PERC 2019 Presentations

Contributed Poster Presentation Abstracts

Aiken, John, Supporting Future Educational Data Miners through a Summer Research Internship

Akinyemi, Abolaji, Linking terms to physical significance as an evaluation strategy

AlFiky, Mohammad, <u>Investigating Students' Difficulties in Calculus-Based EM Using MCQ Tests: Preliminary Study</u>

Alesandrini, Anne T, <u>Types of explanations introductory students use to explain their answers to conceptual physics</u> questions

Alfson, Jonathan, Explicitly Prompting Covariational Reasoning in a Thermodynamics Context

Archibeque, Benjamin, STEP UP: Analyzing Discussions of Underrepresentation

Arielle, Acacia, Introductory Physics Students' Insights for Improving Physics Culture

Arruda, Anthony, Student use of Quantum Notations - Dirac Notation as a Template

Barooni, Amin Bayat, Designing lab activities by using research-based activities

Barringer, Daniel, First steps towards building curriculum around student interests in astronomy

Bauman, Lauren C., Students' use of conceptual resources for understanding superposition

Beatty, Ian D., <u>Improving STEM self-efficacy with a scalable classroom intervention targeting growth mindset and</u> success attribution

Bender, Lydia G., Faculty Perceptions of Three-Dimensional Learning

Bennett, Michael B., What Factors Influence Pedagogical Methods in Informal Learning Spaces?

Beverly, Nancy, Categorizing stages of students' sustained inquiry in self-chosen projects

Bhansali, Aesha Piyush, First year students' emotional engagement with Physics

Bott, Theodore, Preliminary Analysis of Student-Identified Themes around Computation in High School Physics

Brewe, Eric, <u>Instructional fingerprinting</u>: network analysis of Framework for Interactive Learning in Lectures (FILL) data

Brunk, KC, Student activist strategies for creating a welcoming physics culture

Bugge, Danielle, Studying student attitudes and motivation in a first-year physics course

Bumler, Jacqueline N, How do previous coding experiences influence undergraduate physics students?

Burde, Jan-Philipp, Evaluating and improving conceptual understanding of circuits in middle schools

Cao, Ying, Emergent Explicit Group Regulation in Small Group Scientific Activities

Chang, Sheh Lit, Applying text analysis to compare student explanations in PER

Charpentier, Lucas G. G., Understanding student pathways in a physics degree with network analysis

Chasteen, Stephanie, Measuring faculty attitude change towards active learning within a professional development workshop

Chen, Zhongzhou, Evaluating the effectiveness of two methods to improve students' problem solving performance after studying an online tutorial

Cheng, Hemeng, <u>STEP UP</u>: Time Series Structure of High School Students' Physics Identity Development Using Structural Equation Modeling.

Chessey, Mary, Physics faculty's reasoning about life science students pursuing professions

Close, Eleanor, Designing Learning Assistant Program Structures to Create Resilient Community

Close, Hunter G., Meaning and Purpose in the Pursuit of Physics Teaching Careers

Commeford, Kelley, <u>Characterizing Active Learning Environments in Physics: Network Analysis using Exponential Random Graph Models</u>

Conlin, Luke, A framework for recognizing debugging in students computational model building

Coon, Alexander, Assessing Motivations to Engage In Responsible Conduct of Research

Corbo, Joel C., Connecting facilitation to outcomes in the Departmental Action Team model

Corpuz, Aileen, Students' motivation in a student-centered learning environment

Corpuz, Edgar, The physics motivation of life science and engineering majors

Cwik, Sonja, <u>Understanding motivational characteristics of students who repeat algebra-based introductory physics courses</u>

Daane, Abigail R., Physics is Objective - or is it?

Dalka, Robert, Investigating the Mechanisms of Peer Review

Dancy, Melissa, Survey of Physics, Mathematics and Chemistry Faculty

Das, Kushal, Learning About Teacher Recruitment and Retention from Our Math Department

Descamps, Ian, A Critical Assessment of General Physics

Doty, Constance M., Student perspective of GTA strategies to reduce feelings of anxiousness with cold-calling

Doucette, Danny, All Aboard! Challenges and Successes in Training Lab TAs

Dounas-Frazer, Dimitri R., Preliminary model for conditions and processes that facilitate project ownership

Doyle, Jacqueline, Investigating students' mixtures of expert-like and incorrect knowledge of physical science

Duffy, Andrew, AP Physics Results and their Implications for Diversity in Physics

El-Adawy, Shams, <u>Faculty as Learners and Educators: Interactions between Community of Practice, Individual</u>
Experience and Teaching Philosophy

Emigh, Paul J, Student Reasoning about Multivariable Covariation in Thermodynamics

Eriksson, Urban, -Where are the stars? - A citizen science project on light pollution

Fadaei, Azita Seyed, Comparing the Effects of Cook Book and Non-Cook Book Based Lab Activities

Faletic, Sergej, <u>Using Rutgers Scientific Ability Rubrics to Improve Student Learning and Reduce Instructor Workload</u>

Fiedler, Brett, Coordinating epistemic frames in informal physics: Agency, support, and technology

Finzell, Thomas, Computation in the Physics Classroom: A Census of Instructor Beliefs

Fracchiolla, Claudia, Can we foster autonomy within Communities of Practice?

