Dear National STEM Education Research Summit Attendees:

It is our pleasure to welcome you to the second annual National STEM Education Research Summit at the Friday Institute for Educational Innovation (FI). The purpose of this event is to connect leading researchers in STEM education with educators who are engaged in innovative STEM approaches in both PK-12 schools and higher education. We hope that you will find many valuable resources during your time at the Summit and that your professional learning is enhanced through attending this event. The FI and the NC State University College of Education are proud to focus on making STEM education a priority for our students, and we are actively engaged in PK-12 school partnerships around the globe with the goal of providing equitable STEM education opportunities for all children.

Carla C. Johnson, Ed.D.
Executive Director and Associate Dean
Friday Institute for Educational Innovation
College of Education, NC State University
9:00 - 9:35 a.m. Welcome  
Wachovia Innovation Hall, Friday Institute

Dr. Carla C. Johnson  
Executive Director, Friday Institute  
Associate Dean, College of Education  
North Carolina State University

Dr. Christina Chhin  
Program Officer, Institute of Education Sciences

9:45 - 10:15 a.m. Session One

10:25 - 10:55 a.m. Session Two

11:05 - 11:35 a.m. Session Three

11:45 a.m. - 12:15 p.m. Session Four - Poster Sessions

12:25 - 12:55 p.m. Lunch with Keynote Speaker  
Wachovia Innovation Hall, Friday Institute

Dr. Tamara Moore  
Purdue University College of Engineering  
Professor of Engineering

12:55 - 1:40 p.m. Session Five

1:50 - 2:20 p.m. Session Six

2:20 - 2:40 p.m. Afternoon Break

2:40 - 3:10 p.m. Session Seven

3:20 - 3:50 p.m. Session Eight
DR. CARLA C. JOHNSON
As executive director of the Friday Institute and associate dean at NC State’s College of Education, Dr. Carla Johnson provides strategic direction and leadership for the Friday Institute, including developing and sustaining multi-disciplinary collaborations with faculty members within the College of Education, across the university and with external entities to enhance the breadth and depth of the Friday Institute’s impact in North Carolina and beyond. Throughout her career, she has been the principal investigator or co-PI on grants and contracts totaling over $60 million and published over 200 journal articles, books, book chapters and research reports.

DR. CHRISTINA CHHIN
Dr. Christina Chhin joined the National Center for Education Research (NCER), within the Institute of Education Sciences (IES), at the U.S. Department of Education in 2006. She serves as an education research analyst and is the program officer for the Science, Technology, Engineering, and Mathematics (STEM) Education Research topic. Recently, she served on the writing team for the 2018 Federal STEM Education Strategic Plan. In addition, she co-led an effort to examine replication research within efficacy and effectiveness research grants funded by IES. Dr. Chhin also co-led a joint IES-NSF committee to develop the Companion Guidelines on Replication and
Reproducibility in Education Research to supplement the Common Guidelines for Education Research and Development. The Companion Guidelines highlights the importance of replication and reproducibility studies and provides guidance on the steps researchers can take to promote corroboration, ensure the integrity of research, and extend the evidence base. Dr. Chhin received her Ph.D. in human development and family studies from Pennsylvania State University. Her prior research focused on the role of self-efficacy beliefs in academic achievement, with a special focus on gender differences in STEM achievement.

DR. TAMARA J. MOORE
Dr. Tamara J. Moore’s research is centered on integrating the STEM fields — science, technology, engineering and mathematics — in K-12 classrooms. She has examined different mechanisms of bringing engineering content and standards into the classrooms that led to a framework for quality K-12 engineering education. Dr. Moore is one of the lead editors for the book STEM Road Map: A Framework for Integrated STEM Education (2015). Dr. Moore’s team developed PictureSTEM, an instructional module at each level from kindergarten through fifth grade that employs engineering and literacy contexts to integrate STEM content in meaningful and significant ways. The modules use picture books and an engineering design challenge to engage students. Dr. Moore is a professor in the College of Engineering at Purdue University.
Room - Wachovia
Title - Designing and Implementing Rigorous, Research-Based, Large-Scale Evaluations of STEM Programs
Carla C. Johnson, NC State University

In this session, participants will learn about the design and implementation of the research and evaluation of the Department of Defense funded Army Educational Outreach Program (AEOP) portfolio of STEM programs, apprenticeships and competitions. Often the challenge with STEM programming, as well as in-school STEM curricula implementations, is how to assess the impact on student growth in important 21st century skills. This presentation will include an introduction to the 21st Century Skills Assessment tool and an overview of how the use of this measure has transformed the ability of federal STEM programs to determine growth in student outcomes.

