Katie Brkich, PhD
"Oh What Fresh Joy is This?": Teaching K-5 Teachers Science Content

I would like to propose to host a discussion around the role of teaching preservice elementary teachers the science content they will need to be successful K-5 teachers of elementary science. This conversation should be particularly relevant to those who teach, or those who are interested in improving the teaching of the ISCI courses required here in Georgia, but also to those from other states who face the challenge of teaching preservice teachers who lack science content knowledge.
This semester, Fall 2015, I was asked to temporarily take-over teaching ISCI 2002, Physical Science, a course designed to supplement elementary and middle school preservice teacher knowledge of physical and chemical science content related to the K-8 standards in those content areas. As my background is not in either of those areas of science, this was a monumental task I accepted with trepidation and a great deal of self-doubt.
I would like to present why and how I made the decisions I did in redesigning a course which I would only teach once, and what I have learned as possible suggestions for others who are tasked with teaching content courses to preservice elementary teachers. I would then like to facilitate a discussion around how our colleges and universities in the southeastern United States are addressing the need to improve science content knowledge in preservice teachers, and what forms of work or advocacy are needed to further this important goal.

Brendan E. Callahan, PhD and Michael Dias, PhD
Using the POE framework in Middle School Earth Science

The Next Generation Science Standards includes a list of science and engineering practices that should be included in all science classes. Two of these practices: constructing explanations and designing solutions, as well as developing and using models, can be achieved through the Predict-Observe-Explain (POE) framework. We utilized the POE framework with four classes of 6^{th} grade Earth Science students in a Title I suburban middle school in metro-Atlanta. We did two activities that correlated to what they were learning in class and that have been featured prominently as common misconceptions: the cause for the moon's phases, and the cause for the seasons. In both cases the expectation was that the students to develop detailed explanations for the phenomena, rather than rote memorization of facts, and for the students to retain those explanations over time. We conducted interviews with the students approximately 4-6 weeks following the two activities in order to determine whether the students retained a scientifically accurate explanation for the moon's phases and the cause of the seasons. A number of trends became apparent as we examined both the written data from the classroom activities and transcripts from single participant interviews. Most students did not retain a scientifically accurate explanation for the phenomena. When students were able to see their prior work, they were able to generate better explanations. Although students enjoy hands-on activities, and asked for more of them, we found little evidence among the students we interviewed that the activities promoted long-term conceptual understanding.

Chelsea Carrington, Will Haynes, Chelsea Lindskog, Hannah Taylor and Catherine Wolfe (POSTER)
An analysis on the understanding of inquiry among pre-service teachers

The fellows with the NanoBio program conducted research on inquiry through personal experiences and self-reflection. Experiences include: coursework through Auburn University, research in middle and high school settings, and pre-service teaching. Through research we found that pre-service teacher learning experiences are defined as, " A reciprocal relationship that merges both field experience and sustainable community service, to offer learning opportunities that link academics to the service, so both the college students and the community partner benefits" (Ryan & Callahan, 2002). In our experiences as pre-service learners we have completed coursework including: Teaching and Technology, Evaluation of Program in Secondary Science, and Methods which have clearly identify the definition of "inquiry" as it pertains to secondary education. Fellows have also done research at secondary educational schools including Loachapoka high school, and secondary educational summer camps held at Auburn University. As pre-service teachers we have experienced inquiry in the classroom by teaching under several local teachers. Each of the fellows has unique experiences in regards to coursework, pre-service teaching, and research through Auburn University. We have encountered the common notion that inquiry invokes a multi-definitional concept between multitudes of teachers. Due to the increasing interest of inquiry in the classroom setting it is important to set a common core definition. Our aim as fellows and pre-service teachers is to further encourage the process of inquiry in classrooms while also setting the standards for a common core definition

Charles Eick, PhD
Project-Based Instruction in a High School Science Classroom: A Learning Cycle Unit Approach that Makes It Possible

Project-Based Instruction (PBI) is proposed as a way to integrate STEM fields in the science and math classroom. This is evident in the current UTeach Program Model. PBI's intent is progressive, student-centered, resource-rich, and long-duration – all of which are difficult to sustain in the typical high school STEM classroom. A much more modest and doable approach is needed that can maintain the key elements of PBI (e.g., relevant driving question, outside resources, community connection) while working within a limited amount of time in a curriculum-focused classroom. PBI can still be done under such constraints when teachers utilize a Learning Cycle approach to planning lessons in a limited-duration PBI unit. Teachers engage students with a relevant driving question that enables multiple explorations of key concepts required for student learning and that help answer the driving question. The application of learned principles follows through a more student-centered focus in designing solutions (e.g., engineering project), seeking additional evidence (e.g., field trip), or seeking additional resources (e.g., community-based) that help further answer the question. Culminating evidence, projects, and/or presentations demonstrate evidence of learned principles in action. This presentation will show an example of a shorter duration PBI unit that follows a Learning Cycle and is doable in today's high school science and mathematics classrooms.