Frank, Brian, Leveraging FCI-ACT Correlations to Communicate the Impact of Course Reform

Fuller, Elizabeth S, Polaris: Outreach Initiatives for Retention and Sustainability of Underrepresented Minorities and Women in a Competitive Climate

Fung, Anderson, An Exploration of Students' Concept Images of Ordinary Differential Equations

Funkhouser, Kelsey, Developing and Validating a Closed Response Practice-Based Identity Survey

Gambrell, Justin, Identifying important research questions involving computation in physics

Garrido, Geoffrey, <u>How are students' online learning behavior related to their course outcomes in an introductory physics course?</u>

Gerardi, Haley, The role of IPLS in shaping long-term attitudes toward physics

Gifford, Julian D., <u>Categories of mathematical sense making: Exploring how physics understanding can support</u> mathematical understanding

Gokuldass, Priyadarshini, Investigating Undergraduate Astronomy Students' Ideas about Black Holes

Good, Melanie, Graduate teaching assistants' views of broken-into-parts physics problems

Goodhew, Lisa M., <u>Investigating the impact of question style on the resources that students use in written responses:</u> an example from mechanical pulse reflection

Gray, Nickolas, What do Students Know about Electromagnetic Wave Generation?

Guthrie, Matthew W, Comparing student behavior in mastery and conventional style online physics homeworks

Gutmann, Brianne, Supporting Math Skills in Mastery-Style Learning Exercises

Güven, Jasmin, What elements of a community help undergraduates gain confidence?

Hahn, Kelby T., Sensemaking in special relativity: developing new intuitions

Hamerski, Paul C., High School Student Perspectives on Computation in Different Classroom Contexts

Hass, Christopher A., Instructional moves to shift upper division students' epistemic frames

Head, Thomas Blake, STEP UP: Analyzing Student Perceptions of Physics Following a Career in Physics Lesson

Hechter, Richard P., The Giant, The Wintermaker, or The Hunter: Whose belt is it? (And why does that matter!?)

Henderson, Charles, Feedback Requested: Understanding and Humanizing the Journal Review Process

Henderson, Rachel, A Longitudinal Exploration of Students' Beliefs about Experimental Physics

Her, Pachi, Students' Understanding of Matrix Algebra and Eigentheory

Herring, Travis, Evaluative sensemaking: frequency of student strategies and variance among instructors

Hewagallage, Dona Sachini, <u>Differences in the Predictive Power of Pretest Scores of Students Underrepresented in</u>
Physics

Hinrichs, Brant, Changing The Notation That Represents A Force Changes How Students Say It

Hinrichs, Brant, <u>Do I belong here?</u>: <u>Understanding Participation and Non-participation in Whole-Class "Board"</u>
<u>Meetings</u>

Hinrichs, Brant, Social Positioning And Consensus Building In Student-Led Whole-Class Discussions

Hoehn, Jessica R., Epistemology, sense making, and social dynamics in group work

House, Lindsay, <u>Legacy of the Pale Blue Dot: Can introductory astronomy experiences impact self-concept and self-efficacy?</u>

Hu, Dehui, Impact of industry experience on faculty teaching practices in STEM

Huynh, Tra, Personas of undergraduate researchers

Hyater-Adams, Simone, Talking about Race: A resource for advisor-student conversations

Irving, Paul, The PICUP Community and its Evolution Over Time

Ives, Joss, Using cueing from paired questions to engage students in reflective thinking

Izadi, Dena, Identifying Success Markers: A Case Study of Informal Physics Efforts through Organizational Theory

Jambuge, Amali Priyanka, How can we assess scientific practices? The case of "Using-Mathematics"

James, Westley, Hidden walls: STEM course barriers identified by students with disabilities

Jariwala, Manher, Investigating Simulation Use in Algebra-Based Introductory Physics

Johnson, Kimme S., Students' beliefs about the nature of experimental physics: Part one

Junker, Prof. Dr. Elmar, <u>Astronomy is the Trojan Horse for Teaching Physics Invisibly - Experiences from Stargazing with both Students and the Public at a University Observat</u>

Justice, Paul, Developing a Robust Clicker Question Sequence for Larmor Precession in Quantum Mechanics

Kalender, Z. Yasemin, <u>Investigating the role of prior preparation and self-efficacy on female and male students'</u> introductory physics course achievements

Kamela, Martin, Lost in Translation: Newtonian Mechanics with Tibetan Buddhist Monks

Keebaugh, Christof, Improving Students' Understanding of the Wave Function for a System of Identical Particles

Kepple, Caitlin, Students' Sense of Belonging in Introductory Science Labs: Does GTA Training Matter?

Khong, Hien, How can we develop assessment tasks for "planning investigations"?

Kimbrough, Abigail, Teaching Gravitational Potential Energy: Student Interaction with Surface Manipulatives

Kizito, Ndihokubwayo, Effectiveness of Teaching approaches meant to Enhance Active Learning of Optics in Physics subject in Rwandan Secondary Schools

Kohnle, Antje, Using student-generated content to engage students in upper-division quantum mechanics

Kuo, Eric, Using causal networks to map out the targets of resource coordination

Lau, Alexandra C, Developing Reflective Practitioners: A Case from Faculty Online Learning Communities

Leak, Anne E., Physics Perceptions: Challenges, Rewards, and Applicability of Innovation and Entrepreneurship

Lenz, MacKenzie, Students' Sensemaking Skills and Habits: Two Years Later

Lewandowski, Heather, Using custom interactive video prelabs for a large introductory lab course

Li, Yangqiuting, <u>Understanding motivational characteristics of students who repeat calculus-based introductory level physics courses</u>

Lindell, Rebecca, <u>Determining a truly representative sample for Research-based Conceptual Learning Assessment</u>
Instruments (RBCLAIs)

Lindsay, William, The Association Between Sustained Professional Development and Physics Learning