Room - BB&T
Title - Integrating Computational Thinking in STEM: Theory and Current Research
Eric Wiebe, NC State University
Vance Kite, NC State University
Soonhye Park, NC State University

This presentation is based on a chapter for an upcoming STEM handbook and will provide a succinct summary of research in computational thinking integration into STEM through the lens of curriculum and assessment. The presentation will open with a brief history of computer science and computational thinking. Next will be the theoretical underpinnings of learning and teaching computer science and computational thinking within the context of STEM educational disciplines. Finally, a synthesis of contemporary work in CT integration with examples from the research work being conducted by the authors will be presented.

Room - Nortel A
Title - The Impact of Persistence on Historically Underrepresented STEM Students
Richard Lamb, East Carolina University
Douglas Hoston, University at Buffalo

The purpose of this study is to examine the impact of persistence within STEM learning environments as identified through measures of cumulative trauma. This biopsychosocial impact of prolonged stressors has deleterious health effects on historically underrepresented students who enter STEM disciplines. A trauma inventory measure and psychophysio measurement tools ascertained the effects of cumulative stress / trauma as underrepresented students persist in STEM disciplines. Elevated responses on the inventory were triangulated through measures of biological markers for cumulative stress. Examination of the outcomes with latent class profile analysis model suggested the presence of cumulative stress resulting from program participation was significant.
There is an increasing movement toward creating STEM schools as a way to increase the number of students choosing and persisting in STEM career pathways. This study compared science programs in STEM and non-STEM high schools to examine how implementing a STEM design impacts science instruction. Results indicated that STEM and non-STEM science programs were more similar than different. Technology and math integration were similar but STEM schools integrated engineering design where non-STEM schools did not. Science instruction was similar, however, STEM schools had more project-based lessons. This study offers insight into the implementation of STEM education within existing school contexts and the constraints of STEM high school science programs.
Room - Wachovia
Title - Creating a STEM Education Minor: A Multi-Disciplinary Approach Using a Design Process
Helen Douglass, The University of Tulsa

This presentation session shares the process of creating a STEM education minor for undergraduate education students and those students interested in STEM education at the K-12 level. An interdisciplinary team of STEM faculty, staff and community members used a design protocol and process to create a STEM education minor to better serve pre-service teachers entering the workforce, as well as those students from among engineering, business, and the arts and humanities with an interest in STEM education. We share results and next steps in the process as well as solicit feedback on the first prototype.

Room - BB&T
Title - Data Science in Grades 6-12 STEM: Possibilities and Realities
Hollylynne Lee, NC State University
Gemma Mojica, NC State University

This talk will explore aspects of data science that can and should be part of STEM education in grades 6-12. We will discuss how learning with and from data can be developed in science and mathematics classrooms. Results from several research efforts will be highlighted to illustrate how a focus on data science skills and data habits of mind can be incorporated into schools. Participants will also learn how efforts at NC State’s Friday Institute for Educational Innovation and RTI International are focused on improving data science education in secondary schools.

