BCCE

SUNDAY

WALC
1055

Assessment and Measurement in Research and Practice

3:45 Introductory Remarks.

3:50 1. Assembling an assessment of cross-disciplinary practices: graphical representation, covariational and proportional reasoning, and explanation. **R. Gupta**, K.A. Bowe, M. Aikens, N. Altindis, C.F. Bauer

4:10 2. Understanding Where an Item Lives: Designing and Detecting Item Environment Effects Including Internal Calibration of Student Data. **S. Nedungadi**, O. Michels, P.J. Kreke, J.R. Raker, K.L. Murphy

4:30 3. Generalization of a method for the detection of item order effects: Implications for research and practice. **P.J. Kreke**, M.S. Reeves, K.Y. Neiles, O. Michels, T.C. Pentecost, J.R. Raker, K.L. Murphy

4:50 4. Advanced Method for the Detection of Differential Item Functioning. **D.G. Schreurs**, K.L. Murphy

5:10 Closing Remarks.

STEW
302

Blended instruction design and assessment: Leveraging technology to promote adaptive learning for college chemistry

J. Chamberlain, J. J. Stewart, D. Yaron, *Organizers*, *Presiding*

3:45 Introductory Remarks.

3:50 5. The AHA! chemistry project: Improving learning outcomes for all general chemistry students through Active, Hybrid, Adaptive courses. **M. Blaser**, D. Doshi

4:10 6. OLI General Chemistry Courseware: High-Quality, Low-Cost Textbook and Homework System Replacement. **S. Raysor**

4:30 7. Improved learning outcomes from using the Open Learning Initiative (OLI) courseware in general chemistry. **D. Doshi**

4:50 8. Adaptive Learning in the Time of COVID: Lessons learn from an asynchronous ALEKS introductory chemistry course. **A.B. Kuzmishin Nagy**, L. Hibbard

5:10 Closing Remarks.

STEW
306

C.O.V.I.D.: Carrying Over Valuable Innovative Developments

E. G. Malina, *Organizer, Presiding*

3:45 Introductory Remarks.

3:50 9. Design of "at-home" Laboratory Kits for Virtual General Chemistry Laboratories. **M. Abdel Latif**, K.C. Lanigan

4:10 10. At Home Labs: Improving Students Lab Techniques Using Technique Video Quizzes. **F.E. Jacobsen**

4:30 11. Enhancing In-Person Learning of the General Chemistry Laboratory Course at Brown University via the Innovation Created for Remote Learning During the Pandemic. **L. Wang**

4:50 12. Design of an ACS Hands-on Laboratory Workshop for Increased Confidence and Knowledge Assessment. **M. Abdel Latif**, K.C. Lanigan, M.J. Mio, M. Livezey, M. Yousif

5:10 Closing Remarks.

WALC
B093

Disrupting Grading

R. D. Link, *Organizer, Presiding*

3:45 Introductory Remarks.

3:50 13. Using specifications-based grading in the lower-level chemistry and biochemistry curriculum at a PUI: Course design considerations and qualitative impact on students, courses and instructors. **E.E. Wilson**, M.V. Wilson, P.M. Smith

4:10 14. Prioritizing persistence: mastery-based grading and authentic assessments in a large, intro-level biochemistry class. **R. Branco**

4:30 15. Towards a Specifications Grading Framework in an Advanced Biochemistry Course. **S.C. Silver**

4:50 16. Mastering Organic Chemistry and Biochemistry at one's own pace: Use of specification grading in these classrooms. **K.M. Slunt**

5:10 Closing Remarks.

BRWN
1154

Engaging Students in Physical Chemistry

D. E. Gardner, C. M. Teague, *Organizers, Presiding*

3:45 Introductory Remarks.

3:50 17. What Does It Mean to "Understand" the Concepts and Mathematics in Physical Chemistry?. **E.M. Duffy**, M. Smiley, T.N. Chamberlain

4:10 18. Building engagement in the physical chemistry classroom with empathy, clear organization, and a focus on problem solving. **W.C. Duim**

4:30 19. Changes in Physical Chemistry Syllabi Focus Attributed to the Transition to Remote Instruction. **J. Donnelly**, **K. Winkelmann**

4:50 20. Building a New Physical Chemistry Sequence. **R.S. Thompson**

5:10 Closing Remarks.

WALC
1018

Improving implementation of innovative laboratory models

S. J. Gravelle, *Organizer*
D. I. Del Carlo, *Presiding*

3:45 Introductory Remarks.

3:50 21. Step-Wise Development of Process Skills, Collaboration, and Writing in General Chemistry Labs. **C.E. Flener-Lovitt**

4:10 22. Combining forces: SWH and POGIL-PCL in the Physical Chemistry laboratory. **S.J. Gravelle**

4:30 23. Revising a Standard Experiment to Incorporate Inquiry: NMR of the Keto-Enol System. **A. Grushow**

4:50 24. Assessing Shifts in Analytical Chemistry Faculty's Instructional Practices After Their Involvement in the MICRO Project. **A.L. Van Wyk**, M. Reyome, R.S. Cole

5:10 Closing Remarks.

WALC
1132

Innovations, challenges, and practices in large-enrollment laboratory courses

K. A. Gesmundo, *Organizer, Presiding*

3:45 Introductory Remarks.

3:50 25. The organic planner: Challenges and opportunities. **M. Patwardhan**, M. Ogbaje

4:10 26. Lessons learned from large-scale implementation of Undergraduate Laboratory Assistants Program during a pandemic. **L. Gustin**, S. Block, C. Wilkinson, L. Stoll

4:30 27. Critiquing Lab Technique Videos Prior to In Class Use. Can it Improve Technique?. **S. Tenney**, J. Casey, A.A. Russell

4:50 28. Lessons Learned from a Year of Specifications Grading in a Large-Enrollment General Chemistry Lab. **L. Morkowchuk**

5:10 Closing Remarks.

WALC
2087

Learning for All: Making Chemistry Instruction Accessible to Blind/ Low - Vision Students

A. T. DAgostino, *Organizer*, *Presiding*

3:45 Introductory Remarks.

3:50 29. Practical Guide to Accessible Chemistry Instruction for Blind and Low-Vision Students. **A.T. DAgostino**

4:10 30. Multiline Tactile Display: Braille for Future Chemists. **A.E. Neybert**

4:30 31. 3D tactile images to teach STEM courses to visually impaired and sighted students. **E. Hasper**, R. Windhorst, T. Hedgpeth, L. Van Tuyl, A. Gonzales, B. Martinez, H. Yu, Z. Farkas, D. Baluch

4:50 32. Customized 3D Printed Molecular Modeling Kits for use in Lecture Halls and with Visually Impaired Students. **A.C. Davis**, R. Virtue, J.M. Smith

5:10 Closing Remarks.

WALC
3087

STEM Persistence Amid a Pandemic

B. L. Gonzalez, S. Villafane-Garcia, *Organizers*
J. Chan, *Organizer, Presiding*
L. Ye, *Presiding*

3:45 Introductory Remarks.

3:50 33. Seeding Your Future Conference, taking a STEAM conference from in-person to virtual back to in-person again. **J.R. Cole**, H. Albright, K. Dartt, C. Melton, S. Murphy

4:10 34. Impact of the Phone A STEM Professional assignment on organic chemistry students' sense of belonging, career awareness, and career confidence. K. Babics, M. Schen, **S.E. Martin**

4:30 35. Development and Implementation of Mindset and Metacognitive Learning Strategies Workshops in a First-year Chemistry Course. **T. Nguyen**, J. Chan, S. Villafane-Garcia

4:50 36. Improving Teaching in Introductory Chemistry: Lesson Learned from Student Perspectives and Instructor Reflections in Remote Learning. **L. Ye**, J. Chan, P. Bahrami, D.F. Blanco, H.R. Thetford

5:10 Closing Remarks .

MONDAY

WALC
2087

Demystifying Spectroscopy: Methods, Innovations, and Best Practices for Teaching Spectroscopic Interpretation and Structure Elucidation in the Undergraduate Classroom.

C. Theodore, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 116. Exploration of chemistry students' reasoning of ultraviolet/visible light interaction with molecules spectroscopy. **H. Alfulaiti**, A. Cole, M. Balabanoff, A.C. Moon

8:25 117. Infrared Spectroscopy in the General Chemistry Laboratory. **K. Stewart**

8:45 118. Teaching Spectroscopy in Organic Chemistry with Spectra. **B.A. Hathaway**

9:05 Panel Discussion.

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 119. Teaching Organic Instrumentation Using an Online "Choose Your Own Adventure" Website Created Using the Open Source Tool Twine. **F.E. Jacobsen**

11:25 120. A card game for spectroscopy learning in organic chemistry. **J. Ferguson**

11:45 121. Template-Assisted Spectroscopy Interpretation in Undergraduate Organic Chemistry Labs. **M.P. Tracey**, M. Nigam, S. Martinus

12:05 Panel Discussion.

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 122. An Exploration of Post-Secondary Chemistry Instructors' Topic-Specific PCK for Teaching 1H NMR Spectroscopy. **R. Fantone**, E. Zotos, M. Connor, G.V. Szymczak Shultz

2:25 123. Putting the puzzle pieces together: A systematic approach to solving proton NMR problems. **L. Starkey**

2:45 124. Advances in benchtop NMR spectroscopy for the teaching laboratory; higher fields and lower costs. **J. Frost**, C. Karunaweera, J. Price

3:05 Panel Discussions.

3:25 Closing Remarks.

STEW
313

Inclusive practices for unrepresented groups in STEM

N. Lapeyrouse, T. Legron-Rodriguez, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 225. An overview of DEIR in STEM careers in Costa Rica: a demographic study. **I.F. Cespedes-Camacho**, S. Sandi-Urena

8:25 226. Increasing inclusivity of women in STEM: Organizing and improving Arkansas' virtual women in STEM conference. **S.K. Hamilton**, **S.E. Hubbard**

8:45 227. Increasing access to undergraduate research experiences: The OURA Lab. **C. Ngai**

9:05 228. Creating Support Structures to Promote Success for Underrepresented STEM Students. **M.B. Jensen**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 229. Inclusive practices for reducing gender-based stereotype threat in undergraduate classrooms: Results from a national survey. **M. Connor**

11:25 230. STEM Professional Identities: Investigating how students at a Hispanic-serving institute identify. **C. Bechard**, T. Legron-Rodriguez, N. Lapeyrouse

11:45 231. Growing connections from day one: Going beyond the syllabus to develop a foundation for student success. **Z. Mensinger**, K.R. Ries

12:05 232. Student Partnerships and Staff networks as powerful and democratic forces for change: Case Study exploring how the National Association of Disabled Staff Networks (NADSN) STEMM Action Group and Student Partners progress Disability inclusion in Higher Education Institutions and Beyond. **J. Sarju**

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 233. Implementation of culturally relevant pedagogy (CRP) in the science classroom through micro-credentialing. **A. Blecking**, R. Sandrin, C. Berg

2:25 234. Curated content: Anti-racist and inclusive physical science resources on a library research guide. **M. Finnegan**

2:45 235. Investigating the trend of BIPOC representation in chemistry textbooks. **M. Brackett**, C. Lopez-Castilla, B. Chiu, N. Lapeyrouse

3:05 236. Creating Intentional Groups that Support Student Belonging. **J. Casey**, **J. Nissen**, J. Liao, K. Kita, S. Krishna

3:25 Closing Remarks.

STEW
214ABCD

Systems Thinking in Chemistry Education: What it is and why we should do it

J. MacKellar, P. G. Mahaffy, *Organizers*
A. Szozda, S. E. York, *Presiding*

8:00 Introductory Remarks.

8:05 266. Introduction to systems thinking: Benefits and challenges for chemistry education. **M. Orgill**, S.E. York

8:25 267. Investigating chemistry educators' perspectives towards systems thinking in chemistry education in an international setting. **A. Szozda**, K. Bruyere, H. Lee, P.G. Mahaffy, A.B. Flynn

8:45 268. Instructors' definitions and understandings of systems thinking in the context of tertiary chemistry classrooms. **S.E. York**, M. Orgill

9:05 269. Development of two modules for foundational chemistry courses: introduction to systems thinking and learning kinetics with systems thinking. **J.B. Randazzo**, **K. Aubrecht**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 270. Mapping sustainability into chemistry education: exploring the implications of linkages with frameworks, principles and tools. **S. Matlin**

11:25 271. Applying Instructional Design to Teach Systems Thinking. **J.J. Stewart**

11:45 272. Instructors' decision making about climate change instruction. **M. Weinrich**, P. Wilson

12:05 273. Cultivating Connection in the Analytical Chemistry Classroom. **G. Clark**

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 274. A Meta-Analysis of Climate Change Content in General Chemistry Textbooks. **P. Wilson**, N. Duarte, T. Harris, T. Sayers, M. Weinrich

2:25 275. Using systems thinking concepts to build a connecting thread of real world applications for general chemistry topics. **T. Holme**

2:45 276. Systems Thinking in Student Reasoning about Glycolysis. **T. Barton**

3:05 277. Autocatalytic networks in the classroom. **M. Huang**, B. Alappat, Y. Sawalha

3:25 Closing Remarks.

STEW
202

Training, mentoring, and managing laboratory teaching assistants

R. D. Link, D. Sokic-Lazic, *Organizers*
C. S. Bagwill, J. Monahan, C. J. Sobers, C. Zumalt, *Presiding*

8:00 Introductory Remarks.

8:05 293. Developing an inclusive pedagogy & cultural awareness training for chemistry lab TAs. **C.J. Sobers**, G. Santos Mendoza

8:25 294. A first attempt: Incorporating bias, diversity, and inclusion discussions into a teaching assistant training program. **K.S. Anliker**

8:45 295. Exploring, encouraging, and learning from the inclusive teaching practices of STEM laboratory trainee graduate teaching assistants in Higher Education. **J. Sarju**, L.C. Jones

9:05 296. Teaching assistants- Keeping your allies together. **S.M. Mata**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 297. What a GTA Wants: Training and Professional Development Requests by Graduate Teaching Assistants. **M. Herridge**

11:25 298. Mentoring Graduate Teaching Assistants Through Training Sessions and Course Offering at Brown University. **L. Wang**

11:45 299. Training Graduate Teaching Assistants through Role Playing. **D. Sokic-Lazic**, C.S. Bagwill, J. Monahan

12:05 300. Labflow & Data Insights: Using real time grading data to identify TAs in need of coaching early in the semester. **D. DeSutter**, E. Crowe

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 301. Expanding our TA workshop: How much time can I have? 30 hours over 8 days? Excellent!. **K.S. Anliker**

2:25 302. Implementing hierarchical structures and leadership skills for student workers. **A. Chant**

2:45 303. Managing graduate and non-graduate student TA in general chemistry lab. **m. khural**

3:05 304. Training and mentoring practices to foster professional growth for TA laboratory instructors. **L. Funari**, A.M. Bischof, A. Herring

3:25 Closing Remarks.

WALC
3121

Addressing the needs of the non-chemistry majors in general education courses

G. Crawford, K. D. Kloepper, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 37. Kitchens as laboratories: A distance education food chemistry course for non-science majors. **G. Crawford**

8:25 38. Say "Fromage": Tales from a General Education Study Travel Science Course Focused on the Science of Cheese. **J.L. Hawk**

8:45 39. Using historical context to teach science process in a non-major's physical science general education course. **L. Demoranville**

9:05 40. "Chemistry of Soap": A non-science majors lab-based course at Georgia Gwinnett College (GGC). **I.H. Krouse**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 41. Engagement of non-chemistry majors through a citizen science service-learning project. **K.D. Kloepper**, L. Simon

11:25 42. Creating real-life case studies for a non-majors chemistry and environment course.. **A.N. Oldacre**

11:45 43. Small Molecules Big Ideas at Riverview Correctional Facility. **J. Schmeisser**, S. Glazier

12:05 Panel Discussion.

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 44. Meeting students where they are: Intentional design for non-majors' chemistry courses in an interdisciplinary general education program. **R.E. Grote**, C.J. Hayes, B. Ramos

2:25 45. Engaging non-majors through a self-selected reading challenge. **E. Vickers**

2:45 46. Redesign of an Integrated Chemistry and Physics course to meet New Recommended Standards for Preservice Teachers. **L.A. Bolyard**, S. Hootman, S. Reynolds, B. Vermillion

3:05 47. Encouragement-Based Assessment: Grading by Points Rather Than Percentage. **J.A. Suchocki**

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 48. Chemical Literacy in Senior Students. **L.Y. Nabulsi**

4:10 49. Infusing chemistry concepts into interdisciplinary global challenges general education coursework: A Clemson University case study. **B.G. Trogden**, E.A. Boyd

4:30 50. Culinary Reactions - A home cooking lab course. **J. Schmeisser**

4:50 Panel Discussion.

5:10 Closing Remarks.

STEW
302

Blended instruction design and assessment: Leveraging technology to promote adaptive learning for college chemistry

M. Blaser, J. Chamberlain, J. J. Stewart, D. Yaron, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 64. Building student confidence and improving performance through scaffolded practice in a hybrid learning environment. **W. Lampart**, **B. Bekker**, M. Motika, R. Tang

8:25 65. Using technology to promote student metacognition in general chemistry. **T.M. Clark**

8:45 66. Improving learning in general chemistry via interactive courseware: Instructor perspectives. **M. Blaser**, M. McCarthy, J. Vincent

9:05 Panel Discussion: Instructor Use of Open Learning Initiative Courseware.

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 67. OLI General Chemistry Courseware Data Analysis. **S. Raysor**

11:25 68. Learning about the process of learning from logs of student interactions with online resources. **D. Yaron**, S. Raysor, M. Blaser, D. Doshi

11:45 69. Classroom observations for tracking the use of active learning activities in blended learning environments. **R.J. Tang**, M. Motika, M. Molinaro, M. Steinwachs, J. Diaz, J. Edwards

12:05 70. Putting classroom observations into practice: Measuring changes worth keeping in a redesigned hybrid course. **J. Chamberlain**, Z. Soliman, R.J. Tang, M. Motika, J. Diaz, J. Edwards

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 71. Artificial intelligence transcript analysis to support instructor reflection and measure change. **J. Chamberlain**, M. Blaser, M. Steinwachs, M. Molinaro

2:25 72. Is this working as intended? Analyzing student questions to assess the impact of a collaborative pedagogy over video chat. **B. McCollum**, L.A. Morsch, M.T. Wentzel

2:45 73. Improve learning in general chemistry via interactive courseware: Building a community of practice. **T. Shelton**, D. Doshi, M. Blaser

3:05 Panel Discussion: the AHA! Chemistry Project.

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 74. Curation and creation of open educational resources - An experiment in teaching undergraduate chemistry. **G. Shridhar**, L. Ravishankar

4:10 75. Using PhET Simulations to Promote Concept Development in General Chemistry: Are They Efficacious in an Independent Online Setting?. **J.F. Eichler**, K. Atit, L. Ye, M. Casselman, C. Murphy

4:30 76. Exploring a Simulation on Atomic Structure Before Lecture Improves Undergraduate Chemistry Students' Concept Learning. **A.M. Powe**, D.B. Franco, D. McClellan, R. Chastain, J. Hieb, L. Fuselier, M. DeCaro

4:50 77. No chemist left behind: leveraging virtual experiments for student engagement and retention. **T. Shelton**

5:10 Closing Remarks.