Joe Gaston
The Effects of Collaborative Video Production on the Attitudes and Science Knowledge of Sixth Graders

This quantitative study examined the effects of collaborative video production (CVP) on the attitudes and conceptual understanding of sixth-grade science students at a public middle school in the Southeastern United States. This study followed the nonequivalent control group design, as described by Campbell and Stanley (1963). The study involved four classes of sixth-grade students. The two control classes were taught the science concept by the cooperating teacher through direct instruction, and the two experimental classes learned the science concept through the CVP project. Pre- and posttests were administered to all students, as well as two pre- and post-surveys measuring student attitudes towards science and technology. Analysis of covariance (ANCOVA) with the pretest scores as the covariate (Xc) was conducted with the posttest and post-survey data to determine if a significant difference existed in scores between the two groups. In each case, no significant difference was found. The results of this study suggest that CVP was as effective at conveying conceptual understanding to sixth-grade science students as direct instruction. Although not significant, the study also showed that mean scores of students' attitudes towards science and technology increased from pre-surveys to post-surveys for those who participated in the CVP activity. These findings suggest that the treatment contributed to an increase in participants' attitudes towards technology and the academic subject. No such increase in mean post-survey scores existed for students receiving direct instruction.

Barry Golden, PhD and Karena Ruggerio
What children learn about climate change through scientific argumentation

In this paper, we describe research into how middle school children learn about climate change by immersion in scientific argumentation. Sixth grade students were given climate data and asked to develop their own understandings about the data and to communicate these understandings to their peers through Argument-Driven Inquiry (ADI). Several findings emerged, including 1) students understood many disparate facts about climate change prior to the lesson; 2) student understandings about climate change moved towards the current consensus in terms of anthropogenic causation; 3) the students lacked an overall ontological category pursuant to climate change, so their disparate knowledge of facts were lumped into what we deem a "general environmental category" which included both rising temperatures and littering of trash; and 4) the process of scientific argumentation revealed interesting insights into how students arrived at their understandings, including the simple adoption of the views of the most confident student in the group, regardless of the scientific accuracy of their understandings. This was particularly interesting in regard to a female student whose robust scientific understanding of the phenomenon was lost in her group's consensus. We discuss the results of this research in terms of pedagogical strategies for climate education.

Will Haynes, Chelsea Lindskog, Hannah Taylor and Catherine Wolfe (POSTER)
NanoBio Fellowship Program: Probing into the Perspectives of the Fellows

The NanoBio Partnership for Alabama's Black Belt Region is a National Science Foundation funded project. The goal of the program is to provide middle school science teachers with professional development and instructional modules that promote inquiry-centered science instruction in the classroom. Part of the project is a fellowship program for pre-service teachers in science education. The fellowship program's goals include mentoring pre-service teachers in curriculum development skills, promoting knowledge of cutting edge science, and encouraging research and collaboration with both science and science education university faculty. Our objective in this study is to examine the NanoBio Fellowship Program and the effectiveness of the modules created by the fellows in the classroom, with the teachers in those classrooms, and with the fellows themselves including fellows from other universities involved in the program. We used qualitative research methods to explore the experiences of current and past Fellows and how the NanoBio program affected their development as educators. By interviewing members of the fellowship program at Tuskegee University, Alabama State University, and Auburn University we sought to find answers to questions regarding the effectiveness of program modules in the Alabama Black Belt Region, the probability of pre-service fellows to use the modules in their future careers, challenges in the program, and changes or improvements to be made in the program. The study has implications for other institutions that use school partnerships, service learning, or and action research methods for pre-service teacher programs in science education.

Sumitra Himangshu, PhD
Uncommon learning in common spaces: Downtown explorations using the five senses
In this session, the presenters will provide a platform for the audience to engage in discussion regarding childrens' comprehension of science understanding in unusual spaces. A group of third graders from an after-school program were given the opportunity to explore the downtown area near their school using only their five senses. The objective of the activity was to encourage students to test their conceptual frameworks in discussion with other students and thus, to empower them in a guided inquiry process to construct understanding within a local cultural context. Five groups of third graders, working in groups of 6 (n = 30) constructed sequential concept maps, involving observations made within their collaborative subgroups, and then the larger whole group. The initial maps on average, showed no hierarchy of content, and a lack of relationship between terms denoting superficial understanding. This was followed by subgroup discussions with immediate peer-feedback and guided prompts from their group leaders and then a second concept map was constructed within the same subgroups. The second maps contained descriptors that showed a clearer relationship between the initial observations and the students were able to self-identify gaps in their own understanding that were present in the initial concept maps. After additional exposure to the content through interactive discussions among subgroup members, the concept mapping activity was repeated as whole group. Analysis of the whole group map allowed this group of students to recognize a formative process by which to identify misconceptions and gaps within their own understandings. The process provided a safe path for students to recognize and connect science to their everyday lives. Overall, the map quality of the whole group map indicated deeper-level of understanding and correlated well with answers to discussion questions, and subgroup members' journal notes.

