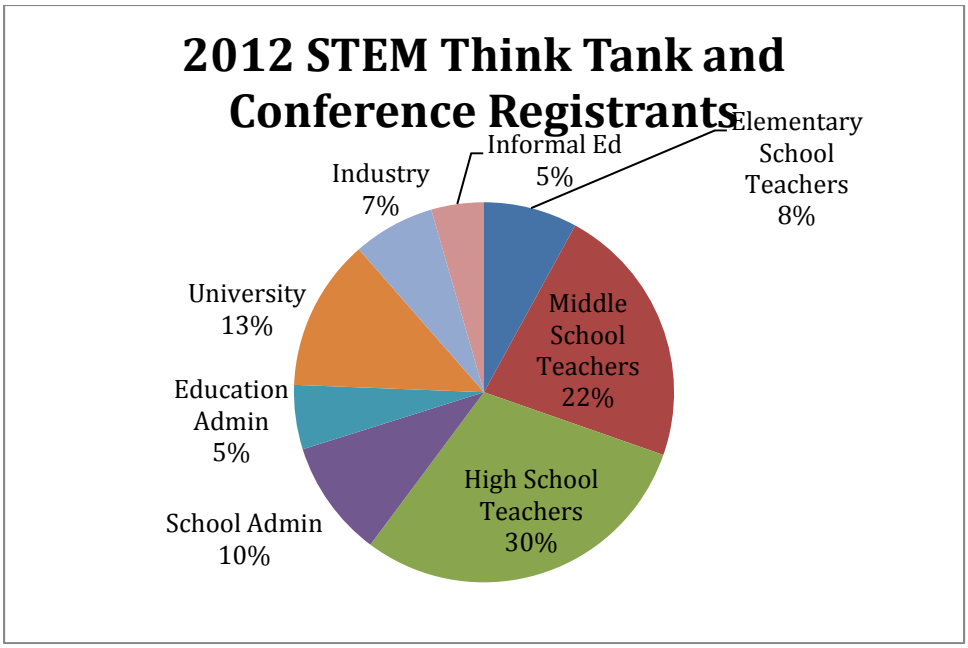

Figure 1. The 2012 TT&C registrants were distributed amongst numerous types of professions.

Methods and Methodologies

Research Questions

Various assessment tools were used in order to answer the previously mentioned two research questions:

1. How does attending the STEM Think Tank and Conference affect communication across communities – K-12 to informal to university to corporate?
2. How does attending the STEM Think Tank and Conference encourage classroom teachers to enact STEM integrated lessons in their own classrooms or to start new STEM integrated courses?

We use the methodology of discourse analysis with surveys and interviews as the methods.

Overview

The participants who gave consent were given an assessment, named the *STEM Think Tank and Conference 2012 Survey*, prior to and at the completion of the STEM TT&C. All attendees were also asked to complete an anonymous STEM TT&C satisfaction survey. A discourse analysis methodology was used, with interviews of the consented participants conducted after the completion of the TT&C. Lastly, the survey data were then aggregated; pre- and post-results were statistically compared.

Method: STEM Think Tank and Conference 2012 Pre/Post Survey

The STEM TT&C 2012 Survey was developed to help assess two topics: 1) how attendees

communicate across professional communities (i.e. K-12 teacher, university, and industry) and 2) how attendees enact STEM integrated lessons in their classroom. Through the survey, attendees describe their experience with these topics through 36 multiple-choice, rating, and open-ended response questions.

Method: Satisfaction Survey

123 participants voluntarily completed the STEM Think Tank & Conference-Satisfaction 2012 at the end of conference. It provided insight into the immediate results of the program. Consisting of 29 multiple choice and open-ended questions, the survey focused on the conference execution performance such as the most and least meaningful experiences, possible improvements for the conference and suggestions for future conferences.