STEW
306

C.O.V.I.D.: Carrying Over Valuable Innovative Developments

E. G. Malina, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 78. Making the Most of Crises: Using Remote Learning to Refine Lab Analysis Goals. **S. Block**, L. Gustin, C. Wilkinson

8:25 79. Learning from the Pandemic: Engaging students through remote access to instrument software in an advanced CURE instrumentation laboratory course. **G. Rabah**

8:45 80. Developing a virtual chemistry lab framework with post-pandemic relevance in mind. **V.S. Vyas**

9:05 81. C.O.V.I.D Carrying Over Valuable Innovative Developments. **S. Narayan**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 82. Using activities and explorations and capstone assignments as innovations in a general chemistry course for non-majors. **M.H. Towns**, C.J. Harwood, C.E. Wright

11:25 83. Second chance General Chemistry I developed as an online, short-term course. **A.B. Ormond**

11:45 84. Investigating student perception of course materials developed during the pandemic for introductory STEM courses. B. Chiu, **N. Lapeyrouse**

12:05 85. Improved Teaching: A Symptom of COVID-19. **C. VanRooyen**

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 86. Keep it or leave it: COVID-19-induced changes in my teaching. **K.S. Craig**

2:25 87. Research informed instructional design for remote teaching results in better student success for face-to-face classes. **D.G. Herrington**, R.D. Sweeder

2:45 88. Is intention to pursue STEM enough? Trends in student self-efficacy and science identify throughout the COVID-19 pandemic. **J. Forakis**, J. March

3:05 Panel Discussion.

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 89. Remote teaching of organic chemistry in two large-enrollment courses over four semesters. **V. Iosub**

4:10 90. Using Google Docs for Real-Time Collaborative Group Work during Virtual Lectures. **A.R. Babij**

4:30 91. How using an ELN to manage lab courses differs from using an LMS alone. **H. Arman**, F. Yoshimoto

4:50 Panel Discussion.

5:10 Closing Remarks.

WALC
B058

Chemistry Education Research: Graduate Student Research Symposium

M. Connor, O. Crandell, *Organizers, Presiding*
C. G. Carlson, E. L. Day, M. Herridge, S. Houchlei, Y. Liu, M. Popova, T. Qu, P. Vincent-Ruz, L. Wright Ward, *Presiding*

8:00 Introductory Remarks.

8:05 92. A novel approach to purposive sampling when mixed quantitative and qualitative criteria are used for participant selection. **K.Q. Magnone**, E.J. Yezierski

8:25 93. Facilitation practices of learning assistants in remote versus in-person settings. **N. Maggiore**, J. Karch, I. Caspari

8:45 94. The Authoritative-to-Dialogic Spectrum of Learning Assistant Facilitation Practices. **C.M. Carlos**, N. Maggiore, V. Dini, I. Caspari

9:05 95. Teachers as learners: professional development with storyboarding and molecular-level phenomena. **J. Ebert**, E.J. Yezierski

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 96. Withdrawn

11:25 97. General chemistry instructors' intentions for and evidence of student learning from external representations of acid-base titrations. **N. Baldwin**, M. Orgill

11:45 98. Assessing the impact of a Master's in Chemistry program on pedagogical content knowledge change in high school science teachers. **M. Bautista**, M.L. Miller

12:05 99. Into the unknown: Investigating STEM future instructors' decisions to implement new instructional strategies. **A. Kraft**, E.L. Atieh, L. Shi, M.N. Stains

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 100. Investigating faculty perceptions of the role of energy and electrostatic/bonding interactions in the context of reactions within their course. **A. Roach**, Z. Roche Allred, B. Adams, S.M. Underwood

2:25 101. Chemical Literacy Changes in General Chemistry and Organic Chemistry Students. **L.Y. Nabulsi**

2:45 102. Investigating the structure of students' organic chemistry knowledge. **S. Abeywardana**, M. Cooper

3:05 103. "That's Phenomenal!: The Translation of Phenomena-Based Learning to Postsecondary Introductory Chemistry as an Entry Point to Causal Mechanistic Reasoning. **L. Scharlott**, D. Rippey, N.M. Becker

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 104. Employer-desired competency development in project-based general chemistry laboratory courses. **B. Eggly**, P. Patterson-Lee, L.A. Posey

4:10 105. The Laboratory as a Vehicle for Argumentation Enhancement among Pre-Service Teachers of Science Education. **M. Hugerat**

4:30 106. Exploring Post-Secondary Chemistry Instructor's Resources for Planning Instruction. **R. Fantone**, G.V. Szymczak Shultz

4:50 107. Using the dynamic transfer framework to explore chemistry students' interpretations of the first law across disciplinary contexts. **A.P. Parobek**, P.M. Chaffin, M.H. Towns

5:10 Closing Remarks.

WALC
B093

Disrupting Grading

D. A. Barr, K. D. Closser, R. D. Link, J. L. Muzyka, J. R. Ring, C. Sorensen-Unruh, *Organizers*

8:00 Introductory Remarks.

8:05 125. Chemistry Coins: A Grading System Based on Bloom's Taxonomy in an Inorganic Chemistry Course. **K. Young**

8:25 126. Quantized grading: An ab initio approach to using specifications-based grading in physical chemistry. **K.D. Closser**, M.J. Hawker, H. Muchalski

8:45 127. Implementation of specifications grading in an online forensic science quality assurance course. **T. Legron-Rodriguez**, C. Randles

9:05 128. Help, I've been Chegged! Understanding academic integrity in the chemistry classroom. **B.K. DeKorver**, D.G. Herrington

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 129. An implementation of mastery-based grading based on Marzano's Taxonomy in large-enrollment general chemistry. **S. Garrett-Roe**, T.D. Shepherd

11:25 130. An alternative grading strategy in a General Chemistry I classroom. **J. Haile**

11:45 131. Standards-based grading, flipped design, and connection-building activities: a three-pronged approach to promote student engagement in a first-semester general chemistry course. **M.J. Hawker**, K.D. Closser, T. Brooks, R. Olarte

12:05 132. On the quest to improve student learning in general chemistry lecture using a competency-based approach before and during COVID. **B.E. Taylor**

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 133. Shifting the focus away from points: A year of alternative grading in large-enrollment General Chemistry lab. **K.A. Gesmundo**, V.M. Berns

2:25 134. Using specifications grading to enhance scientific writing in a general chemistry II lab. **E. Wachter**

2:45 135. Specifications grading by a scared first-timer in general chemistry. **W. Kennerly**

3:05 136. Reducing performance gaps in chemistry through equity-focused course design. **K.Y. Neiles**, R. Bowers, R.K. Larsen

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 137. Ungrading for Meaningful Chemistry Learning. **J. Brown**

4:10 138. Innovative grading practices in introductory chemistry courses at a 2-year institution. **M.T. van Opstal** , J.B. Wachter, J. Ellefson-Kuehn

4:30 139. Ungrading in Environmental Toxicology and General Chemistry. **C.M. Woodbridge**

4:50 140. Lessons learned from ungrading the general chemistry classroom at a primarily undergraduate institution. **T.E. Alivio**

5:10 Closing Remarks.

WALC
3122

Effective Graduate Education for Masters and Doctoral Chemistry Students

J. Harshman, G. V. Szymczak Shultz, *Organizers*, *Presiding*

8:00 Introductory Remarks.

8:05 141. Critical challenges to chemistry doctoral education in the United States. **J. Harshman**

8:25 142. Investigating how chemistry graduate students develop and engage in the use of scientific practices within their research. **B. Martinez**, Z. Roche Allred, P. Alvarez, S.M. Underwood

8:45 143. Factors which predict the perceived value of a seminar talk. **E.W. Kelley**

9:05 144. Professional identity: Catalysis in the synthesis of chemists. **G. Bhattacharyya**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 145. Graduate School Experiences in the Chemical Sciences: Student Views and Implications for Change. **J. Stockard**

11:25 146. Mentorship needs for chemistry students and early career researchers. **E.W. Kelley**

11:45 147. Investigation of Advisor-Advisee Conflict Communication in U.S. Chemistry Graduate Education. **T. Qu**, J. Harshman

12:05 148. Focus groups with chemistry graduate students from English-additional language (Eng+) backgrounds. **J.M. Deng**, A.B. Flynn

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 149. The ACS Bridge Program: Enhancing diversity, equity, inclusion, and respect in graduate education in the chemical sciences. **J. Schlatterer**

2:25 150. Measuring the Impact of the Individual Development Plan Process in Chemistry Graduate Education. **C. Kuniyoshi**, C. Fuhrmann, L. O'Dwyer, **J. Schlatterer**

2:45 151. Preparing chemistry graduate students for careers in industry and national labs: An innovative and holistic training model. **S.E. York**

3:05 152. Effective graduate training in soft skills with a full-day professional development workshop. **S. Lim**, V. McLaughlin, C. Patterson, R. Richardson, J. Goodey Pellois, C. Hilty, M. Harthcock

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 153. Connecting the Dots between Organic Chemistry and Social Justice through Mechanistic Reasoning. **I. Caspari-Gnann**, G. Pichard, R. Scheck

4:10 154. Instructional Coaching: A Community-based Approach to Supporting Graduate Student Instructors. **G.V. Szymczak Shultz**, E. Zotos, R. Fantone, J. Spencer

4:30 155. Workshop Series for Graduate Student Mentors of Undergraduate Researchers: Development and Impact on Mentor Perspectives and Teaching Practices. L. Coté, M. Helix, C. Stachl, E. Stone, **A.M. Baranger**

4:50 156. Chemistry education research group culture and individual student growth: Toward best practices in management and development. **E.J. Yezierski**

5:10 Closing Remarks.

WALC
B066

Engaging Students in Organic Chemistry: A Symposium to Honor Barbara Murray

P. J. Kreke, B. Murray, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 157. Colorful polymers. **C.F. Hermann**, C. Burke

8:25 158. Engaging organic chemistry students through projects that address green chemistry principles. **D.C. Bromfield-Lee**

8:45 159. Engaging students in interpreting NMR spectra with metacognition. **L.J. Martin**

9:05 160. Scaffolding organic chemistry laboratory: Start with experiments. **M. Turon**, L. Ahlberg

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 161. Employing forensic case scenarios in Organic Chemistry laboratory. **A.B. Waghe**, A.A. Waghe

11:25 162. Teaching scientific thinking through writing to learn: Give your students CPR. **B. Burlingham**

11:45 163. 'My Favorite Drug': Exploring connections between organic chemistry and medicine. **A.V. Aditya**

12:05 164. Developing video games to communicate organic chemistry concepts. **S.G. Sogo**

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 165. Reading assignments and term projects in Honors organic chemistry. **C. Stephens**, **S. Davis**, S.A. Dandekar

2:25 166. Adapting problem solving activities for enhancing students' conceptual understanding in organic chemistry. **G. Shridhar**, L. Ravishankar

2:45 167. Integrating the preparation of biomolecules and pharmaceutical drugs in teaching undergraduate Organic Chemistry: Examining electrophilic and nucleophilic aromatic substitution in the synthesis of thyroxine. **N.C. Kallan**, S.N. Mahapatro

3:05 168. Teaching a literature-based advanced organic chemistry course at a primarily undergraduate institution. **D.L. Silverio**, M.J. Mistretta, S.P. Buzzolani

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 169. Abductive reasoning for problem solving in organic chemistry. **J.W. Wackerly**

4:10 170. Supporting remote learners with an electronic whiteboard. **P.M. Morgan**

4:30 171. Helping organic chemistry students generate the right questions: A blend of online homework and written problem sets. J.M. Karty, **R. Jew**

4:50 Panel Discussion.

5:10 Closing Remarks.

BRWN
1154

Engaging Students in Physical Chemistry

D. E. Gardner, C. M. Teague, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 172. Lessons learned in the conversion of a flipped physical chemistry course sequence to a Hyflex format. **L.M. Goss**

8:25 173. Student posters as a way to modernize the PChem Lab when new equipment is not an option. **J. Monahan**

8:45 174. Oral exams: A useful tool to help your students learn physical chemistry better. **D.E. Gardner**

9:05 175. Non-traditional approaches to curricula, assessments, and personal growth in the physical chemistry classroom. **A.N. Giordano**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 176. Integrating computational modeling in physical chemistry laboratory. **H.L. Berghout**, M.J. Perri

11:25 177. Game: Quantum Particle-in-a-Sandbox. **D.V. Chulhai**

11:45 178. Water, water everywhere: A guided-inquiry molecular dynamics experiment. C.D. Bruce, M.J. Perri, A.K. Sharma, **R.M. Whitnell**

12:05 Panel Discussion.

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 179. Exploring Internal Energy with Python: A Computational Guided Inquiry Assignment for Physical Chemistry Students. **T. Guasco**, S. Neshyba, G. Stokes, W.C. Pfalzgraff

2:25 180. Engaging students in physical chemistry using Python and Jupyter notebooks to target conceptual, mathematical, and graphical reasoning. **K. Tibbetts**, S.S. Hunnicutt

2:45 181. Using R in the Physical Chemistry Laboratory. **B.D. May**, K. Range

3:05 Panel Discussion.

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 182. Encouraging student engagement in scientific practices through a gas-phase IR POGIL physical chemistry laboratory experiment. **J. Beck**, D.M. Miller

4:10 183. Withdrawn

4:30 184. Estimating λMAX for conjugated dye systems with a finite well quantum mechanical approximation. **D. Catlett**

4:50 185. Dynamical and statistical monitoring of temperature and pressure in the measurement of the heat capacity ratio by adiabatic expansion. **D. Catlett**

5:10 Closing Remarks.

WALC
3090

Faculty Experience with Course-based Undergraduate Research Experience (CURE)

K. J. Ho, *Organizer*
J. L. Stafford, T. Terry, *Presiding*

8:00 Introductory Remarks.

8:05 194. Course-based Research Experiences for High School Students: Start Early, Repeat Often. **T. Terry**

8:25 195. A pre-CURE implementation in a large General Chemistry lecture course. **D. Habel-Rodriguez**, K.J. Ho

8:45 196. Development of a team taught, first year course based undergraduate research experience at the interface of biology and chemistry. **L. Knecht**, J. Van Dyken

9:05 Panel Discussion.

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 197. Exploring the frontiers of chemistry: A research methods course at a diverse, urban, R1 university. **K. Tibbetts**, L. Waller, M. Smith

11:25 198. Development of a two-semester undergraduate research methods course sequence. **A.J. Carroll**

11:45 199. Iteration of a CURE for biochemistry II lecture. **E. Ragan**

12:05 Panel discussion.

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 200. Teaching Next Generation Chemists: How to Prepare Lab Instructors/TAs to Teach CURE. **J.L. Stafford**

2:25 201. Development and Implementation of a Multi-Year, CURE-based Chemistry Lab Curriculum. **E.D. Helms**, J.J. Peterson

2:45 202. Design and implementation of a graduated approach to an independent instrumental analysis project. **T. Thomas-Smith**

3:05 203. Integrating Student-Focused Interdisciplinary Research to Enhance Laboratory Capabilities and Student Preparedness. **D.M. West**, M. Becker, J. Selaya, J. Wilson, N. Dascher, L. Losey, J. Long, J. Murphy, P. Tompkins, J.D. Patton

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 204. Implementing course based undergraduate research experiences that bridge coursework between the spectroscopic identification of organic molecules and inorganic chemistry labs: A survey of three offerings. **W. Carroll**, E.C. Lisic

4:10 205. From the bench to the desk to the bench: Experiences developing and implementing an inorganic chemistry CURE during COVID-19. **E. Victor**

4:30 206. Comparing different modality of CURE and their effects on student's learning. **K.J. Ho**

4:50 Panel Discussion.

5:10 Closing Remarks.

WALC
2007

George R. Hague Memorial AP/IB Chemistry Symposium

L. Cummings, P. D. Price, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 214. Inner Strength: Why do acids break up?. **K.L. Hendren**

8:25 215. Kinetics Activities that Promote a Particle Collisions Point of View. **A. Snyder**

8:45 216. Just a droplet in the bucket of AP Chemistry; equilibrium, acid/base reactions, and thermodynamics all in one microscale chemistry experiment. **R. Johnson**

9:05 217. Claim Evidence Reasoning (CER) in the AP Chemistry Classroom using a Smartphone Spectroscopy Beer's Law and Rate Law Experiments. **A. Schmidt**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 218. Pattern Investigations in AP Chemistry. **J. Brown**

11:25 219. Using Student Misconceptions as a Guide to Create Assessment Items for AP Chemistry. **M. Farabaugh**

11:45 220. AP Readiness: an access and equity program. **M.A. Morgan**

12:05 221. Implementing best practices to improve scores on the AP Chemistry exam. **J. Benigna**

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 222. College Board resources and updates for AP Chemistry. **J. Benigna**

2:25 223. Review of the 2022 AP Chemistry Exam. **K.A. Beran**, J. Benigna

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 224. Q&A with Chief Reader, Development Committee, and College Board. **K.A. Beran**, J. Benigna

5:10 Closing Remarks.

WALC
3138

Innovations and Experiences In the Chemistry Classroom During the First Two Years

T. B. Higgins, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 237. Particular Meaning. **B. Ratcliff**

8:25 238. STEM Based Cross-Curriculum Modules to Enhance Student Engagement and Learning. **R. Bright**, T. Holmes, C. Dodd

8:45 239. 'Mole of reaction': Using units consistently in general chemistry. **D.Z. Keifer**, D. Rieck

9:05 240. The Use of Analogies in General and Organic Chemistry Courses. **B.E. Love**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 241. Adopt a Chemical Substance: Explore How General Chemistry Topics Are Cross-linked. **R. Zhang**

11:25 242. Using the flipped classroom in first year general chemistry courses at a community college. **S. Stegall**

11:45 243. Student generated connections to chemistry content to enhance interest in introductory chemistry. **M. Hands**

12:05 244. Mobile Technology in the Chemistry Classroom: Do students think it's worth surpassing the activation barrier?. B. Baldock, **A.L. Fernandez**

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 245. Uniting Chemical Concepts Using Ocean Acidification in a General Chemistry 2 Course. **C.S. Haslag**

2:25 246. Using scientific literature to increase students' understanding of what it means to be a scientist. **J.M. Liu**, A. Perla, S. Hollar

2:45 247. Implementation of Pop Quizzes as an Inclusive Teaching Tool in General Chemistry. **E. Johnson**

3:05 248. VSEPR flat packs. **K. Rust**

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 249. Curriculum Transformation and Student Engagement in General Chemistry. **L.B. Lamont**, J.J. Weaver, J.M. Trate, r. bain, t. pesavento, C.R. Landis, E.L. Sibert

4:10 250. How an EDI in STEM Community of Practice prompted a successful change in General Chemistry discussion activities. **A.J. Kabrhel**

4:30 251. How do undergraduate students solve a neutralization reaction problem before and after instruction?. **N.M. Dickson- Karn**, T.M. Clark

4:50 252. What to do about the Henderson-Hasselbalch equation?. **N.M. Dickson-Karn**, T.M. Clark

5:10 Closing Remarks.

STEW
310

Integrating Green Chemistry and Sustainability into Chemistry Education

L. Bastin, A. P. Dicks, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 253. Phenomena and Storyline Tools for Using Green Chemistry in High School Classroom. **J. Butler**, S. Loomis, J. Burdick

8:25 254. Greening the high school classroom through a hands-on collaborative workshop. **J.E. Wissinger**, C.K. Lydon, C. Javner

8:45 255. Re-orienting preservice chemistry teachers towards sustainability and its integration. **R. Hanson**, C. Hanson

9:05 256. Effects of the use of standard and alternative materials in acid/base titration on secondary school chemistry students' achievement and attitude towards environmental sustainability. **F.I. Umanah**, T.E. Owoyemi

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 257. A Multi-institutional and Industry Collaboration Towards Greening the General and Inorganic Chemistry Laboratory Curriculum. **N.J. O'Neil**, D.J. Campbell, J. Moir, J. De Backere

11:25 258. What are Efficient Reactions? A Module for General Chemistry Connecting Green Chemistry and Systems Thinking. **J. D'eon**, **J.R. Silverman**

11:45 259. Integrating the tenets of green chemistry in gateway chemistry courses through an incremental approach in order to facilitate deeper understanding and retention. **D.A. Laviska**

12:05 Panel Discussion.

