

2019 Mid-Atlantic ASTE Regional Conference  
 Pipestem, WV September 27<sup>th</sup>-28<sup>th</sup>  
 September 27<sup>th</sup>-28<sup>th</sup>

Conference Overview

<b>Date/Time</b>	<b>Room Location</b>	<b>Proceedings</b>
<b>FRIDAY</b>		
7:00 - 8:30	Dining Room	Breakfast
8:35 - 8:45	Faulconer	Welcome and Introductions
8:45 - 10:30	Faulconer	Session I - Paper Presentations 1
10:30 - 10:45	Faulconer	Break
10:45 - 12:00	Cardinal	Session II - Roundtables 1
12:00 - 1:00	Dining Room	LUNCH
1:00 - 2:30	Faulconer	Session III - Paper Presentations 2
2:30 - 4:00	Cardinal	Session IV - Roundtables 2
6:00 - 7:30	Dining Room	Dinner
8:00	To Be Announced	Social
<b>SATURDAY</b>		
7:00 - 8:45	Dining Room	Breakfast
9:00 - 11:00	Faulconer	Session V - Paper Presentations 3
11:00 - 12:15	Cardinal	Break & Session VI - POSTER SESSION
12:15 - 1:15	Dining Room	Lunch
1:15 - 2:15	Faulconer	Business Meeting

## 2019 Mid-Atlantic ASTE Regional Conference

*Thank you to our colleagues for their support of this conference.*

Conference Co-Chairs: Jeffrey Carver, Tina Cartwright, Deb Hemler & Paula Magee

Current officers:

**Regional Director:** Tina Cartwright, Marshall University

**Secretary:** Meredith Kier

**Treasurer:** Lisa Gross

### Presentation Schedule

FRIDAY		
Session Number	Title of Session	Individual Title Presenters
7:00-8:30		BREAKFAST
8:35-8:45		WELCOME
Session I Paper Presentations 8:45 - 10:30	Professional Educators and Higher Education STEM Learning	<p><i>Integration of K-16 STEM Education Through a University STEM Center.</i> Ashley Vaughn, Madhura Kulkarni &amp; Ellen Hokkanen, Northern Kentucky University.</p> <p><i>Teachers Experiences in the Pulsar Search Collaboratory.</i> Kathryn Williamson, Jeffrey Carver, Eleanor Bell West Virginia University &amp; Sue Ann Heatherly, Green Bank Observatory.</p> <p><i>Science and Mathematics Majors Perceptions of the Value of a Course in Inquiry-Based Teaching.</i> Nancy Spillane, West Virginia University.</p> <p><i>K-12 Teachers of Science Understanding of Evolution Laws and Approaches to Teaching Evolution.</i> Ronald Hermann, Towson University, Ian Binns, UNC-Charlotte, Lee Meadows, University of Alabama-Birmingham &amp; Joseph Shane, Shippensburg University.</p> <p><i>Transforming Science Teacher Learning through Content-oriented Critical Case Studies,</i> Lenore Crabtree, University of North Caroline - Charlotte</p>
10:30-10:45		BREAK

<p>Session II Roundtable 1 Friday 10:45- 12:00</p>	<p>Promoting STEM Careers Through Multiple Pathways</p> <p>Chair: Paula Magee</p>	<p><i>A Teaming Approach for After-School STEM Clubs: Successes and Challenges</i>, Meg Blanchard, North Carolina State University.</p> <p><i>Promoting Student Interest in the Bioeconomy and Related Careers: Successes and Challenges of a Teacher Professional Development Program</i>, Katie McCance, Shana McAlexander, Meg Blanchard &amp; Richard Venditti, North Carolina State University.</p> <p><i>Exploring How to Support Effective Communication in Community- School Partnerships to Promote Students' Career-Mindedness in STEM</i>, Meredith Kier, William and Mary.</p> <p><i>Developing a Professional Development Model for Integrating Computer Science into Core Content Areas for all K-5 Learners</i>, Kristie Gutierrez, Old Dominion University, Amy Hutchison, George Mason University, Jamie Colwell, Old Dominion University, Jeff Offutt, George Mason University &amp; Anya Evmenova, George Mason University</p>
<p>Session II Roundtable 2 Friday 10:45 – 12:00</p>	<p>Innovative Science Pedagogies and Partnerships</p> <p>Chair: Tina Cartwright</p>	<p><i>Preparing to Teach Engineering in the Elementary Classroom</i>, Scott Townsend &amp; Krista Adams, Eastern Kentucky University</p> <p><i>A 20-year Journey in Elementary and Early Childhood Science/Engineering Education: An Iterative Cycle of Reflection, Refinement, and Redesign</i>, Cody Sandifer, Pamela Lottero-Perdue &amp; Rommel Miranda, Towson University</p> <p><i>Partnership with a Purpose: A School University Collaboration</i>, Aimee Govett &amp; Jamie Price, East Tennessee State University</p>
<p>12:00-1:00</p>		<p>LUNCH</p>
<p>Session III Paper Presentations 1:00-2:30</p>	<p>Understanding science learning</p>	<p><i>Insights From a Multiyear Study on a First Grade Multimodal Science Unit: Impacts of Explicit Drawing Instruction</i>. Leslie Bradbury &amp; Rachel Wilson, Appalachian State University</p> <p><i>Charged Up! An Examination of Science Explanations From 4<sup>th</sup> Grade ELL</i>, Lisa Gross &amp; Shanan Fitts, Appalachian State University</p> <p><i>One Group of Adolescent Urban Children and Their Perceptions of Nature</i>. Randall Gibson, University of Cincinnati</p> <p><i>Efficacy of an Astronomy Modeling Workshop on Teacher Learning</i>, Breanna Ausbrooks &amp; Tom Tretter, University of Louisville</p>
<p>Session IV Roundtable 3 Friday</p>	<p>Improving Learning and</p>	<p><i>And Yet, They Persisted</i>, Helen Meyer &amp; Karen McGarry, University of Cincinnati</p>