Method: Interviews

The data collected for this study also consisted of post-TT&C interviews with consented participants. 6 of these consented participants were asked to elaborate on their responses given the STEM TT&C 2012 Pre Survey and share their TT&C experience. The interview protocol consists of 14 questions that readdress the two topics: 1) how attendees communicate across professional communities (i.e. K-12 teacher, university, and industry) and 2) how attendees enact STEM integrated lessons in their classroom.

Methodology: Phenomenology

This study utilizes phenomenology, looking for common shared experiences. Phenomenology focuses on interpreting an experience as it is perceived by those who have taken part in it (Ary, Jacobs, & Sorensen, 2010). Structured interviews gathered from multiple participants are the primary data source in this type of research. Questions explored TT&C participants' views on their professional connections and integration of STEM in the classroom both pre and post the TT&C. The phenomenological analysis provides a composite description of the overall essence of the TT&C experience.

Study Participants

Every pre-registered K-12 teacher was assigned a number; using a random number generator, thirty-five of these teacher registrants were randomly selected for recruitment to participate in this study. Of these, eighteen participants gave informed consent, seventeen completed the pre-conference survey and fourteen completed the post-conference survey. These seventeen teachers included nine co-ed schools and eight all girls' schools, four public and thirteen private schools. Four teachers taught elementary school, four taught middle school, and nine taught high school. Six teachers completed additional telephone interviews within one month of the conference.

Data and Data Analysis

Professional Connections

There were 16 total subthemes that appeared in the interview with high frequency: 10 subthemes related to participants' views on their professional connections pre TT&C and 6 subthemes related to participants' views on their professional connections post TT&C.

Pre TT&C

The threshold point for the number of interviews needed to determine high frequency of occurrence for the pre TT&C views was four interviews. This number was selected because a gap existed in the number of subthemes between 4 sources and 2 or fewer sources, clearly not important subthemes. The subthemes, which appeared in high frequency, 4 or more, are reported and analyzed below (Table 1).

Table 1. Significant Themes Related to Participants' Views on Professional Connections-Pre TT&C. N=6. Number of sources refers to the number of teachers interviewed. All results represent teacher reported perceptions who referenced this theme at least once. Total number of references is the total times that the participant referenced the subtheme in the interview. Some teachers referenced a theme more than once. Bolded subthemes and total number of references correspond to themes with a frequency of 4 or more reported references.

Subtheme	**Sources pre TT&C**	**Total number of references pre TT&C**
Have connections not in STEM	1	1
Have connections in industry	2	2
Brings in STEM speakers to classroom	2	**4**
Have connections in university	4	**7**
Concerned with professional connections	4	**5**
Wants to collaborate with other professions	1	1
Have connections with those that teach same subject	2	2
Difficult to collaborate with others	1	1
Have learned from professional connections	2	2
Have connections in STEM	1	1

Responses to interview questions such as "Explain how you utilized these professional connect within the past year." and "Prior to attending the conference were you concerned with your professional connections?" allowed participants the recall their experiences prior to the conference. These responses fell into the major themes of (1) Participants having connections with university, (2) Participants having STEM speakers come to their classrooms, and (3) Participants being concerned with their number of professional connections and how they utilize them.

When the participants were asked about their experience with professional connections pre TT&C, the subtheme that received the greatest responses was the participants having

connections with a university before attending the TT&C. These associations included participants using connections with their local universities to conduct STEM summer programs for K-12 students. This subtheme also included participants utilizing their university connections to host conferences specific to subjects they teach. Other participants have members of university share their science research with K-12 students.

Having STEM speakers come to classrooms was also important among the participants' responses. For example, participants use members of industry who work with their extracurricular robotics team to speak with students in the classroom also. Participants also welcomed female scientists to speak with female students in the classroom.

A significant subtheme was the participants being concerned with their professional connections. Though many participants wished to have more connections, this subtheme included additional areas of concern. Participants relayed their difficulty in making general professional connections. Some participants were concerned with their connections with a specific profession such as industry. Participants also responded they were not comfortable with utilizing professional connections in their profession.

