

102nd Mississippi Valley Technology Teacher Education Conference

Southeastern Technology Education (STEC) and
Mississippi Valley Technology Teacher Education (MVTTEC) Conferences
Co-located STEC/MVTTEC, Clarion Hotel, Nashville Downtown Stadium
Nashville, TN, November 5-6, 2015

SESSION I - 102nd Mississippi Valley Technology Teacher Education Conference: *Leadership Role for Technology and Engineering Education*

Time: Thursday, November 5, 2015, 9:30 a.m.
Presiding: Carl Blue, University of Maine
Session Chair: Steve Barbato, ITEEA
Presenters: Bill Havice, Pam Havice, Chelsea Waugaman, and Kristen Walker - Clemson University

Presentation (topic) Title: STEM Teacher Professional Development Program: *Institute on Integrative Science, Technology, Engineering and Mathematics (STEM) Teaching and Learning*

Overview: How can technology and engineering educators prepare diverse educators to deliver hands-on problem based STEM learning? Over 480 upstate K-12 classroom teachers, K-12 administrators and business/industry persons in the Upstate of South Carolina have participated in integrative STEM education institutes during the past nine years. Participants are developing knowledge and skills to create and implement relevant and innovative integrative STEM activities for use in their classrooms. The integrative STEM education institutes are designed to provide a forum for educators in Upstate South Carolina who share the goal of transforming integrative STEM education in local schools. The institutes provide participants opportunities for:

- learning about researched teaching methodologies that can enhance student learning;
- exchanging information and ideas;
- developing alliances;
- identifying higher education teaching programs that will ensure quality STEM teachers;
- identifying teaching strategies that teachers can incorporate in classroom instruction to help students be more successful;
- ensuring that Anderson, Oconee, and Pickens (AOP) counties have a skilled and qualified workforce, which will enable local employers to compete in the global economy;
- helping educators utilize educational resources more effectively;
- providing businesses and industries with a well-educated pool of STEM prepared students; and
- improving preparedness for careers in local manufacturing and related industry.

The School Districts of AOP counties, Tri-County Technical College, Clemson University, AdvanceSC, Business and Industry Partners STEM Institute Task Force continue to collaborate on this professional development project.



Institute participants drilling
holes in wood



Institute participants giving a presentation of their
engineering design project



Institute participants on a field trip to BorgWarner (global leader in vehicle powertrain technologies)



NASA Astronaut Patrick Forester speaking to elementary teachers at summer institute

Who Attended the 2015 Integrative Stem Institute? Their Demographics

Nineteen individuals attended the Integrative STEM Institute last summer (2015), with instructional teachers representing kindergarten (n=1, 5.26%), first grade (n=2, 10.53), third grade (n=5, 26.32%), fourth grade (n=2, 10.53%), and fifth grade (n=3, 15.79%). The Institute was open to all kindergarten through sixth grades as well as administrators/instructional coaches. The 2015 cohort included three school administrators, one instructional coach, and two multi-grade instructional teachers, composing nearly a third (31.58%) of the participants. When one considers the instructional teachers present at the Institute, 13 (68.42%) of the participants indicated that they planned to teach a mathematics subject in the 2015-2016 academic year, 11 (57.89%) planned to teach science, five (26.32%) technology, and two (10.53%) engineering. Please note that the total number of teaching subjects exceeds number of Institute Participant (n=19) because some of the teachers planned to be interdisciplinary and teach two or more subjects.

A majority of the participants (n=13, 68.42%) had 10 or more years of teaching experience, two attendees (10.53%) had between seven and nine years of experience, one attendee (5.26%) had between four and six years of experience, three attendees (15.79%) had between one and three years of experience. A significant majority of participants (n=17, 89.47%) had never participated in an Integrative STEM Institute prior to 2015, yet two attendees (10.52%) had done so through previous Institute offerings. The participants taught in either one of five districts in Anderson County, South Carolina (n=11, 57.89%) or one district within Pickens County, South Carolina (n=8, 42.10%). This program is also available to the Oconee County, South Carolina district, however no one from that county/district attended this past year.

Institute Learning Outcomes

A research team of faculty members, a staff member, and an education Ph.D. student at Clemson University gathered immediate evaluation and outcomes data from the 2015 summer Integrative STEM Institute by surveying the participants at the very beginning of the Institute and at the conclusion of the last session of the final day. In both instances participants indicated their current level of expertise on topics related to the program's eight learning outcomes. A summary of that expertise and the programmatic learning outcome topics appears in Table 1.

The levels of expertise at these two points in the participants' knowledge development were compared using an independent-samples t-test using SPSS® version 23. Given that the study's α level was set to .05 with a confidence interval of 95, the results of the t-test indicate that there was a statistically significant difference in the eight scores following the institute (n=18) compared to the scores reported at the beginning (n=19). Table 2 summarizes the results from the t-test analysis.

These results serve as an indication that the participants believed that the learning outcome objectives for the program were adequately addressed in the 2015 institute.