2:30-3:45	Engaging in STEM Settings  Chair: Aimee Govett	<i>Growth Mindset Assessments</i> , Tina Cartwright & Brian Kinghorn, Marshall University  <i>Computational Thinking with Middle School Teachers in an RET</i> , Stephanie Phillip, University of Tennessee-Chattanooga, Olfa Nasaraoui & Jason Immekus, University of Louisville
Session IV Roundtable 4 Friday 2:30-4:00	Complex and Critical Issues in STEM Education  Chair: Deb Hemler	<i>Science and Religion in Symbiosis: Part 2 – A Follow-Up Discussion to Last Year’s Presentation, “A Collaborative Learning Experience for Biology Majors in a Liberal Arts Undergraduate Setting</i> , Darla French & James Browning, University of Pikeville  <i>Technology for Justice: Using Educational Technology Creatively and Critically in Service of Social Justice</i> , Lauren Angelone, Xavier University.  <i>Culturally Relevant Science Teaching in an Elementary Science Methods Course</i> , Paula Magee, Indiana University – Indianapolis  <i>Benefits of Nonformal Education Teaching Experiences for Preservice Teachers</i> , Sarah Haines & Chelsea McClure, Towson University
4:00 – 6:00		On Your Own
6:00-7:30		DINNER
8:30		SOCIAL

SATURDAY			
Session Number	Title of Session	Individual Title	Presenters
7:00-8:45		BREAKFAST	
Session V Paper Presentations 9:00 – 11:00	Teaching Innovations	<i>Students Perceptions and the Effectiveness of a Flipped Instructional Model on Student Performance in General Chemistry Courses</i> . Kumar Bharath Sampath, Midway University.  <i>Development of an Open Online Course on Teaching STEM in Rural Areas</i> . Wayhu Setioko, Ohio State University.  <i>The Level of Inquiry as an Approach to Improve Students Intellectual Skills: A Case Study in a Public</i>	

		<p><i>Middle School 3 of Pontianak, Indonesia.</i> Risa Haridza, Ohio State University.</p> <p><i>Efficacy of an Astronomy Modeling Workshop on Teacher Learning,</i> Breanna Ausbrooks &amp; Tom Tretter, University of Louisville.</p> <p><i>The Mini-Zam: Physics Formative Assessment (The Six Year Review),</i> Robert Arts, University of Pikeville</p>
<p>Break &amp; Poster Session 11:00-12:15</p>	<p>Poster Session</p>	<p><i>Earth &amp; Space Science Passport: Changes in Teaching Scientific and Engineering Practices Self Efficacy,</i> Deb Hemler &amp; Sean Harwell, Fairmont State University</p> <p><i>Building a Meta-Analysis: Quantitative Research on Teacher Induction Efficacy,</i> Bradley Lanier, University of Cincinnati</p> <p><i>Hands-on Ants: Using Authentic Biology Research to Enhance Middle School Science Teacher Professional Development,</i> Faith Weeks, Towson University</p> <p><i>Nearpod VR Influence on Science Engagement and Content Retention Among Elementary and Middle School Students,</i> Joanne Vakil &amp; Lin Ding, Ohio State University</p> <p><i>Using Engineering Design Challenges to Foster Growth Mindsets,</i> Suzanne McDonald, Jennifer Robertson-Honecker, Monica Lepp &amp; Johnna Bolyard, West Virginia University</p> <p><i>Investigating Opportunities to Elicit Children's Thinking in 4-H Experiential Learning Activities,</i> Ashley Kookan &amp; Jennifer Murray, West Virginia University</p> <p><i>Politics at the nexus of science and education: Engaging teacher candidates in political issues affecting science education,</i> Angela Webb, James Madison University</p> <p><i>Navigating a Coaching Relationship at the Boundaries of STEM Integration,</i> Justin McFadden, University of Louisville</p> <p><i>Perceptions of Teacher Leadership: The Impact of Organizational Structures on the Professional Identity of Urban STEM Teacher Leaders,</i> Anna Hutchinson, University of Cincinnati</p> <p><i>Flipping Biology: The Effects of a Flipped Classroom on Science Achievement Scores,</i> Gary Wright, North Carolina State University</p>

		<p><i>Inclusive Excellence a Professional Development for Postsecondary Science Faculty</i>, Rommel Miranda, Towson University</p> <p><i>ENABLE STEM and Teacher Leadership: Years 1-3</i>, Karen Irving, Patti Brosnan, Justina Ogotdo &amp; Lin Ding, Ohio State University</p>	
12:15-1:15		LUNCH	
1:15-2:15		BUSINESS MEETING	
2:15		ADJOURN	

## Contributed Papers

*Integration of K-16 STEM Education Through a University STEM Center.* Ashley Vaughn, Madhura Kulkarni & Ellen Hokkanen, Northern Kentucky University.