Jada Hoyle-Gardner
Gender Roles in Teaching: Exploring Gender Roles in My Teaching Journey

In this paper, I recorded my pathway to exploring secondary STEM education in a summer program. Initially I was interested in studying students' attitudes towards the STEM courses in the summer program. However, over time this goal transformed into a more specific project--gender analysis. Based on my classroom observation, I noticed that students have a mixture of learning types—or a completely new one than what they claimed to be. Taking this further, I am taking a look at how gender plays a role in how the students respond to the teaching styles.
I observed how the students respond to different teaching methods, including visual lessons like taking notes and videos, and engaging in hands--on activities like group presentations. I chose these methods because, from my own classroom experiences, they are favored in many classrooms today. My data analysis focused on my observation notes, adaptions of teaching methods, and my interactions with the students. This is important because it will help the teaching assistants consider the design of activities that can address different learning styles when interacting with students.
Reflecting on this summer experience has changed my attitude toward education. I realized higher level students like high school students need the same amount of time and guidance as the other levels. This is where we lose a lot of our students' interest in the STEM courses. But if the classroom shifts to adapt to their individual learning abilities then that interest can be sparked once again.

Lauren Johnson
Southeastern forests and climate change

This workshop will introduce a new Project Learning Tree (PLT) secondary module on climate change impacts on southern forest ecosystems, the role of forests in sequestering carbon, and strategies for reducing greenhouse gas emissions and adapting to changing climatic conditions.

The module includes 14 engaging activities designed for use in life science, environmental science, and agriculture classes in grades 9-12 and undergraduate coursework.

Leslie Sandra Jones, PhD and David Long
Creationist preservice teachers reactions to evolution instruction

The fact that Gallup polls over the last 33 years have shown no change in people's attitudes toward evolution is a serious failure on the part of biological education. It is especially alarming that teacher's attitudes show a lack of commitment to teaching the subject out of a desire to avoid the potential for controversy. Furthermore, a recent review of the number of biology teacher education programs in the country that require a stand-alone course on biological evolution reveals the primary reason that ignorance of the subject remains so pervasive. Given the stubborn persistence of controversy in the Bible Belt, we have made a proactive effort to ensure that science teacher candidates receive explicit instruction covering both the scientific content as well as the socio-cultural objections to the teaching of the theory in public schools. The efficacy of non-traditional strategies was evaluated by recording the attitudes of creationist

preservice science teachers while they were undergoing instruction. Several students volunteered to participate in cogenerative dialogues with another science educator outside of the course where it was possible to examine their reactions to ideas about religion and science. The co-author who was the designated instructor for this biology course had no involvement in the cogenerative conversations and the identities of students participating in the dialogs were not disclosed to the teacher. Their comments revealed how they delineated the social and conceptual boundaries of their understanding of science, faith, and each other.

Jan Kent and Leslie S. Jones, PhD
Modeling Inquiry in Large Science Courses

We make an effort to teach science content to preservice teachers in the way we hope they will teach children. However, providing an Inquiry-Orientation is a challenge with large numbers of education majors, so we devised a system of scheduling multiple 50-minute activity periods in the laboratory throughout the day, and a single combined lecture section later on the same day. Lab activities are designed to prompt students to raise questions and develop curiosity about a subject before we deliver the structured information. If this sounds like the start of a 3E lesson, it is. After the Exploration (activity) and the Explanation (lecture), they are assigned a specific Extension (assignment) to ensure that they can apply whatever concept was presented. Often that assignment incorporates a K-8 Georgia Performance Standard and a prompt to consider applications in the classroom. We always make our teaching practices explicit in the hope that the blend of scientific information and novel teaching practices will foster the development of Pedagogical Content Knowledge. This strategy was developed by faculty members in the Biology Department of the College of Arts & Sciences to squelch student complaints about how difficult their science courses were. Many of those protests had sounded like these people were not accustomed to rigorous coursework, so this was a way to tailor these designated service courses to the professional goals of the students. We constantly meet practicing teachers who are eager to tell us how they use these ideas in their classrooms.