Room - Nortel A
Title - What Does It Mean To Be a STEM Early College?
Nina Arshavsky, University of North Carolina-Greensboro
Julie Edmunds, SERVE Center and University of North Carolina-Greensboro

This presentation reports on a mixed-methods, quasi-experimental evaluation of impacts on students and schools from the STEM Early College project. This large-scale project combined a STEM focus with the college readiness emphasis in the Early College model and expanded it to comprehensive schools, reaching 22,000 high need secondary students. There were significant impacts on the percentage of students receiving at least one college credit and the average number of credits earned, driven by the increased enrollment and success in dual enrollment courses. These impacts resulted from comprehensive changes in schools, including more rigorous STEM curriculum and instruction and STEM-focused pathways.
This session presents an overview involving engineering practices in an after-school space for elementary students. After-school time was used to promote students’ understanding of interdisciplinary skills and knowledge relevant to STEM education. Students were given ill-structured problems and asked to devise potential solutions.
Room - Wachovia
Title - The 2018 NSSME+: Findings and Implications for STEM Education
Eric Banilower, Horizon Research, Inc.
Courtney Plumley, Horizon Research, Inc.

The 2018 NSSME+ collected data from a nationally representative sample of K–12 schools and science, mathematics, and computer science teachers. In this session, we will use the data to examine the current nature of instruction in computer science, mathematics and science classes, including opportunities for STEM integration and the extent to which coding and engineering are currently integrated into instruction in science and mathematics classes. We will also consider how teachers’ preparation and perceptions of preparedness may relate to their ability to implement integrated STEM instruction.

Room - BB&T
Title - Scaling a Science Professional Development Program That Works in a High-Needs District: Impact on Learning and the Role of Math Integration
Kathleen Roth, California State Polytechnic University, Pomona
Arlo Caine, California State Polytechnic University, Pomona

The session reports on the scale up of an effective, rigorously tested science professional development program, with the goal of reaching K-6 teachers throughout a high-needs urban district. To achieve district-wide reach, a Teacher Leader development program was created to prepare district teachers to lead the program. The program was also modified to integrate mathematics with science. In a quasi-experimental study, Teacher Leaders (TLs), peer teachers (PTs) they led, and students of TLs and PTs outperformed comparison group teachers and students. The session will first present science learning results and then address the challenges and successes of integrating mathematics.

Room - Nortel A
Title - A Freshman iSTEAM Academy Professional Development Project: The Influence on Student Engagement and Educational Attitudes
David J. Shernoff, Rutgers University
Denise Bressler, Rutgers University
Isabella Massaro, Rutgers University
Supama Sinha, Rutgers University

In this study, we attempted to combat the escalating problems of student disengagement and dropout at a partnering high school by piloting and evaluating a teacher professional development program to create a freshman “iSTEAM Academy” designed to radically transform the freshman experience. We found that students participating in the iSTEAM Academy were significantly more engaged, demonstrated more positive attitudes, and had greater aspirations to continue in STEM subjects than those in a more traditionally taught, comparison academy. Implications of the study for
future practice included the importance of forums for transdisciplinary collaboration, a supportive administration, and continued professional development.

**Room - Nortel B**  
**Title - Statewide Collaboration for Institutional Change: Preparing the Next Generation of STEM Teachers in Washington State**  
*Tamara Holmlund, Washington State University*  
*Kristin Shawn Huggins, Washington State University*  
*Vickei Hrdina, Educational Service District 112*  
*Edward Geary, Next Generation of STEM Teacher Preparation Project and Western Washington University (Retired)*

The Next Generation of STEM Teacher Preparation project is a collaborative effort to improve STEM teacher education statewide, increase recruitment of diverse students into STEM teaching, and create a research-based model for collaboration. The project work involves two levels of collaboration: eight statewide working groups (WGs) and multiple institution-based implementation teams. We discuss the structures and processes that support this complex collaboration and show the resources developed by the WGs and how these are being utilized by implementation teams to plan and implement short and long-term changes relevant to the context of each.
Poster Session - Poster #1 - Upstairs / Collaboratory
Title - Fostering Self-Efficacy, Science Identity, and the Sense of Belonging to Further Persistence in STEM Majors
Jeffrey C. Patton, University of North Carolina-Greensboro
Malcom Schug, University of North Carolina-Greensboro
Lynn Sametz, University of North Carolina-Greensboro
Ayesha Boyce, University of North Carolina-Greensboro
Lee Phillips, University of North Carolina-Greensboro
Adyemo Adetogun, University of North Carolina-Greensboro
Cherie Avent, University of North Carolina-Greensboro
Grettel Arias Orozco, University of North Carolina-Greensboro
Amy Germuth, EvalWorks, LLC
Michele Abee, University of North Carolina-Greensboro