In this paper, we discuss the impact of a unique university STEM center on a board range of stakeholders, including university STEM faculty, staff, and students; PK-12 students and teachers; and informal science educators. Infrastructure and integration through the STEM center brings together six departments across three colleges as well as PK-12 and informal educators. The center is integral in STEM undergraduate recruitment and retention, undergraduate and STEM faculty research, STEM teacher development, community engagement, and building regional partnerships. Our findings suggest a dual facing (internal/external), interdisciplinary STEM center is able to generate greater impact for stakeholders than is typically found in medium-sized institutions, by better leveraging university, departmental, and community resources to promote enthusiasm, excellence, and equity in PK-16 STEM education.

*Teachers Experiences in the Pulsar Search Collaboratory.* Kathryn Williamson, Jeffrey Carver, Eleanor Bell West Virginia University & Sue Ann Heatherly, Green Bank Observatory.

The Pulsar Search Collaboratory (PSC) engages high school students and teachers in analyzing real data from the Robert C. Byrd Green Bank Telescope for the purpose of discovering new stars called pulsars ,which act light lighthouses in space. To learn how to analyze pulsar data, teachers attend an orientation at West Virginia University, bring a student leader to PSC Camp at the Green Bank Observatory, and then integrate the PSC into their curriculum or as an optional club throughout the school year. They help their students pass certification tests and analyze hundreds of data plots. Students can then earn their way to present their work at an annual Capstone event and attend Summer Camp the following summer. To understand the impact of the program on teachers' beliefs about research and how to involve students in research, we conducted and analyzed pre and post interviews with teachers. Here we present common themes that emerged.

*Science and Mathematics Majors Perceptions of the Value of a Course in Inquiry-Based Teaching.* Nancy Spillane, West Virginia University.

WVUteach encourages mathematics and science majors to “take teaching for a test drive” by registering for a one-credit course in Inquiry Approaches to Teaching. While this experience often encourages students to stay to complete coursework necessary to earn a secondary math or science teaching credential while still earning their BA or BS in a STEM field, about half of the students choose not to continue in the program. This study examines how students see the value of this one course on their subsequent academic coursework and learning in general, future career choices, perceptions of equity, diversity and inclusion, and other thinking or behaviors.

*K-12 Teachers of Science Understanding of Evolution Laws and Approaches to Teaching Evolution.* Ronald Hermann, Towson University, Ian Binns, UNC-Charlotte, Lee Meadows, University of Alabama-Birmingham & Joseph Shane, Shippensburg University.

In this session we describe a study exploring K-12 public school teachers' approaches to teaching evolution, views of evolution and creation, and knowledge of past legal cases. The present study expands on Moore's (2004) survey by attaining more information about teachers, surveying teachers from 42 states, including all K-12 teachers of science, and including "I don't know" as an option on the original survey developed by Moore. A 32-question survey was completed by 208 teachers. Findings include teachers' understanding of evolution laws, views of evolution and religion, approaches to teaching evolution, and time devoted to teaching evolution. The results indicate those who avoid evolution or advocate for alternatives to evolution are generally less understanding of evolution laws. Teachers who devote more time to evolution have a significantly greater understanding of evolution laws. The presentation will include resources that science teacher educators can use to help prepare K-12 public school teachers to teach evolution in a manner consistent with the law (Author, 2013a; 2017) including an upcoming book on the topic.

*Transforming Science Teacher Learning through Content-oriented Critical Case Studies,* Lenore Crabtree, University of North Carolina - Charlotte

Culturally relevant science education requires that practitioners be prepared to support the development of student critical consciousness. Content-centered critical case studies present a novel way for pre-service and in-service science teachers to make important connections between science, social justice, pluralism, and equity. A recent study conducted with in-service teachers explored this approach using Design-based research methods. Working with a design team, the primary investigator developed a place-based case study that engaged secondary science educators in multiple science practices and provoked critical reflection and discourse. In this presentation, the process of developing a critical case study will be described, a concrete example will be provided, and research findings will be discussed. Exploring science content through case studies that support the development of critical consciousness among teachers and students presents a novel way to expand science teacher education.

*Insights From a Multiyear Study on a First Grade Multimodal Science Unit: Impacts of Explicit Drawing Instruction.* Leslie Bradbury & Rachel Wilson, Appalachian State University

We focus on the results of a multi-year study of science learning within a first-grade multimodal unit on carnivorous plant structure and function. We will describe the impact of explicit instruction on the use of drawing as a mode of communication in science. There was a change in student learning as a result of the inclusion of drawing instruction and an additional modeling activity. Results show that in Year



2, students included more labels in their drawings, as well as more carnivorous plant structures and functions in their writings. We believe that the labels served as a scaffold for the writing task for the emerging writers.

*Charged Up! An Examination of Science Explanations From 4<sup>th</sup> Grade ELL*, Lisa Gross & Shanan Fitts, Appalachian State University

Our project introduced elementary classroom teachers (Grades 3, 4, 5) to the use of inquiry-based science instruction in promoting students' communication of science conceptual understanding. This presentation focuses on one unit from the project and includes the analyses of fourth-grade students' written explanations in a science unit on magnetism. Data included science notebooks collected from 16 fourth-grade students in two classrooms and focuses on the explanations produced by three linguistically diverse students from the group. Findings revealed that most students were successful in making and supporting claims with evidence, but often struggled to represent their scientific reasoning in writing. This study reinforces the need to model scientific reasoning orally and in writing, and demonstrates the importance of SFL in our assessment of student writing and thinking.