Natalie King, Rose M. Pringle, PhD, Mayra L. Cordero, and Natalie Ridgewell
Middle Grades African American Girls' Science Learning in a Community-Based Summer Program

If the United States is to maintain its national security and global competitiveness, it is imperative that all students are provided with the foundation to promote their participation in Science, Technology, Engineering, and Math (STEM). However, many reform efforts in education that seek to promote effective instruction still fail to meet the needs of underrepresented populations, especially African American girls, thus only a limited number of African American women pursue STEM careers. FOCUS, an informal learning STEM program, provided African American 4th-8th grade girls with culturally-relevant, engaging, and empowering reform-based STEM learning experiences. Using an interpretive design, we investigated the following two questions: (a) How do African American 4th – 8th grade girls experience an informal summer program that focuses on STEM and cultural relevance? (b) What is the impact of a summer informal STEM program on African American middle grades girls' perceptions of themselves as learners? Data analysis revealed that becoming aware of STEM

career options provided the girls with opportunities to dream of possibilities and to envision themselves making those dreams a reality; culturally aware STEM teachers embrace their roles as mentors and mediators of content knowledge; and an informal STEM learning environment provides girls with a sense of belonging and stimulates their interest in STEM careers. Our findings have implications for practice and seeks to confirm that when credence is given to the cultural experiences of African American girls in the middle grades, they are poised to reveal their luster toward STEM learning.

Natalie King, Rose M. Pringle, PhD and Mayra L. Cordero
Preparing Science Teacher Leaders to Become Agents of Change

With a decreasing budget for professional development and low returns on investments over the years, school administrators are searching for cost-effective alternatives to improve teachers' practices and increase students' achievement in science. The concept of Science Teacher Leaders (STLs) has emerged in schools nationwide as evidenced in the literature and recently conducted interviews. In order to retain teachers, administrators are providing more leadership opportunities to hone their craft, excel in their professions, and effect change from within their classrooms (Pankake & Moller, 2007). Currently, there is no formalized system for how teachers are selected to become STLs or clear definition of their roles and expectations. Teachers are selected as STLs based on their high engagement in formal and informal science activities, positive attitudes toward science, or interest in pursuing leadership roles. There is a recognized need for schools to have teachers who can impact change within their schools and districts (Brenneman, 2015) but a void exists in the system for how to prepare Science Teacher Leaders to fulfill the existing context-dependent professional development needs. Research indicates that many STLs are not prepared for their roles. To address this issue, in our recently-funded NSF project, we prepare STLs by immersing them in formal science content and pedagogical courses and simulated activities and practices in PLCs. In this presentation, we describe how we prepare STLs to engage their peers in transformative science teaching and learning and share their experiences in enacting change from within their classrooms.

Michelle Klosterman, PhD
Moving science from the center to capture the diversity of skills on the fringes

For science educators, the content of science and its associated skills take center-stage among our goals and classroom instruction. But what if science was not the center of instruction, and instead, perspective taking, active listening, and developing solutions for others were the emphasis - the context in which science is applied? What might students learn?

This presentation will examine an innovative summer academic program for high school students during which students confront complex, real-world issues through a combination of dynamic classroom and community instruction. As a culminating experience, students participate in small-group community service projects and prepare action proposals for community non-profit organizations, connecting the theme of sustainability throughout the program.
In addition to examining students' understandings of science, in 2015, participants completed pre- and post-program knowledge, confidence, and usefulness (KCU) surveys adapted from Lane, Menzies, Bruhn, and Crnobori (2011) to assess increases in student perceived knowledge

of, perceived confidence in using, and perceived usefulness of skills and concepts central to the summer experience. The KCU surveys were selected as they assess the three areas critical for the adoption of new attitudes and behaviors, and have been used for other short- and medium-length courses and professional development (Lane et al., 2014). Students reported statistically significant ($p < .05$) increases in overall perceived knowledge, confidence, and usefulness of the program-related skills and concepts.

This presentation will examine the overall goals, implementation, and outcomes of the program, as well as lessons learned for future programming.