Little, Angela, Reflections on a Context-Dependent Beliefs Approach to Studying Mindset

Lo, William, Developing a concept inventory for statistical mechanics

Lock, Robynne M, Impact of the Next GEN PET Curriculum on science identity

Logan, Savannah, GFO Copy Write: Development of written materials for recruiting STEM teachers

Love, Joshua, Effectiveness of Modified Fluid Flow Diagrams for Student with and without Prior Instruction

Lunk, Brandon, Conceptual Blending in Computational Modeling

López Tavares, Diana Berenice, <u>Visualizing Student Simulation Interactions: A Dashboard to Differentiate Between Instructional Approaches</u>

Macias, Vina, Transferability and specialization: analyzing STEM students' perspectives of problem-solving

Madsen, Adrian M., User-centered personas for PhysPort

Majiet, Nuraan, Why the mean? Probing conceptual change

Makwela, Tshiamiso, Probing student engagement of distances in astronomy

Marsh, Daniel, Students' Reasoning about the Inverse-square Law in Multiple Representations

Mason, Andrew, Learning Goals and Belief in Lack of Relevance to Major

Massey-Allard, Jonathan, Learning to learn by inquiry: are simulations too challenging for novices?

May, Jason M, Exploring Students' Enactment of Data Analysis Practices in Interdisciplinary IPLS Laboratory

<u>Courses</u>

McCauley, Austin, Is it Teaching or is it Physics?

McPadden, Daryl, Curriculum as more than content: thinking about the assumptions built into curricular materials

Mestas, Gabriel R., Framing the Pursuit of a Physics Degree as a Hero's Journey

Meyer, Aurora J, Topic Clustering in PER Abstracts using Computational Linguistics

Modir, Bahar, Impact of online discussion in forming a community of practice for educators

Monsalve, Camila, <u>STEP UP</u>: <u>Case study of teacher's changing beliefs about discrimination during the</u> implementation of a women in physics lesson

Moore, Daryl L., Growth Mindset and Agency in Learning Physics Innovation and Entrepreneurship

Moshfeghyeganeh, Saeed, Muslim Women Physicists' Career Choice; Investigating the Effect of Culture

Mullen, Claire, Why it should be and not or: Physics and Music

Muller, Sarah, Student Performance and Stress Level in Different Testing Environments

Munsell, Jeremy, <u>Using Machine Learning to Classify Descriptions of Problem Solving Strategies</u>

Myers, Carissa, Quantifying the Linguistic Persistence of High and Low Performers in an Online Student Forum

Nissen, Jayson M., Educational debts incurred by racism and sexism in students' beliefs about physics

Nokes-Malach, Tim, <u>How is perception of being recognized by others as someone good at physics related to female</u> and male students' physics identities?

Ochoa-Madrid, Egla, Examining Students Views on Ethics and the Atomic Bomb

Odden, Tor Ole, Computational Essays and Computational Literacy at the University of Oslo

Oleynik, Dan, Scientific Practices in Minimally Working Programs

Ortiz, Nickolaus, Physics Learning through Computing: An Analysis of Equity Patterns within Physics Teachers'

<u>Classrooms</u>

Owens, Lindsay, Identifying Qualities of Physics Graduate Students Valued By Faculty

Park, Soojin E., Students' beliefs about the nature of experimental physics: Part two

Pawlak, Alanna, Developing change agency and valuing participation in Departmental Action Teams

Pearson III, Richard L, Faculty Perceptions of Teaching as a Profession development and validation interviews

Peters, Nathaniel, Assessing the longitudinal impact of IPLS on student reasoning

Pina, Anthony, Presentation of integrals in introductory physics textbooks

Poirier, Jacob, Preventive and exploratory: two workplace problem-solving cultures

Pollard, Benjamin, Methodological Development of a New Coding Scheme for an Established Assessment on Measurement Uncertainty in Laboratory Courses

Prefontaine, Brean, Supporting Multiple Identities in Informal Spaces: Examining Design Choice

Price, Edward, <u>Interrogating a propagation model</u>: How faculty respond to a semi-flexible curricula with sustained online community support

Price, Virginia, Determining Motivating Factors for Undergraduate Women Pursuing Physics Degrees

Profeta, Audrey, <u>Identifying Student Conceptual and Computational Resources in Setting Up Integral Expressions</u> for the Electric Field of Continuous Charge Distribution

Pulgar, Javier, <u>Contextual details</u>, <u>cognitive demand and kinematic concepts</u>: <u>exploring concepts and characteristics</u> of student-generated problems at the university

Quan, Gina, The Access Network: Cultivating Equity and Student Leadership in STEM

Quealy, Erin, Rockets, Drones, and Electronic Payloads: Research Prep Curriculum Increases Interest in STEM
Careers at Minority Serving Community Colleges

Quichocho, Xandria R, Who does physics: Understanding the composition of a physicist through the lens of women of color and female LGBQ+ physicists.

Rainey, Katherine, Survey on Upper-Division Thermal Physics Content Coverage

Richardson, Connor, Were they right? Replicating IRC-based analyses using FMCE data

Rispler, Caleb, <u>Understanding University Students' Identity through Engagement in Informal Physics Programs</u>

Robertson, Amy D., <u>Prevalence of Impetus-Force-Like Drawings Among Contemporary University Physics Students</u>

Rodriguez, Miguel, <u>Social Interdependence Theory and Transfer in a Collaborative Learning Environment</u>

Rosenblatt, Rebecca, Investigating the Effectiveness of Two Instructional Interventions for Fluid Dynamics

Ruggieri, Charles, Students' Perceptions and Use of Online Resources in Introductory Physics

Rutberg, Joshua, ISLE-Based Laboratory Reform at an Urban University

Ryan, Qing, Evaluating Students' Performance on the FCI (force concept inventory) at A Minority Serving PUI (primary undergraduate institution)

Ríos, Laura, <u>Creation of pre-test for an upper-division physics laboratory assessment using think-aloud student interview data</u>

Sachmpazidi, Diana, Instructional change teams in undergraduate STEM: Identifying paths to success

Sachmpazidi, Diana, The effect of departmental policies on physics graduate students' self-efficacy and persistence.