*One Group of Adolescent Urban Children and Their Perceptions of Nature*. Randall Gibson, University of Cincinnati

Using a youth participatory action research approach, the researcher explores how a group of urban minority students perceive nature within their community. The literature shows that children in lower socio-economic neighborhoods have limited access to nature; this forces educators in these areas to confront these social inequities. This photo voice project seeks to understand how a small group of urban high school children interpret nature in their Midwest neighborhoods. This presentation will engage a larger audience to the possibilities of giving urban adolescent students a voice about the green spaces in their neighborhoods. How do neighborhoods green spaces affect student's sense of attachment to nature? It is through this project that a consciousness is being raised with the students about the importance of access to green spaces. Urban children are missing out on the benefits of spending time in nature. Just to simply enjoy green spaces in their communities, many urban children have to overcome obstacles such as safety and crime, until we fully understand their perspective, we can't begin to equalize the accessibility to green spaces for everyone.

*Efficacy of an Astronomy Modeling Workshop on Teacher Learning*, Breanna Ausbrooks & Tom Tretter, University of Louisville

Modeling Instruction is an innovative pedagogy which relies on students constructing, using and applying scientific models to develop conceptual understandings. Through practice and teacher guidance and questioning, students construct their own models to predict, explain, design, and describe the phenomena around them. Modeling Instruction has been applied to high school chemistry, biology, mathematics, and middle school science. For the first time this pedagogy was field tested in an astronomy modeling workshop hosted by the American Modeling Teachers Association (AMTA) which included 15 teacher participants.

We present a case study on the efficacy of Modeling Instruction on teacher learning during the workshop. Teacher learning includes how to use modeling as a pedagogy to enhance student engagement, learning how to use new tools using real astronomical images for incorporating into the classroom, and developing the skills to allow their students to do science as a scientist does.

*Students Perceptions and the Effectiveness of a Flipped Instructional Model on Student Performance in General Chemistry Courses.* Kumar Bharath Sampath, Midway University.

Affording adequate time and engaging students with the material has remained a constant struggle for those teaching chemistry courses. Flipped instruction maximizes learning by moving content delivery online, allowing for class time to focus on student-centered active learning. The longitudinal study presented herein surveyed students' perception of the flipped classroom and assessed the role of educational technology, problem solving or mastery learning and self-pacing in a flipped classroom. The survey utilized qualitative and quantitative measures which provided a broader understanding of how students responded as a group and as individuals. The study also compared student performance in a flipped versus traditional instruction. Major finding of this study illustrates that technology can provide a self-paced instructional setting that can effectively support mastery learning for students. The flipped method also resulted in a significant improvement in the course grade point average (GPA) compared to a non-flipped class. Additional findings as well as recommendations that emerged from the findings for improving flipped classroom will be presented.

*Development of an Open Online Course on Teaching STEM in Rural Areas.* Wayhu Setioko, Ohio State University.

This project is conducted through an online mentoring program called Open Education for a Better World organized by the UNESCO Chair on Open Technologies for Open Educational Resources (OER) to unlock the potential of open education in achieving Education for All -one of the UN's Sustainable Development Goals (SDG)-. We designed an open online course for pre-service and in-service rural elementary school teachers providing them the basic principles of how to teach Science, Technology, Engineering, and Mathematics (STEM) through an active and engaging learning experience despite the lack of resources situation. The presentation discusses the design, implementation, and deployment phases of the course development. We will share some lessons learned from this project. Feedback and suggestions are expected and appreciated for further plans.

*The Level of Inquiry as an Approach to Improve Students Intellectual Skills: A Case Study in a Public Middle School 3 of Pontianak, Indonesia.* Risa Haridza, Ohio State University.

Inquiry-based learning is a learning approach that can be applied to develop students' higher order thinking skills. There are various inquiry approaches,

however this study will focus on the implementation of the level of inquiry that has been developed by Wenning (2012) in order to answer the question how are the improvement of student' intellectual skills, as one of students' higher order thinking skills, after the inquiry learning? This research is a quantitative study, and it aims to understand the relationship between the level of inquiry with students' intellectual skills. Data were collected using pretest and post-test as well as classroom observation. This level of inquiry had been conducted at Public Middle School 3 of Pontianak, Indonesia to foster the intellectual skills of seventh graders when they learn photosynthesis. Research results revealed that the level of inquiry is not only increasing students' intellectual skills about 26.78, but also in mastering the concept of photosynthesis.

*Efficacy of an Astronomy Modeling Workshop on Teacher Learning*, Breanna Ausbrooks & Tom Tretter, University of Louisville.

Modeling Instruction is an innovative pedagogy which relies on students constructing, using and applying scientific models to develop conceptual understandings. Through practice and teacher guidance and questioning, students construct their own models to predict, explain, design, and describe the phenomena around them. Modeling Instruction has been applied to high school chemistry, biology, mathematics, and middle school science. For the first time this pedagogy was field tested in an astronomy modeling workshop hosted by the American Modeling Teachers Association (AMTA) which included 15 teacher participants. We present a case study on the efficacy of Modeling Instruction on teacher learning during the workshop. Teacher learning includes how to use modeling as a pedagogy to enhance student engagement, learning how to use new tools using real astronomical images for incorporating into the classroom, and developing the skills to allow their students to do science as a scientist does.

