

**The Joint Conference of the  
107<sup>th</sup> Mississippi Valley Technology Teacher Education Conference and the  
58<sup>th</sup> Southeastern Technology Education Conference**

Clarion Hotel, Nashville Downtown Stadium, Nashville, TN  
November 18 – 19, 2021

**Thursday, November 18, 2021**

**9:00 a.m.** Welcome, Introductions and Announcements  
**Dr. Michael Daugherty, Life Chair, MVTTEC**  
**Dr. Dan Kelly, President, STEC**

**9:30 a.m.**                    **SESSION I: MVTTEC- Research in Technology Education**

Presiding:                    Dr. Andy Klenke, Pittsburg State University  
Session Chair:              Dr. Kurt Helgeson, St. Cloud State University

**1. Learning by Evaluating (LbE)**

This presentation investigates the potential for using evaluation and comparison practices as a learning intervention toward improving student design thinking. Specifically, the project sought to identify the impact of engaging students as judges in adaptive comparative judgments (ACJ) of previous student work. A significant learning gain for students in the experimental group who received the learning by evaluating (LbE) intervention was identified.

Dr. Scott Bartholomew, Brigham Young University  
Dr. Nathan Mentzer, Purdue University

**2. A Quasi-Experimental Study Examining Secondary Students' Views of Physical Computing**

This study provides important implications for examining the benefits of physical computing versus traditional screen-based learning activities. It provides insight for STEM and computer science educators seeking engaging ways to integrate CT in authentic contexts. It provides substantial implications for T&E educators who may find their programs competing with computer science programs as elective courses at the secondary level. Physical computing, if utilized appropriately, can help T&E educators draw upon their expertise to provide a unique standards-based interdisciplinary learning experience that integrates traditional electronics concepts, the T&E design process, and CT concepts. This study calls for further research regarding physical computing instruction and ways to improve students' attitudes about physical computing, especially in their views of classroom use and future career skills.

Drs. Tyler Love and Reuben Asempapa, Penn State University Harrisburg

**3. Expectancy-Value Theory within “Making & Doing” in a Technology, Engineering, and Design Education Fabrication Space**

Safely making and doing are central to technology and engineering education. This remains its signature trademark, differentiating technology and engineering from other content areas (STEL, 2020, p.77). How students motivate themselves and are motivated to engage in making and doing within a technology and engineering education environment varies according to their self-perception of making and doing abilities, value of course outcomes, and intrinsic motivation. Inherent within the difference is the student’s belief about their abilities and the extent to which they value the activity. Expectancy-Value Theory (Wigfield & Eccles, 1992) posits that choice, persistence, and performance will be explained by the student’s beliefs, value, and utility of the activity. This research project focused on analyzing the student’s perceptions of their making and doing abilities, the perceived cost (value), the personal and professional utility of making and doing as defined by STEL (ITEEA, 2020), and the participant’s self-described motivational rating of all course facets of making and doing.

Drs. Steven Miller and Justin Egresitz, North Carolina State University

**4. Integrated STEM Education for Underrepresented Populations**

Despite the increased attention to STEM education, there is a paucity of research on promoting STEM education among underrepresented populations. This session examines the importance to increase STEM learning opportunities for underrepresented populations and discuss the theoretical frameworks that could empower STEM educators and students. In this session, we introduce a previously NSF funded project, TRAILS 1.0, where teachers and researchers collaborated to provide integrated STEM learning experience to high school students in Indiana. We further discuss how TRAILS 2.0 was proposed to scale up drawing from the literature and summarize the key features of the theoretical frameworks, *place-based education* and *community of practice*. In this session, we aim to address how incorporating these theories can contribute to increasing STEM engagement among underrepresented populations.

Drs. Taejung Ma; Todd Kelley; Jung Han, Purdue University; Dr. J. Geoffery Knowles, Bryan College

**11:30 a.m.                      SESSION II: STEC**  
**Lunch Session - (lunch provided for MVTTEC/STEC members/guests)**

Presiding:                      Dr. Aaron Clark, North Carolina State University  
Session Chair:                Dr. Nolan Fahrner, North Carolina Department of Public Instruction

**1. Diversifying Talent Pipelines is Broader Impacts in Industry: Tackling Industry Collaborations**

Dr. Bryanne Peterson, YNOTI Solutions

**2. The Impact of Integrated STEM Instruction on Students' Engineering Design Learning and 21st Century Skills**

Jung Han, Purdue University

**1:30 p.m. SESSION III: MVTTEC – Innovative Programs**

Presiding: Dr. Paul Post, The Ohio State University

Session Chair: John Flanagan, Goodheart-Willcox Publishing

**1. Educators in Industry: How Teacher Externships Influence Classroom Practices**

This research investigates the impacts of industry-based externships for K-12 teachers and reports teachers' behaviors and perspectives on how these experiences influenced K-12 classroom practices. The program of focus in this research is the Educators in Industry: K-12 Externship Program. Results from this study provide empirical evidence that teachers who participated in an industry-based externship program demonstrated an increased understanding of the fundamental importance of engaging students in future workforce skills, such as problem-solving, collaboration, and communication.