Post TT&C

The threshold point for the number of interviews needed to determine high frequency of occurrence for the post TT&C views was six interviews. This number was selected because a gap existed in the number of subthemes between 6 sources and 4 or fewer sources, clearly not important subthemes. The subthemes, which appeared in high frequency, 6 or more, are reported and analyzed below (Table 2).

Table 2. Significant Themes Related to Participants' Views on Professional Connections-Post TT&C. N=6. Number of sources refers to the number of teachers interviewed. All results represent teacher reported perceptions who referenced this theme at least once. Total number of references is the total times that the participant referenced the subtheme in the interview. Some teachers referenced a theme more than once. Bolded subthemes and total number of references correspond to themes with a frequency of 4 or more reported references.

Subtheme	**Sources post TT&C**	**Total number references post TT&C**
Met people at TT&C	4	**6**
Learned from others at TT&C	4	**6**
Looking to bring in STEM speaker to classroom	2	2
Looking to collaborate with other professions	3	4
Made connections at TT&C	4	**6**
Looking to stay connected to connections	1	3

Responses to interview questions such as “What professional connections did you make at the TT&C?” and “How do you plan to utilize your professional connections from the TT&C?” fell in to the major themes of (1) Participants learned from others at the TT&C. (2) Participants met people at the TT&C and made connections at the TT&C.

When the participants were asked about their experience with professional connections post TT&C, a subtheme that received many responses was the participants having learned from others at the TT&C. Participants were noted to have learned from presenters who shared STEM lessons they were using, industry who shared how to connect what they have to offer to K-12 students, and teachers who had experience with teaching and scheduling STEM into their classrooms.

Significant subthemes were also noted as the participants met people/made connections at the TT&C. Participants meeting people included participants simply introducing themselves to other participants. Participants making connections included participants exchanging contact information and planning to follow up with each other. These themes were had equal total number of references. This shows that the participants were forming connections with the people they were meeting at the TT&C.

In the TT&C Satisfaction Survey, open to all attendees, 91% of the 123 respondents indicated that the conference was successful in meeting its theme of “Lessons up and down the pipeline – K12 to University to Corporate.”

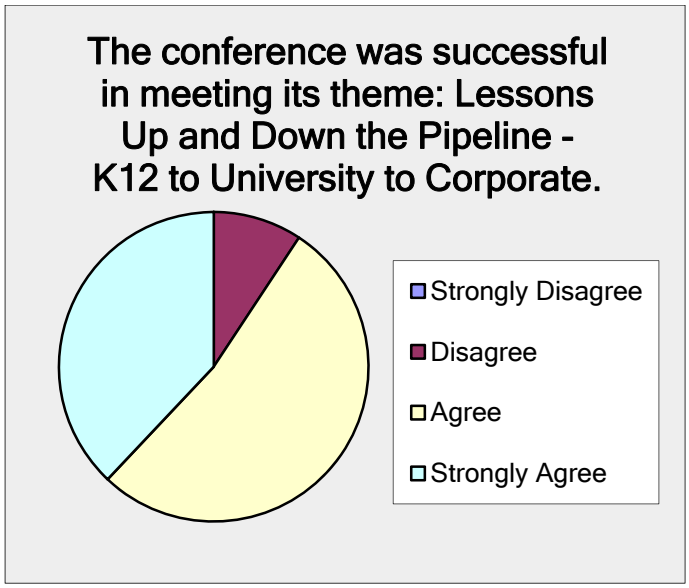

Figure 2. TT&C Satisfaction Survey Data on assessing the conference’s success in meeting its theme. 91% of respondents indicate that they either agree or strongly agree that the conference met its goals.

One of the more common responses in the satisfaction survey question about what would participants like to see more of was “more interaction with industry” indicating that this is still an

area for growth in this conference. A few responses requested specific programming for those in the same line of work to form connections with their peers.