*The Mini-Zam: Physics Formative Assessment (The Six Year Review)*, Robert Arts, University of Pikeville

This presentation will focus on a formative assessment item called the Mini-Zam used in the general physics course taken by science majors. Having now completed its sixth year since implementation, many interesting statistics have come to light. A brief overview of the assessment item will be followed by a more detailed presentation of the six-year findings; specifically those of spring-term topics.

## Posters

*Earth & Space Science Passport: Changes in Teaching Scientific and Engineering Practices Self Efficacy*, Deb Hemler & Sean Harwell, Fairmont State University

Earth & Space Science (ESS) Passport is a two-year professional development cohort designed to engage teachers in the three dimensions of NGSS while enhancing Earth & space science content. The efficacy of the second year, science engineering practices workshop, is explored. Data sources included pre-post Teaching Engineering Self Efficacy (TESS) instrument, participant journals, and action research involving their classrooms. By the end of the PD, participants made positive gains on all aspects of the Teaching Engineering Self-Efficacy Scale (TESS) instrument. TESS results showed that teachers made significant gains in their engineering design efficacy on all subscales ( $p < 0.05$ ) and all but one instrument item. Journal entries noted concerns about knowledge of engineering design processes and equipment. Participant posters demonstrated all were able to conduct standards-based engineering design lessons in the context of their Earth and space science programs with students.

*Perceptions of Teacher Leadership: The Impact of Organizational Structures on the Professional Identity of Urban STEM Teacher Leaders*, Anna Hutchinson, University of Cincinnati

Professional identity is socially constructed while navigating within K-12 education systems. When opportunities to contribute are lacking, teachers become isolated within K-12 systems, disenchanted with teaching, and disengaged from the teaching profession. The problem will persist if conditions for educator development are incremental and isolated (Fullan, Galluzzo, Morris, & Watson, 1998). The purpose of this qualitative case study is to investigate how the professional identity of 17 STEM teacher leaders are shaped from embedded organizational leadership activities. Research questions to be addressed are: 1) What perceptions do experienced teachers in the UC Noyce MTF program have about teacher leadership? and, 2) How do organizational structures of the school district and UC program impact their construction of being a teacher leader? Participant data will be analyzed using York-Barr and Duke's (2004) framework of teacher leadership practices. Results can inform effective design of professional development and teacher educator programs.

*ENABLE STEM and Teacher Leadership: Years 1-3*, Karen Irving, Patti Brosnan, Justina Ogoogo & Lin Ding, Ohio State University

Thirteen Fellows in the Empowering Noyce Apprenticeships By Leadership Engagement in STEM Teaching (ENABLE-STEM) have positive opinions of the Program, affirming its usefulness and would recommend it to others. They valued how ENABLE-STEM helped them close the gap between teaching theory and practice and connected them to resources that helped sustain their commitment to high-needs schools. Fellows specifically praised the Urban Teaching Seminar,

culturally relevant pedagogies, community mapping activities, and the ENABLE Leadership & Mentoring (ELM) professional development sessions as key components to the program's success. Progress includes: 1) 9 Cohort-1&2 Fellows are excelling as STEM teachers at high-needs schools. Cohort-3 Fellows all have positions; 2) Outreach to underrepresented minorities resulted in fellowships to four black students (4 out of 17 fellowships awarded = 24%); 3) The COSI element provided hands-on learning opportunities to engage with a diverse audience; 4) ELM is an exceptional model of a new teacher support system.

*Investigating Opportunities to Elicit Children's Thinking in 4-H Experiential Learning Activities*, Ashley Kookan & Jennifer Murray, West Virginia University

Reform in science education acknowledges the importance of giving youth the opportunity to discuss their thinking about scientific phenomenon for meaningful science learning. If you ask a child, "Why do shadows change length throughout the day?", then he might respond by saying, "Light doesn't flow around you, like pebbles in water." This nugget of everyday thinking is productive towards his learning about shadows. However, as a field, we have limited knowledge of the range of ways out of school places and contexts (i.e. after school programs, community clubs, or summer camps) elicit children's everyday thinking in science. In our research group, we are beginning to address this gap in knowledge by investigating 3 peer reviewed science curricula designed for 4-H youth to participate in independent experiential learning opportunities in 3 science disciplines—life science, physical science, and earth space science.

*Building a Meta-Analysis: Quantitative Research on Teacher Induction Efficacy*, Bradley Lanier, University of Cincinnati

A common answer to the teacher retention problem in America has been states and local education agencies implementing teacher induction programs. Efficacy of these programs is often measured by teacher satisfaction and retention rates. Research indicates that several states are having success, but not all. A meta-analysis of the body of teacher induction empirical research is needed to potentially discover program components for further investigation. My poster discusses how the quantitative studies for my future literature review have been selected and invites feedback.

*Using Engineering Design Challenges to Foster Growth Mindsets*, Suzanne McDonald, Jennifer Robertson-Honecker, Monica Lepp & Johnna Bolyard, West Virginia University

The use of various engineering design challenges to foster a growth mindset in youth was investigated. Growth mindset is the understanding that people can improve their abilities and intelligence through dedication, practice, and perseverance. Children with a growth mindset understand that challenges are opportunities to grow and making mistakes is an important part of learning. Because of this, they are much more likely to enjoy learning and reach higher levels of

achievement. Pre-developed engineering design challenges were tested with different age groups in 4-H summer camp classroom settings. For each challenge module, students were given time to explore the topic and test materials for their design prior to the announcement of the challenge criteria. Emphasis was placed on the importance of prototype revision so that students viewed each design change as a step toward success. A selection of the challenge modules will be replicated in after-school and classroom settings during the 2019-2020 school year.