Santangelo, Brianna, Psychometric analysis of instrument measuring student reasoning skills*

Sarriugarte, Paulo, Students' understanding on rigid body rotation

Sayer, Ryan, <u>Advanced students</u>' and faculty members' reasoning about the double-slit experiment with single <u>particles</u>

Scanlon, Erin, Physics Instructors' Views about Supporting Learner Variation: Modifying the Inclusive Teaching Strategies Inventory

Schermerhorn, Benjamin, Student perceptions of math and physics throughout spins-first quantum mechanics

Schipull, Erin M., "Success Together": Physics Departmental Practices Supporting LGBQ+ Women and Women of Color

Scott, Keely, STEP UP: The Impact of a Women in Physics Lesson on Students' Figured Worlds

Sedberry, Stephanie J., Three factors that complicate self-efficacy research and affect whether self-efficacy interventions succeed or fail

Seese, Sydney, Hidden Value: Investigating the Physics Demonstration as Aesthetic Experience

Semak, Matthew Richard, <u>An Examination of the Correlation Between Cognitive Ability and Achievement on the</u> FCI

Shafer, Devyn, Predictive Modeling of Exam Performance from Mastery-Style Homework Behavior

Singh, Chandralekha, <u>Investigating and improving student understanding of Dirac notation in the context of a three-dimensional vector space</u>

Sivitilli, Alexander, Exploring Productive Modes of Engagement in the Planetarium

Smith, Emily M, Evaluating students' sense of authority when evaluating the quality of measurements

Smith, Trevor I., Using psychometric tools as a window into students' quantitative reasoning in introductory physics

Smith-Joyner, Annalisa, Graduate teaching assistant fidelity of implementation in introductory physics laboratories

Southey, Dr. Philip, The Ratio Table: Making Meaning with Ratios and Units Involving "Per"

Speirs, J. Caleb, Network analysis of reasoning chain tasks to test theoretical perspectives*

Staveland, Owen, Causal Statements Improve Concept Application

Stein, Martin M., No room for error: Students' perception of measurements in quantum mechanics

Stone, Antoinette, A Team-planning and Assessment Protocol to Guide Student Group Projects

Strubbe, Linda E., An asset-based view of faculty and their ideas about teaching

Sundstrom, Meagan, Intellectual Humility: Mindsets and Behaviors of Introductory Physics Students

Thacker, Beth, A Rubric for Assessing Thinking Processes in Free-Response Exam Problems

Topdemir, Zeynep, Identity Development Comparison of Physics Majors with Different Career Goals

Tran, Khanh, The Alma Project: Cultivating Cultural Capitals in Physics through Reflective Journaling

Traxler, Adrienne, Student network positions in active learning physics classrooms

Valencia, Josilyn, Studying the factors that impact the development of community of practice for educators

Valente, Diego, Effects of group interactions on student cognitive load in vector tests

Van Dusen, Ben, Scoring rating scale assessments: A case study of the CLASS

Vieyra, Rebecca E, A Survey of Teachers' Integration of Earth and Space Science Contexts for Teaching Physics

Villasenor, Armando, Evaluating Gender and Racial Gaps on the Force Concept Inventory at A Minority Serving PUI (primary undergraduate institution)

Wagner, DJ, Perceived Effect on Buoyancy of Weight vs. Gravitational Force

Walsh, Cole, Assessing the assessment: mutual information between response choices and factor scores

Walsh, Kenneth C., Tracking students engagement with open educational resources and online homework

Walter, Paul J., Transition Matrices Applied to the Force Concept Inventory

Wan, Tong, Characterizing graduate teaching assistants' teaching practices in physics "mini-studios"

Waterson, Alyssa C., Highlighting Earlier Time-to-Degree from Preparation through Transfer Courses

Webster, Christopher, Tracking the referent system to understand students' math modeling processes

Weinlader, Nolan K., A new approach for uncovering student resources with multiple-choice questions

Weller, Daniel, Investigating Teacher Learning Goals Involving Computation in High School Physics

Wells, James E, Modelling Student Collaborations Using Valued ERGMs

Whitcomb, Kyle, An examination of gender differences in self-efficacy and academic performance in different STEM domains

Wikowsky, Jacob, Differences between Adapted Modeling Instruction and lecture in Introductory Mechanics

Wilcox, Bethany, Student behavior and test security in online conceptual assessment

Williams, Stephanie, Peer Support for instructors negotiating new pedagogical approaches with students

Willison, Julia, Developing a Methodology for Determining the Landscape of Informal Physics Programs

Wilson, Michael B, Visualizations of E&M Plane Waves Designed for Better Student Understanding

Wolf, Steven, <u>Introductory Physics I lab practical exam development: Investigation design, explanation, and argument</u>

Wood, Laura, <u>Developing a Coding Scheme for Self-Efficacy Opportunity Experiences</u>

Wu, Xian, Adapting differentiated cognitive load measurement in physics classroom