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 260. Integration of green chemistry into the organic chemistry curriculum: Findings from a nationwide survey. **K.D. Grieger**, A. Leontyev

2:25 261. Integrating Green Chemistry into the Organic Laboratory using Project-Based Experiments and Case Studies. **M. Zhang**, E.L. Day, M. Cooper, H. Mcfall-Boegeman, S. Petritis, R.E. Maleczka

2:45 262. Proline Catalyzed Solventless Green Aldol Reaction: An Undergraduate Organic Laboratory Experiment. **M. Nigam**, M.P. Tracey

3:05 263. Sustainable Catalysis Research through an Integrated Chemistry Laboratory Course. **o. villanueva**

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 264. The importance of a common philosophy, resource sharing, and peer-to-peer learning and mentorship in broadening and deepening the integration of green chemistry in chemistry education. **J. Moir**, A.S. Cannon, J. MacKellar

4:10 265. Addressing Environmental Racism in through Community and Political Engagement in Chemistry Courses. **L. Bastin**, A. Martin

4:30 Panel Discussion.

5:10 Closing Remarks.

WALC
3127

Teaching in the chemistry laboratory: Beyond confirmatory experiences

B. M. Neal, D. J. Styers-Barnett, K. Weber Stickney, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 278. A Two Week Model for Introducing Guided Inquiry into General Chemistry Lab. V. Fringer, K. Mandery, T. Bibelnieks, **J. Wainman**

8:25 279. Physical Sciences Research Experience – a model for co-designing lab experiences with students, for students. K. Kim, E. Sauer, **S. Mikhaylichenko**

8:45 280. Argument driven inquiry for introductory chemistry students. **M. Hands**

9:05 281. Development of a Chemistry Laboratory Course for Online Instruction. **C. Schrank**, S. Post, K.J. McKnelly

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 282. Materials Characterization Project: Developing critical hard and soft skills for success in chemistry careers. **D.A. Belle-Oudry**, J.E. Pemberton

11:25 283. Design of a half-semester, undergraduate research project: Optimization of the separation of a three-component mixture by reverse-phase HPLC using C_{18}. **A.S. Breitbach**

11:45 284. Training Tomorrow's Scientists: Lessons Learned from Embedding Professional Skills into a Guided Grant and Laboratory Project. **D.J. Styers-Barnett**, A.N. Giordano

12:05 285. Making the Switch: Employing the "Cooperative Chemistry" model of General Chemistry lab at a large R2 university. **D.E. Blumling**, B. Boardman, C.A. Hughey, O.H. Judd

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 286. Community garden field experiences as a means to reduce anxiety and increase self-efficacy. **E.L. Lebeau**

2:25 287. Metal-organic frameworks in lower-division chemistry courses. K. Wiese, M.D. Haak, M. Burand, **K.C. Stylianou**

2:45 288. Aquatic photodegradation of pharmaceutical pollutants: Cultivating research skills in the undergraduate lab. **J.M. Buth**, R. Ossola, S.B. Partanen, K.P. McNeill, W. Arnold, D.E. Latch

3:05 289. What's in the water?: Using real world water samples in the teaching laboratory. **N.A. Law**, **B.L. Brabetz**, J.T. Sprague

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 290. From synthesis and analysis to elucidating steric and electronic effects: An acyl substitution organic chemistry lab. **J.P. Moerdyk**

4:10 291. A research-based capstone project for sophomore level organic chemistry lab. **C.S. Bagwill**, B. Woods, I. Brown

4:30 292. Shedding light on organic synthesis: A supplemental spectroscopy course to accompany Organic Chemistry 2 Laboratory. **K. Weber Stickney**, L.H. Mielke

4:50 Panel Discussion.

5:10 Closing Remarks.

WALC
1055

Assessment and Measurement in Research and Practice

K. L. Murphy, J. R. Raker, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 51. Insight into student reasoning using online reasoning chain construction assessments (ORCCA). **M.L. Nagel**, B. Lindsey

8:25 52. Investigating Item Validity on Answer-Until-Correct Assessments. **D.G. Schreurs**, J.M. Trate, M.A. Teichert, C.J. Luxford, J.L. Schneider, K.L. Murphy

8:45 53. Re-Envisioning Learning Outcomes and Assessment Practices for a High Enrollment General Chemistry II Course. **J.M. Trate**, L.B. Lamont, J.J. Weaver, T. Pesavento

9:05 54. Variations in Assignment Expectations as Represented by Rubric Structure and Content in General Chemistry. **M. Herridge**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 55. Labflow: Using big data to trace and assess laboratory skills. **D. DeSutter**

11:25 56. Do We Ask Students to Do What We Want Them to Learn? An Investigation of the General Chemistry Laboratory Course. **E.M. Duffy**, A. Kreps, A. MacNeil

11:45 57. Comparing proctored in-person exams with unproctored online exams in general chemistry: Performance, security, and perspectives of students and faculty. **D.A. Turner**, T.M. Clark

12:05 Panel Discussion.

12:25 Closing Remarks.

STEW
218ABCD

Biochemistry Education: Discussions of the Laboratory Learning Environment

S. Johnson, *Organizer*, *Presiding*

8:00 Introductory Remarks.

8:05 58. Imaging single molecules of Annexin V binding to membranes in an undergraduate physical biochemistry lab course. **J.D. Knight**, N. Alansari, D.T. Giardina, T.N. Huynh

8:25 59. Designing a Western Blot Method Optimized for the Time Constraints of a Biochemistry Teaching Laboratory. **S. Katner**, C. Krois

8:45 60. 39andWoof: Canine breed determination using DNA microsatellite analysis. D. Punthrankul, **K.R. Willian**

9:05 Panel Discussion.

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 61. Modernizing the Biochemistry Lab Experience: A Blended Computational and Experimental Biochemistry CURE. **E. Reynolds**

11:25 62. Reimagining an established CURE to provide high-quality digital learning experiences that are intentionally equitable, inclusive and accessible for all students. **A. Sikora**, B. Hall, S. De, P.A. Craig

11:45 63. Does the use of an Integrated Lab Notebook in an Undergraduate Biochemistry Laboratory Increase Student Understanding?. **S. Katner**, C. Krois, J.R. Pribyl

12:05 Panel Discussion.

12:25 Closing Remarks.

WALC
1132

Chemistry education research at a crossroads: Where do we need to go now?

D. G. Herrington, *Organizer, Presiding*
O. Crandell, R. D. Sweeder, *Presiding*

8:00 Introductory Remarks.

8:05 108. Moving along the pandemic response continuum from survival towards intentionality. **M. Cooper**, **T. Holme**

8:25 109. Blurring the lines: Embracing intersectionality within (and beyond) the biochemistry education community.. **T.J. Bussey**, **E. Offerdahl**

8:45 110. Broadening relevance, dissemination, and impact of Chemistry Education Research. **V. Talanquer**, **P.G. Mahaffy**

9:05 111. Promoting high quality chemistry education research. **O. Crandell**, D.G. Herrington, R.D. Sweeder

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 112. How do we define effective practice in chemistry education and how do we get people to use it?. **B. McCollum**, **G. Rushton**

11:25 113. Envisioning an education research community invested in racial equity. **S.F. Bancroft**, **V.R. Ralph**

11:45 114. Changing the conversation around secondary chemistry CER: Creating win-win collaborations among teachers and researchers. **R. Stowe**, **E.J. Yezierski**

12:05 115. Implementing effective chemistry education practices. **R.D. Sweeder**, D.G. Herrington, O. Crandell

12:25 Closing Remarks.

BRWN
3102

Extended Reality in Chemistry Education

L. Wright Ward, *Organizer*
E. Echeverri, *Presiding*

8:00 Introductory Remarks.

8:05 186. Interdisciplinary collaboration: The key for a successful immersive educational experience. **D. Venegas**, **H. Gutiérrez**

8:25 187. Mobile Augmented Reality: a new way to train in the chemical lab!. **j. dominguez alfaro**, P. Van Puyvelde

8:45 188. Using Augmented and Virtual Reality to Enhance Students' Visualization and Understanding of Molecular Structures. **S. Dalili**, M. Abdinejad, H. Qorbani

9:05 189. Eye tracking and AR in an experimental setting. **S. Syskowski**, J. Huwer

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 190. Development and Exploration of a Virtual Reality Learning Environment (VRLE) build around a novel model to extract, represent, and predict Cycloaddition Reactions. **E. Echeverri**, M. Oliver-Hoyo

11:25 191. A Mobile Augmented Reality (AR) Application for Visualizing Molecular Symmetry and Orbitals. M. Zambri, **J. De Backere**

11:45 192. Making Virtual Reality a Reality in the Biochemistry Classroom. **D.A. Jackson**, C. Yu, K. Belozerov

12:05 193. Withdrawn

12:25 Closing Remarks.

BRWN
3100

Favorite half-hour lab experiments

G. Lisensky, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 207. A Quick and Easy Electroless Deposition and Alkanethiol Treatment to Form a Superhydrophobic Surface. **G. Lisensky**

8:25 208. Measuring the molar mass of air. **D.J. Campbell**

8:45 209. Beaker batteries: Making electrochemical cells to better understand battery chemistry and components. **L.J. Lyons**

9:05 210. Identifying Solutions by Chemical Properties. **L. Hansen**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 211. Demystifying source modulation-lock-in amplification in chemical instrumentation: a short experiment. **L.R. Sharpe**

11:25 212. The Firestarter. A Classroom Demo of Adiabatic Compression. **N.E. Schlotter**

11:45 213. A Series of NGSS Aligned Acid-Base Chemistry Activities for Second Grade Students. **A. Alveshere**, R. Waterman

12:05 Panel Discussion.

12:25 Closing Remarks.

STEW
307

Well thats interesting! Emergent results, unexpected findings, and new areas for research

M. Herridge, N. M. James, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 305. Leveraging Social Comparisons: an Exploratory Study of How Students Self-Evaluate in Peer Review Settings. **S. Berg**, A.C. Moon

8:25 306. The Lemonade Tastes Good: Co-teaching the Methods Course for the Benefit of the Students. **J.R. Pribyl**, L.A. Senden

8:45 307. A Side Trip into Work orientation and Chemistry Teacher Longevity: What the Covid-19 pandemic might have to teach us. **S.B. Boesdorfer**

9:05 308. How Prompt Iteration Can Affect Student's Explanations of an Intramolecular Reaction Mechanism. **S. Houchlei**, M. Cooper

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 309. Student Resource Use in Introductory Chemistry and the Impacts of COVID-19. **L.C. Williams**, J.N. Orvis, S. Melvin

11:25 310. Online Learning and study habits: Perspectives from three universities in Spain and the UK. **S. Fergus**, A. Notario, Y. Diaz, R. Blackburn, D. Williams

11:45 311. The forgotten materiality of chemical education: A research and teaching opportunity. **D.J. Wink**

12:05 Panel Discussion.

12:25 Closing Remarks.

PMU
North Ballroom

General Posters 1

M. T. van Opstal , *Organizer, Presiding*

9:30 - 10:30

312. Teaching Chemistry Outside of the Text. **D. Ventura**

313. Chemical composition of copper-tin-aluminum alloys from a system of three equations in three variables via non-destructive sample analysis. **A. Van Sertima**, S. Simmons, R. Zablah-Vasquez, A. Villalta-Cerdas

314. Emphasizing Student success wtih /collaborative Learning Strategies Utilizing the Study cycle in a Hybrid General Chemistry I Course. **M.H. Benko**

315. Withdrawn

316. Case Studies of Using McGuire's "Teach Students How to Learn" Intervention to Successfully Decrease DFW Rates in General Chemistry I. **S.R. Trevino**

317. Encouraging Argumentation on Chemistry Education with an Interrupted Case Study. **M. Silva de Lima**, D. Gomes Lima dos Santos, S. Queiroz

318. Computational chemistry assisting the identification of polymers. **C. Salter**

319. Flipped Classroom Approached in Chemistry Classes. **R.S. Perera**

320. The Improvements for Interpretation of the Law of Definite Proportions in Science Textbooks in Korea. **H. Kim**, H. Lee

321. Photoacoustic Demonstration: Making Music with Light. **H. Park**

322. The Cognitive Load of Significant Figures. **R. Britt**, T. Jones, M. Weinrich

323. How does problem-solving with organic chemistry molecules literally look like?. **A. Langner**, N. Graulich

324. Merging Organic and General Chemistry in a Four Semester Chemistry Curriculum. **T.F. Doherty**, X. Prat-Resina

325. Alginate encapsulation preserves enzyme activity in an oxidative environment. A.A. Lee, E.D. Gervasio, S.A. Musso, A.A. Maalouf, R. Hughes, **E.M. Woolridge**

326. Student Conceptions of pH Buffers using Resource and Reasoning Frameworks. **M.A. Sheppard**, C.F. Bauer

327. Introducing Postdoctoral Scholars to Careers at Primarily Undergraduate Institutions through a Visiting Seminar Program. **J.E. Mihalick**, E. Winterrowd

328. Active Learning Approaches in Large Enrollment Organic Chemistry Course. **A. Frantz**

329. Specifications Grading as a Catalyst for Mastery Learning in Organic Chemistry Courses. **D.T. Fujito**

330. Student Perceptions of Hybrid Labs: Changes in Attitudes Toward Chemistry. **E.B. Mobley**, H.G. Sturtevant, A. Anderson-Wile

331. Demonstrating bacterial resistance to antibiotics. **D. Marous**, C. DeWeese, R. Boyette

332. Using the M-ASSIST (modified approaches and study skills inventory) to probe student study-related behaviors. **J.N. Orvis**, E. Johnson

333. The ACS Committee on Community Activities (CCA): Resources for outreach and public engagement. **L.R. Stepan**, **W.J. Doria**

334. Development of Interactive Tutorials to Improve Course Outcomes in a High-Enrollment General Chemistry Course. E. Olson, **T.L. Vickrey**, M.A. Griep, M. Balabanoff, J.A. Kautz, E.G. Malina

335. Do case studies help students understand the relevance of chemistry?. **A. Glass**

336. A card game for reviewing chemical instrumentation. **K.K. Cline**

337. Contemporary Chemists Project. **R.C. Dudek**

338. The corundum rainbow: Designing a computational experiment as an introduction to solid state chemistry. **S. Parrott**

339. Chemists as voters: Pedagogical strategies to improve student democratic participation. **B.G. Trogden**

340. An Inquiry-Based Comparative Analysis of Salt Content in Food for Quantitative Analysis Laboratory. **E.M. McCorquodale**, K. Fogarty

341. Laboratory Report Scaffolding. **K. McElhoney**

342. Context Matters: Evaluating the effects that integrating context into POGIL curricula had on students achieving content proficiency in a general chemistry course. **G.D. Ibarrola Recalde**, D. King

343. Outcomes and experiences from a faculty fellows program on Three-Dimensional Learning. **D.C. Chatfield**, **M. Delgado**, **M.M. Gillespie**, **P. Graves**, **R. López de la Vega**, U. Swamy, S.M. Underwood, J.H. Carmel

344. A Workshop CURE: The UIC STEM Initiative CoLab Program. **A. Wierzchowski**

STEW
206

Engaging Students in Analytical Chemistry - Classroom Practices and Learning Environments

L. Mier, M. Queen, *Organizers, Presiding*

11:00 Introductory Remarks.

11:05 345. Effects of modalities on student performance in an introductory analytical chemistry course. **E. Kwong**

11:25 346. Just-in-Time Videos and Mini-Case Studies to Engage and Prepare Students for a Classic Quant Lab. **C.A. Lucy**, J.J. Harynuk

11:45 347. Take-Home Examinations for Analytical Chemistry Courses to Evaluate and Enhance Learning. **A. Jacobs**

12:05 348. Equity is paramount: making analytical chemistry accessible to blind and vision impaired students. **A.M. Palmer**, A.A. Hill

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 349. Build a Spectrometer Lab: Construct and characterize a spectrometer with interchangeable parts. **A.D. Gift**, J.A. Godek

2:25 350. 'Tis the Season for Measuring pH in a Project-Based Quantitative Analysis Course. **M. Queen**

2:45 351. Incorporating scientific instrumentation design into the Analytical Chemistry curriculum. **B.J. LeSuer**

3:05 352. Using Paper Microfluidics as a Platform for Increasing Inquiry in the Analytical Laboratory. **K. Frederick**, A.L. Van Wyk, R.S. Cole, M. Lieberman, R. Roller

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 353. Choose Your Own Adventure in the Instrumental Analysis Laboratory. **K.H. Fogarty**, E.M. McCorquodale

4:10 354. Environmental Chemistry Virtual Research Project for Quantitative Analysis. **K.C. Lanigan**

4:30 355. Leveraging Pack Mentality to Unleash Student Engagement in Instrumental Analysis. **K. Proctor**

4:50 356. Harmonizing the Grammar for Scaled Measures of Concentration. **D.E. Thompson**

5:10 Closing Remarks.

STEW
311

Research Investigations in STEM Identity in Chemistry Learning Environments

J. H. Carmel, M. L. Head, *Organizers, Presiding*

11:00 Introductory Remarks.

11:05 357. Validation and pilot use of social capital and chemistry identity survey instruments at a Hispanic-serving institution. **G. Castano**

11:25 358. Characterizing power structures: using positionality theory to develop a chemistry classroom observation protocol. **G. Castano**

11:45 359. Dimensionality of Sense of Belonging in First-Year Chemistry Students. **J. Young**, S.E. Lewis

12:05 Panel Discussion.

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 360. Exploring the relationship between a student's STEM professional identity and their perception and performance in the chemistry laboratory – An analysis across the chemistry curriculum. **M.L. Head**, G. Taasoobshirazi, K.J. Linenberger Cortes, D. Dayani

2:25 361. The Effect of Curricular Intensity on STEM Identity, Academic Persistence, and College Major Stratification. **C.L. Aronson**, **K.R. Black**

2:45 362. Post-Secondary URM STEM Students' Perceptions of Their Science Identity. **S. Nealy**, M. Orgill

3:05 Panel Discussion.

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 363. An S-STEM cohort and activities to foster scientist identity and sense of belonging in chemistry and biochemistry majors. **M.G. Grunert Kowalske**, J.M. Ribble

4:10 364. Using Pen Pals to Normalize Struggle in General Chemistry. **K. Reiser**, M. Weinrich

4:30 365. Understanding the experiences of marginalized women pursuing doctoral degrees in chemistry. **T. Jones**, J.M. Pratt, M. Popova

4:50 Panel Discussion.

5:10 Closing Remarks.

WALC
2051

Teaching Chemistry through Art and Archaeology

K. L. Braun, K. Jansen Labby, *Organizers, Presiding*

11:00 Introductory Remarks.

11:05 366. Using Art and Archaeology to Demonstrate the Chemistry of Materials in a General Education Course. **J.E. Mihalick**

11:25 367. Taking the Show on the Road: Leveraging Study Abroad to Enhance the Chemistry and Art Curriculum. **M.J. Samide**, A.M. Wilson

11:45 368. Development of learning objectives for a science of art course for non-science majors. **B.G. McBurnett**

12:05 Closing Remarks.

12:10 Lunch.

1:40 Introductory Comments.

1:45 369. Dyeing to Learn Chemistry: Fibers and Dyes in the Chemistry Classroom. **A.H. Gorensek-Benitez**

2:05 370. Curricular Materials on the Chemistry of Pottery, Including Thermodynamic Calculations for Redox Reactions in the 3−Stage Firing Process of Athenian Black− and Red−Figure Vases Produced from the Sixth−Fourth Centuries BCE. **C. Vyhnal**

2:25 371. The Cultural Heritage Science Open Source (CHSOS) database of analytical spectra from archaeological and historical pigments: a free and fun chemistry instructional tool for use in 'chemistry of archaeology and art' courses. **C. Vyhnal**

2:45 372. Synthesis and Analysis of Novel Azo-pigments based on Naphthol AS-G for the Teaching Laboratory. **J.F. Lomax**, S.Q. Lomax

3:05 Closing Comments.

3:10 Break.

3:25 Introductory Comments.

3:30 373. Technical Analysis of Paintings Course and Museum Exhibition. **K. Jansen Labby**, C. Story

3:50 374. Chemistry and Art: An Inquiry Based Travel Course for Non-Science Majors. **C. Theodore**

4:10 375. Using art and archaeology collections to encourage students to find their own voice in the chemistry communication. **P.K. Jue**

4:30 376. Integrating Archaeology and Interdisciplinary Collaborations with Museums throughout the Undergraduate Chemistry Curriculum. **K.L. Braun**

4:50 Panel Discussion.