This presentation reviews the effectiveness of cohort building activities, peer and faculty mentoring, and common coursework utilized in The National Science Foundation funded Science Technology And Mathematics Preparation Scholarship (STAMPS) program at UNC Greensboro. The program’s aim is to develop a strong science identity and strengthen the self-efficacy of a diverse group of academically talented students with demonstrated financial need majoring in the sciences. Data indicate that the program is very successful as measured by retention rates in a STEM major. Additionally, survey results and interviews indicate high levels of satisfaction with the activities and support offerings of the program.

Poster Session - Poster #2 - Upstairs / Collaboratory
Title - Integrating Computational Thinking in STEM Education: A Literature Review
Changzhao Wang, University of Miami
Ji Shen, University of Miami
Jie Chao, The Concord Consortium

There has been an increasing trend in integrating computational thinking (CT) into science, technology, engineering, and mathematics (STEM) education. To get an overview of this field, we reviewed 41 empirical research articles to address the following questions. How is CT defined in STEM education? What instructional strategies are used? How is CT assessed? Our findings include: (a) multiple CT definitions exist in STEM education; (b) various instructional strategies like the problem-based instruction are adopted; (c) the assessment of CT is at its rudimentary stage.

Poster Session - Poster #3 - Upstairs / Collaboratory
Title - Integrating STEM into an Elementary Mathematics Methods Course to Expand Dispositions Towards Teaching STEM
Cathrine Maiorca, California State University, Long Beach
Babette M. Benken, California State University, Long Beach
Pre-service teachers’ dispositions towards integrated STEM impact their willingness and ability to teach it. This study examined the impact of STEM modules in an elementary mathematics methods course on preservice teachers’ dispositions towards mathematics and sciences and teaching integrated STEM units. After completing the activities in the STEM modules, all participants felt more prepared and confident to designing and teaching integrated STEM. This study demonstrates the importance of including integrated STEM in elementary mathematics methods courses.

Poster Session - Poster #4 - Upstairs / Collaboratory
Title - Doing Integrated STEM Intentionally: Engaging Pre-Service Teachers
Brandon Aigner, The Ohio State University
Lindsay Burns, The Ohio State University

This poster overviews initial findings from an elective for preservice teachers that focuses on using community based experiences as the foundation for integrated units for their K-12 placements. Preservice teachers were exposed to a number of frameworks that fall under the umbrella of integrated STEM education in increasingly complex ways. Results cover changing perceptions of integrated STEM education and impacts on pedagogical decision-making as a result of the course.

Poster Session - Poster #5 - Upstairs / Collaboratory
Title - Texas Tech University / Lubbock ISD Middle School STEM Challenge: Two Years of Community-Engaged Scholarship
Levi Johnson, Texas Tech University
Lane J. Sobehrad, Texas Tech University
Jessica Spott, Texas Tech University
Rebecca Hite, Texas Tech University

Texas Tech University (TTU) and the Lubbock Independent School District (LISD) have partnered to coordinate an annual STEM Challenge to encourage STEM in the middle grades. Each summer, teams of (3-4) students from 10 LISD middle schools participate in a week-long engineering design challenge, facilitated by TTU undergraduates (mentors) and their teachers, using the Engineering Design Process (EDP). Results from 2 years show how students garner STEM knowledge and leverage non-cognitive (21st century) skills to accomplish a shared aim (design challenge). Data from years 1 and 2 are discussed as well as recommendations for programmatic improvements and further research.