*Navigating a Coaching Relationship at the Boundaries of STEM Integration*, Justin McFadden, University of Louisville

The current study examined how an elementary teacher interpreted the enactment of a STEM coach's role. The findings of the case study reported detail how a coach's role was misinterpreted. Additionally, the data presented reveal how strict adherence to a presupposed coaching stance (i.e. reflective) or role, can limit the fruitfulness of a teacher-coach relationship. Finally, and given the likelihood coaches and teachers possess varying forms of expertise, the study contends that when paired with elementary teachers, a STEM coach might employ more direct coaching supports so individual teachers can implement and experience the potential benefits of new, instructional strategies.

*Inclusive Excellence a Professional Development for Postsecondary Science Faculty*, Rommel Miranda, Towson University

This HHMI-funded Inclusive Excellence professional development program presentation focuses on two overarching goals: 1) reform science laboratory courses to incorporate authentic research experiences via course-based undergraduate research experiences (CUREs), and 2) provide professional development for postsecondary science faculty to promote effective inclusive teaching practices. This poster presentation can help to inform and guide postsecondary science faculty who are interested in developing course-based undergraduate research experiences (CUREs), as well as creating a curriculum and support system that allows both traditional and non-traditional students, especially under-represented ethnic minority students, to participate in multiple authentic research projects and provide assistance in continuing research at the university and beyond graduation. This poster presentation can further help to inform and guide science education professional developers about innovative year-round inclusive professional development that is designed to help postsecondary science faculty develop CUREs, their science education approaches, and their inclusive pedagogical techniques.

*Nearpod VR Influence on Science Engagement and Content Retention Among Elementary and Middle School Students*, Joanne Vakil & Lin Ding, Ohio State University

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research experiences (CUREs), and 2) provide professional development for postsecondary science faculty to promote effective inclusive teaching practices. This poster presentation can help to inform and guide postsecondary science faculty who are interested in developing course-based undergraduate research experiences (CUREs), as well as creating a curriculum and support system that allows both traditional and non-traditional students, especially under-represented ethnic minority students, to participate in multiple authentic research projects and provide assistance in continuing research at the university and beyond graduation. This poster presentation can further help to inform and guide science education professional developers about innovative year-round inclusive professional development that is designed to help postsecondary science faculty develop CUREs, their science education approaches, and their inclusive pedagogical techniques.

*Politics at the nexus of science and education: Engaging teacher candidates in political issues affecting science education*, Angela Webb, James Madison University

This HHMI-funded Inclusive Excellence professional development program presentation focuses on two overarching goals: 1) reform science laboratory courses to incorporate authentic research experiences via course-based undergraduate research experiences (CUREs), and 2) provide professional development for postsecondary science faculty to promote effective inclusive teaching practices. This poster presentation can help to inform and guide postsecondary science faculty who are interested in developing course-based undergraduate research experiences (CUREs), as well as creating a curriculum and support system that allows both traditional and non-traditional students, especially under-represented ethnic minority students, to participate in multiple authentic research projects and provide assistance in continuing research at the university and beyond graduation. This poster presentation can further help to inform and guide science education professional developers about innovative year-round inclusive professional development that is designed to help postsecondary science faculty develop CUREs, their science education approaches, and their inclusive pedagogical techniques.

*Hands-on Ants: Using Authentic Biology Research to Enhance Middle School Science Teacher Professional Development*, Faith Weeks, Towson University

In higher education, authentic research experiences have been found to increase student interest in science and their knowledge of science concepts. These experiences have also been found to help students better explain how research contributes to science and the scientific process. However, few pre-service science teacher preparation programs offer these opportunities, yet these future teachers are expected to help their students understand the scientific process and nurture new scientists. This study offered middle school science teachers the opportunity to partake in authentic biology research. These teachers spent four weeks conducting research on symbiotic relationships between ants and mealybugs, including handling specimens, interacting with specialists, and collecting data. Participants also designed then taught lessons that integrated this experience into their science curriculum. After this experience, all participants reported an increase in their

science teaching self-efficacy, interest in teaching with live insects, and feeling more comfortable with entomology and the scientific process.

*Flipping Biology: The Effects of a Flipped Classroom on Science Achievement Scores*, Gary Wright, North Carolina State University

In response to recommendations for quasi-experimental and controlled studies that focus on the influence of flipped classrooms on objective learning outcomes, the purpose of this study was to empirically evaluate the effects of a flipped and traditional classroom on high school biology students' learning during an organic compounds unit. Achievement scores were the primary source of data and obtained through identical pre- and posttests completed by 46 students. A one-way MANOVA was used to establish equivalency of the two groups on both measures, and dependent sample t-tests indicated that students in the flipped classroom had significant learning gains from pre- to posttest scores in contrast to the traditional class. Findings from this study will help educators and researchers make informed decisions regarding the use of this instructional strategy to support students' science learning.



## Roundtables

*A Teaming Approach for After-School STEM Clubs: Successes and Challenges*, Meg Blanchard, North Carolina State University.