STEM Integration in the Classroom

There were 21 total subthemes that appeared in the interview with high frequency: 10 subthemes related to participants' views on their integration of STEM in the classroom pre TT&C and 11 subthemes related to participants' views on their integration of STEM in the classroom post TT&C.

Pre TT&C

The threshold point for the number of interviews needed to determine high frequency of occurrence for the pre and post TT&C views was four interviews. This number was selected because a gap existed in the number of subthemes between 5 sources and 3 or fewer sources, clearly not important subthemes. The subthemes, which appeared in high frequency, 5 or more, are reported and analyzed in (Table 3 and 4).

Table 3. Significant Themes Related to Participants' Views on STEM integration-Pre TT&C. Number of sources refers to the number of teachers interviewed. All results represent teacher reported perceptions who referenced this theme at least once. Total number of references is the total times that the participant referenced the subtheme in the interview. Some teachers referenced a theme more than once. Bolded subthemes and total number of references correspond to themes with a frequency of 4 or more reported references.

Subtheme	**Sources pre TT&C (n=6)**	**Total number of references pre TT&C**
Integrates engineering	4	**4**
DOESN'T engage girls	1	2
Integrates technology	2	2
Integrates robotics in classroom	1	1
Difficult to bring STEM across subjects	2	3
DOESN'T integrate engineering	1	1
Difficult to bring STEM across grade levels	2	3
Wants to find better way to integrate	2	**5**
Has never used STEM	1	3
Integrates STEM already	2	**5**

Responses to interview questions such as "How have you been involved in STEM education?" and "Elaborate on your experience with using STEM integrated methods in the classroom for more than one year." fell in to the major themes of (1) Participants wanted to find better ways to integrate in the classroom, (2) Participants already integrating STEM, and (3) Participants specifically integrating engineering.

When the participants were asked about their experience with STEM integration pre TT&C, a subtheme that received an important number of responses was the participants wanting to find a better way to integrate more. This shows how the participants were already looking to improve their ways of STEM integration before attending the TT&C. Participants relayed that their integration tactics were not effective; for example, student often did not relate connections being made between math and physics. This subtheme also included participants' ideas for better integration pre TT&C. Participants thought integration would be efficient in an after-school. Some participants had specific ideas such as incorporating laser cutters in the classroom.

An important subtheme was the participants were already integrating STEM in the classroom. This ranged participants integrating STEM into physics and statistics courses to teachers incorporating STEM into the art classes. With the art classes, participants were using environmental sciences and chemistry to teach students about paint.

Pre TT&C participants were also noted to have specifically integrated or have plans for integrating engineering into their classroom. This subtheme included participants bringing engineering projects into to physic classes. Participants also incorporated engineering design projects into art classes. Teachers were also noted to have purchased Engineering is Elementary (EIE) kits pre TT&C and purposely waited until they attended the TT&C before make planning how to integrate the kits into the classroom. At the same time, there participants who had plans for engineering classes and programs pre TT&C.

Post TT&C

The threshold point for the number of interviews needed to determine high frequency of occurrence for the post TT&C views was four interviews. This number was selected because a gap existed in the number of subthemes between 5 sources and 3 or fewer sources, clearly not important subthemes. The subthemes, which appeared in high frequency, 5 or more, are reported and analyzed in (Table 4).

Table 4. Significant Themes Related to Participants' Views on STEM integration-Post TT&C. Number of sources refers to the number of teachers interviewed. All results represent teacher reported perceptions who referenced this theme at least once. Total number of references is the total times that the participant referenced the subtheme in the interview. Some teachers referenced a theme more than once. Bolded subthemes and total number of references correspond to themes with a frequency of 4 or more reported references.