Yang, Jie, Multidimensional Item Response Theory and the Force and Motion Conceptual Evaluation

Young, Nicholas T, Using Machine Learning to Understand Physics Graduate School Admissions

Zamarripa Roman, Brian, Attending to Emotion in a Metaphor for Success in Physics with Poetic Analysis

Zamarripa Roman, Brian, Results from the People of Color Discussion Space at the 2017/2018 PERCs

Zavala, Genaro, Students' conversion from electric field line diagrams to other representations

Zavala, Genaro, The effect of similar surface features on students' understanding of the interaction of charges with electric and magnetic fields

Zeng, Liang, Using Skateboarding Experiential Learning to Teach Introductory College Physics Course

Zhang, Muxin, Realistic Exam Practice Study

Zich, Raymond, A Revision of a Traditional Astronomy Course through Active Learning

Zimmerman, Charlotte, Toward Understanding and Characterizing Expert Physics Covariational Reasoning

Zisk, Robert, The quality of instructional artifacts and teachers' content knowledge for teaching energy

Zohrabi Alaee, Dina, Phenomenographic study of physics faculty's instructional change

Zwickl, Benjamin M, Agile, Scrum, Fishbones: Teaching Structured Problem-Solving in STEM Workplaces

Custom Format Abstracts

Maier, Steve, PERC 20/20: A Sneak Peek at "Insights, Reflections, & Future Directions: Emergent Themes in the Evolving PER Community

Zamarripa Roman, Brian, Discussion Space for People of Color

Juried Talk Abstracts

Braden, Sarah K., Analyzing the role of evidence in the model revision process.

Chessey, Mary, Student activist strategies for creating a welcoming physics culture

Farlow, Brian, Square Peg Thinking, Round Hole Problems

Hazari, Zahra, Breaking with Tradition: How Informal Learning Experiences in Physics Contribute to Physics Identity Development

Lau, Alexandra C, <u>A framework for classifying learning opportunities in Faculty Online Learning Communities: A multipurpose tool with practical applications</u>

Quan, Gina M., Longitudinal analysis of a student's identity trajectory within the physics community

Wawro, Megan, Student Reasoning about Eigenvectors and Eigenvalues from a Resources Perspective

Zu, Tianlong, Impact of Group Work on Cognitive Load and Conceptual Test Performance

Plenary Abstracts

Bell, Jamie, Informal STEM Learning and Science Communication: An Expanding Landscape of Resources,
Research and Collaborators

Bergin, Shane, A Collective Exploration of Physics Beyond the Classroom.

Hooper, Paula, Making through a lens of culture, power, & equity: Visions for Learning and Teaching in Informal Settings

Symposium Poster Abstracts

Fiedler, Brett, PISEC: A partnership of physics, research, and youth agency

Hansen, Alexandria, Fabricating fidgets with special education students. Study of middle school students with disabilities designing, fabricating, and testing fidget tool

Hyater-Adams, Simone, <u>The Design of Performing Physics: using the CPI framework for program structure and analysis</u>

Macias, Meghan, Magnetism, light, structures, and rotational motion: Mixed-methods study of visitors engaging with four exhibits at a science museum

Marckwordt, Jasmine, <u>Developing interactive activities about complex topics for all ages: Quantum ideas in interactive science centers</u>

McColgan, Michele, Siena Saturday Scholars: How understanding students creates valued outcomes

Muller, Ali, <u>Design-based research project to develop a science and engineering education program linking field trip</u> experiences to classroom experiences.

Prefontaine, Brean, It's not just about a physics identity: How informal programs can support multiple identities

Sanosa, David, Introducing Children to Computer Coding in Virtual Reality in an Interactive Science Center

Skinner, Ron, Educating informal educators to facilitate learning through practice-based facilitation.

Smith, Trevor I., Using IRT to rank incorrect responses FMCE questions

Spina, Alexis, <u>Math and Making</u>. Study of visitors exploring mathematics through knot tying, string art, tessellations, and minimal surface bubbles.

Stewart, John, The Second Dimension of the FCI is Mostly Medieval

Stewart, John, Using Multidimensional Item Response Theory to Understand the FCI, the FMCE, and the CSEM

Traxler, Adrienne, Network Analysis of Students Descriptions of Scientific Research

Van Dusen, Ben, <u>Modernizing use of regression models in physics education research: a review of hierarchical linear modeling</u>

Symposium Talk Abstracts

Adams, Wendy K., Development of a Practical Problem Solving Assessment Tool

Binz, Steven, Cooperative Exploration of Electric Fields and Charges using AR

Brahmia, Suzanne White, <u>Assessing the math+physics conceptual blend: A new mathematical reasoning inventory for introductory physics</u>

Burkholder, Eric, Assessing adaptive expertise in undergraduate engineering curricula

Canright, Jared, Teaching Gauss's Law using Virtual Reality: Motivation and Implementation

Chini, Jacquelyn J., Exploring Assumptions of Dis/Ability in Physics Education

Heckler, Andrew, Building up to complexity: synthesizing multiple concepts to solve problems

Hyater-Adams, Simone, Performing Physics: An Analysis of Design-Based Informal STEAM Education Programs

Izadi, Dena, The Art Lab Project: The Schrodinger's Cat is in Town!