In the STEM Career Clubs project, middle school teachers work together in ways that are not typical for teachers involved in professional development. They work in school teams during the PD, and then return to their schools and implement after-school clubs as a teacher team of 5-8 teachers. They participate in pre-club planning sessions with teacher team members where they review plans prior to carrying out the club with students. In all of these activities, the teachers need to work closely, in interdisciplinary teams. In this presentation, successes and challenges are shared.

*Promoting Student Interest in the Bioeconomy and Related Careers: Successes and Challenges of a Teacher Professional Development Program*, Katie McCance, Shana McAlexander, Meg Blanchard & Richard Venditti, North Carolina State University.

The three-year Sustainable Bioproducts/Bioenergy Program (SBBP) aims to develop the knowledge and skills of diverse undergraduate students and high school science/CTE teachers to promote interest in the sustainable bioeconomy and related careers. Program participants include sixteen teachers who teach in predominantly rural, high-poverty schools. During the program's first year, teachers attended a one-day orientation where they were introduced to bioproduct/bioenergy topics. They then completed two asynchronous online courses to further develop their knowledge and awareness of the bioeconomy. Teachers also participated in a four-day summer workshop to learn new bioeconomy lab activities and co-develop curricula to integrate bioproduct/bioenergy topics into their classes. This presentation will discuss successes, challenges, and lessons learned from the first year of SBBP. We will share our experiences with communicating expectations to teachers, fostering community and collaboration online and in-person, co-developing curricula with teachers, and soliciting and responding to teachers' formative feedback.

*Exploring How to Support Effective Communication in Community- School Partnerships to Promote Students' Career-Mindedness in STEM*, Meredith Kier, William and Mary.

This proposal seeks to explore how researchers might structure productive partnerships between STEM undergraduates and middle school STEM teachers. While studies that have used STEM undergraduates as mentors are prevalent, there is a lack of research examining the actual nature of the mentors' involvement or how they can be trained to effectively support K-12 youth to apply engineering discourse when approaching problems and considering research-based solutions. In order for engineering undergraduates to offer their content expertise within formal partnerships with schools, they must be able to effectively communicate to a variety

of stakeholders. Research shows that industry experts consider the communication skills of engineering graduates to be weak, and engineering graduate students themselves feel anxious about communicating with those outside of their discipline. Thus, how might experts in STEM teacher professional development best support the communication skills between engineering undergraduates, middle school teachers, and students within a community- based partnership?

*Developing a Professional Development Model for Integrating Computer Science into Core Content Areas for all K-5 Learners*, Kristie Gutierrez, Old Dominion University, Amy Hutchison, George Mason University, Jamie Colwell, Old Dominion University, Jeff Offutt, George Mason University & Anya Evmenova, George Mason University

Participants will learn about a design-based research study from the pilot year of a 3-year National Science Foundation-funded project. Researchers aim to develop an effective professional development (PD) model for integrating Computer Science (CS) instruction into core subject areas (e.g., science, mathematics) for all K-5 learners, including those with high-incidence disabilities. The design for the first PD cycle was guided by an existing PD model (Hutchison & Woodward, 2018), input from the partnering school division, and classroom personnel through a researcher-practitioner partnership. To kick off the PD cycle, a 4-day institute was held in Summer 2019 to engage educators in unplugged and connected activities, goal setting practices, and discussion of CS pedagogy and tools. Researchers led all aspects of the PD. The Technology Integration Planning Cycle (Hutchison & Woodward, 2014) was used as the framework for planning for CS integration. Plans for the current, year-long PD cycle will also be shared.

*Preparing to Teach Engineering in the Elementary Classroom*, Scott Townsend & Krista Adams, Eastern Kentucky University

The NGSS has called for the inclusion of engineering in K-12 classrooms. However, traditional education programs do not provide teachers with ample opportunities to learn about engineering as well as experience ways to implement engineering in the classroom. This presentation will share the implementation of an undergraduate course “Engineering in the Classroom” that supports elementary and middle grade education majors to explore science through engineering. We will discuss the developed and implemented pedagogical strategies from problem based activities to soldering. In the first two years of implementation, the pre-service teachers have developed unique ways of incorporating science and engineering through exploration of electricity, biomedical engineering, and nanoscience among the many concepts. It is our hope that sharing the strategies, successes and lessons learned, and student products will help other science educators to develop ideas for supporting preservice teachers understanding of science and engineering.

*A 20-year Journey in Elementary and Early Childhood Science/Engineering Education: An Iterative Cycle of Reflection, Refinement, and Redesign*, Cody Sandifer, Pamela Lottero-Perdue & Rommel Miranda, Towson University

The experiences of six middle grades science teachers in a Research Experience for Teachers (RET) program focusing on Big Data and data science will be shared. Support for translating their research experience using the practice of mathematical and computational thinking and Blanchard and Sampson's Theory of Action for RETs resulted in teachers developing multi-dimensional curriculum materials. The graduate students and computer science faculty who worked with the teachers in the RET were surprised at the teachers' resourcefulness in learning new content, their persistence in problem solving and their understanding of student-teacher relationships.

*Partnership with a Purpose: A School University Collaboration*, Aimee Govett & Jamie Price, East Tennessee State University

A research development grant funded travel for a cadre of university faculty and middle school teachers to visit Tennessee schools in the Nashville area that were successful in receiving a STEM School designation in order to understand how the schools pursued the application process and how they are implementing STEM curriculum. Two main benefits came from this project. The visits were very successful and the cadre was able to take back lessons learned to help area schools that are currently seeking to achieve STEM School designation from the state. Second, faculty involved in teacher preparation can better prepare teacher candidates to enter the “dynamic pipeline of future STEM professionals who are highly skilled across industries and in academic research” (TN Department of Education, 2018, p.2). We would like to share our experiences and see if colleagues within the mid-Atlantic region can enrich this discussion using the round table format.