5:10 Closing Comments.

WALC
2124

Teaching Large Classes

A. Paterno, *Organizer, Presiding*

11:00 Introductory Remarks.

11:05 377. Creating an Environment for Engaging Students in a Large Chemistry Class. **Q. Liu**

11:25 378. Impact of the Pandemic on Student Readiness: Laboratories, Preparedness, and Support. **J. Garcia**, M.H. Towns

11:45 379. Don't drown in resources: know where the lifevest is. **S.M. Taylor**

12:05 380. Varying the timing of content introduction to enhance student performance in undergraduate general chemistry. **A. Howcroft**, D. King

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 381. Using the Chem101 app to Enhance Active Learning in General Chemistry. **A. Paterno**

2:25 382. The role of TA mentors in training graduate TAs for large General Chemistry lecture courses. **M.J. Bojan**, L. Funari

2:45 383. Lessons Learned from "flipping" a large-lecture, General Chemistry Course. **A.M. Powe**

3:05 384. The Use of Technology and Team Teaching in a Large Lecture. **T. Hidalgo**

3:25 Closing Remarks.

3:30 Break.

3:45 Introduction.

3:50 385. Making a large-enrollment class feel smaller: Design and implementation of a new model for introductory chemistry. **K. Welch**, L.M. Columbus, G. Hunger

4:10 386. Assessment and structural strategies for a very large enrollment (1000+), online-only introductory chemistry course. **E. Pelton**

4:30 Panel Discussion.

5:10 Closing Remarks.

BRWN
3102

Community-Based Learning in Chemistry: Implementation, Best Practices, and Evaluation

Y. K. Gorske, *Organizer*
E. Lesher, *Presiding*

2:00 Introductory Remarks.

2:05 387. Chemistry for the community: a multi-semester service learning oriented curriculum. **E. Lesher**, Y.K. Gorske, K.A. Bowe, C.F. Bauer

2:25 388. Community-Engaged Learning in First-year Chemistry. **D.G. Mitchell**

2:45 389. Implementing Environmental Science in Service-Learning Class. **K.M. Deavers**, A. Cutler

3:05 390. Using Creative Exercises (CE) to assess knowledge gains in a multi-year community-based learning (CBL) chemistry curriculum. **Y.K. Gorske**, E. Lesher, A.R. Green, K.A. Bowe, C.F. Bauer

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 391. Student perceptions of chemistry service-learning opportunities across multiple semesters. **K.A. Bowe**, A.R. Green, E. Lesher, Y.K. Gorske, C.F. Bauer

4:10 392. Undergraduate Instructional Resources for Performance of Chemical Demonstrations. **J.W. Dumm**

4:30 393. Professional development during COVID: Interactive webinar trainings to support STEM outreach practitioners. **J.M. Pratt**, **M.L. Cole**, **T.R. Ryan**

4:50 394. Sustainable partnerships with community partners in a service-learning chemistry curriculum. **K. Post**, E. Lesher

5:10 Closing Remarks.

STEW
204

COVID Keepers: Positive lessons learned from the pandemic

M. A. Erdmann, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 395. From an emergency pandemic course to an online course: A General Chemistry course in a resource constrained HSI case study. **K. Davila-Diaz**

2:25 396. Lessons learned transitioning High Structure Active Learning (HSAL) in General Chemistry from in-person to remote and back again. **A. Curtis**, **C. Bliem**

2:45 397. Comparing performance disparities in general chemistry courses taught online and in-person. **T.M. Clark**

3:05 Panel Discussion.

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 398. Fact or fiction: Lessons learnt from teaching high school chemistry online. **S. Akaygun**, S. Celik, F.O. Karatas

4:10 399. Pandemic-related gaps in foundational knowledge normally acquired in introductory chemistry courses. **S. Srinivasan**

4:30 Panel Discussion.

5:10 Closing Remarks.

STEW
307

Designing and Implementing Chemistry Learning Environments that Support Students in Connecting Molecular Behavior to Phenomena

T. M. Kuborn, C. Schwarz, R. Stowe, *Organizers*
A. Schafer, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 400. What Are We Saying? A Self-Critical Analysis of the Messages Communicated by Reformed Curricular Materials. **A. Schafer**, R. Stowe

2:25 401. Chemistry Students Development and Revision of Models to Explain Phenomena. **S. Balbach**, T. Kuborn, A. Schafer, C. Schwarz, R. Stowe

2:45 402. Our Model: High School Students' Discourse When Collaboratively Generating Models to Explain Chemical Phenomena. **J. Timmer**

3:05 Panel Discussion.

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 403. There's More Than One Way to Model: Understanding the many ways students use particle-level representations to explain phenomena. **P. Waples**, A. Schafer, T. Kuborn, R. Stowe

4:10 404. Messaging Within The Classroom: When Student Groups Evolve Practices. **T.M. Kuborn**

4:30 Panel Discussion.

5:10 Closing Remarks.

WALC
1132

Jim Spencer Memorial Symposium

R. S. Moog, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 405. A Mentor Model for Undergraduate Research: Life in Jim Spencer's Research Group. **A. Grushow**

2:25 406. Collaborative Writing of POGIL Activities. **L. Trout**

2:45 407. Towards a Best Version of the AP Chemistry Exam: Reflections on the Work of Jim Spencer. **P.D. Price**

3:05 408. Toward the vision of student-centered assessments in General Chemistry. **S. Garrett-Roe**

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 409. The evolution of POGIL-PCL: workshops, materials, and faculty network. **S.S. Hunnicutt**, A. Grushow, M.N. Muniz, R.M. Whitnell

4:10 410. The SPIRAL (Strengthening the use of Process, Inquiry, Reflection, and Application in the Laboratory) Project for first year inquiry laboratory experiments. **A.B. Mahoney**, E.C. Bucholtz, S. Fiddler, M.P. Garoutte, T.A. Herzog, M.D. Perry, C.M. Teague, M.T. van Opstal , G.H. Webster, R.M. Whitnell

4:30 411. Engaging students in physical chemistry. **R.S. Cole**

4:50 412. Jim Spencer: Teacher, scholar, leader, innovator, mentor, friend. **R.S. Moog**

5:10 Closing Remarks.

PMU
North Ballroom

General Posters 2

M. T. van Opstal , *Organizer, Presiding*

5:30 - 6:30

413. Preparation of a dynamic, eight-coordinate, rhenium(V) polyhydride complex; a research-based advanced inorganic laboratory experiment. D.V. Naik, **G.A. Moehring**

414. Exploring green chemistry awareness and knowledge of undergraduates and industrial workers in Lagos metropolis, Nigeria: implications for its integration in school curriculum. **T.E. Owoyemi** , A.M. Akinsete

415. Implementation of Recitations in General Chemistry I Laboratory Courses to Increase Student Performance. C. Lilly, **A.B. Ormond**, **A.A. Carter**, W.J. Powell

416. Evaluations of weekly short metacognitive interventions in first- and second-year chemistry courses. **D.M. Schirch**

417. Chemistry in the kitchen: food-based chemistry labs suitable for in-home exploration. **P.S. Workman**

418. Access to Early Research Opportunities in Inorganic Chemistry. **J.P. Lanorio**

419. Adsorption isotherms, kinetic, and thermodynamic studies of magnetite-charcoal: linearized and non-linearized modeling of experimental data in general chemistry. **R. Zablah-Vasquez**, **S. Simmons**, A. Van Sertima, A. Villalta-Cerdas

420. Learning Chemical Principles with Computational Chemistry: Using Gaussian and GaussView in general chemistry lab and lecture Computer-based activity. **H. Haouari**

421. Student Self-Efficacy Beliefs About NMR Problem-Solving. **S. Kariyawasam Gamage**, J. Cui, S. Mooring

422. Withdrawn

423. The pros and cons of using Jigsaw as a mode of cooperative learning for occupational therapy and biology undergraduate majors in a higher education laboratory setting. **D.S. Derminio**, J. Mirowsky

424. How Students' Perceptions of Faculty Mindset Influences their Motivation, Engagement, and Performance in Introductory Level Chemistry Courses. **R. Kattoum**

425. Student interactions with open-response chemistry tutors. **E. King**, T. Holme, D. Yaron, S. Raysor, M. Benson, J. Sewall, K. Koedinger

426. Determination of five physical constants in the General Chemistry laboratory. **S. Simmons**, L. Hendrickson, A. Villalta-Cerdas

427. Understanding the Learning Gap Between Undergraduate General Chemistry and Organic Chemistry. **T. Williamson**, S. Nedungadi, J.P. Darr, J.A. Conrad, A.D. Gift, A. Miller, D.L. Richter-Egger, E. Tisko

428. Can You Master This?? Initial Attempts at Specifications-based Grading in Introductory Chemistry. **L. Kopff**

429. A Progression on Organic Chemistry Students' Translation Between Reaction Mechanisms and Reaction Coordinate Diagrams about a Set of Acylation Reactions. **K. Barkho**, I. Zaimi, G.V. Szymczak Shultz

430. Workshopping writing skills with interactive 10-minute video lessons. **G. Murray**, M.M. Morgan, E.P. Wagner

431. Instructors' perceptions of the benefits and challenges of systems thinking in chemistry education. **S.E. York**, M. Orgill

432. Creating an Inquiry-Based Lab: Gibbs Free Energy Investigation Using Cobalt(II) Ion. **E.L. Danzeisen**, C.L. Stanford, J.W. Ribblett

433. Undergraduate students value drawing to learn biochemistry. **J. Mitchell**, M. Pennella

434. Chemistry olympiad during COVID pandemic - My experience as the coordinator for the Central MA section. **M. Krishnamurthy**

435. Specifications grading: Learning through mistakes. **T. Eaton**

436. Mastery Quizzes as a Tool for Content Retention in Organic Chemistry. **W.E. Brenzovich**, **E.E. Hardy**, W.G. Hollis

437. The effect of gender identity on chemistry identity: Amplifying nonbinary voices. **V.A. Montalti**, I.M. Lopez, J.H. Carmel

438. Employing research-based teaching practices for enhancing faculty-student engagement. **M. Abdel Latif**, J. Sinutko, E. Nyutu

439. Classroom Activities and Strategies for the Flipped Analytical Chemistry Course. **C. Edwards**

440. A Curriculum Embedded Framework for Metacognitive Development. **S. Gamby**, C.F. Bauer

441. Implementation of Three-Dimensional Learning assessments for in-person, remote and online general chemistry courses. **M.M. Gillespie**, S.M. Underwood, J.H. Carmel

442. The use of perovskite nanocrystals across the chemistry curriculum. **R. Sanchez-Gonzalez**

443. InChI OER. **R.E. Belford**, J. Cuadros, A.P. Cornell, T. Gupta, E.C. Bucholtz

444. Incorporating Spectroscopy Throughout General and Organic Four-Semester Sequence. **D. Marell**, M. Nelson, X. Prat-Resina, D. Butani, T.F. Doherty

TUESDAY

WALC
B066

Beyond Classroom Observation

J. Velasco, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 473. A qualitative study to capture classroom patterns/behaviors based on COPUS. **Y. Muten**, J. Harshman

8:25 474. Student Interaction Discourse Moves: Characterizing and visualizing student discourse patterns. **N.E. States**, **H.T. Nennig**, M. Montgomery, S. Spurgeon, R.S. Cole

8:45 475. Inquiry Into Teacher Practices: A Rasch Based Observational System for Science Classroom. **Y. Chen**, Y. Yin, S.M. Werner, M. Stieff

9:05 476. An Overview of External Review. **R.C. Dudek**, K. Pate

9:25 Closing Remarks.

WALC
3121

Engaging Non-Majors in Introductory Chemistry Courses

M. Mullen Davis, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 565. Superhero science. **S. Pierce**

8:25 566. Using the covid-19 phenomenon to improve students' connection to the nature of science. **G. Kerstiens**

8:45 567. Scientists who change the world. **K. Hess**, L. Burt-Nicolas

9:05 568. Increasing student engagement in a non-major introductory chemistry course by writing children's books. **M. Mullen Davis**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 569. Using themes to engage non-science majors in introductory chemistry: from nuclear and radiochemistry to scientific literacy and the science of superheroes. **B. Shepler**, C.L. Anfuso, R. Simmons

11:25 570. The Chemistry of Art & Color – A Course for the Non-Major. **K. Kostecka**

11:45 571. A well-balanced course: Incorporating collaborative learning and community service into a food chemistry course. **H.V. Clontz**

12:05 572. Development of an Online Chemistry and Sustainability Class for Non-Majors at UW - Green Bay. **J.E. Kabrhel**

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 573. Framing scientific literacy as a pathway to environmental justice. **S. Brown**

2:25 574. Creating authentic learning experiences in an online non-majors chemistry lab. **U. Swamy**

2:45 575. Building a brain: helping pre-service elementary teachers find their place in science education. **K. Rust**

3:05 576. Life is a candle: Connecting chemistry and philosophy in a cross-disciplinary learning community for undergraduate science majors. **B.G. McBurnett**, P. Lewis

3:25 Closing Remarks.

WALC
3090

Present and Future Directions in Organic Chemistry Laboratory Courses

C. S. Callam, N. M. Paul, *Organizers, Presiding*

8:00 Introduction.

8:05 609. Choose-Your-Own-Adventure Virtual Organic Chemistry Labs Through the Story-Game Program Twine. **S. Saluga**, H. Peacock, D. Seith, R.D. Link

8:25 610. How a Journal of Chemical Education article changed my perspective on Organic laboratory experiments 34 years ago, and what I've done in my labs since. **B.A. Hathaway**

8:45 611. Leveraging Undergraduate Learning Assistants for the Return to In-Person Labs. **J. Griffin**, P. Lopez, R.D. Link

9:05 Panel Discussion.

9:25 Closing Remarks.

9:30 Break.

11:00 Introduction.

11:05 612. Computer-Aided Drug Design for the OChem Lab Using Accessible Molecular Modeling Tools. **R.J. Yoder**

11:25 613. A colorful comparison of in person vs. distance learning assessment in an Organic Chemistry Extraction Laboratory. **M. Grimminger**

11:45 614. Multiple short polymer experiments for the undergraduate organic chemistry laboratory. **M.R. Korn**, M.F. Scilley

12:05 Panel Discussion.

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introduction.

2:05 615. Evaluating reaction conditions for the Buchwald-Hartwig coupling. **N.J. Hill**

2:25 616. Synthesis of 4-(Dimethylamino)benzyl Alcohol via Vilsmeier-Haack Formylation Reaction. An Organic Chemistry Laboratory Experiment for Upper-Division Undergraduate Students. **V.A. Sichula**

2:45 617. Photocatalytic Isomerization of (E)-2-nitrocinnamaldehyde Using an Inexpensive Open-Source Photoreactor. P. Lampkin, A. Xu, B.J. Esselman, **N.J. Hill**

3:05 Panel Discussion.

3:25 Closing Remarks.

STEW
302

Active Learning in Organic Chemistry

A. Leontyev, *Organizer*
M. D. Casselman, V. M. Maloney, J. L. Muzyka, C. Welder, *Presiding*

8:00 Introductory Remarks.

8:05 445. Active Learning in Organic Chemistry: Let the adventure begin!. **S.M. Strickland**

8:25 446. Transparent Teaching in Organic Chemistry. **M. Kelley**

8:45 447. Active-learning and Traditional Lecture Outcomes – A Direct Comparison in a Transformed Learning Environment, Part 1. **B.J. Esselman**, R. Stowe, A. Ellison, J. Martell, E.D. Greenhalgh, K. DeGlopper, C. Schwarz, N.J. Ellias

9:05 448. Active-learning and traditional lecture outcomes – A direct comparison in a transformed learning environment, Part 2. **C. Schwarz**, K. DeGlopper, N.J. Ellias, R. Stowe, B.J. Esselman, A. Ellison, J. Martell, E.D. Greenhalgh

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 449. Organic Chemistry Successes and Failures– Sustaining relevance, Teaching for equity, Useful resources. **A. Steelman**

11:25 450. Everything Is Connected: Teaching Organic Chemistry as a Unified Story through Mechanisms, A Mechanistic Approach to the Organic Chemistry Curriculum Based on Patterns of Electron Flow. **R.N. Salvatore**

11:45 451. Solicited and Unsolicited Use of Molecular Models in the Organic Chemistry Curriculum. **M. Nelson**, D. Butani, D. Xue

12:05 452. Simulated Drug-Discovery Workshops: Development of a C/PBL activity that replicates the hit-to-lead optimization process in a classroom environment. **R. Blackburn**, S. Flower

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 453. Using Distractor Analysis and Backward Design to craft a new activity on Structural Isomerism. **A.M. Pesce**, D. King

2:25 454. Create, Share, Solve: promoting engagement & collaborative learning through group crossword puzzle tasks. **R.J. Pearson**

2:45 455. It's not just me! Using international partnerships to maintain active learning during the global pandemic. **M.T. Wentzel**, B. McCollum, L.A. Morsch, M. Gelata, H. Hussen

3:05 456. Collaborative Exams – Active Learning on Test Day. **G.E. Ferris**, J.M. Karty

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 457. Flipping a two-semester organic chemistry sequence to reduce DFW rates and support instruction during the pandemic. **D.M. Schirch**

4:10 458. Gathering resources and planning for a foolproof flipped classroom. **L. Starkey**

4:30 459. Use of iClicker for flipped organic chemistry courses for in-person, online, and HyFlex classes. **J.M. Leslie**

4:50 460. How active learning practices improved academic performance in Sophomore Organic Chemistry in spite of 2020: A Comparison of Fall 2019 and Fall 2021. **C. Serrano**

5:10 Closing Remarks.

WALC
2007

Biochemistry Education: Discussions of the lecture learning environment

R. Austin, T. A. Murray, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 477. Protein of the Year: Assessing skill-development in Biochemistry. **K. Culhane**

8:25 478. Building science identity one hemoglobin molecule at a time. **C.J. Conway**, K. Boyle

8:45 479. Engaging students in scientific literature review and structure visualization through the writing of molecular case studies. **E. Pollock**, K. Riley, D. Vardar-Ulu, S. Dutta

9:05 480. Fostering intellectual equity in an introductory biological chemistry course by engaging student-created activities. **S. Testa**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 481. Enacting team-based learning in upper-division biochemistry lecture courses: Key considerations and evidence of success. **E. Offerdahl**, J. Woodbury, J. Arneson

11:25 482. Integrating best practices into a Biochemistry course to create a student-centered classroom. **K. Slade**

11:45 483. Utilizing active learning strategies to enhance student understanding of foundational concepts in biochemistry. **M. Kopecki-Fjetland**

12:05 Panel Discussion.

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 484. Teaching carbohydrate metabolism in biochemistry using contemporary examples of synthetic and natural sweeteners. **A.E. Shinnar**

2:25 485. Integrating contextualization, scaffolding and active learning: A trifecta approach in enhancing health science students' cognition and affect towards biochemistry. **K. Fernandez**, C. Thompson, N. Samarawickrema, T. Overton

2:45 486. Gamifying Biochemistry: Do games support student learning?. **D. Emmert**

3:05 Panel Discussion.

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 487. Demonstrating biochemical mechanisms using student movement. **M. Mullen Davis**

4:10 488. Connecting the Dots: Students' Mental Organization and Storage of Biochemistry Visual Literacy Skills. **C. Terrell**, A. Aguirre Lopez, V. Andrade, N.A.

Bobick, J. Contreras Vital, A. Erickson, C. Fondie, A. Lawrence, C. Morin, X. Prat-Resina

4:30 489. Incorporating "Molecular Case Studies" into large biochemistry courses. **D. Vardar-Ulu**, A. Lebov, E. Pollock, S. Dutta

4:50 Panel Discussion.

5:10 Closing Remarks.

STEW
311

Building Momentum for Systemic Change (#AdvancingEquityinCER)

S. M. Werner, *Organizer*
M. E. Howe, V. R. Ralph, C. Stachl, *Presiding*

8:00 Introductory Remarks.