Subtheme	Sources post TT&C (n=6)	Total number references post TT&C
Looking to integrate engineering	3	**5**
Looking to engage girls in STEM	2	3
Looking to integrate technology	2	2
At TT&C, learned new things about/better understood STEM	4	**6**
At TT&C, learned what already knew	2	3
Looking to bring STEM across grade levels	1	1
Looking to bring in hands on	2	3
Looking to work with robotic in classroom or extracurricular	3	3
At TT&C, did not get specific tools/activities on how to integrate	2	2
Will try more integrating	2	4
Looking to bring STEM across subjects	2	2

Responses to interview questions such as "Elaborate on how you will start using STEM integrated methods in the classroom for the first time, in the coming year." and "What changes will you be making to your course(s) during the next academic year, as a result of attending the TT&C?" fell in to the major themes of (1) Participants were looking to integrate engineering into the classroom and (2) Participants learned new things/better understood STEM, from the TT&C.

When the participants were asked about their experience with STEM integration post TT&C, a subtheme that received an important number of responses was the participants were looking to integrate engineering into the classroom. Participants took ideas from the TT&C that they could add to their preexisting knowledge of integrating engineering into the classroom. For example, participants decided would use engineering design to their physics course. Others planned to add STEM portfolios to their engineering class. Participants gained ideas from the TT&C that will help with incorporating engineering into environmental science classes. Specially, participants relayed that they learned ways to connect engineering to K-12 from attending an industry presentation at the TT&C.

From attending the TT&C, participants learned new things/better understood STEM. One participant responded that by going to the TT&C, "has helped me better understand the interdisciplinary role and how to introduce and approach STEM with school." Participants relayed that they came away with information, ideas, and websites on tools for STEM integration in the classroom. Participants also responded that they would not have used an idea if it were not for attending the TT&C. For example, participants learned about the Legacy cycle which they hope to use in the classroom.

While conference satisfaction survey data was very positive, respondents still hoped for even more classroom ready STEM integrated materials. Some teachers wished for more at the K-3 level, while others asked for more mathematics.

Conclusion

The STEM Think Tank and Conference was successful in accomplishing its goals. In relation to professional connections, before attending the TT&C, participants shared difficulty in making general professional connections, especially with industry. Participants also stated that they were not comfortable with utilizing professional connections in their profession. From attending the TT&C, participants found themselves more aware of making professional connections. Participants were noted to have learned from presenters who shared STEM lessons, industry who shared involvement with K-12 students, and teachers who had experience with STEM into their classrooms. In addition, participants making connections included participants exchanging contact information and planning to follow up with each other showed that the participants were successfully forming connections with each other at the TT&C.

In relation to STEM integration in the classroom, before attending the TT&C, participants shared an interest in wanting to learn how to better integrate STEM. The participants' eagerness to learn more about STEM integration was complimented by their reliance on the TT&C as a potential source to help them do so. From attending the TT&C, participants found themselves more informed about STEM and were more willing to integrate subjects such as engineering into their classroom using tools and resources from the TT&C.

Participants are increasing communication amongst groups such as teachers, administrators, university professors and outreach leaders, informal educators and industry. Teachers are also planning to integrate STEM more effectively and more frequently in their classrooms. Future research studies should assess the impact teacher participation has on the overall effectiveness of a school's STEM programming in terms of STEM course enrollment, STEM course offerings, and after-school STEM offerings.

Other STEM conferences, whether focused on single gender or not, should aim to incorporate some of the same important aspects as this conference. Participants must be given time and space – and encouragement – to focus on networking. Participants must also be given practical best practices for the STEM classroom that are classroom-tested and ready for implementation in the participants' classrooms. Other conference organizers may also wish to take the time to assess stated conference goals and research questions.

Ultimately, the conference's impact and success must be measured over time with changes made in classroom practice and ultimate student outcomes.