Poster Session - Poster #6 - Upstairs / Collaboratory
Title - Training Teachers as Advocates: Exploring Experiences and Acts of Advocacy Among the NSTA/NCTM STEM Teacher Ambassadors Program
Richard Carlos L. Velasco, Texas Tech University
Rebecca Hite, Texas Tech University
Advocacy in the K-12 teaching profession has had a political and divisive history, causing many teachers to eschew advocacy activities, despite being a numerically large and situationally appropriate group to influence educational reform within their communities. Perhaps now, more than ever, are needed the voices of science, technology, engineering and mathematics (STEM) teachers in local, state, regional and national conversations on K-12 STEM education. This research study explored the experiences and advocacy activities of teachers who participated in the NSTA/NCTM STEM Teacher Ambassadors program to understand in what ways programmatic teacher leadership may help inspire and empower teacher advocates.

Poster Session - Poster #7 - Upstairs / Collaboratory
Title - K12 STEM Professional Development Programs: Design of the Programs and the Transfer of Teacher Knowledge and Practice
Jaime Diamond, University of Georgia

Recent standards and international priorities in STEM areas challenge the single discipline model of PD programs. One reason for this is increased awareness of the need to improve the STEM literacy of citizens to ensure they are prepared to engage in today’s advanced technological and scientific global society. Such initiatives require that K-12 teachers advance their knowledge in ways that demonstrate the connections between the STEM disciplines and in ways that can help their students connect STEM learning to their daily lives. Unfortunately, few evidence-based roadmaps exist for creating and studying well-conceptualized STEM PD programs. This review of research was therefore conducted with the goal of assisting those who design, implement and study STEM PD programs. In order to be a purposeful review, it examines the configuration of current STEM PD programs. Guiding this analysis are the design features associated with high-quality PD programs. In addition, this examination is framed by the concept of transfer, which pertains to the utility of knowledge. These frameworks provide insights into the integrated nature of STEM PD programs that can be used by those who develop and study PD programs.

Poster Session - Poster #8 - Upstairs / Collaboratory
Title - STEM Schools: Positive Outcomes for Students
Carla C. Johnson, NC State University

There has been considerable movement in the U.S. toward an integrated approach to STEM that leverages English/language arts, social studies/history, and the arts as contexts and tools for solving the grand STEM challenges of our society. Selective STEM schools have been demonstrated as having positive outcomes for students but enroll students based upon academic criteria rather than interest and effectively exclude underrepresented groups in STEM. In this study, we examine the impact of an integrated STEM high school on student academic and nonacademic outcomes. Findings indicate students outperformed their peers at the 13 comparison schools in district on ACT and end-of-course assessments. Further, I-STEM eliminated the achievement gap for ethnic/racial minority students on the mathematics portion of ACT.
Dr. Moore’s research is centered on integrating the STEM fields — science, technology, engineering and mathematics — in K-12 classrooms. She has examined different mechanisms of bringing engineering content and standards into the classrooms that led to a framework for quality K-12 engineering education. Dr. Moore is one of the lead editors for the book STEM Road Map: A Framework for Integrated STEM Education (2015). Dr. Moore’s team developed PictureSTEM, an instructional module at each level from kindergarten through fifth grade that employs engineering and literacy contexts to integrate STEM content in meaningful and significant ways. The modules use picture books and an engineering design challenge to engage students. Dr. Moore is a Professor of Engineering at Purdue University.
With various – and sometimes inconsistent – messages about STEM in the classroom, educators may find it difficult to find a basis on which to ground their teaching and learning. A practice-based framework and insight into the intricacies of STEM integration can provide a needed lens for planning or evaluating STEM teaching and learning. We explore one such framework and its application in a teacher professional development setting, including findings from teacher experiences and recommendations for STEM professional development.

The Next Generation Science Standards present an integrated approach to science and engineering education in which science is foundational to engineering and engineering contextualizes and reinforces science ideas. The research presented here explores how one elementary school teacher and her students came to understand what is expected of them when asked to engage in an integrated science and engineering unit on simple circuits. Analysis of whole class and small group video transcripts and artifacts revealed that an integrated approach may be more problematic than promising for teachers and students.