Jones, Steven, <u>How many calculus concepts are grounded in meanings in math classes that do not align well with how those same concepts are used in science</u>

Porter, Chris, A controlled study of Smartphone-based Virtual Reality in Freshman Electricity and Magnetism

Prefontaine, Brean, We Are Not Only Physicists: Creating Spaces That Support Students in Many Ways

Price, Argenta, Identifying expert problem solving decisions

Rosa, Katemari, Research, practice, and activism: when Critical Race Theory meets the classroom

Salehi, Shima, Improving Problem-solving Through Reflective Training

Schermerhorn, Benjamin, <u>Adapting the structural features framework to address computation: Exploring student preferences when calculating expectation value</u>

Traxler, Adrienne, Asking different questions: Critical Theory lessons for physics education

Van Dusen, Ben, Equity in College Physics Student Learning: a Critical Quantitative Intersectionality Investigation

Vieyra, Chrystian, Supporting Students' Visualization of Magnetic Fields with Smartphones and AR

Wawro, Megan, Student Meanings for Eigenequations in Mathematics and in Quantum Mechanics

Workshop Abstracts

Alvarado, Carolina, Measuring the conceptual development of teachers: A data analysis workshop

Conlin, Luke, <u>Video Analysis of Student Thinking in Labs</u>
Fairfield, Jessamyn, <u>Bright Approaches to Informal Physics Education for New Audiences</u>
Nokes-Malach, Tim, <u>Using Social psychological intervention to make STEM classrooms inclusive and improve learning</u>

PERC 2019 Author Index

Adams, Wendy K.: 330, 705 **Agunos, Darwin Del**: 512, 530

Aiken, John: 698

Akinyemi, Abolaji: 698 AlFiky, Mohammad: 698 Alesandrini, Anne T.: 21, 698 Alfson, Jonathan W.: 153, 288, 698

Allen, Emily: 263

Alvarado, Carolina: 705 Archibeque, Benjamin: 698

Arevalo, Erik: 342

Arielle Evans, Acacia: 26 Arielle, Acacia: 698 Arruda, Anthony: 698 Ayers, Abigail: 464

Bajracharya, Rabindra: 360

Barniol, Pablo: 220

Barooni, Amin Bayat: 698 Barringer, Daniel F.: 32, 698 Bauman, Lauren C.: 38, 698 Beatty, Ian D.: 44, 541, 698

Bell, Jamie: 9, 704 Bender, Lydia G.: 698

Bennett, Michael B.: 51, 159, 698

Bergin, Shane: 15, 704 Beverly, Nancy: 698

Bhansali, Aesha Piyush: 698

Binz, Steven: 705

Bott, Theodore E.: 57, 698 **Boudreaux, Andrew**: 560, 693

Braden, Sarah K.: 704

Brahmia, Suzanne White: 560, 693, 705

Bretl, Kai S.: 26 Brewe, Eric: 117, 698 Brookes, David T.: 63 Brown, Jonathon R.: 464

Brunk, KC: 698 Bugge, Danielle: 698

Bumler, Jacqueline N.: 69, 698

Burde, Jan-Philipp: 698 Burkholder, Eric: 75, 705 Bustamante, Caroline: 257 **Caballero, Marcos**: 57, 69, 214, 429, 627, 669

Campos, Esmeralda: 81, 220

Canright, Jared: 705 Cao, Ying: 87, 698 Carusone, Carmen: 239 Chang, Sheh Lit: 698

Charpentier, Lucas G. G.: 698 Chasteen, Stephanie: 93, 698 Chattergoon, Rajendra: 93

Chen, Zhongzhou: 99, 165, 190, 698

Cheng, Hemeng: 698

Chessey, Mary K.: 105, 698, 704

Chini, Jacquelyn J.: 129, 257, 524, 609, 675, 705

Chodkowski, Nicole: 554 Clark, Lindsay: 378 Clark, Russell: 135

Close, Eleanor: 488, 535, 698 **Close, Hunter G.**: 111, 384, 698

Coble, Kim: 282

Colesante, Robert J.: 378 Commeford, Kelley: 117, 698

Conlin, Luke: 698, 705
Conn, Jessica: 488
Connolly, Tarah: 396
Coon, Alexander: 698
Corbo, Joel C.: 482, 698
Corpuz, Aileen: 698
Corpuz, Edgar: 698
Corrales, Adriana: 300

Daane, Abigail R.: 26, 699 Dalka, Robert: 123, 699 Dancy, Melissa: 699 Das, Kushal: 699 DePalma, Chris: 560 Descamps, Ian: 699

Cwik, Sonja: 699

Doty, Constance M.: 129, 609, 699

Doucette, Danny: 135, 699

Dounas-Frazer, Dimitri R.: 141, 458, 699

Doyle, Jacqueline: 699 Duffy, Andrew: 263, 699 Dumelle, Michael: 603 Durden, Jared: 147 Eaton, Philip: 560 El-Adawy, Shams: 699 Elobeid, Maha A.: 44, 541

Emigh, Paul J: 153, 196, 288, 699

Engel, Andrew: 682 Eriksson, Urban: 699 Etkina, Eugenia: 506 Fadaei, Azita Seyed: 699 Fairfield, Jessamyn: 705 Faletic, Sergej: 699 Farlow, Brian: 704

Fiedler, Brett: 51, 159, 699, 704 Finkelstein, Noah: 51, 172 Finzell, Thomas: 699 Flynn, Michael: 75 Fox, Elizabeth: 402

Fracchiolla, Claudia: 251, 390, 651, 699

Frank, Brian: 699 Franklin, Scott: 441 Fuller, Elizabeth S: 699 Fung, Anderson: 699

Funkhouser, Kelsey: 214, 699

Gambrell, Justin: 699 Garcia, Matthew: 318 Garrido, Geoffrey: 165, 699 Gavrin, Andrew: 402 Gerace, William: 44, 541 Geraets, Ashley A.: 129, 609