Yotah Koulagna
Creating Formative Assessment Tasks: Making Connections and Keeping Science Learning on Track

Evidences from studies expose the impact of formative assessment on instruction and student learning but its presence is sparse in a diverse science classrooms due to pressure to improve students' achievement and teachers' limited knowledge of its practices. Although professional development efforts have been directed towards helping teachers acquire formative assessment skills, it is sporadic and limited to providing teachers with theoretical guidance on how to embed formative assessment strategies into their lessons and rarely any talk on how to create tasks that will ensure successful implementation. This paper presents a sample practical lesson with descriptive arrangement that science teachers can follow and transform their own classroom teaching and learning process. The teacher creates multiple sequential tasks using formative strategies that will illuminate what students know and provide them with incremental steps to demonstrate their understanding and move them towards mastery. After clarifying the objective with the students (where they are going?), the teacher uses an initial task to assess students' prior knowledge (where they are?), and a set of scaffold-tasks with skills that students need to acquire to demonstrate understanding (how to get there?). Teacher will provide specific iterative feedback to address each student's need and use the information to adjust instruction and the students will self-assess, peer-assess, and serve as resources for each other to work towards lesson objective. The knowledge gained from this representation will help teachers practicing in diverse science classrooms improve both their instruction and student learning.

Jennifer Mesa, PhD
Preparing NGSS-ready elementary science teachers in an online methods course

What does it mean to prepare pre-service elementary teachers to teach the three dimensions of the Next Generation Science Standards (NGSS Lead States, 2013) in a state that has not yet adopted the new standards? What are best practices for preparing elementary pre-service teachers who are engaged in a fully online program of study to teach science? We have struggled with these two questions in re-designing the online elementary science methods course at our university over the past year. We will share our course syllabus and initial attempts to engage our pre-service teachers in understanding how to design, deliver, and assess inquiry-based science instruction aligned with the NGSS in the online methods course. In addition, we will seek feedback on the design of the course from the audience, and promote discussion of alternative methods and strategies used at other institutions to prepare pre-service elementary teachers to

understand and plan inquiry-based instruction aligned with the new standards in their blended or online coursework. Finally, we will seek to establish a critical friends group composed of faculty members and graduate students who are interested in ongoing collaborative discussions to improve their blended or online coursework for pre-service elementary teachers in this new era of reform.

Brittany Mixon and Leslie S. Jones, PhD
A lab that really lets them do something scientific

One of the most ludicrous mantras of science education reform was the call to "Let Students Do Science." It sounded as if removing all structure and promoting Open Inquiry was going to be the magic formula that would resolve all of the distain most people have for learning science. Did they really think it was going to be possible to propose hypotheses and follow the misleading program known as "The Scientific Method" that students had been forced to memorize? Nobody is capable of "doing science" without years of training and guided experience. Therefore, we devised a laboratory exercise that emphasizes some of the most important processes that scientists employ in genuine investigations. With reusable inexpensive materials and about $5.00 of freshwater bait minnows it is possible to break the mold of boring cookbook labs and encourage students to go through a simulation of the real research process in a short period of time. This session will be a workshop in which participants actually go through the entire exercise in a speed version with real fish. There is an Inductive observation for the opening piece. This leads to a Deductive test that generates good data for simple descriptive statistical analysis. This is effective as a Pre-K demo and works at every grade level, but best of all it really lets pre-service teachers do something they can adapt to their classrooms.

Jaclyn Murray
First-year engineering majors' spatial and functional design ability

Spatial knowledge is associated with competency in science, technology, engineering, and mathematics (STEM) (Wai, Lubinski, & Benbow, 2009). However, explicit learning about skills associated with and the uses of spatial knowledge are not emphasized in US formal K12 education (NRC, 2006). Spatial knowledge, as defined here, results from both an inherent spatial ability and practiced spatial skills. Spatial ability shall refer to an individual's implicit understanding about how to engage in object manipulation and perspective taking (Sorby, 2009; Kozhevnikov & Hegarty, 2001). Conversely, spatial skill will imply proficiencies developed through formal instruction.
Furthermore, STEM fields require aspects of creativity for discovery of phenomena and invention of new products and processes. The theoretical model of functional creativity is specific to products, and refers to both novelty and the ability to serve some useful social purpose (Cropley & Cropley, 2014). According to the model five dimensions elaborate on measures of product creativity (Cropley & Kaufman, 2012).
The aim of this exploratory investigation was to comprehend the design process involved in the creation of a novel and useful package from the perspective of an introductory engineering student. In addition, we examined how the design process and product related to spatial ability. Preliminary data and analysis will be presented.