Merrimack College’s Lawrence Math Science Partnership (L MSP) has served more than 1,200 at-risk middle school students (5th-8th grade) since its inception in 2002 through a Community for National Service Learn & Serve Grant. Merrimack College currently partners with eight community-based organizations working in nearby urban centers. We are proud of our efforts to bring STEM to the youth of our community and to continually improve the program through 360 degrees of program assessment.

Edtech efficacy and effectiveness studies produce differing results with “real world” studies often demonstrating lower effect sizes. This study examined effect sizes for two
different math edtech products across three different studies conducted within four school districts during the 2016-2017 and 2017-2018 school years. Overall, the findings were mixed, with districts demonstrating smaller effect sizes for two edtech products when compared to efficacy studies. This presentation will explore what these disparate findings mean for the future of education research.
Room - Wachovia
Title - Supporting Students in STEM: The Long-Term Impacts of Afterschool Robotics Programs
Alan Melchior, Brandeis University
Cathy Burack, Brandeis University

Do afterschool STEM programs help support student interest and engagement in STEM? This session presents the 5-year findings of an ongoing longitudinal study of participants in three national middle and high school robotics programs. The study is tracking over 1,200 program participants and comparison program students as they move through middle and high school into college and careers. The session will discuss the current findings, which include positive long-term impacts on STEM interests and attitudes, college course-taking and majors, and interest in STEM careers for multiple groups of students, and explore the implications for afterschool STEM programs generally.

Room - BB&T
Title - Animation as Tool to Support the Implementation of STEM
Anne Estapa, University of Iowa
Kristina Tank, Iowa State University

Technology can be used as a tool to provide teachers experiences with content and practices prior to implementation in the classroom. Within this study, we analyzed how teachers animated the launch of an engineering design challenge and how this translated into classroom enactment. Findings indicate that the use of technology to scaffold implementation enhanced the existence of certain practices for engineering, such as identifying a problem, within classroom instruction. Discussion on how animation served as a tool to allow congruence across all phases of implementation is explored and the need for further research to understand additional benefits for animation.

Room - Nortel A
Title - STEM is not a monolith: A preliminary analysis of variations in STEM disciplinary cultures and implications for change
Becky Matz, Michigan State University

Research suggests that STEM departments are a productive unit of focus for systemic change efforts. In particular, they are relatively coherent units of culture, and cultural changes are critical to creating sustainable improvements. However, the STEM disciplines are often treated as a monolith in change literature, and unique aspects of these different disciplinary cultures—and consequences for change efforts—remain somewhat underdeveloped. This exploratory study focuses on similarities and differences among STEM disciplinary cultures, drawing on data gathered from scholars in discipline-based education research who attended two sessions at the 2017 Transforming Research in Undergraduate STEM Education conference.
In this presentation, we will begin with a discussion of the emergence of STEM-focused specialized schools over time. We will report a synthesis of key characteristics of STEM-focused elementary and secondary schools from exemplary case studies, analyzing the most influential characteristics. We will summarize the presentation by comparing key components of STEM-focused elementary with STEM-focused secondary schools for the purposes of vertical articulation.
Room - Wachovia
Title - Leveraging Technology to Promote Powerful STEM Learning
Bernadette Adams, US Department of Education
Barbara Means, Digital Promise
Carrie Ann Miller, Greene Central High School (NC)

In this panel, we discuss evidence-based approaches for using technology to support powerful STEM learning in classrooms identified by the U.S. Department of Education’s Office of Educational Technology in partnership with Digital Promise as part of the Department’s STEM Innovation Spotlights project. We describe the methodology used to review the scholarly literature on STEM teaching and learning that identified a rubric of nine dimensions for powerful STEM learning using technology. We then share video-based stories from ten schools across the United States who are using technology in impactful ways aligned to the rubric across grade levels and across STEM subjects. We conclude the session by inviting audience participation through a Q&A with STEM teachers, researchers and federal policymakers who participated in the project.