8:05 490. A broader take on Trigwell and Prosser's conceptions of teaching and learning: relating instructors' thoughts on diversity in higher education to their conceptions of teaching and learning. **A. Heidbrink**, N. Suarez, S.M. Lo

8:25 491. A seminar series that enhances a chemistry degree by supporting students and developing their soft skills. **M.A. Vanalstine-Parris**

8:45 492. An Interdisciplinary Peer-Mentoring Program to Promote Inclusive Teaching Practices at a Small Liberal Arts College. **J. Fishovitz**, M. Schaeffer, J. Coblentz, S. Mancino, R. Rohatgi

9:05 493. Elements of equity and opportunities for equitable reform in chemistry instruction. **A. Margiotta**, C.E. Brown

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 494. Examining the STEM institution from the perspective of parenting women in STEM doctoral programs: An Institutional Ethnography. **C.E. Wright**

11:25 495. Graduate Student Women's Perceptions of Faculty Careers in Chemistry. **M.E. Howe**, M.M. Kim, S. Pazicni

11:45 496. STEM Career Perceptions of Black/African American, Latina/o/x, and Puerto Rican Graduate Students. **J.M. Ribble**

12:05 Panel Discussion.

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 497. For whom do we design? Considering culture, reflexivity, and partnership within the design process. **J.L. Spencer**, D.N. Maxwell, G.V. Szymczak Shultz

2:25 498. Caught between two worlds: Graduate school for Black and Latinx STEM students at PWIs. **M.G. Grunert Kowalske**

2:45 499. Navigating within the Borderlands: Experiences of Historically Marginalized Graduate Students within a Chemistry Doctoral Program. **J.E. Nardo**

3:05 500. Professional, Inclusive, Engaged, and Research-Based Reforms in Science, Technology, Engineering, and Mathematics. **V.R. Ralph**

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 501. How Individual Change Can Build Momentum for Systemic Change. **J. Tashiro**, V. Talanquer

4:10 502. Making invisible work visible and valued: creating a model to measure and report the impact of invisible work in academia. **S. Jilani**

4:30 503. Unfreezing equity for general chemistry curriculum and instructional reform. **T. Pesavento**, **S. Pazicni**, S. Block, J. Moore, J.M. Trate, E. Garand, J. Zhou

4:50 504. Course redesign for inclusive excellence: a framework for engagement. **S.L. Debbert**

5:10 Closing Remarks.

WALC
B058

Chemistry Education Research: Graduate Student Research Symposium

M. Connor, O. Crandell, *Organizers, Presiding*
C. G. Carlson, E. L. Day, M. Herridge, S. Houchlei, Y. Liu, M. Popova, T. Qu, P. Vincent-Ruz, L. Wright Ward, *Presiding*

8:00 Introductory Remarks.

8:05 505. Characterizing Chemistry Students' Domain-General Symmetry Knowledge. **A. Sangha**, S. Pazicni

8:25 506. Qualitative investigation of student attention to molecular structure features when prompted to consider symmetry. **R. Morgenstern**, S. Pazicni

8:45 507. Unprompted Student Gestures in a Model-Based Inorganic Symmetry Activity. **J.J. Markut**, D.J. Wink

9:05 508. Emphasizing the role of coordination class theory on the study of student learning with representations. **S. Spurgeon**, M. Stieff

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 509. Presenting a Progression on Organic Chemistry Students' Translation between Reaction Mechanisms and Reaction Coordinate Diagrams. **I. Zaimi**, K. Barkho, G.V. Szymczak Shultz

11:25 510. General Chemistry Students' Data Analysis and Interpretation of Graphical Data. **S. Berg**, A.C. Moon

11:45 511. Understanding how changing molecular representations impact students' process of predicting the location of strongest intermolecular forces. **A. Farheen**, H.T. Nguyen, S.E. Lewis

12:05 512. Using eye-tracking technology to measure three kinds of cognitive load during organic chemistry problem-solving. **Y. Lu**, J.J. Stewart

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 513. Investigating STEM student responses to the PISQ-5D survey: A mixed methods approach. **C. Bechard**, T. Legron-Rodriguez, N. Lapeyrouse

2:25 514. Measuring the graduate school self-efficacy of Latinx undergraduates. **J.L. Rivera-Colon**, M.E. Howe, S. Pazicni

2:45 515. Exploring achievement emotions of general chemistry students. **A. Graves**, C.E. Brown

3:05 516. Student Experience in the UIC STEM Initiative CoLab Program. **A. Wierzchowski**

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 517. Cognitive Engagement in Small-Group General Chemistry Activities: Application of Qualitative Content Analysis and the ICAP Framework to Group Conversations. **S. El-Mansy**, J. Barbera, A. Hartig

4:10 518. A literature review of studies analyzing chemistry textbooks. **Z.L. Bunch**, B. Thompson, M. Popova

4:30 519. Development of Rubrics for Evaluating Students' Data Analysis and Interpretation. **M.T. Urbanek**, B. Couch, L. Prevost, A.C. Moon

4:50 520. Student expectations, buy-in, and engagement in lower division undergraduate chemistry labs. **E.B. Vaughan**, J. Barbera

5:10 Closing Remarks.

WALC

B058

Computational Chemistry in the Classroom

J. B. Dudek, A. N. Migues, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 521. Overcoming the barriers to using computational chemistry in your classroom. **K.R. Gallagher**

8:25 522. Exploring electron configurations of atoms and ions with WebMO and Gaussian. **K. Range**

8:45 523. Computational chemistry as part of the first-year undergraduate curriculum. **J.B. Foresman**, K. Howard

9:05 524. Introducing computational chemistry to General Chemistry freshmen vs. Physical Chemistry seniors. **D.V. Chulhai**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 525. Computational Exercises in Physical Chemistry: From Gaussian to the WebMO Mobile App. **S.M. Basu**

11:25 526. Blended lab for use in undergraduate chemistry courses: The influence of solvent polarity on the cis-trans isomerization of 4-anilo-4'-nitrobenzene. **A.N. Migues**, J.B. Dudek

11:45 527. Computational Chemistry Calculations of the Molecular Charge Distribution and Dipole Moments of Solvatofluorchromic Dyes for the Physical Chemistry Curriculum. **B. Findley**, R. Pawlaczyk

12:05 528. Withdrawn

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 529. Introducing the dihedral angle of H2O2 through computational chemistry. **C. Salter**

2:25 530. Using computational chemistry to peer through the window at molecules responsible for the greenhouse effect. **L. Tribe**, K.R. Gallagher

2:45 531. Creating your own chemistry simulations is easier than you think. **W.J. Vining**

3:05 532. Using the Compute-to-Learn Pedagogy in Physical and General Chemistry Courses. **H.P. Hendrickson**

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 533. Visualizing potential energy surfaces to deepen chemical understanding. **J.L. Sonnenberg**

4:10 534. Computational Chemistry in the Inorganic Classroom: Using WebMO and Gaussian to Teach Group Theory. **A.C. Davis**, J.M. Smith

4:30 535. Using Computational Software to Model Concepts in Organic Chemistry Lecture. **D.C. Bromfield-Lee**

4:50 Panel Discussion.

5:10 Closing Remarks.

WALC
2051

Culturally Relevant and Inclusive Chemistry Curriculum and Pedagogies

J. L. Muzyka, *Organizer, Presiding*
S. Sanders, L. Winfield, *Presiding*

8:00 Introductory Remarks.

8:05 536. Fostering Diversity and Inclusion and Understanding Implicit Bias in Undergraduate Chemical Education. **A. Nakamura**

8:25 537. Inclusive course design to support student success in organic chemistry: Development, implementation, and evaluation of resources and assessments. **D.A. Turner**

8:45 538. Tips on increasing the diversity, equity, and inclusivity of your chemistry classroom and curriculum. **M. Livezey**

9:05 539. Practical applications of Universal Design for Learning (UDL) in First-year Chemistry. **D.G. Mitchell**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 540. Inclusive Chemistry: Storytelling, Vibranium and Equity. **S.N. Collins**, T. Steele, M. Nelson

11:25 541. Teacher ethnicity: reflections on awareness and representation. **M. Navarro-Camacho**

11:45 542. Creating space for culture in the science classroom: Power dynamic patterns during a classroom-based, culturally relevant research project. **K. Hosbein**, J. Spencer, D.N. Maxwell, G.V. Szymczak Shultz

12:05 Panel Discussion.

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 543. Sign Language Incorporation in Chemistry Education (SLICE): How efforts made to include a few have rippling effects for many. **T. Goudreau Collison**, J. Swartzenberg, A. Sheikh, K. Clark, A. Gleason, C. Cummings, J. Dominguez, M. Mailhot

2:25 544. Challenges and Removing Barriers in the Undergraduate Chemistry Curriculum for Blind and Low Vision Students. **A.T. DAgostino**

2:45 545. Course-level social belonging: Effects on student performance and persistence in General Chemistry. **R. Frey**, A. Fink, J. Edwards

3:05 546. A Comparison of Perceptions of Chemistry and Chemistry Self-Efficacy among General Chemistry Students from Two Settings. **S.B. Wilson**

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 547. Curating Connections between the Chemistry Curriculum and Student's Lives. **S. Sanders**

4:10 548. Linking chemistry to the community: Integration of culturally-responsive teaching into general chemistry I laboratory. **A.J. Winstead**

4:30 549. Using environmental chemistry to engage students in scientific thinking while affirming their cultural context. **J.L. Spencer**, D.N. Maxwell, L. Nicholas-Figueroa, K.A. Pratt, G.V. Szymczak Shultz

4:50 550. Incorporating inclusive teaching practices in the design of a course-based undergraduate research experience in polymer chemistry. **A. Abdulahad**

5:10 Closing Remarks.

WALC
B093

Disrupting Grading

R. D. Link, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 551. Specifications Grading in Organic Chemistry. **J.L. Muzyka**

8:25 552. How To Earn Your Specs Grading Retakes (So That You Won't Need Them). **J.R. Ring**

8:45 553. And the points don't matter: Specifications grading in a summer accelerated organic lecture course. **R.D. Link**

9:05 Panel Discussion.

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 554. Specifications-based Grading in Intermediate Organic Chemistry. **S. Zingales**

11:25 555. A grading system for organic chemistry to focus student learning and reduce student stress. **F.M. Rossi**

11:45 556. Ungraded in Organic I: Lessons and Suggestions. **T.D. Gaines**

12:05 557. Adaptive grading: Using a simple R script to more fairly and equitably assign grades in organic chemistry. **S.M. King**

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 558. An Integrated Approach to Grading Using Peer Learning Assistants to Facilitate Mastery of Course Outcomes. **D.A. Barr**

2:25 559. A flipped classroom with (almost) mastering learning, learning outcomes assessments, and equity grading. **J. Collins**

2:45 560. Specifications Grading and Practical Examination in Organic Chemistry I Lab at Trine University. **D.A. Quist**, **S.B. Dulaney**

3:05 561. How Student Buy-In to Specifications Grading Changes Throughout a Term. **W.J. Howitz**

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 562. Leaving exams behind: Presentations as assessment. **S.S. Hunnicutt**

4:10 563. Hybrid Grading Methods in Organic Chemistry. **L.J. Martin**

4:30 564. Group and Speed-Dating Models for Cooperative Formative Exams. **P. Smith**, **R. Clark**

4:50 Panel Discussion.

5:10 Closing Remarks.

STEW
306

General Chemistry Lab: Curriculum and Best Practices

J. Maeyer, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 593. Design, Management, and Implementation Strategies in General Chemistry Labs. **C. Rezsnyak**

8:25 594. Characterizing student engagement with scientific practices in a project-based, cooperative general chemistry laboratory. **O.H. Judd**, D.E. Blumling, B. Boardman, C.A. Hughey

8:45 595. Linking Core Concepts and Competencies: Towards An Integrated Framework for General Chemistry. **S.A. Reid**, V.S. Vyas

9:05 596. Designing new undergraduate teaching labs at Arizona State University (ASU) to support pedagogical improvements in general chemistry instruction. **B. Smith**, R. Briggs, S. Sendler

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 597. Best practices for teaching general chemistry lab at a diverse, minority serving institution. **m. khural**

11:25 598. Student-based Experimental Design in the General Chemistry Lab: Use of the Scientific Process to Propose New Labs Highlighting the Chemistry Underlying Global Environmental Challenges. **K. Connelly**, A. Prasad

11:45 599. What Comes Next: Increasing Use of Instrumentation and Recurring Chemical Systems of Study to Serve Students Staying in STEM. **S. Block**, P. Doolittle, B.J. Esselman, E. Garand, L. Gustin, S. Pazicni

12:05 600. Teaching thermochemistry through experiments and demonstrations. **A.E. Shinnar**, M. Weitz, R. Bienenstock

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 601. The Use of a Lab Practical as a Formative and Summative Assessment. **E. Marlier**

2:25 602. General chemistry lab practicals at Augusta University. **S.A. Myers**, A.C. Spencer, C. Eidell

2:45 603. Microsoft Excel in the General Chemistry Laboratory. **K. McElhoney**

3:05 604. Eliminating reports in general chemistry lab: Using small assignments to teach and assess understanding. **J. Maeyer**

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 605. Computer-Assisted Lab Experiments in a Two-Year College Setting. **R. Fealy**, **M. Michalovic**

4:10 606. Adapting the Classics: New Calorimetry and Concentration Determination Experiments. **C.J. Sobers**, J. Harrell, D. Garandouka, A. Sahoo, A. Karagiannis, O. Kucukosman

4:30 607. So what if my lab looks like a stock photo for chemistry: Food dyes and HPLC in the general chemistry laboratory. **G.R. Wyllie**, S. Palme, A.H. Johnson

4:50 608. A Libretexts based electronic lab manual involving IOT enhanced experiments connected to Google workbooks. **L. Poirot**, E. Lisitsyna, R.E. Belford

5:10 Closing Remarks.

BRWN
3102

An Early CURE: Course Based Undergraduate Research Experiences in General Chemistry.

G. R. Wyllie, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 461. What's in your water? A CURE for general chemistry students. **D. Behmke**

8:25 462. Brewing up engagement in the General Chemistry laboratory: a semester-long pre-CURE course focused on the chemistry of beer. **D.E. Blumling**, C.A. Hughey, B. Boardman, O.H. Judd

8:45 463. A scaffolded gold nanoparticle CURE in a general chemistry laboratory. **K.L. Stone**

9:05 464. Including X-ray diffraction in traditional and research-based undergraduate chemistry labs. **P. Woodward**, T.M. Clark, T. Weaver, R.A. Ricciardo

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 465. Remediation of metal ions using modified cellulose - A first semester general chemistry CURE project. **J.A. Conrad**, S. Kerkman

11:25 466. Creating a connected CURE - linking student research teams in general chemistry across space and time. **G.R. Wyllie**

11:45 Panel Discussion.

12:25 Closing Remarks.

WALC
1055

Assessment and Measurement in Research and Practice

K. L. Murphy, J. R. Raker, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 467. How does an early math review impact a student's arithmetic skills and performance in first-semester general chemistry?. T.E. Alivio, E. Howard, B. Mamiya, **V.M. Williamson**

8:25 468. Item analysis of Math up Skills Test (MUST) questions after an early math review in a first-semester general chemistry class. **T.E. Alivio**, C.E. Galloway, B. Mamiya, V.M. Williamson

8:45 469. Math skills, GPA, and first exam scores: Predictors of success in first-semester Organic Chemistry. **K. Lee**, B. Rix

9:05 Panel Discussion.

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 470. Using a web-based STEM assessment platform in a controlled environment to administer General Chemistry examinations efficiently and securely for a large, multi-sectional class. **J.C. Rienstra-Kiracofe**, D. Steffen, B. Carmichael, M. Miller, C. Wright, W. Grauvogel, A. Poore, N. Pizzala

11:25 471. Construction and Assessment of Cumulative Final Exams in General Chemistry. **C. Rezsnyak**

11:45 472. The Impact Online, Standards-based Homework Assignments have on Student Homework Completion and Academic Self-Reflection in a High School Science Classroom. **C. Evans**

12:05 Panel Discussion.

12:25 Closing Remarks.

WALC
1018

Evidence-based Instructional Practices: Claims, evidence, reasoning (CER) and Argument-driven inquiry

K. E. Carrigan, A. Modic, M. Orgill, S. Pazicni, *Organizers*
J. P. Walker, *Presiding*

8:00 Introductory Remarks.

8:05 577. The Argument-Driven Inquiry instructional model: A brief overview, its origin, and some ways it has been refined over time. **V. Sampson**

8:25 578. Research on student learning during Argument-Driven Inquiry: Some findings from studies conducted in middle and high school classrooms. **V. Sampson**

8:45 579. Laboratory Learning and Research: 10-years of research on Argument-driven inquiry in post-secondary education. **J.P. Walker**

9:05 580. The transformation of introductory science laboratories from traditional to Argument-Driven Inquiry at East Carolina University: Avoiding barriers for successful large-scale change. **K. Hosbein**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 581. Hybrid ADI-SWH Labs: Bringing together the best of both worlds. **D.I. Del Carlo**

11:25 582. Loose in the Lab? Inquiry Implementation in the High School Classroom. **A. Modic**

11:45 583. Argument Driven Inquiry with a theme and specifications grading in general chemistry laboratory. **K.D. Edwards**

12:05 584. Implementing argumentation sessions in an upper division laboratory course. **M.N. van Staveren**, L. Kesner

12:25 Closing Remarks.

BRWN
1154

Gateways to success: Initiatives and programs to support STEM diversity

V. L. Miller, C. P. Schick, P. M. Takahara, *Organizers*
L. J. Anna, *Organizer, Presiding*

8:00 Opening Remarks.

8:05 585. NASA Day Events Promote Science in the Community. **C. White**

8:25 586. Teaching Chemistry to Underrepresented Middle School Students in an Informal STEM Program. **M. McColgan**

8:45 587. Design of a STEM Workshop Focused on Natural Products for Middle School and High School Students. **H. Albright**

9:05 588. Strategies Aimed at Increasing Chemistry Undergraduate Enrollment. **T. Porter**, E.C. Long

9:25 Closing Remarks.

9:30 Break.

11:00 Opening Remarks.

11:05 589. Exploring alternative preparation and co-requisite support course models to open the gate to general chemistry. **L.J. Anna**, V.L. Miller

11:25 590. A Different Flavor of 'Swirl': Supporting Instructors Teaching Gateway STEM Courses Across Institutions. **E.A. Boyd**, B.G. Trogden, S. Stefl, K.A. High

11:45 591. The Ramps-into-Research Collaboration: a Pilot-Project of the STEM Center at Sam Houston State University. **D.E. Thompson**, F. Yildiz, T.M. Trad, K. Trotter

12:05 592. Withdrawn

12:25 Closing Remarks.

BRWN
3100

Project Orientated Undergraduate Lab Design

A. L. Courtney, R. Loy, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 618. Towards Course Based Undergraduate Research in Advanced General Chemistry Laboratory. **J. Nelson**, B. Abrams

8:25 619. Project-oriented lab design to integrate drug discovery research methods into the organic chemistry laboratory. **A.L. Courtney**, K. Bushell

8:45 620. Organic Chemistry Laboratory Capstone Projects. **R. Loy**

9:05 Panel Discussion.

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 621. A two-stage project orientated redesign of an introductory biochemistry laboratory. **D. Vardar-Ulu**

11:25 622. High Point University Advanced Topics Laboratories: Interdisciplinary Lab Courses Designed to Engage Students with Cutting-Edge Topics and Laboratory Experiences. **B. Augustine**, M.S. Blackledge, P.M. Lundin, K.H. Fogarty

11:45 623. Investigations of nanoparticle applications: An undergraduate experiment probing filtration effectiveness of Acid Prepared Mesoporous Spheres (APMS). **M. DiPinto**, C.C. Landry

12:05 Panel Discussion.

12:25 Closing Remarks.