Dr. Bradley Bowen, Virginia Tech University

Dr. Teresa Shume, North Dakota State University

**2. Community Resilience Engaging Advanced Training and Education Program with Technology that Saves Lives**

This presentation will describe a project that brought together a diverse group of disciplines, that accounted for computer science, technology, weather forecasting, and warning; disaster preparedness and mitigation; effective communication; in addition to the behavioral and social science aspects to assess the mental and emotional impacts before, during and after a disaster. The greatest outcomes of this project were more educated and prepared communities, and a new generation of young minority students inspired to pursue careers in emergency management disciplines.

Dr. Jessica Murphy, Jackson State University

**3. The Web-based AeroEducate Activities**

The aviation industry faces pipeline shortages similar to that of other STEM fields. The Experimental Aircraft Association (EAA) collaborated with North Carolina State University to address this shortage by revising and revamping the web-based AeroEducate. This educational platform increases awareness and engagement in aviation for formal and nonformal K-12 students and educators by providing free, age-appropriate resources. Twenty-four newly developed aviation-themed, STEM standards-

aligned activities, posters, and glossaries were recently added to this website. This paper and presentation provide an overview of how multiple agencies collaborated with industry partners to develop these resources and the delivery platform and includes a preview of some of the materials available to students and educators.

Dr. Kevin Sutton, North Carolina State University  
Dr. Justin Payton, Experimental Aircraft Association  
Dr. Jeremy Ernst, Embry Riddle Aeronautical University

#### **4. Improving Student-centered Teaching Through a STEM Faculty Institute (STEMFI)**

One of the primary reasons why students leave STEM majors is due to the poor quality of instruction. Teaching practices can be improved through professional development programs; Creating lasting change by overcoming these barriers is the primary objective of the STEM Faculty Institute (STEMFI). STEMFI was designed according to the framework established by Ajzen's Theory of Planned Behavior. To evaluate its effectiveness, the COPUS tool was used before and after an intensive year-long faculty development program and analyzed using copusprofiles.org, a tool that classifies each COPUS report into one of three instructional styles: didactic, interactive lecture, and student-centered.

Drs. Geoffrey Wright, Jamie Jensen, Rebecca Sansom, Rick West, Jen Nielson, and Steve Turley, Brigham Young University

### **3:30 p.m.                   SESSION IV: STEC**

Presiding:                   Dr. Daniel Kelly, Texas Tech University  
Session Chair:             Dr. Kevin Sutton, North Carolina State University

#### **1. Conceptualizing and Investigating Student Pathways into Secondary STEM-CTE Concentrations**

Dr. Anthony Perry, Texas Tech University

#### **2. State of the State of North Carolina**

Dr. Nolan Fahrer, North Carolina Department of Public Instruction

### **4:30 p.m.                   SESSION V: MVTTEC Business Meeting**

Presiding:                   Dr. Michael Daugherty, 8<sup>th</sup> Life Chair, MVTTEC

1. Report of the Membership Committee
  - a. Dr. Vinson Carter, University of Arkansas
2. Consideration of nominations for membership
3. Status of the collaboration

4. Outstanding Presentation Award
5. MVTTEC Benefactors
6. Other Business

**4:30 p.m.      STEC Past Presidents and Officers Meeting**  
Clarion Hotel Lounge

**Friday, November 19, 2021**

**8:30 a.m.              Installation of New MVTTEC Members**

Master of Induction Ceremony: Dr. Aaron Clark, North Carolina State University

**9:00 a.m.              SESSION VI: MVTTEC – Related Research**

Presiding:              Dr. Bradley Bowen, Virginia Tech University  
Session Chair:         Dr. Vinson Carter, University of Arkansas

**1. Reflective Writing in Engineering Design-based Learning**

Critical incidents can yield “high impact” reflective performances in learners, and critical reflection has often been correlated with successful design thinking (DT) in engineering design-based learning (DBL). However, a framework for integrating reflection in DBL does not exist, and researchers know little about students’ reflections during iterative decision making where critical reflection might count. For example, it is possible that scaffolding critical reflection during the active phases of DBL could help students review their intrapersonal frameworks more often and slow their decision making. Since writing is reflective and it slows thinking, critical reflective writing might be a useful medium for concretizing students’ reactions around critical incidents and slowing their decision making. This research constructs a framework for integrating critical reflective writing in several first-year engineering classes. Eventually, after describing its themes and comparing its impacts with several untreated engineering DBL classes, this study hopes to inform ways scaffolding for critical reflective writing complements DBL problem solving, so less-expert engineers can close the gaps with more-expert engineers.