Room - BB&T
Title - Designing a Transdisciplinary Model-Eliciting Activity: Questions and Challenges
Margret A. Hjalmarson, George Mason University
Courtney K. Baker, George Mason University
Nancy Holincheck, George Mason University
Terrie M. Galanti, George Mason University
Jill K. Nelson, George Mason University

In this presentation, we are exploring the design and implementation of a transdisciplinary model-eliciting activity, the Box Turtle MEA. The MEA asked students to create a process for identifying the age of a box turtle. The activity was used in two elementary grades settings after professional development for teachers and mathematics coaches. We explore how transdisciplinary activities engage students in meaningful, authentic STEM learning experiences and teachers' perspectives about their usefulness.

Room - Nortel A
Title - Learning Leadership, Learning STEM: A Rural District Case Study
Tamara Holmlund, Washington State University
Kristin Shawn Huggins, Washington State University

Research on integrated STEM education shows there is a need for innovative instructional practices and curricula to support all students’ learning. Teacher leadership is essential to supporting these innovations. We studied how a team of teacher leaders supported the enactment of integrated STEM for all students across their rural school district. Results show that teacher leaders deepened their understanding of integrated
STEM by enacting innovative practices with their students. They learned to use examples from their own classrooms in one-to-one interactions with colleagues and to attend to administrator understanding in order to influence their colleagues’ willingness to enact STEM lessons.

Room - Nortel B
Title - Developing Rural Elementary Teachers’ STEM Knowledge: The NebraskaSTEM Project
Amanda Thomas, University of Nebraska–Lincoln
Wendy Smith, University of Nebraska-Lincoln

This paper describes features of the NebraskaSTEM Noyce Master Teaching Fellowship (MTF) program that address STEM disciplinary content knowledge for elementary teachers. The paper focuses on the design of the NebraskaSTEM Master’s degree program and addresses the research question: What are the features of a degree program that support the development of rural elementary teachers’ STEM knowledge? Participants included 14 MTFs who teach in high-need rural Nebraska schools. The content, pedagogy and research courses that comprised the program are described in relation to how they intended to develop STEM disciplinary content knowledge for rural elementary STEM teacher-leaders.
Inclusive STEM high schools (ISHSs) are intended to broaden participation in STEM. This research investigates school characteristics that distinguish ISHSs from other high schools and predict STEM career interest and being in a STEM major. Principal and student survey responses from 29 ISHSs and 24 non-STEM comparison schools in Texas and North Carolina were used in combination with data from state K-12 and higher education records. We found that schools implementing key elements of the ISHS model had higher proportions of graduates interested in STEM careers and actually in a STEM bachelor’s degree program two years after high school.

Students in introductory biology labs with course-based research experiences (CURE) learned to perform and interpret statistical analysis of the experiments they designed. Unlike matched students from traditional sections, CURE students had statistically significant Pre/Post improvement on a statistics test as well as reporting statistically significant Pre/Post improvements in science attitudes in open-ended reflections. CURE students indicated that while statistics was the most difficult part of the course, it was also the most valuable experience. Our findings support the value of statistical education in the context of undergraduate science laboratories where students have increased agency in their experimental design.
centers, the Center for the Integration of STEM Education & Research (CISER) and the STEM Center for Outreach, Research & Education (STEM CORE). We present ongoing research and evaluation on a STEM traveling lab (kits) program for underserved students in rural contexts, impacts of STEM clubs led by scientists augmenting elementary Latinx students' perceptions of science and scientists, and a community event, improving STEM outcomes for girls through STEM habitus and capital interventions for their teachers and parents.

Room - Nortel B
Title - Engaging Middle Grades Students in STEM-Based Entrepreneurial Challenges

Jere Confrey, NC State University
Erin Krupa, NC State University
Michael Belcher, NC State University

This presentation introduces the attendees to “Design and Pitch” a set of nine STEM-based entrepreneurial challenges for use in middle grades. The goal is to engage students in STEM-based activity through challenging them to propose innovative solutions to real-world challenges and to investigate related solutions, conduct market research, create technical briefs and business models, and participate in a culminating Pitch competition with peers. The goal is to increase students' engagement in STEM fields and learn more about related careers, while experiencing collaborative STEM activities that deepen related STEM content knowledge. Attendees will learn about the approach and engage in one challenge.