*And Yet, They Persisted*, Helen Meyer & Karen McGarry, University of Cincinnati

We share the stories of several urban STEM teachers, with between ten and thirty years' experience, who chose to teach in urban secondary schools. We used a narrative inquiry design to develop individual stories, which we supported with additional qualitative data to highlight the common and divergent themes of the teachers' stories.

*Growth Mindset Assessments*, Tina Cartwright & Brian Kinghorn, Marshall University

This roundtable will discuss strategies that can be incorporated in our classes that support the development of a growth mindset through innovative assessments. One example, a two stage exam, supports a growth mindset by providing students the opportunity to take a traditional exam two times once on their own (80% of grade) and again in a small group (20% of grade). Additionally, what strategies are students using to cheat on our assessments which threatens our learning goals and their growth mindset? Several online resources that students use to short cut and undermine our learning goals as well as innovative assessment strategies will be discussed that span low stakes to high stakes assessments.

*Computational Thinking with Middle School Teachers in an RET*, Stephanie Phillip, University of Tennessee-Chattanooga, Olfa Nasaraoui & Jason Immekus, University of Louisville

The experiences of six middle grades science teachers in a Research Experience for Teachers (RET) program focusing on Big Data and data science will be shared. Support for translating their research experience using the practice of mathematical and computational thinking and Blanchard and Sampson's Theory of Action for RETs resulted in teachers developing multi-dimensional curriculum materials. The graduate students and computer science faculty who worked with the teachers in the RET were surprised at the teachers' resourcefulness in learning new content, their persistence in problem solving and their understanding of student-teacher relationships.

*Science and Religion in Symbiosis: Part 2 – A Follow-Up Discussion to Last Year's Presentation, "A Collaborative Learning Experience for Biology Majors in a Liberal Arts Undergraduate Setting*, Darla French & James Browning, University of Pikeville

Last year, we shared an innovation collaboration in which a biology professor and a religion professor linked two undergraduate courses. Each instructor taught a course and was embedded in the other's. Students were co-enrolled in REL 383 Religion & Science (Dr. Browning) and BIO 383 Nature of Science (Dr. French), both discussion-based courses. Students participated in a variety of high-impact, non-cognitive teaching practices, including leading discussions and doing experiential learning activities, all intentionally planned and executed to allow exploration of connections between science and religion and articulation of personal worldviews. After many discussions with colleagues, we have determined the importance of practically sharing our experience on a wider stage. This roundtable session will help the presenters clarify a vision for development of a set of resources to assist K-12 science teachers in understanding the connections between religion and science in order to increase their comfort level in addressing this topic with their own students.

*Technology for Justice: Using Educational Technology Creatively and Critically in Service of Social Justice*, Lauren Angelone, Xavier University.

In this roundtable, the restructuring of an undergraduate Instructional Technology course as well as nascent research on the course will be shared. The course has been restructured to focus on technology for social justice, utilizing critical media literacy as a lens through which to view the use of technology in the classroom and its empowerment and effects on different groups of students. Twitter chats will be utilized as a pedagogical strategy and analyzed to understand how students conceptualize and take up technology for justice.

*Culturally Relevant Science Teaching in an Elementary Science Methods Course,*  
Paula Magee, Indiana University – Indianapolis

The need for culturally relevant and racially conscious elementary teachers is compelling. Statistics overwhelmingly show that students of color are most often underserved by schools resulting in limited opportunities for learning, low graduation rates and higher levels of disciplinary actions (when compared to white students). Additionally, “color blind” science curricula used in predominantly white schools fail to challenge the reality of structural racism in the United States. While exceptions to these practices certainly exist the majority of schools, and the educators in them, are struggling to provide equitable and just educational experiences for students. In schools filled with students of color, the responses to these inequities have largely translated to unsuccessful “reforms” such as high-stakes testing, charter schools, skill and drill programs and recruitment of teachers “willing” to work in “high needs” schools. In schools that are predominantly white, critical curricula rarely expose white racism, either historically or in the present. Despite being well-intended, professional development often decenters racism, reinforces white supremacy and perpetuates deficit narratives of students of color. This roundtable discussion will include specific activities and philosophical approaches used in an elementary science methods course designed to support equitable and racial conscious science teaching.

*Benefits of Nonformal Education Teaching Experiences for Preservice Teachers,*  
Sarah Haines & Chelsea McClure, Towson University

We formed a partnership between an institution of higher education and an informal educational institution in which preservice teachers deliver educational programming focusing on Chesapeake Bay water quality and human impact to students from local schools. Teaching Environmental Awareness in Baltimore (TEAB) is designed to engage students (both preservice and K-12) in environmental issue investigations relevant to the local community to promote deep, critical thinking. We will present data focusing on the effect of the project on preservice teachers. In particular, we wanted to answer the following questions:

- Can integrating non-formal educational field experiences that focus on local environmental issues into teacher preparation programs promote better preservice teacher content and pedagogical knowledge?
- Can integrating non-formal educational field experiences that focus on local environmental issues into teacher preparation programs promote more positive attitudes towards teaching environmental education, and perhaps toward the environment itself?