Institute Presenters

- Michael K. Daugherty - University of Arkansas - STEM Education for Early Childhood (K-4) Graduate Certificate
- William L. Havice - Clemson University
- Kim M. Weaver - Retired Elementary School Teacher, Author, and Curriculum Writer

Table 1

The Average Level of Expertise in Topics Related to Institute Learning Outcomes, as Self-Reported by 2015 Institute Participants Prior to and Concluding the Institute

Integrative STEM Institute Programmatic Topics	Pre-Institute Level of Expertise (scale of 1-5)	Post-Institute Level of Expertise (scale of 1-5)
How heuristics are used as a conceptual tool in delivering project/problem-based learning.	2.16	4.44
How content standards can be delivered using an interdisciplinary teaching approach	3.00	4.56
How a teacher can use STEM as a curricula organizer.	2.32	4.44
The role and purpose of integrative STEM education.	3.11	4.61
How one can teach STEM content to the age group I currently teach.	2.58	4.72
How standards are integrated into the learning experiences delivered through STEM curricula.	2.84	4.67
How the narrative curricular approach is used to launch STEM learning.	1.89	4.50
How integrated STEM lessons are developed and delivered in the classroom.	2.53	4.83



AOP fifth grade teachers participating in A World In Motion Jet Toy Challenge Training (Society of Automotive Engineers)



Institute participant testing her Egbert Save Racer Challenge vehicle.

2015 Participant Perspectives on Institute

At the conclusion of the Institute, all participants surveyed indicated that they found the program to be a worthwhile professional development opportunity and that they planned to work with fellow attendees and professionals at their schools to implement the integrative STEM pedagogical activities in their classrooms and schools. Please note that the data analyzed for the classroom-related outcomes included only grade-specific teachers, instructional coaches, and multi-grade instructional teachers. Administrators were not considered since many may not have classroom-based responsibilities in the academic year following the institute. In addition, every participant indicated that he or she would seek out additional resources or opportunities to learn more about integrative Stem activities. Thirteen of the participants demonstrated an understanding of what those resources or opportunities could

be, noting that they would refer to sources such as Clemson University, University of Arkansas, Tri-County Technical College, STEMCenters and peer elementary STEM teachers and administrators whose schools were utilizing this instructional model.

Attendees also had an opportunity in their post-institute survey evaluation to recognize several strengths of the Institute that were a benefit to them as they learned more about integrative STEM instruction. Frequently mentioned strengths included the hands-on learning activities that they participated in, which could later become example activities that they might plan to use themselves in their own classrooms with their own students. They also appreciated the Institute's panel presentations from previous program alumni who shared their experiences implementing integrative STEM in their school systems. Participants also found value in the lesson plan examples and ideas that were shared and the opportunities that they had to plan actual lesson plans for use in their classrooms.

Participants (n=11) also provided feedback on what could be done to improve the Institute. All but one mentioned that they wanted to participate in more hands-on projects versus hearing the level of lecturing that took place on the first day of the program. One other person requested that larger groups attend the Institute in each summer session, which would allow greater outreach to and enlightenment of more teachers and school officials about the concept and value of integrative STEM education.

Table 2

Results of t-test and Descriptive Statistics for Levels of Self-Reported Expertise in Learning Outcome Topics , Comparing Pre-Institute Levels and Post-Institute Levels

	Pre-Institute Level of Expertise			Post-Institute Level of Expertise			95% CI for Mean Difference		t	df
	M	SD	n	M	SD	n				
How heuristics are used as a conceptual tool in delivering project/problem-based learning.	2.16	1.167	19	4.44	.616	18	-2.911, -1.662	-7.51*	27.60	
How content standards can be delivered using an interdisciplinary teaching approach	3.00	.943	19	4.56	.511	18	-2.066, -1.045	-6.19*	35	
How a teacher can use STEM as a curricula organizer.	2.32	.946	19	4.44	.511	18	-2.640, -1.617	-8.45*	35	
The role and purpose of integrative STEM education.	3.11	.994	19	4.61	.502	18	-2.036, -.976	-5.77*	35	
How one can teach STEM content to the age group I currently teach.	2.58	.902	19	4.72	.461	18	-2.62, -1.66	-9.17*	27.11	
How standards are integrated into the learning experiences delivered through STEM curricula.	2.84	1.015	19	4.67	.594	18	-2.38, -1.27	-6.63*	35	
How the narrative curricular approach is used to launch STEM learning.	1.89	.875	19	4.50	.618	18	-3.114, -2.097	-10.40*	35	
How integrative STEM lessons are developed and delivered in the classroom.	2.53	.841	19	4.83	.383	18	-2.746, -1.869	-10.83*	25.47	

* p < .05.

Note: For outcomes 1, 5, and 8 a Satterthwaite approximation was employed due to unequal group variances.

For more information go to: <http://dropoutprevention.org/wp-content/uploads/2015/05/newsletter-v24n1-2013.pdf>; International Technology and Engineering Educators Association Engineering byDesign, go to: <http://www.iteea.org/EbD/ebd.htm>; and Clemson University, go to: <http://www.clemson.edu/hehd/departments/stem/index.html>