Mattie Quesenberry Smith, Virginia Tech/Virginia Military Institute

**7. Undergraduate Design & Innovation Curriculum Design to Reach New Audiences**

Researchers at Purdue led by Dr. Strimel were awarded an NSF I-USE to study this collaborative initiative, through a program called Mission Meaning Making (M3) designed to synergize key strengths of three partnering academic units (Purdue University’s Polytechnic Institute, College of Liberal Arts, and Krannert School of Management) to create a leading-edge undergraduate experience. The M3 overarching goal is to serve as a model to help universities to better prepare undergraduates for

addressing complex, contemporary challenges in innovative and transdisciplinary ways so that we can best harness the nation's great scientific and technological potential.

Drs. Greg Strimel and Todd Kelley, Purdue University

**8. Curriculum development using the Delphi method for competency-based education courses**

This presentation describes the results of research related to curriculum development for competency-based education courses using a combination of “best practices”. Employing various curriculum development models, educational objectives can be identified for further development into curricula. The educational objectives (EOs) developed in this study were validated through consensus drawing measures from a panel of experts in the fields of (technology education, career and technical education, construction management, and related industries). The process and procedures used to develop and validate this information was a conventional Delphi process.

Dr. Dominick Manusos, Millersville University

**10:30                      SESSION VII: STEC – Active Learning**

Presiding:                      Dr. Dominick Manusos, Millersville University  
Session Chair:                Dr. Bryanne Peterson, YNOTI Solutions

**1. Success Through Active Learning Modules: A Final Report**

Dr. Jeremy Ernst, Embry-Riddle Aeronautical University Worldwide  
Dr. Daniel P. Kelly, Texas Tech University  
Dr. Aaron C. Clark, North Carolina State University  
Erik J. Schettig, North Carolina State University  
Dr. Kevin G. Sutton, North Carolina State University

**2. STEM Explorers: An Update on the State of The Program**

Dr. Daniel Kelly, Texas Tech University

**12:00 p.m.                      SESSION VIII: MVTTEC – Challenges for the Field  
Lunch Session - (lunch provided for MVTTEC/STEC members/guests)**

Presiding:                      David Holloway, American Technical Publishers  
Session Chair:                Dr. Kevin Howell, Appalachian State University

**1. STEL and the Integration of Tinkering and Take-Apart in the Elementary Classroom**

Propelled by the prediction of future shortages in the workforce in science, technology, engineering, and mathematics policy makers and educators continue to focus on enhancing STEM experiences and proficiencies for P-12 students. Research and projects designed to improve the delivery of project-based learning, standards, technological literacy or related information. Specifically, this proposal is designed to address improving the delivery of technological and engineering literacy by asking the question: How might the integration of tinkering and take-apart in the elementary classroom advance technological and engineering literacy?

Leah Cheek, University of Arkansas

## **2. Merging Expertise to Implement Literature-based STEM Curricula at the Elementary Level**

This session will describe a program that leverages children's books to integrate STEM education into a balanced reading program to build literacy skills along with a broader awareness of the natural and human-made world. The books in question featured stories about real people, especially women and minorities, that made significant contributions to science, technology, engineering, and mathematics. Reading these stories requires recognizing problems, understanding contexts, learning STEM vocabulary, and comprehending the thought processes that led to viable solutions. Furthermore, they provide opportunities for hands-on learning activities that enable students to experience how the heroines and heroes depicted in children's literature used their knowledge and skills to solve real problems in the recent and distant past.

Dr. Kenneth Welty, University of Wisconsin-Stout

## **3. Standards for Technological and Engineering Literacy: Turning Silos into Bridges**

This presentation focuses on promulgating and implementing the STEL into all areas of academia from PreK-18. No longer can literacy be considered the ability to read, write, and comprehend written text (ITEEA, 2020) but must include "a fluid construct" that adapts to the needs and wants of the society at any given time. It is imperative that there is emphasis on the inclusive nature of the standards with their associated crosswalks to Next Generation Science Standards (NGSS), Common Core for math and English, and ISTE Standards (International Society for Technology in Education (Daugherty, et al, 2021). Combine these 21<sup>st</sup> century skills with the needs for learners to obtain emotional engagement (emotional intelligences) supports the need for a rapid deployment of the STEL as its focus is upon blurring lines and ensuring technology and engineering literacy is taught, included, and understood in every discipline for every learner.

Kelly Dooley, Executive Director, ITEEA  
Virginia Jones, President, ITEEA  
Debra Shapiro, President-Elect, ITEEA.

**1:45 p.m.      SESSION IX: STEC – Panel Discussion on the Impact of COVID-19 on Technology and Engineering Education.**

Moderator:              Daniel Kelly, Texas Tech University

- 1. This session will include Technology and Engineering educators at all levels to discuss the current and future impact of the pandemic on the field.**

**3:00 p.m.      MVTTEC Adjournment**

Presiding:              Dr. Michael Daugherty, Life Chair, MVTTEC

**3:15 p.m.      STEC Business Meeting**

Presiding:              Dr. Dan Kelly, President, STEC

1. Report of the Membership Committee
2. Consideration of nominations for membership
3. Other Business