BRWN
3104

Using Eye-tracking technology as a magnifying glass to investigate learners' cognition

M. Atkinson, S. J. Hansen, K. L. Havanki, J. R. Vandenplas, M. Weinrich, *Organizers*
N. Graulich, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 624. Investigating undergraduate organic chemistry students' use of cognitive resources during stereochemical tasks through eye tracking. **A. Corrales**, A.S. Allen, M. Atkinson

8:25 625. "I've derived them logically": Exploring students' drawing processes of resonance structures in organic chemistry via eye-tracking. **I. Braun**, A. Langner, N. Graulich

8:45 626. Modifying Particulate-level Animations Using Eye-tracking Technology. **S. Akaygun**, J.R. Vandenplas

9:05 Panel Discussion.

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 627. Using eye-tracking to investigate the task dependency of visual attention during cognitive tasks in organic chemistry. **K.L. Havanki**

11:25 628. How have I solved the problem? An eye-gaze augmented retrospective to foster students' comprehension of organic chemical representations. **A. Langner**, N. Graulich

11:45 Panel Discussion.

12:25 Closing Remarks.

PMU
North Ballroom

General Posters 3

M. T. van Opstal , *Organizer, Presiding*

9:30 - 10:30

629. Agar Art as an Instructional Tool to Teach Inducible Promoters via Fluorescence Protein Expression. **L. Jefferies**, A.N. Giordano

630. Computation exercises for undergraduate students to learn about molecular geometry, and formal charges (Freshmen and Sophomore level) as well as Temperature Dependence of Heat Capacity (Junior and Senior) levels. **F.M. Chen**

631. Lessons Learned: Constructing new Chemistry Program Learning Outcomes. **R.M. Kelly**, P. Dirlam, M.R. Radlauer

632. It takes a village to embed interprofessional skills into the chemistry curriculum.. **A.E. Kondo**, J. Fair, M. Benjamin, K. Bohl, R. DeSoto Jackson, M. Hildebrandt, R. Major, H. Molina

633. Barriers to Incorporating More Chemistry Content by Elementary School Teachers. **A. Alveshere**, R. Waterman

634. Launching a middle school STEM academy – lessons learned. **J. Henderleiter**, L. Kasmer, A.L. Masko, K. Pachla, T. Shreiner, J. Vigna, G.D. Warsen, P.W. Yu

635. Investigating English Language Learners Engagement and Challenges in a Process Oriented Guided Inquiry Learning (POGIL) Based General Chemistry Class. **S. Zakher**

636. It's a Square, Nautical Analogy, and the Equilibrium AttraKor: Innovative Tactics to Approach Some Common General Chemistry Topics.. **J.F. Lomax**

637. Development of a multistep synthesis of imrecoxib, rofecoxib and zolimidine as a versatile capstone project for the organic chemistry laboratory. **J.I. Juncosa**, L. Black, W. Turner, T. Martin

638. Impacts of intentional journaling on high school science learners. **C. Evans**

639. Using a cumulative review problem in general chemistry. **M.D. Fritz**

640. Design, Cloning, Expression and Purification of two OprF Epitope Fusion Proteins as Potential Targets for Vaccines against *Pseudomonas aeruginosa*: A Course-Based Undergraduate Research Experience in Biochemistry I. **T. Sucheck**, B. Hoobler, M. Stanley, T. Sullivan

641. Beyond the drawn structures: Investigating students' reasoning with own resonance drawings in organic case comparison tasks. **I. Braun**, N. Graulich

642. Reinforcing linguistic accessibility in chemistry: Developing more equitable assessment items. **A. Stephens**, **A. Pares Alicea**, E. Lee

643. An at-home enzymes kinetics simulation using yeast fermentation. S. Gilpatrick, **S. Dew**

644. Leveraging journal article use in gen chem lab assignments to improve students' study skills. **D. Fisher**

645. Academic Persistence to Graduation: Past, Present, and Future for Undergraduate Students. **C.L. Aronson**, **K.R. Black**

646. Integration of evidence-based learning strategies in chemistry bridge courses at Sam Houston State University. **A. Villalta-Cerdas**, S.L. Hegwood, D.E. Thompson

647. Do students think employer-desired competencies can be developed in online general chemistry labs?. **B. Eggly**, P. Patterson-Lee, L.A. Posey

648. Connections between intermolecular forces and chemical separation/adsorption/purification: An example of teaching forces in liquids and solids by systems thinking. **C. Wang**

649. Impacts of the 2021 and 2022 Active Learning in Organic Chemistry Workshops. S.E. Ruhe, **J. Houseknecht**

650. Understanding Energy Across Disciplines. **M. Kimball**, M. Gosselin, K. Warner, S. Virtue, **T.A. French**

651. Learning the chemistry of ceramics and pottery via a field trip. V. Gupta, S. Kumar, **M. Nigam**

652. Reducing researcher bias: Participant-driven visual representation in qualitative education research. **E.A. Boyd**, K.B. Lazar, M. Voigt

653. Repairing the Reputation of the STEM Teaching Profession through the Use of Get the Facts Out Teacher Recruitment Materials. **J. Breakall**, L. Grande, D. May, W.K. Adams

654. Creating a Forensic Chemistry Capstone for General Chemistry students. **S. Parrott**

655. Investigating supports and barriers in chemistry classroom materials for English Language Learners (ELLs) at a Hispanic Serving Institution. **D.R. Martinez Rioseco**, J.H. Carmel

656. Toward the quantification of serotonin in crayfish hemolymph by gas chromatography - mass spectrometry (GC-MS). E. Lovins, **L.H. Mielke**

657. Engaging Teens in Career Exploration and STEM Leadership through Formal/Informal Education Partnerships. **B. Oatman**

658. Scaffolding a Successful Chemistry Lab Curriculum. **A. Altemose**, E. Lee, A.C. Songok

659. Using Gradescope to Probe Student Understanding and Facilitate Consistency in Grading. **D. Marell**, X. Prat-Resina

660. Utilizing student attitude in introductory STEM courses: A closer look into General Chemistry I student feedback. **C.D. Glenn**, P.M. Clevenger, D.S. Williams

661. General Chemistry Lab Design – Creating Inquiry-Based Experiences for Gen Chem 2 Students. **S. Beechboard**, C.L. Stanford, J.W. Ribblett

STEW
206

A Contextualized Approach to Teaching Chemistry

B. D. Fahlman, *Organizer*, *Presiding*

11:00 Introductory Remarks.

11:05 662. Design of interactive videos for a context-first chemistry course. **B.D. Fahlman**

11:25 663. Perusall: A social reading annotation platform that connects students in contexts that matter. **J.M. Buth**

11:45 664. Inspiring students with sustainable invention. **J. Butler**, K. Anderson

12:05 665. Assessing students' critical thinking skills with a molecular design project. **S. Sun**

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 666. Real-world related assignments in lower and upper division chemistry classes. **F. Hou**

2:25 667. Sprinkling short modules on current research and emerging topics throughout an undergraduate biochemistry course to engage student interest. **L.A. Rowe**

2:45 668. Biochemistry and citizen science: Cell phone colorimetry and detecting stress responses in milkweed. **B. Oatman**

3:05 Panel Discussion.

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 669. Molecular beauty: The chemistry in cosmetic products. A novel course for undergraduates highlighting the applicability of chemistry topics and principles in a ubiquitous product, namely cosmetics. **S. Thyagarajan**

4:10 670. Teaching in context: Analyzing food in the instrumental analysis laboratory. **D.A. Belle-Oudry**

4:30 671. From vine to bottle: Lessons learned working in a wine lab during the 2020 harvest in Oregon. **B.E. Taylor**

4:50 672. Engaging students in chemistry through literary metaphor. **K. Hoffman**

5:10 Closing Remarks.

WALC
B066

Advances in e-Learning, Digital Learning, and Online Chemical Education

D. A. Canelas, *Organizer, Presiding*

11:00 Introductory Remarks.

11:05 673. Moving Whiteboarding Online: Attempting Interactive Learning in Online Discussion Boards. **B.E. Jenkins**

11:25 674. Use of an online social annotation platform to facilitate asynchronous, collaborative learning in a flipped organic chemistry course. **A. Sigmon**

11:45 675. Building Community in an Online Course. **J. Selco**

12:05 676. Student writing in massive open online chemistry classes. **D.A. Canelas**

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 677. Meeting the Need of Diverse Learners: New Technology that Remediates Math Skills & Chemistry Struggle Points with Spaced Practice. **J.B. Weinberg**

2:25 678. Implementation and analysis of a free-form intelligent tutoring system for general chemistry calculations. **E. King**, T. Holme, D. Yaron, S. Raysor, M. Benson, J. Sewall, K. Koedinger

2:45 679. How do students in a large general education Chemistry course use their personal technology for their academic work?. **T. Porter**, L. Zhu, R. Elliott

3:05 680. Why Students Withdraw from Online General Chemistry. **E. Faulconer**

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 681. Using Socrative Online Polls for Active Learning in the Remote or Hybrid Classroom. **A.M. Christianson**

4:10 682. Academic Help-Seeking in the (Post) COVID Era: Insights from the Past and Considerations for the Future. **D. Williams-Dobosz**, N. Bosch, C. Ray, M. Perry

4:30 683. Free multi-media learning objects that help students learn chemistry content. **J. Selco**

4:50 684. Breaking Barriers – Science Outreach Through Service Learning over Zoom. **D.L. Richter-Egger**, K. Rud, S. Nedungadi

5:10 Closing Remarks.

WALC
1132

In Memoriam: Celebrating the Life and Works of George M. Bodner

G. Bhattacharyya, A. C. Davis, *Organizers, Presiding*

11:00 Introductory Remarks.

11:05 685. The relevance of George Bodner's to the work of modern practitioners. **K. Casey**, S. Holladay

11:25 686. In the Beginning was Problem Solving, Spatial Ability and a Motorcycle. **J.R. Pribyl**

11:45 687. Let's make learning more challenging: The influence of desirable difficulties on general chemistry students' problem-solving performance. **O. Gulacar**, B. Vernoy, A. Wu

12:05 Audience Remembrance.

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 688. Lessons from George Bodner: “Framing” quality chemistry education research. **M. Orgill**

2:25 689. Theoretical Frameworks: How you Never Forget your “First Love”. **D.I. Del Carlo**

2:45 690. Gadamer's Hermeneutics and Narrative Analysis: Complementary Theoretical Frameworks. **J.W. Shane**

3:05 Audience Remembrance.

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 691. Revisiting the problem-solving mindset. **D.E. Gardner**

4:10 692. Toward an educational theory of "Organic Chemistry as a Second Language.". **R. Ferguson**, D.P. Cartrette

4:30 693. What does research on electron pushing tell us about students’ sense-making and the continued viability of the mechanistic approach to teaching organic chemistry?. **G. Bhattacharyya**

4:50 Audience Remembrance.

5:10 Closing Remarks.

STEW
313

Innovations in instruction in large-enrollment lecture courses

C. Reck, D. Snaddon, *Organizers*
K. Arnold, *Organizer, Presiding*

11:00 Introductory Remarks.

11:05 694. Undergraduate Teaching Interns: Impacting Teaching and Learning Through Mentorship. **D. Snaddon**, K. Arnold

11:25 695. The impact of Supplemental Instruction on teaching students how to learn. **C. Reck**, **K. Arnold**

11:45 696. Comparing student performance and persistence in face-to-face and online live modalities of CLUE General Chemistry courses. **U. Swamy**, E. Kwong Lam, J. Carmel, S.M. Underwood

12:05 697. Headstart Classes for Early Intervention: A Strategy to Promote Retention in Large Introductory Chemistry Courses. **D. Snaddon**

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 698. An empirical investigation of the relationships among conceptions of teaching, instructional practices, and student outcomes. **Q. Cui**, S. Swarat, D. Drane, R. Baiduc, G.J. Light, S.M. Lo

2:25 699. The Effect of Flipped Learning and Multiple Assessment Opportunities on Achievement in a Large General Chemistry Course. **M.R. Porter**, J.K. Robinson, **E. McKenzie**

2:45 700. A New Approach to Characterizing General Chemistry Exam Questions Using Marzano's Taxonomy. **J. Finney**, R. Osman, G. Mittal, M. Avila, S.A. Toledo, C. Craig

3:05 701. PackPrep Collaboration: Unleashing Pack Mentality for Student Success in General Chemistry. **K. Proctor**

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 702. Using clickers for peer instruction in weekly discussion sessions of a large-enrollment course of organic chemistry. **D. Cruz-Ramirez de Arellano**

4:10 703. Course Modifications to Increase Student Success in Organic Chemistry 2. **L.C. Brown**

4:30 704. Data-informed Messaging: Guiding Student Engagement and Increasing Metacognition in Large Enrollment Courses. **A. Brummett**, J. Russell

4:50 705. Are my students engaged? Nonverbal interactions as an indicator of engagement in a stadium-style lecture hall. **N.E. States**, C. Bruno, R.S. Cole

5:10 Closing Remarks.

STEW
202

Preparing students for success in organic chemistry

J. M. Fautch, J. Houck, *Organizers*, *Presiding*

11:00 Introductory Remarks.

11:05 706. OrgoPrep: improving student outcomes in organic chemistry through a peer-led remote intersession program. **B. Abrams**

11:25 707. Personalized System of Instruction for the Foundational Knowledge of Organic Chemistry. **G.C. Tay**

11:45 708. Minimizing the shock of organic chemistry: using adaptive technology for organic prep. **J.M. Fautch**

12:05 709. Development and Implementation of a 2-Week Course to Prepare Students for Organic Chemistry. **K. Stewart**

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 710. Using digital tools to engage students in prerequisite review for organic chemistry. **J. Houck**

2:25 711. Participating in a high-structure general chemistry course found to increase student retention to organic chemistry. **J. Casey**, K. Supriya, S. Shaked, J. Caram, A. Courey

2:45 712. Drawing Upon General Chemistry Concepts to Explain Mechanisms in Organic Chemistry. **C.T. Cox**, A. Witherspoon, M. Tripp, J. Laster

3:05 713. Eliciting mechanistic reasoning underpinning syntheses with intentional prompt design. **A. Ellison**, B.J. Esselman, R. Stowe

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 714. How to design tutorial videos in organic chemistry and what do students truly learn from them?. **J. Eckhard**, M. Rodemer, S. Bernholt, N. Graulich

4:10 715. "Small Bites" - Selected general chemistry topic reviews relevant to organic chemistry. **G. Castillo Valdes**, **S.A. Dandekar**

4:30 716. Prelecture Videos for Organic Chemistry Lecture. **R. Loy**

4:50 717. Teaching in a Shared Curriculum: A Collaborative Process of Generating A Unified Organic Chemistry I Topics List. **S. Bridges**, A.M. Kiefer

5:10 Closing Remarks.

WALC
1018

Assessment Instruments: Design, Development, and Evaluation

M. Atkinson, J. Barbera, *Organizers, Presiding*

2:00 Introductory Remarks.

2:05 718. Examining the Psychometric Properties of ROXCI: A Rasch approach. **G. Rushton**, Y. Jin, C. Rodriguez, L. Shah

2:25 719. The Development of Ordered Multiple-Choice Items for measuring Students' understanding of Light and Light Matter Interaction. **H. Alfulaiti**, M. Balabanoff, A.C. Moon

2:45 720. Measuring Understanding with the Reaction Coordinate Diagram Inventory (RCDI). **M. Atkinson**, S. Bretz

3:05 721. The Water Instrument: Assessment of Fundamental Concepts in General Chemistry. **M. Balabanoff**

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 722. Design and Evaluation of Assessment Instruments to Measure Students Knowledge of Green Chemistry Principles. **A. Leontyev**, K.D. Grieger

4:10 723. Utilizing Differential Item Functioning to Further Validate the Fundamental Concepts for Organic Reaction Mechanisms Inventory. **S. Nedungadi**, C.E. Brown

4:30 724. Establishing the validity and reliability of the organic chemistry representational competence assessment (ORCA). **L. Wright Ward**, F. Rotich, J. Hoang, J.R. Raker, M. Popova

4:50 Panel Discussion.

5:10 Closing Remarks.

STEW
307

Big 10 Gen Chem Labs: Advances, Innovations, and Challenges

E. G. Malina, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 725. Developing and implementing online laboratories: Leveraging sense-making and writing evidence-based arguments. C.J. Harwood, C.E. Wright, J. Meyer, **M.H. Towns**

2:25 726. General chemistry labs during a pandemic: Hands-on laboratory work at home. **M.D. Driessen**

2:45 727. Returning to the labs after remote instruction; lessons learned in General Chemistry Labs at Penn State. **A.M. Bischof**, L. Funari, A. Herring

3:05 728. What COVID-19 "brought to the table" in our general chemistry laboratory curriculum. **B. Opoku-Agyeman**, A. Moore, T. Weaver, A. Welch, M. Nolan, T. Hanks

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 729. Why do we teach lab: How remote instruction motivated lasting change in General Chemistry lab assessments. **K.A. Gesmundo**, V.M. Berns

4:10 730. Implementing Introductory Project-Based Labs: Developments & Drawbacks. **B. Busby**, **J.L. Herman**

4:30 Panel Discussion.

5:10 Closing Remarks.

BRWN
1154

Evolution of the ACS Guidelines for Approved Programs & the Future of Chemical Education

M. Brooks, *Organizer*
S. Reid, *Presiding*

2:00 Introductory Remarks.

2:05 731. Evolution of the ACS Guidelines for Approved Programs: 2022 Preview. **S.A. Reid**

2:25 732. Adopting the Diversity, Equity, Inclusion, and Respect (DEIR) Guidelines by Programs offering Bachelor's Degrees in Chemistry. M. Brooks, F.A. Fullilove-Cashwell, A.B. Mahoney, **E.A. Arriaga**

2:45 733. Exploring the Value of ACS Approval for Baccalaureate Programs. **C.E. MacBeth**

3:05 734. A Data "Snapshot" of ACS Approved Institutions. **M. Brooks**, F.A. Fullilove-Cashwell, N. Jenkins, S.A. Reid

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 735. Rethinking the Laboratory Requirements in the ACS Guidelines: Best measures for assessing the laboratory experience. **K. Frederick**, E.A. Arriaga

4:10 736. Hands-On Laboratories and ACS Public Policy Statements. **L.E. Pence**, L. Posey

4:30 737. Human and Animal Pharma Perspective on Required Lab Skills in Discovery and Development Labs. **B.M. Mathes**

4:50 738. Back into the Lab: Remediating Hands-on Lab Skills Taught in Critical Chemistry Courses. **F.A. Fullilove-Cashwell**, N. Jenkins, M. Brooks

5:10 Closing Remarks.

BRWN
3100

Reimagining Chemistry Education: Integrating Systems Thinking into Green & Sustainable Chemistry Education

N. J. O'Neil, *Organizer*
G. Hurst, J. E. Wissinger, *Organizers, Presiding*

2:00 Introductory Remarks.

2:05 739. Investigating student reasoning in green and sustainable chemistry through the design-based research of decision memos. **S. Petritis**, H. Mcfall-Boegeman, M. Zhang, E.L. Day, M. Cooper

2:25 740. Development and implementation of an organic chemistry module on nucleophilic substitution reactions emphasizing solvent selection through a sustainability and systems thinking approach. **S.A. Cummings**, T. Fernando

2:45 741. Implementing systems thinking and the UNSDGs into the organic chemistry curriculum: Teaching NMR spectroscopy and MS spectrometry as powerful tools to Introduce students to global issues. **K.M. Halligan**, I. Larraza

3:05 742. Choose your own green chemistry synthesis adventure: A general chemistry laboratory experience. **A. Thomas**, C.R. Pulliam, E.E. Liu

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 743. Preparing the next generation of scientists for sustainable action. **N.K. Obhi**, N.J. O'Neil, A.S. Cannon

4:10 744. Life imitates art: Encouraging systems thinking in chemistry through a curriculum inspired by Wagnerian opera. **D.A. Laviska**

4:30 Panel Discussion.

5:10 Closing Remarks.

BRWN
3102

The affective domain in chemistry education: Impact of affective and cognitive factors on student learning and pedagogical practices.

S. Srinivasan, S. Villafane-Garcia, *Organizers*
M. Anzovino, *Presiding*

2:00 Introductory Remarks.