Jan Nourollahi
Examination of preservice/mentor science teacher interactions on professional identity

The purpose of this study of mentor and preservice science teachers during field teaching assignments is to gain a further understanding of the influence of the mentor teacher on preservice teacher professional identity development. The main research question is: How do the interactions between the preservice and mentor science teachers influence the professional identity development of the preservice teacher? This question was explored through a situated learning lens utilizing a descriptive, single case study design. One-on-one interviews of eight preservice and four mentor teachers (N=12) were conducted and analyzed for specific categories on professional science teaching identity: Traditional, Instructive, Transitional, Responsive, and Reform-based (adapted from Fletcher & Luft, 2011). Video-recorded planning sessions, and written reflections of preservice and mentor teachers revealed changes in preservice teachers' views of their professional identity over the course of a semester-long field teaching assignment. The case study narrative that results from the written and verbal communication between the preservice and mentor teachers provides important insight into their relationship and the possible subsequent influences on preservice teacher professional identity. Preservice science teacher professional identity is influenced by previous science teaching and learning experiences (Darling-Hammond, Chung, & Frelow, 2002; Bullough, 2005; Crawford, 2007; Fletcher & Luft, 2011) and has important implications for the development of effective science teachers who have the ability to implement the Next Generation Science Standards in their classrooms. This may have implications for the design of preservice teacher field experiences in science teacher education programs. As the importance of reflective practice in field teaching experiences has been previously discussed by Eick and Reed (2002), findings from this study will also provide prospective teacher mentors insight into the importance of reflective practice during field-teaching experiences.

Kitchka Petrova
Interdisciplinary lesson design and pre-service elementary school teachers' self- efficacy

The project goal is to investigate, if educating pre service elementary school teachers to use interdisciplinary approaches to design lessons increases their overall confidence to teach science. The interdisciplinary approach to teaching science is valuable, because it facilitates students' learning of the science concepts in the broader context of other disciplines and issues.
Our research question is Does learning to design interdisciplinary lessons increase pre-service elementary school teachers' confidence to teach science?
This is an ethnographic case study that involved pre service elementary school teachers. They were interviewed to evaluate their confidence in teaching science and their understanding of the interdisciplinary lesson design. A hands-on workshop "Interdisciplinary Approaches to Teaching Science" was organized for the participants after the first interview took place. The NGSS framework was used to conduct the workshop. Follow- up interviews were conducted after the workshop. The recorded interviews were transcribed and analyzed using NVivo.
The preliminary findings indicate that pre-service elementary school teachers find teaching interdisciplinary lessons engaging, they feel more comfortable introducing the science concepts and they see it as a way to introduce more science in the elementary school classroom.

The results of this study contribute to expanding the knowledge about pre service teachers' self – efficacy and could potentially have an impact on higher education institutional policies that regulate the elementary education programs course work

Azhar Qureshi
Children's Interactive Experiences and Meaning Making of Scientific Exhibits at Community Museum

The purpose of this mini research project was to identify the impacts of interactive experiences on the effective science learning of the children. Through observing their non-formal activities in a community natural history and science museum, this research tries to identify some of the tools and strategies that children used in their quest for science knowledge and possible evidence for science meaning-making. Two primary sources of evidence for science learning were included: dialogic conversations between children and their parents and children's behavior as they interacted with certain exhibits within the Nature Quest area of the museum. Only observations and fields notes were used for data collection. Three themes of personification, essences and functional reasoning based on Ash (2003) framework were initially used to estimate the children's biological understandings of exhibits. An additional theme of problem-solving and collaborative skills emerged due to specific nature of few exhibits. The nature of the study was qualitative, and ethnography was used as the methodology. Only children's interactive exhibits experiences were selected for the analysis of the study. Through these thematic analysis children meaning making into the type of interactions were explored. The findings of the study indicate that most of their interactive experiences were brief and did not involve in-depth scientific meaning-making process. However, it was evident that children had fun and remained engaged consistently with these exhibits, and their meaning-making of scientific phenomena was stress-free. Problem-solving was most evident as a strategy in their search for scientific knowledge.

Karena Ruggiero
A Criteria-Based Evaluation of Environmental Literacy Plans in the United States

In response to the lack of formalized environmental education, 48 states have developed Environmental Literacy Plans (ELP) through their state environmental education organization. The guidelines for ELP development, produced by NAAEE, provide a framework for the integration of environmental education into current state curricula, propose graduation requirements for environmental literacy, suggest steps for teacher professional development, detail assessment strategies and propose funding sources and policy action steps. Due to the extreme variations in educational systems, policies, and politics on a state-by-state basis, the 48 ELPs are in dramatically different phases of progress.

The purpose of this research is to examine the progress of ELPs through a criteria-based matrix, allowing the researcher to identify states which are successfully planning and implementing their ELPs and identify how 'best practice' states arrived there. Preliminary analysis of data has shown a relationship between the robustness of the graduation requirement in the plan with the overall status of the plan in terms of successful implementation. The preliminary analysis also shows that state environmental education organizations value planning for professional development.