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Appendices

Appendix A

Concurrent Session A	Concurrent Session B
Project-Based Learning in STEM Education using MATLAB and Simulink Underwater Robotics: Engineering Design in the Classroom	Top 5 STEM Projects in Independent Schools
What Makes An Authentic Research Program for Girls Work?	Why Do I Have to Know This?
Awareness of College Scholarships	Robotics Supports STEM
Using the Legacy Cycle to Challenge Students in STEM	Leadership, Persistence, Mindset and STEM
Engaging Girls In STEM Beyond The Classroom	Finding Your Passion – Presenting the Possibilities with STEM
Clues to becoming a STEM Major: How the SAT Questionnaire and AP exam taking patterns & performance can predict STEM majors	Write Less, Think More
Flowers, Food, and Farms: An Edible Garden STEAM Project	Expanding STEM Options Through Online Classes
The Innovation Portal and the Engineering Design Process Portfolio Scoring Rubric	Beer's Law Module
Engineering Cartilage Regeneration!	Summer Physics Camp for Girls
Clues to becoming a STEM Major: How the SAT Questionnaire and AP exam taking patterns & performance can predict STEM majors	Top 5 STEM Projects in Independent Schools

Appendix B

Concurrent Session C	Concurrent Session D
Research and Curriculum: Biofilms and Deutschland	Inspired Design: Engaging Girls in STEM through Product Development
Engineering, implementing and assessing a rich STEM educational experience	Engaging Girls in STEM: What the research shows
Improving Girls' Self-Efficacy	Micro-messages: The Missing Link Between Bias and Behavior
Role models, Connections, Interactions and The Power of the Personal Narrative	Creating Your Own E-textbook
Using Edmodo to collaborate and communicate with peers throughout the world	A Parent Education Program to Promote Girls in STEM

Blooming through STEM	Attracting and Engaging Young Women in the STEM Classroom and Beyond - STEM Lessons and Clubs
Adventure Girls: Promoting STEM Through an Interactive Program for Grades 2-6	Bringing STEM Ideas Into Your Classroom
The STEM Initiative at Foxcroft School	Exploring Girls' Implicit Attitudes Towards Math
Flipped Instruction of Biology	STEM @ Marymount: It's More Like Alphabet Soup!
Building on a Proven Model: A Proposal for the Virginia Science Technology Engineering and Applied Mathematics (STEAM) Academy	Getting Started in Elementary STEM
Building Technical Women's Networks at Work	Getting hands-on with STEM: SciGirls style!

Appendix C

Concurrent Session E	**Concurrent Session F**
So I've Been Exposed to Engineering in the Classroom...Now What???	Early Childhood Science: From Crawdads and Crickets, to Chemistry and Cars
Scaffolding STEM with Stemples™	Our Students Are Mobile, Should We Make Our Learning Mobile?
Student learning outcomes in a rigorous STEAM high school	Getting Young Women to Pursue IT-related Degrees by Increasing Awareness of IT Career Options and Providing Role Models
Community College Pathways to STEM Education for Women: A Challenge to Gender Stereotypes?	Water Purification in Perú, Haiti, and China: A Scientific and Cultural Collaboration
Collaboration is Critical To Give Girls Access to STEM	Development of a Physics Identity in High School
"Is This Good? Is This Right?": Empowering Girls to Overcome the Limitations of Their Self-Perception as Scientists/ Engineers	Mentors for STEM
Examining the effects of a K-3 mathematics formative assessment system on teaching and learning	STEM at The Madeira School - what we have done and where should we go?
Life After High School for Women in STEM	Girls, Technology and Quality of Life: A Partnership between The Ellis School and the Quality of Life Technology Center at Carnegie Mellon University and the

	University of Pittsburgh
Today's Technical Women Inspiring Tomorrow's Technical Women	Looking at Curriculum Through a STEM Based Lens
	Getting Girls to Do Science: How to Implement an On-Campus Student-Centered Research Program
	ROBOTICS (Research Opportunities—Beyond Ordinary Traditional Instruction Classroom)