Gerardi, Haley: 699 Gifford, Julian D.: 172, 699 Gire, Elizabeth: 153, 196, 288 Gokuldass, Priyadarshini: 699

Goldberg, Fred: 300 Good, Melanie: 178, 699

Goodhew, Lisa M.: 38, 184, 699

Gray, Nickolas: 699 Guisasola, Jenaro: 81

Guthrie, Matthew W.: 99, 165, 190, 699 **Gutmann, Brianne**: 423, 482, 699

Güven, Jasmin: 699 Hahn, Kelby T.: 196, 699 Halpern, Megan: 548 Hamerski, Paul C.: 69, 699 Hansen, Alexandria: 704

Harlow, Danielle: 202, 342, 396, 476

Harryman, Samuel: 591 Hass, Christopher A.: 699 Hazari, Zahra: 208, 704 Head, Thomas Blake: 208, 699 Hechter, Richard P.: 699 Heckler, Andrew: 705

Henderson, Charles: 518, 699 **Henderson, Rachel**: 214, 226, 699

Her, Pachi: 700 Hernandez, Eder: 220 Heron, Paula: 21, 184 Herring, Travis: 700

Hewagallage, Dona Sachini: 226, 700 Hinko, Kathleen: 251, 390, 470, 500, 548, 651 Hinrichs, Brant: 63, 147, 233, 700, 700, 700

Hobbs, Robert: 458 Hoehn, Jessica R.: 700

Holmes, Natasha: 554, 573, 597

Hooper, Paula: 704 House, Lindsay: 700 Hu, Dehui: 239, 700 Huynh, Tra: 354, 700

Hyater-Adams, Simone: 700, 704, 705 **Irving, Paul**: 57, 69, 435, 627, 700

Ives, Joss: 245, 372, 700

Izadi, Dena: 251, 651, 700, 705 Jambuge, Amali Priyanka: 700 James, Westley: 257, 700 Jariwala, Manher: 263, 700 Johnson, Kimme S.: 700 Johnson, Nicole E.: 159

Jones, Steven: 705

Junker, Prof. Dr. Elmar: 700

Justice, Paul: 269, 700

Kalender, Z. Yasemin: 275, 415, 639, 700

Kamela, Martin: 700 Kane, Michael J.: 44 Kauzmann, Michael: 579 Keebaugh, Christof: 700 Kepple, Caitlin: 282, 700 Khatri, Raina: 208

Khong, Hien: 700

Kimbrough, Abigail: 288, 700 Kizito, Ndihokubwayo: 700 Kohnle, Antje: 294, 700 Kuo, Eric: 621, 700 LaSasso, Victor: 560 Lamons, Kamryn: 257

Lau, Alexandra C: 300, 700, 704

Leak, Anna: 306 Leak, Anne E.: 700 Lenz, MacKenzie: 700

Lewandowski, H. J.: 141, 312, 458 Lewandowski, Heather: 700

Li, Feng: 657

Li, Yangqiuting: 700 Lindell, Rebecca: 700

Lindsay, William E.: 318, 700

Little, Angela: 700 Lo, William: 700

Lock, Robynne M: 208, 324, 700 **Logan, Savannah L**.: 330, 701

Love, Joshua: 701

Loverude, Michael: 446, 693

Lucas, Krista: 342

Lunk, Brandon R.: 336, 701

López Tavares, Diana Berenice: 701 López-Tavares, Diana Berenice: 579

Macias, Meghan: 342, 704 Macias, Vina: 348, 452, 701 Madsen, Adrian M.: 105, 354, 701

Maier, Steven: 324, 704
Majiet, Nuraan: 701
Makwela, Tshiamiso: 701
Maldonado, Audiel: 32
Malysheva, Marina: 506
Marckwordt, Jasmine: 342, 704

Mari, Aikaterini: 87 Marsh, Daniel B.: 360, 701

Marshman, Emily: 178, 269, 275, 415

Mason, Andrew: 366, 701

Massey-Allard, Jonathan: 372, 701

May, Jason M: 701 McCauley, Austin: 701

McColgan, Michele W.: 378, 704

McKagan, Sarah B.: 354

McKay, Timothy: 123 McPadden, Daryl: 701 Mestas, Gabriel R.: 384, 701

Meyer, Aurora J: 701 Miller, Casey: 441 Modir, Bahar: 701 Monsalve, Camila: 701 Moore, Daryl L.: 306, 701 Moore, Emily: 159

Morphew, Jason: 682

Moshfeghyeganeh, Saeed: 701 Mullen, Claire: 390, 701 Muller, Alexandria: 396

Muller, Ali: 704 Muller, Sarah: 701 Munsell, Jeremy: 701 Myers, Carissa: 402, 701 Nass, Jacob L.: 63

Nation, Jasmine: 342 Nieberding, Megan: 464

Nissen, Jayson M.: 408, 585, 701

Nokes-Malach, Timothy J.: 275, 415, 621, 639,

701, 705

Ochoa-Madrid, Egla: 423, 701 Odden, Tor Ole B.: 429, 701 Oleynik, Dan P.: 435, 701 Olmstead, Alice R.: 32, 423 Olsho, Alexis: 560, 693 Orban, Christopher: 464 Ortiz, Nickolaus: 701

Ouimet, Pierre-Philippe A.: 87 Owens, Lindsay: 441, 701 Park, Soojin E.: 701 Passante, Gina: 530, 573

Pawlak, Alanna: 701

Pearson III, Richard L.: 330, 701

Perkins, Katherine: 579 Peters, Nathaniel: 701 Pina, Anthony: 446, 701 Poirier, Jacob: 348, 452, 701