The implications of this research may extend beyond environmental education to inform broader goals in science/STEM education in its progress toward scientific literacy. The importance of teaching problem-solving and critical-thinking skills are major tenants in both environmental and scientific literacy. This research has the potential to assist states in the passage of their ELPs; in turn impact the integration into science and STEM curriculum as well as professional development for teachers in science fields.

Shakevia Robinson
Summer of teaching, learning, and planning: Is teaching my passion?

As a sophomore at Spelman, I was determined to find my passion. I knew I always had a passion for children, but I did not know if I had a passion to teach children. I decided to apply for the Spelman STEM Teacher Education Pipeline. Getting accepted into this program I was able to go through different phases of teaching. I observed various classrooms, tutored students in Pre-calculus 2, and taught ninth grade coordinate algebra during Atlanta Public Schools summer school. As I was teaching summer school I found myself falling in love with the teaching field. Even though, it was hard managing the students since some students background was different from other, I did not allow that to make me afraid to teach. I worked harder with the students who were behind in order for them to learn and keep up with the class. I also found myself being more than a teacher. Teachers have to take on many roles inside the classroom. They have to be mother figures, counselors, mediators, and motivators. This summer I learned that teaching is a career where having patience is a key to having a successful classroom. This summer I was able to learn how to be patience and teach the students the information they need in order to pass. This has helped me plan my life after graduation.

Melody Russell, PhD, David Laurencio, Laura Crowe, Stanton Belford and Jared Russell, PhD.
Preservice Science Teacher Candidates Perspectives on Cultural Diversity

Today new teachers are expected to be competent in their content and pedagogy while implementing strategies that address the needs of diverse learners (Beatty O'Ferrell, Green, & Hanna, 2010). It is also essential for teacher education programs to emphasize the importance of better preparing new teachers for the increasingly diverse classrooms. Teachers must understand the role culture plays in teaching and learning in order to promote equity. This study investigates 5 science education students' perspectives, beliefs, and attitudes on classroom management and culturally diversity awareness relative to their school placements or internship field experiences. Data consisted of pre- and post- questionnaires, demographic surveys, and the Henry (1991) CDAI survey instrument. Research questions driving this investigation were: 1) What are preservice science teacher's perspectives on cultural diversity? 2) What prior experiences impact preservice science teacher's perspectives on diversity, equity, and classroom management? Results indicated the following based on participants in this study: 1) preservice science teachers lack experience with cultural diversity and diverse classroom settings, 2) mentor teachers and school partners (e.g. internship placements) play a key role in providing critical support for preservice science teachers to better prepare them as beginning teachers for the culturally diverse classroom.

Ozden Sengul
An Inquiry-based Approach to Teaching Ray Optics in an Undergraduate Physics Laboratory: Action Research

This action research study examines implementation of an alternative approach to teaching and learning practices in an undergraduate physics laboratory in an urban university. Instructor-as-researcher plans, observes, acts, and reflects on teaching and learning processes by incorporating the 5E instructional model on Ray Optics. The intent of this study is to explore how the 5E model can be implemented into lesson plans for three-hour laboratory instruction as a way to improve the effectiveness of teaching practices. This study reports the challenges of an instructor from the previous semesters (Spring 2015 and Summer 2015), actions taken to overcome in Fall 2015, and students' reactions to the changes. We will specifically demonstrate the implementation of 5E learning cycle on Ray Optics. Data include the lesson plans, pre/post reflections of the instructor, and students' reflections on the instructional practices. The results provide the insight of the instructor's thinking, challenges she encounters, and the benefits of examining and reflecting upon instructional practices and her students' learning. The instructor has found that through action research, she was able to develop her ability to incorporate 5E learning cycle into laboratory instruction in spite of challenges such as time commitment and curriculum constraints. Students' engagement in the activities and learning progress also reflected this development. This study is an example of a physics laboratory instructor's attempt to put inquiry-based instructional strategies into practice through 5E model that can be useful for other instructors, who are willing to improve their teaching practices and students' learning.

Jennifer Schellinger
Making student thinking visible with the assistance of technology tools

We are beginning to see 3D printing technology available in our K-12 classrooms, however, minimal literature exists about how to connect this technology to student science learning. This project explores how technology can be leveraged to help elementary students' ideas come alive within a larger science curriculum, as well as to help develop their understanding of models and modeling. Student groups were tasked with designing an animal that would float on water using 2D drawings. Student designs were converted to 3D models, 3D printed, and tested by students for their floating potential. This presentation will share the lesson learned, as well as ideas about the broader constraints and affordances of this technology.