2:05 745. Student Goals and the Contexts of a Flipped-Learning General Chemistry II Course. **E. Roth**, C. Randles, R. Tasker

2:25 746. GPS guidance for building community and motivating students. **L. Starkey**

2:45 747. Withdrawn

3:05 Panel Discussion.

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 748. Relationship between Course-Level Social Belonging (Sense of Belonging and Belonging Uncertainty) and Academic Performance in General Chemistry 1. **J. Edwards**, R. Barthelemy, R. Frey

4:10 749. Learning outside the textbook: Pedagogical practices that impact the affective domain in general chemistry classes. **L.D. Montes**, **C.B. Frech**

4:30 750. Collaborative Research: Assessing effects of behavioral and affective factors on community college students' success in an introductory biology course. **H.L. Torres**, R. Frey, M. Hardy

4:50 Panel Discussion.

5:10 Closing Remarks.

BRWN
3104

Think, Plan, Teach: Enacted Pedagogical Content Knowledge in Higher Education

E. L. Atieh, L. Shi, *Organizers, Presiding*

2:00 Introductory Remarks.

2:05 751. Think, plan, act: Mediating factors of university instructors' enacted pedagogical content knowledge. **E.L. Atieh**, L. Shi, A. Pellegrini, R. Erdmann, M.N. Stains

2:25 752. Why we do what we do: Factors that influence STEM faculty members' instructional decisions. **R. Sansom**

2:45 753. Pedagogical Chemistry Sensemaking: A conceptual framework to promote pedagogical sensemaking in model-based lesson planning. **M.M. Wu**, E.J. Yezierski

3:05 Panel Discussion.

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 754. Exploring Instructors' Conceptions about Assessment and Reasoning behind their Choices of Assessment. **L. Shi**, J. Mitchell-Jones, M.N. Stains

4:10 755. Case study characterizing organic chemistry instructors' Pedagogical Content Knowledge around teaching with representations. **T. Jones**, J.M. Pratt, M. Popova

4:30 756. Impact of Covid-19 Pandemic on Introductory STEM Instructors ePCK. **S.B. Boesdorfer**

4:50 Panel Discussion.

5:10 Closing Remarks.

WALC
3090

Chemistry education research: Undergraduate student research symposium

J. Donnelly, N. Lapeyrouse, *Organizers, Presiding*

3:45 Introductory Remarks.

3:50 757. Key Experiences and Best Practices for Emergency Remote Learning. **B. Chiu**, N. Lapeyrouse

4:10 758. Analyzing gender representation and stereotypes in college general chemistry textbooks. **C. Lopez-Castilla**, M. Brackett, B. Chiu, N. Lapeyrouse

4:30 759. Integrating the teaching of biomimicry through Nanoeducation and its impact on attitudes and argumentation among high school students - the case of gecko behavior and nano liposomes as drug carriers. **M. Hugerat**, S. Elgamal, S. Asli

4:50 760. Applications of the MAtCH Model to Analyze Student Problem-Solving. **B. Chiu**, C. Randles, S.M. Irby

5:10 Concluding Remarks.

PMU
North Ballroom

General Posters 4

M. T. van Opstal , *Organizer, Presiding*

5:30 - 6:30

761. Development of a microwave-assisted synthesis of salen H2 and Co(salen) undergraduate experiment. **S.A. Henrie**, J.H. Davis, B. Johnson

762. Teaching Chemistry Using the of the Apollo 11 Lunar Landing from Popular Media. **J.G. Goll**, E. Romanin

763. Investigating the Effects of Instructor Facilitation on Student Engagement in a POGIL Based General Chemistry Class. **K. Abouelyamin**, G. Rushton, J. Reid, S. Fateh

764. Investigations Into Aryne Reactivity through Summer and Course-Based Undergraduate Research. **J.K. Kisunzu**

765. Analysis of the elements of journalism and constructively responsive reading in promoting reading comprehension and analytical writing when learning industrial and environmental chemistry. **S.R. Esjornson**

766. Elucidating Goals for Institutional Change Initiatives in STEM from NSF Annual Reports. **S. Feola**, B. Couch, B. Whitt, B. Earl, A. Lane, J. McAlpin, L. Prevost, S.E. Shadle, J. Skvoretz, M.N. Stains, J. Ziker, J.E. Lewis

767. Breaking the language barrier in chemistry assessment: Project plan and outcomes. **A.E. Kim**, E. Lee

768. Fun and Games with InteractiveChemistry.org. **S.G. Sogo**

769. Assessment of Student Understanding of Organic Chemistry through Creative Exercises. **A.R. Green**, Y.K. Gorske, C.F. Bauer

770. Gamifying inorganic chemistry in a small college (and virtual) classroom setting. **J. Wolfgram**, B. Wile

771. Pandemic silver linings: Online lab materials development and subsequent use to improve face-to-face general chemistry labs. **D. Fisher**, J.M. Denton, M.D. Fritz

772. ACS Project SEED During the Pandemic: Improvements and Learning Outcomes in Providing Professional Development and College Readiness to Promising High School Students. **E. Speidell**, C. Kuniyoshi, N. Bakowski

773. Developing Writing Techniques in a First-Year General Chemistry Laboratory. **G. Pealer**, C. Johnson

774. Extraction and Isolation of Sulfur Phases in Meteorite Simulants. **R.W. Hilts**

775. Creative exercises in organic chemistry: Analysis of student responses and perceptions. **K.D. Grieger**, A.A. Lam, A. Leontyev

776. Ten minutes a semester: Evaluation of a short wellness intervention for undergraduate chemistry and biology courses. **M.K. Meadows**, **K. Strickland**, A.N. Chaffin, K.D. Kloepper, L. Simon, J.P. Stanga

777. A Socially-Collaborative Model-Based Symmetry Activity for Inorganic Chemistry. **J.J. Markut**, D.J. Wink

778. The Exploration of Integrating a Community Service Learning Water Project into a Postsecondary Analytical Chemistry II Lab. K. Ho, **S. Smith**, **C. Venter**

779. Research Module for Undergraduate Organic Chemistry Students. **T. Sucheck**, G. Gordon, M. Grandsko, J. Hussein, J. Rawski, A. Schwab

780. Addressing learning gaps in acid-base chemistry using novel three-dimensional models. **G. Grimes**, A. Blecking, M. Hoelzer

781. Examining the Impact of an Online Pre-Course and Values Affirmation Activity in a First-Semester Organic Chemistry Course on Course Outcomes. **T.L. Vickrey**, G. Grinde

782. How do you see carbs? Undergraduate Students' Interpretation of Carbohydrate Projections. **J. Garcia**, M.H. Towns

783. Assessing Learning in the Laboratory for a General Chemistry Course-Based Undergraduate Research Experience. A. Potts, K.A. Grice, **T.A. French**

784. Aggies Versus The Pandemic. **A. Altemose**, E. Lee, A.C. Songok

785. Design for Online Collaborations – Beyond the Pandemic. **L.A. Morsch**, B. McCollum, M.T. Wentzel

786. DIY in General Chemistry Lab. **K.E. Anderson**, S.R. Livingston

787. The Internet of Chemistry Things (IoCT). **L. Poirot**, E. Lisitsyna, H. Tiner, E. Bouzid, E.C. Bucholtz, R.E. Belford

788. Reformed Experimental Activities (REActivities): Assessing student engagement in an undergrauate organic chemistry lab.. **T. Goudreau Collison**, J.A. Cody, D. Newman, J.P. Anderson, B.L. Edelbach

789. Forensic analysis of go kart racing tire preparation solutions. I. Johnson, **L.H. Mielke**

790. Strategies for Encouraging More Chemistry and Biochemistry Students to Take Math Beyond the Two Semesters of Calculus Required. **B. Findley**, M.J. Andrea, D.R. Wawruck, G. Ashline

791. Evolution of the Organic Laboratory Program at Hope College as a Result of the COVID-19 Pandemic. **T. Smith**

792. The Effect of Growth Mindset Intervention on Students' Perceptions of Self Efficacy in a first-year general education science course. **J. Kavalakatt**, **N. Tran**, J. Park, T. Nguyen, J. Chan

793. Synthesis of difluoromethyl esters from carboxylic acids: Introduction of fluorine chemistry and 19F NMR in undergraduate organic chemistry labs. **C. Barrett**, R. Broyer

WEDNESDAY

WALC
1055

Assessment and Measurement in Research and practice

K. L. Murphy, J. R. Raker, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 823. Capturing evidence of inclusive teaching in undergraduate STEM classrooms through an inclusive teaching observation protocol (ITOP). **J.M. Mutambuki**, C. Muteti

8:25 824. Walk-by observational protocol for institution-wide assessment of active learning. **C.F. Bauer**

8:45 825. Factors that impact the difficulty of organic chemistry exam items: Item order and item environment effects. **O. Michels**, T.C. Pentecost, S. Nedungadi, J.R. Raker, K.L. Murphy

9:05 826. Applying and adapting a cognitive complexity rubric to physical chemistry exam items. **M.S. Reeves**, T.C. Pentecost, J.R. Raker, K.L. Murphy

9:25 Closing Remarks.

WALC
B058

Chemistry Education Research: Graduate Student Research Symposium

M. Connor, O. Crandell, *Organizers, Presiding*
C. G. Carlson, E. L. Day, M. Herridge, S. Houchlei, Y. Liu, M. Popova, T. Qu, P. Vincent-Ruz, L. Wright Ward, *Presiding*

8:00 Introductory Remarks.

8:05 841. Second-semester general chemistry undergraduate students ideas about polarity when viewing multiple molecular representations. **C. Chatha**, S. Bretz

8:25 842. Exploring modifications to scale-themed instruction in general chemistry II: Determining content area and scale concepts targets for increased scaffolding. **A.R. Tomczyk**, K.L. Murphy

8:45 843. Mapping Students' Chemical Thinking During Collaborative In-Class Tasks. **M. Macrie-Shuck**, V. Talanquer

9:05 844. Analysis of factors that influence success in introductory general chemistry: Relationship between factors and student's study habits in general chemistry. **L. Laguerre Van Sickle**, R. Frey, J. Edwards

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 845. Exploring Students' Understanding of Electrophilic Aromatic Substitution Reactions. **S. Kariyawasam Gamage**, S. Mooring

11:25 846. Does a scaffold fit all? - Exploring students' engagement with a scaffolded task in relation to their prior knowledge. **D. Kranz**, M. Schween, N. Graulich

11:45 847. Does online learning impact students' ability to draw mechanisms?. **V. Scammahorn**, M. Cooper, S. Houchlei

12:05 848. Supporting students to construct causal mechanistic explanations in the context of complex phenomena such as impact of solvents on rate of organic reactions. **K. Seth**, E.L. Day, S. Houchlei, M. Cooper

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 849. Undergraduate chemistry and biology student engagement in causal mechanistic reasoning about protein-ligand binding. **C.G. Carlson**, K. Noyes, J.R. Stoltzfus, T.M. Long, C.V. Schwarz, M. Cooper

2:25 850. Metabolism Instruction: Students' REDOX knowledge transfer and attitude towards metabolism. **T. Jones**

2:45 851. Effects of a simulation-based activity on student reasoning about absorption. **Y. ZHANG**, N. Spitha, P. Doolittle, A.R. Buchberger, S. Pazicni

3:05 852. Investigating the Landscape of the Biochemistry Course across the United States. **K. Nix**, S.M. Underwood

3:25 Closing Remarks.

WALC
3121

Communicating chemistry: Improving oral and written communication skills to foster academic and career success

J. Thompson, B. Widanski, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 853. Posters as a Pedagogical Device to Foster Oral Chemical Literacy. **B. Widanski**, J. Thompson

8:25 854. Effects of video assignments on communication and community in an undergraduate chemistry course. **S. Post**, C. Schrank, K.J. McKnelly

8:45 855. Successes, challenges, and next steps of integrating communication skills taught from a stand-alone Chemical Communications course into subsequent courses. **J.W. Karr**, J.L. ODonnell

9:05 856. Fitting students for the world in which they will live: Development of a curriculum spanning seminar series. **D.K. Hoover**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 857. Comparing delivery modalities of College to Career and Research course. **G.B. Ray**

11:25 858. Designing writing assignments for cognitive skill development. **J.B. Easter**

11:45 859. Annotated Writing Exemplars for Organic Chemistry Laboratory Reports. **A.P. Dicks**, C. Phillips, J. Bayne, D. Stone, A. Williams

12:05 860. Withdrawn

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 861. Science and speculation: A writing-intensive, first-year seminar. **S.S. Tartakoff**, A.D. Hill

2:25 862. Implementing K-12 Educational Tools in a Capstone (Senior Seminar) Biochemistry and Chemistry Classroom. **C. Chant**

2:45 863. Use of oral and written communication in general and organic chemistry courses.. **B. Miller**

3:05 864. Immersion in the Chemical Biology Literature and Scientific Communication through Case Studies. **B. Blacklock**

3:25 Closing Remarks.

STEW
306

Engaging students in Analytical Chemistry - Curriculum and Cognition

S. Oxley, *Organizer, Presiding*
L. Mier, A. M. Palmer, J. K. Robinson, *Presiding*

8:00 Introductory Remarks.

8:05 885. Chromatography Simulators for Teaching Analytical Separations. **C.A. Lucy**

8:25 886. A POGIL-Based Quantitative Analysis Laboratory Curriculum Utilizing Python via Google Colab. **L. Mier**

8:45 887. The idea generator: New topics in active learning laboratories generated through the investigative laboratory writing assignment. **L.H. Mielke**

9:05 888. Flipping the Analytical Classroom: Lessons from COVID. **M.B. Jensen**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 889. Science meets soft skills: Active learning in the quantitative analysis laboratory. **S.M. Strickland**

11:25 890. Kinetics analysis of the isomerization of alpha and beta acids found in hopped beer. **P. Doolittle**

11:45 891. Incorporating Experimental Design into a Bioanalytical Chemistry Laboratory Course. **J.K. Robinson**

12:05 Panel Discussion.

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 892. Applications first: Using primary literature and case studies to promote critical thinking and scientific writing in instrumental analysis courses. **S.E. Gray**

2:25 893. Reflective Writing and Process-Oriented Goals in the Analytical Chemistry Curriculum. **D.L. Donohoue**

2:45 894. Teaching industry ready skills in an Instrumental Methods course via independent student projects. **J.L. Hawk**

3:05 895. Analytical Chemistry Students' Conceptions of Monoprotic Acid-Base Titration. **D.N. Maxwell**, E.A. Teich, S.A. Finkenstaedt-Quinn

3:25 Closing Remarks.

WALC
3138

Science Communication in Classrooms and in the Public (#SciComm)

S. Drury, L. Wysocki, *Organizers, Presiding*
S. A. Ryan, *Presiding*

8:00 Introductory Remarks.

8:05 954. Deliberation in the chemistry classroom: Developing science communication around socio-scientific issues. **L. Wysocki**, S. Drury

8:25 955. Models of Deliberative Pedagogy in Chemistry Courses. **S. Drury**, L. Wysocki

8:45 956. Preparing to Facilitate Deliberation. **A.M. Nienow**, P. Conners

9:05 957. White Sands, Smeltertown, and Systems Thinking: a Situative Approach to Implementing Place-Based Education Design Principles in Core-Idea Centered General Chemistry. **E.L. Day**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 958. Undergraduate Course on Science Communication to the Public. **J. Sridhar**

11:25 959. The Development of Pedagogical Methods for Training Undergraduates in Skills of Science Communication to the Public. **F.L. Payton Stewart**, J. Sridhar

11:45 960. Scientific storytelling: A general education course to teach science communication, writing instruction, and narrative building. **K.Y. Neiles**

12:05 961. Turning My Kitchen Into a Classroom. **J. Lee**

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 962. Using Popular Social Media Platforms to Empower Parents in their STEM abilities. **S.A. Ryan**

2:25 963. Five lines and 280 characters: Using Twitter to share chemistry concepts via limericks and other light verse. **C.J. Hayes**

2:45 964. Solar System Map. **B. Salles**

3:05 965. Making chemistry relevant to everyday life using the podcast Chemistry For Your Life. **M. Collini**

3:25 Closing Remarks.

WALC
3127

Writing to Promote Learning and Disciplinary Thinking in Chemistry

S. A. Finkenstaedt-Quinn, *Organizer, Presiding*
F. M. Watts, *Presiding*

8:00 Introductory Remarks.

8:05 997. Integrating a Conceptual Writing Assignment in General Chemistry I. **P. Muisener**

8:25 998. Inquiry-Driven Proposal Writing in Carbohydrate (Bio)Chemistry. **A.L. Pirinelli**

8:45 999. Introduction of Scaffold Writing Across the Chemistry Department. **S.L. Skiles-Jones**, E.S. Eitrheim, C.B. Frech, L.D. Montes, D.G. New, A.L. Waters

9:05 Panel Discussion.

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 1000. Characterizing Student Interactions During Peer Review and Revision. **S.A. Finkenstaedt-Quinn**, F.M. Watts, G.V. Szymczak Shultz

11:25 1001. How a Writing-to-Learn Assignment’s Design Shapes Second-Semester Organic Chemistry Students' Elaborations on Reaction Mechanisms. **I. Zaimi**, A. Dood, G.V. Szymczak Shultz

11:45 1002. Research into Practice: Scaffolded and Discussion-based Case Comparison Activity in Organic Chemistry. **D. Haas**, F.M. Watts, A.J. Dood, G.V. Szymczak Shultz

12:05 1003. Helping students synthesize chemistry with context through soundboarding. **A. Lolinco**, T. Holme

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 1004. A machine learning approach to exploring students' writing about reaction mechanisms. **A.J. Dood**, F.M. Watts, G.V. Szymczak Shultz

2:25 1005. Developing a tool for automated, formative feedback on an organic chemistry writing-to-learn assignment. **F.M. Watts**, A. Dood, G.V. Szymczak Shultz

2:45 1006. Development of a machine learning model to predict levels of electrophile understanding. **S.J. Frost**, B.J. Yik, D. Cruz-Ramirez de Arellano, K.B. Fields, F. Costanza, J.R. Raker

3:05 Panel Discussion.

3:25 Closing Remarks.

WALC
1132

Active learning implementation

D. B. King, *Organizer*, *Presiding*

8:00 Introductory Remarks.

8:05 794. Use of real-world applications to improve in-class activities. **D.B. King**

8:25 795. A forensics capstone for general chemistry: enriching the lab experience and evaluating students' scientific skills. **A.A. Lam**, S. Eveland-Parrott

8:45 796. Implementation of three-dimensional learning into the General Chemistry classroom. **J.P. Darr**, J.A. Conrad, D.L. Richter-Egger

9:05 797. Case Study Classes: Incorporating NGSS into active-learning assignments in a large enrollment university general chemistry course. **L. Munro**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 798. Creating Digital Interactive Card Sorts. **A. Green**

11:25 799. Effects of supplemental content-rich songs and crossword puzzles on secondary school students' performance, retention and interest in chemistry in Ondo State, Nigeria.. **E.O. Ayeni**

11:45 800. Remote Learning and Laboratory Practices for AP® Chemistry. **L. Acampora**

12:05 801. Ohio University STEMStart: A Jump Start for First Year Science Majors. **C. Beck**

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 802. Tossing the Textbook. **E.L. Bailey**

2:25 803. Engagement in the Classroom and Student Learning. **L. Aronne**

2:45 804. Active learning to enhance student outcomes in General Chemistry. **D. Bassolino**, L.A. Ekanger, R.A. Hunter, J. Baker, B. Chan

3:05 805. Team-based learning large and small: Implementation across class sizes. **T. Legron-Rodriguez**, **J. Donnelly**

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 806. Using LEGO® brick activities to increase active learning in the biochemistry classroom. **S. Austin**, S. Christmas, C. Millar

4:10 807. Throwing Away Paper Wads: An Active Learning Activity in Chemical Kinetics, Reaction Orders, and Mechanisms. **J.A. Orvis**

4:30 808. Escape room! Digital activity using Google Forms. **T. Eaton**

4:50 809. Static and interactive concept maps for general chemistry learning. **K. Nishida**, R.M. Wong, O.O. Adesope

5:10 Closing Remarks.