Pollard, Benjamin: 312, 458, 482, 701

Pollock, Steven: 530, 645 **Porter, Chris D.**: 464, 705

Potvin, Geoff: 208

Prefontaine, Brean: 390, 470, 500, 701, 704, 705

Price, Argenta M.: 75, 705

Price, Edward: 701 Price, Virginia: 701 Profeta, Audrey: 702 Pulgar, Javier: 476, 702 Ouan, Gina M.: 482, 702, 704

Quealy, Erin: 702

Quichocho, Xandria R.: 488, 535, 702

Rainey, Katherine: 494, 702 Richardson, Connor: 702 Rispler, Caleb: 500, 702

Robertson, Amy D.: 38, 184, 702

Rodriguez, Miguel: 702

Roll, Ido: 372

Rosa, Katemari: 705

Rosenblatt, Rebecca: 687, 702

Ross, Amad: 26

Rothwell, Susan: 348, 452 Rottman, Benjamin M.: 621 Ruggieri, Charles: 702 Rutberg, Joshua: 506, 702 Ryan, Qing: 512, 702 Ríos, Carlos: 476 Ríos, Laura: 141, 702

Sachmpazidi, Diana: 518, 702, 702 Sadaghiani, Homeyra: 512, 530 Saitta, Erin K. H.: 129, 609

Salehi, Shima: 705 Sammons, Amber: 687 Sanosa, David: 704

Santangelo, Brianna: 702 Sarriugarte, Paulo: 702

Sayer, Ryan: 702 Sayre, Eleanor: 354

Scanlon, Erin: 257, 524, 702

Schermerhorn, Benjamin P.: 530, 702, 705

Scherr, Rachel: 184

Schipull, Erin M.: 488, 535, 702 **Schunn, Christian**: 275, 415, 639

Scott, Keely: 702

Sedberry, Stephanie J.: 44, 541, 702

Seese, Sydney: 548, 702

Semak, Matthew Richard: 702

Sermon, Jenay R.: 87

Shafer, Devyn: 702 Siegel, Reese R.: 153 Simmons, Amber: 464

Singh, Chandralekha: 99, 135, 178, 269, 275, 415,

639, 702

Sivitilli, Alexander: 702

Skinner, Ron K.: 202, 396, 704

Small, Alexander: 512

Smith-Joyner, Annalisa: 657, 702

Smith, Emily M.: 554, 702 **Smith, Joseph R**: 464

Smith, Trevor I.: 560, 693, 702, 704

Southey, Dr. Philip: 702 Southey, Philip: 567 Speirs, J. Caleb: 702 Spilka, Roberto: 257 Spina, Alexis: 476, 704 Sprague, Mark W.: 657 Stagar, Erik M.: 464 Stang, Jared B.: 245 Staveland, Owen: 703 Stein, Martin M.: 573, 703

Stelzer, Timothy: 682 Stewart, John: 226, 704, 704 Stone, Antoinette: 703 Straguzzi, Scott: 560

Strickhouser, Jason E.: 44, 541 Strubbe, Linda E.: 354, 703 Sundstrom, Meagan: 703 Swanson, Dayna M.: 233 Thacker, Beth: 703

The Access Network: 482 Thompson, Amreen Nasim: 87

Topdemir, Zeynep: 703 **Tran, Khanh**: 703

Traxler, Adrienne: 117, 402, 703, 704, 705

Turpen, Chandra: 105, 300, 482

Valencia, Josilyn: 703 Valente, Diego: 663, 703

Van Dusen, Ben: 324, 408, 585, 703, 705, 705

Vary Schwandes, Amy: 675 Vieyra, Chrystian: 705 Vieyra, Rebecca E: 703

Villasenor, Armando: 512, 530, 703

Wagner, DJ: 703

Wagner, Doris J.: 591 Walker, Joi P.: 657 Walsh, Cole: 597, 703

Walsh, Kenneth C.: 603, 703

Walter, Paul J.: 703 **Wan, Tong**: 129, 609, 703

Ward, Issac: 651

Waterson, Alyssa C.: 703 Wawro, Megan: 704, 705

Webster, Christopher: 615, 703 Weinlader, Nolan K.: 621, 703 Weller, Daniel P.: 57, 627, 703 Wells, James E.: 633, 703

West, Colin G.: 312

Whitcomb, Kyle M.: 99, 639, 703

White, Courtney: 573

Whitener, Christopher: 560

Widman, Sari: 318 Wieman, Carl: 75 Wikowsky, Jacob: 703

Wilcox, Bethany: 494, 645, 703

Williams, Katy: 603 Williams, Stephanie: 703 Williamson, Krystina: 306 Willison, Julia: 251, 651, 703

Wilson, Michael B: 703 Wolf, Steven: 657, 703

Wood, Laura: 703 Wu, Xian: 663, 703 Yang, Jie: 703

Yerushalmi, Edit: 178

Young, Nicholas "Nick": 669

Young, Nicholas T: 703

Zamarripa Roman, Brian: 675, 703, 703, 704

Zavala, Genaro: 81, 220, 703, 703

Zeng, Liang: 324, 703 Zhang, Muxin: 682, 703 Zich, Raymond: 687, 703

Zimmerman, Charlotte: 693, 703

Zisk, Robert: 703

Zohrabi Alaee, Dina: 354, 704

Zu, Tianlong: 704 Zuza, Kristina: 81

Zwickl, Benjamin M: 239, 306, 348, 441, 452, 615,

704