Melissa Schoene and Katharine Wade
Tweaks to a Non-Majors Chemistry Lab: Connecting Research to Practice

Instructor's pedagogical discontentment with traditional cookbook type labs inspired changes in the second half of a two semester non-majors chemistry laboratory course in an urban community college. In this course the following changes were made: students were required to complete pre-lab questions; lab partners were changed weekly; students engaged in a whole-class post-lab discussion; and traditional lab reports were supplemented with a personal reflection. Data sources collected included student artifacts and surveys, which were qualitatively analyzed for patterns in student perceptions of learning experiences in lab.

We found that offering students more opportunities to engage with the content inside of the laboratory setting in collaboration with their peers and instructor laid the foundation for more authentic meaning-making and self-directed learning outside of the laboratory. Additionally, by adding to the requirements for what constitutes a laboratory report, it was necessary for students to spend time outside of the walls of the laboratory reflecting on the course content. These changes increased student engagement and confidence, supported metacognition, and encouraged students to make authentic connections with chemistry. Additionally, the role of the instructor and students' cultural resources were revealed to be important contributing factors to students' engagement and self-reported understanding of the course material.

Randy Spaid, PhD
Ecojustice Showcase: Middle Schoolers Sharing Their Environmental Research With Their Communities

Global awareness, investigation, and action (GAIA): Middle school students analyze and share how extreme fluctuations in conditions can challenge the functioning of an ecosystem's biodiversity.

Students enrolled in GAIA work collaboratively with science mentors to identify a specific topic of interest or concern in their community to develop a deeper understanding of the complex interactions, including anthropogenic contact, which affect coastline habitats. Through scientific research, community engagement, and sharing collected data, tents work toward developing and implementing a sustainable solution.

During this session, the presenters will share how those investigations are aligned with the NGSS; Engaging in argument from evidence, Ecosystem Dynamics, Functioning and Resilience; Adaptation and Human Impacts on Earth's Systems; as well as the cross-cutting concept cause and effect. Several projects will be showcased, including how students investigated plastic pollution and its impact on all life in and out of the sea; sea turtle life history and ecology; mariculture and aquaponic systems; and coral aquaculture as a tool for reef restoration.

GAIA raises student awareness of the natural world to provoke inquiry investigations and facilitates the use of sophisticated instruments to collect data for analysis, interpretation and dissemination to their school community. GAIA organizes inter-school research activities to give students the opportunity to work and learn with each other and present their research in a symposium with scientists and community stakeholders.

Luis Valdes and Deniz Peker, PhD
Teachers' implementation of Nature of Science standards

The nature of science (NOS) is currently a co-requisite of Georgia science standards under the characteristics of science. Even though the NOS has been widely studied in the literature, there is still paucity of research about how science teachers implement NOS. Research indicates teaching and learning the nature of science is a challenging process, and unfortunately many high school students do not have an adequate understanding of the NOS by the time they graduate mostly because they do not receive a consistent NOS instruction that would enable them to develop such

understandings. The purpose of this qualitative exploratory research is to investigate the extent high school science teachers implement the NOS related Georgia Performance Standards. Eight participants were individually interviewed once and completed the Views of NOS (VNOS) instrument. Participants also provided lesson plans within the last two months of the interview date so that how they address the NOS standards in their plans can be tracked. The data is triangulated to find out patterns in teachers views of NOS and their practices of teaching NOS. Preliminary results show that teachers are mostly focused on teaching content standards over the characteristic of science standards, which includes the NOS standards, due to testing demands tied to teacher evaluations.

Chris Wright, PhD, Barry Golden, PhD, Tam'ra Kay Francis, Chris Bowen and Amelia Adams

Nature of Science in children's movies about science

This paper describes our research into what aspects of the Nature of Science (NOS) are represented in popular children's movies that ostensibly feature science or scientists. We identified several suitable movies through surveying elementary school teachers about which movies they use for these purposes. They indicated several films used in this research, including "Rio", "Meet the Robinsons" and "Cloudy with a Chance of Meatballs". We then analyzed the NOS content in these movies, according to the Next Generation Science Standards (NGSS)' release of Appendix H: Understanding the Scientific Enterprise: The Nature of Science in the Next Generation Science Standards" (2013). Our research team of four analyzed each of three movies separately, coding the films' scenes according to Appendix H. When we encountered disagreement, we then negotiated a consensus understanding. Our findings are marked by some clear trends in that the films tend to portray science in ways largely not consistent with the goals of the NGSS. For example, we found the movies tended to portray science as the endeavor of individual geniuses, who are largely white males. This runs counter to the goals of the NOS category "Science as a human endeavor", which emphasizes that science is conducted by people of all backgrounds, and that scientists often work in teams. In our paper, we relate five other broad themes which emerge from this research, as well as discuss the pedagogical implications of using children's movies as vehicles to promote science literacy.