WALC
B066

Advances in e-Learning, Digital Learning, and Online Chemical Education

D. A. Canelas, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 810. Immersive Digital Learning in STEM Laboratory Courses. **E.M. Rezler**, **O. Yavuz-Petrowski**, A.C. Perkins, J. Krill, J. Golden Botti

8:25 811. Lab kit vs. Virtual Labs: An Investigation into Lab Delivery Methods for Online Students in Service Courses. **B.E. Jenkins**

8:45 812. Labflow & Visual Data: Student attitudes and experience working online with visual data. **A.M. Dark**

9:05 813. Integrating chatbots into the chemistry classroom. **A. Lolinco**, T. Holme

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 9999. The Unlimited and Innovative World of OER: An Interdisciplinary Approach to Successful Chemistry Laboratory Manual Development. **A.C. Perkins**, O. Yavuz-Petrowski, E.M. Rezler, J. Golden Botti, J. Krill

11:25 815. Effects of an Online Climate Change Project on Preservice Science Teachers' Knowledge, Hope, and Self-Efficacy Toward Climate Change. **Y. Liu**, Y. Song, X. Wang

11:45 816. Google forms, iPads, and retrieval practice: Small changes in the classroom for effective teaching. **J.B. Eberle**

12:05 Panel Discussion.

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 817. What I'm learning about myself: Student meta-reflections in organic chemistry. **L.A. Morsch**, B. McCollum, M.T. Wentzel

2:25 818. A Highly Compressed Organic Chemistry Laboratory Course for Online Degree Students. **S.T. Pillai**, A. Austin, M. Zhu, I.R. Gould

2:45 819. Lessons learned from design and implementation of a year-long online organic chemistry class. **S.M. King**

3:05 Panel Discussion.

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 820. Experiences in developing online OER Preparatory Chemistry content during the pandemic and its applications to post pandemic hybrid learning. **E. Lisitsyna**, L. Poirot, R.E. Belford

4:10 821. The Fully Online BS and BA Degrees in Chemistry and Biochemistry at Arizona State University. **S.T. Pillai**, A. Austin, I.R. Gould, M. Zhu

4:30 822. The evolution of online chemistry education. **D.A. Canelas**

4:50 Panel Discussion.

5:10 Closing Remarks.

WALC
3122

Chemical Education Xchange: Engaging with Contributors

J. L. Holmes, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 827. An Invitation to Share Content with the ChemEd X Community. **D. Cullen**

8:25 828. The Wonderful Chemistry of Crayola's "Color Wonder" Markers. **T.S. Kuntzleman**, D.J. Campbell

8:45 829. Using Scientific Evidence and Real World Phenomena to Drive Instruction. **K. Drury**

9:05 830. Chemical Philately: A Perforated Picture of Chemistry. **M.A. Morgan**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 831. Strategies for Helping Students to Avoid Common Errors and Improve Their Understanding. **M. Farabaugh**

11:25 832. Getting Ahead of Common Misconceptions with Intentional Lesson Design. **N. Walsh**

11:45 833. I "Lava" Particulate Models. **M. Hemling**

12:05 834. Standards based grading: changing the culture of the high school chemistry classroom. **C. Husting**

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 835. ChemEd X: An Introduction to Chemical Education Xchange. **J.L. Holmes**

2:25 836. Teaching General Chemistry from an Applications Approach. **S.J. Donnelly**

2:45 837. ChemEd X is the activity platform we needed. **D.J. Campbell**

3:05 838. Exchanging Ideas with Chemistry Educators: Chemical Education Xchange. **M.J. Harvey**

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 839. Open Science and Open Pedagogy: My Journey as a TYC Lead Blogger at ChemEdX. **C. Sorensen-Unruh**

4:10 840. Asynchronous Online Chemistry Promotes Equity and Inclusion. **K.E. Carrigan**

4:30 Panel Discussion.

5:10 Closing Remarks.

WALC
B093

Course-Based Undergraduate Research Experiences (CUREs) in the chemistry and biochemistry teaching laboratory

A. Goodman, M. Pikaart, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 865. Researching slime in organic chemistry lab: A CURE project. **A.P. Johanson**

8:25 866. An Organic Chemistry CURE in a Laboratory Course for Chemistry and Biochemistry Majors. **S.C. Otte**

8:45 867. A library project for a first-year chemistry Course-embedded Undergraduate Research Experience (CURE) at Georgia Gwinnett College (GGC). **A. Button**, C.L. Anfuso, I.H. Krouse, B.C. Shepler

9:05 868. Catalyzing new research opportunities at a primarily undergraduate institution using a CURE in analytical chemistry. **E.D. Niemeyer**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 869. Microplastics and the Cahaba River: Introducing students to environmental chemistry through curriculum-based research. **J. Forakis**, J. March

11:25 870. Applying Metagenomics to Undergraduate Research: A Bacterial Profile of Soil Samples from the Potomac River Basin. **A. Taraboletti**

11:45 871. Lessons Learned from the Design and Implementation of an Analytical Chemistry CURE Investigating Indoor Films. **A.L. Van Wyk**, L. Andrews, A. Julius, B. Shrestha, S.K. Shaw

12:05 Panel Discussion.

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 872. An Authentic Research and Online Publication Experience in the Undergraduate Biochemistry Lab: Student and Instructor Perspectives. **B. Hall**

2:25 873. Lowering the activation energy: introducing a CURE in multiple small steps at a small, primarily undergraduate liberal arts college. **A.A. Carter**, P.A. Craig

2:45 874. Design, synthesis and analysis of small molecule inhibitors of quorum sensing in Vibrio bacteria: a year-long course-based undergraduate research experience (CURE) for first- and second-year students. **L.C. Brown**

3:05 875. A win-win collaborative interdisciplinary Course-based Undergraduate Research Experiences (ci-CUREs) program for undergraduates: Training undergraduate students to effectively navigate across traditional discipline boundaries. **G. Rabah**, S. Franzen

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 876. Course-based Undergraduate Research in a Small Liberal Arts Undergraduate Institution. **X. Song**

4:10 877. Teaching the Nature of Science to Nonmajors Through a Course-based Undergraduate Research Experience. **M.J. Harvey**

4:30 878. A look at moving to University designated CURE courses within the Chemistry and Biochemistry Department at Weber State University. **T.M. Covey**

4:50 879. Investigation of Research and Time Commitment Aspect of CUREs Beyond the CURE. **A. Ayella**

5:10 Closing Remarks.

WALC
2007

Exploring strategies for decreasing DFW rates in General & Organic Chemistry

E. S. Eitrheim, A. L. Waters, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 896. Analyzing Factors for First Semester General Chemistry Student Success at the University of Central Oklahoma. **A.L. Waters**, **E.S. Eitrheim**, T. Cook

8:25 897. Strategies to move the needle for at-risk students and lower the DFW rate in general chemistry. **B. Augustine**, H.B. Miller, T. Knippenberg

8:45 898. One-semester general chemistry increases completion rate compared to two semesters. **W. Kennerly**, K. Sheppard, K. Frederick

9:05 899. Impacting Student Success in General Chemistry I: Using a Co-Requisite Support Course. **R.J. Weber**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 900. Bridging the Gap for Students Transitioning Between General Chemistry and Organic Chemistry. **M.K. Maron**

11:25 901. Oral Exams in General and Organic Chemistry as a Method of Student Support and Equity. **A.J. Kabrhel**, J.E. Kabrhel

11:45 902. Two decades of improving the DFW rate in organic chemistry at Elon University: Organizing by mechanism, flipping the classroom, adopting an online homework system, and facilitating a growth mindset. **J.M. Karty**

12:05 903. Mathematical Practices in Chemistry: a supplemental course to support mathematics preparation for general chemistry. **A.M. Fleshman**, D.L. Donohoue, R.M. Doughty

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 904. A Mid-Semester Alternative for At-Risk Students in Introductory Chemistry. **J. Morris**

2:25 905. Implementation of a Remedial General Chemistry I Intersession Course on Preparing Students for General Chemistry II. **M. Jaffe**

2:45 906. Ramp To Success: Perspectives and lessons learned in building and implementing a student recovery course. **B.M. Neal**, A. Cutler, D.J. Styers-Barnett

3:05 907. Incorporating Study Hall into the General Chemistry Program at Tennessee Tech University. **A.J. Carroll**, E. Alonge, L. Kocher, C. Rezsnyak, K. Rust

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 908. Reading in chemistry: How students can succeed. **L.E. Johnson**, B.A. Lucius, T. Habeck, F. Diawara, A. Blecking

4:10 909. Determining the effect of spaced retrieval practice in introductory chemistry courses. **L. Hoyt**

4:30 910. Improving student learning and course appreciation in General and Organic Chemistry. **J.P. Lanorio**

4:50 Panel Discussion.

5:10 Closing Remarks.

STEW
310

Incorporating diversity, equity, inclusion, and respect (DEIR) learning opportunities in the chemistry classroom

A. Nakamura, K. R. Ries, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 919. Effects of teaching the United Nation's Sustainable Development Goals in undergraduate chemistry classroom. **A. Nakamura**

8:25 920. Exploring impacts of influences upon students' mindsets and personality characteristics. **D.J. Nelson**

8:45 921. Integrating antiracism, social justice, and equity themes throughout an undergraduate biochemistry course. **J.M. Liu**, C. Hollond, R. Sung, S. Hollar

9:05 Panel Discussion.

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 922. Sarah Reisman, titan of organic synthesis: inculcating the contribution of female scientists in sophomore organic chemistry. **S. Chamberland**

11:25 923. Diversity and Inclusion in Science Teaching and Learning (DISTL): Focusing on the perspectives of undergraduate chemistry Students and Graduate Teaching Assistants. **A. Aidoo**, **T. Gupta**

11:45 924. Navigating a Homogenous History: Belonging and Empowerment in Undergraduate Chemistry. **S.N. Knezz**

12:05 925. Role of International Research Experiences in the Development of Women of Color in Chemistry. **R. Davis**, **Z.S. Wilson-Kennedy**, L. Winfield, D. Spivak

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 926. Conversations About Bringing Racial and Social Justice into a General Chemistry Classroom at an Open-Access Metropolitan Commuter Community College. **A. Glass**, K. Wittman Howell

2:25 927. Decolonizing Chemistry: Rethinking the Language of Chemistry. **P. Gittins**, R.M. Hanson

2:45 928. Challenges of Inclusivity and Diversity. **E.A. Nalley**

3:05 Panel Discussion.

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 929. Teaching chemistry through a DEIR lens. **E.A. Arriaga**

4:10 930. Withdrawn

4:30 931. Chemical education: Intergroup dialogue as an approach for creating inclusive classrooms. **D.J. Wink**, M. Ryu, M. Stieff, G.A. Papadantonakis, E. O'Leary

4:50 Panel Discussion.

5:10 Closing Remarks.

WALC
3087

Research in Chemistry Education

M. Anzovino, J. H. Carmel, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 938. Impact of simulation order on general chemistry students' cognitive engagement while completing a dissolving simulation activity. **K.J. Linenberger Cortes**, K. Barbee, A. Randolph, C. Terrell

8:25 939. A Socio-cognitive Approach to Qualitatively Investigate Student Understanding of Chemical Equilibrium using a Concurrent Think-aloud Interview Protocol. **H.S. van den Bogaard**, E.L. Day

8:45 940. First-year students' epistemologies on the structure of chemistry knowledge linked to problem solving strategies: A think aloud study. **A. Lekhi**, S. Nashon, M. Milner-Bolotin

9:05 941. Understanding Discourse Patterns in a Small Discussion Course. **H.T. Nennig**, R.S. Cole

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 942. How academic self-efficacy and metacognitive learning strategies affect the academic performance of college students in chemistry. O. Fayeun, **O.O. Babajide**

11:25 943. Development of semi-structured student interviews for insight into student problem-solving in key general chemistry II content areas. **A.R. Tomczyk**, K.L. Murphy

11:45 944. Scientific Practices in Lab Curricula: Examining the Evidence. **N.S. Stephenson**, P.C. Facey, N.P. Sadler-McKnight

12:05 945. Modeling Abstraction in Physical Chemistry Instruction. **J. Karch**, H. Sevian

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 946. Investigation into the paths students engage in to predict molecular shape and how molecular representations relate to such paths. **A. Farheen**, S.E. Lewis

2:25 947. Efficiently visualizing implicit hydrogens with the prime method. **D.L. Silverio**, M.J. Mistretta, S.P. Buzzolani, A. Sam, A. Bugajczyk, S. Elezi

2:45 948. The Role of Chemical Representations in General Chemistry Textbooks on Students' Learning. **B. DEMIRDOGEN**, G. DEMIRCAN AKMAN

3:05 949. What does it mean to capture and characterize representational competence? An analysis of how students reason about representations of molecular structure. **M. Popova**, L. Wright Ward, F. Rotich, J. Hoang

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 950. Applications of computer-based scoring for the teaching and learning of reaction mechanisms in organic chemistry. **B.J. Yik**, S.J. Frost, D. Cruz-Ramirez de Arellano, K.B. Fields, F. Costanza, J.R. Raker

4:10 951. Impact of Assessment Emphasis on Organic Chemistry Students' Explanations for an Alkene Addition Reaction. **N. Ellias**, K. DeGlopper, C. Schwarz, R. Stowe

4:30 952. Organic Chemistry Gamified: Students' Perceptions and Learning. **S. von Gillern**, J. Li, L. Fang, J. Pennington, W. Schneller

4:50 953. Influence of spatial aptitude on student success in organic stereochemistry. **E.N. Kadnikova**

5:10 Closing Remarks.

WALC
3090

Teaching Programming in the Chemistry Curriculum: Approaches, Challenges, and Best Practices

J. A. Nash, *Organizer*
A. Ringer McDonald, *Presiding*

8:00 Introductory Remarks.

8:05 966. Integrating Interactive Python Coding Exercises Across Physical and General Chemistry Courses. **G.Y. Stokes**, S. Neshyba, P.M. Rowe, T. Guasco, A.L. Mifflin, W.C. Pfalzgraff, S.W. Suljak, E. Gillette

8:25 967. Integrating Interactive Python Exercises into General Chemistry Labs. G.Y. Stokes, **H. Mirafzal**, M.E. Tichy, K. Wheeler

8:45 968. Introducing chemistry students to programming concepts using MATLAB Live Scripts. **K.D. Closser**

9:05 969. Teaching chemistry majors to code in physical chemistry lab. **M.N. van Staveren**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 970. Accelerating Chemical Discovery: Teaching Undergraduate Chemistry Through the Lens of Data Science. **B. Rubenstein**, J. Ho, S. Anisetti, M. Trouilloud, D. Lu

11:25 971. Project-based learning in an Internet of Chemistry Things special topics class. **E. Lisitsyna**, L. Poirot, H. Tiner, E. Bouzid, P. Williams, R.E. Belford

11:45 972. Incorporating Programming as a Transferable Skill and Tool for Active Learning in a Graduate Physical Chemistry Elective Course on Molecular Modeling. **S.E. Mason**

12:05 973. Jupyter Pandas GUI: Open Source Graphical User Interface Tools to Facilitate Using and Teaching Python Data Analysis, Visualization and Fitting. **J.H. Gutow**

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 974. Blending Data Structures and Organic Chemistry. **S. Sharif**

2:25 975. Jupyter Physical Science Lab: An Open Source Electronic Laboratory Notebook and Data Acquisition Platform for Educational Use. **J.H. Gutow**

2:45 976. Techniques and insights on teaching Python programming for chemists. **A.J. Bonham**

3:05 977. Python Scripting for Biochemistry and Molecular Biology. **P.A. Craig**

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 978. Teaching a Dedicated Programming Course for Chemistry Students. **C. Weiss**

4:10 979. A modular approach to introducing Python coding in a lower division analytical chemistry course. **E. Gillette**, J.A. Schafer, D.O. Dehaan

4:30 980. LibreTexts resources for teaching programming. **R.E. Belford**, J. Cuadros, S. Kim, E.C. Bucholtz

4:50 981. Programming Education Resources from the Molecular Sciences Software Institute. **J.A. Nash**

5:10 Closing Remarks.

WALC
2051

Trends in GOB Chemistry

L. D. Frost, *Organizer, Presiding*
C. E. Brown, L. Eaton, A. Murkowski, K. S. Owens, *Presiding*

8:00 Introductory Remarks.

8:05 982. Let's Teach Chemedistry!. **W.D. Urban**

8:25 983. Strategies for Teaching the B in GOB Chemistry. **C.E. Brown**

8:45 984. Development and Implementation of a COVID mRNA Vaccine Case Study for GOB Students in Remote and Hybrid Synchronous Teaching. **S. Dunham**

9:05 985. What I learned about introductory GOB by teaching practicing nurses. **L.D. Frost**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 986. Using POGIL to increase student engagement and belonging in Allied Health both online and F2F. **A.B. Mahoney**, M. Garoutte

11:25 987. Pandemic Performance Pivot? Effects of Online Instruction in a GOB (General/Organic/Biochemistry) Course. **T.W. Stringfield**

11:45 988. Curricular and Pedagogical Strategies for Engaging GOB Students in Interdisciplinary Learning Activities. **K.S. Owens**, **A. Murkowski**

12:05 989. Teaching GOB students how take the lead in their own learning. **K.E. Carrigan**

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 990. Technology-based strategies to build a community of learning in a GOB course. **C. Patel**

2:25 991. Gamification of math content in a GOB course. **B. Lybbert**

2:45 992. Exploring how students connect symbolic equations, vocabulary and molecular-level representations in a first-semester GOB course. **M.E. Jewell**

3:05 993. The impact of emotions on pre-nursing students success in a GOB chemistry course. **C.E. Brown**, S. Nedungadi, A. Graves

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 994. Spike protein to ferritin: A scaffolded approach to develop a deeper appreciation of proteins. **S.A. Mason**

4:10 995. Using canola oil as a replacement for hazardous non-polar alkanes in testing the solubility and miscibility of organic and inorganic substances in the undergraduate GOB chemistry laboratory. **M.R. Korn**

4:30 996. GOB chemistry curriculum. **S. Narayan**

4:50 Panel Discussion .

5:10 Closing Remarks.

STEW
313

Educational Research in the High School Science Classroom

M. E. Jewell, M. L. Miller, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 880. Incorporating Action Research into the M.S. Chemistry – Chemistry Education program at South Dakota State University. **M.E. Jewell**, M.L. Miller

8:25 881. Teachers as researchers; implementing action research into the chemistry classroom. **R. Johnson**

8:45 882. Take "OAIM" and Fire: The OAIM Method for Procedure Writing and Its Effectiveness. **L. Detwiler**

9:05 Panel Discussion.

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 883. Understanding High School Students' Misconceptions about Chemistry using Particulate Level Drawings: Focusing on the Third Angle. **S. Smith**

11:25 884. Chemistry Content Knowledge And Verbal Analogical Reasoning As Potential Predictors Of Teachers' Quality Of Chemistry Concept Analogies. **S. Asenjo**

11:45 Panel Discussion.

12:25 Closing Remarks.

STEW
302

Functional Groups: Collaborative learning in organic chemistry and related subjects

J. L. Kiappes, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 911. Organic Chemistry Small-Group Term Project: Collaboration via Google Docs and Slides. **B.N. Churchill**, S.A. Dandekar

8:25 912. Incorporating groupwork and inquiry into organic chemistry lab. **M.A. Vanalstine-Parris**

8:45 913. Collaborative Huddle Engaging Magnification: CHEM. **K. Johnson**

9:05 914. Practice and Pitfalls of Using Student Roles in Organic Chemistry Collaborative Groups. **M. Barranger-Mathys**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 915. Conversations about flipping an organic chemistry classroom in the midst of a pandemic. **K.M. Slunt**, **J.A. Asper**

11:25 916. Collaborative activities encourage higher order thinking in biochemistry. **J. Fishovitz**

11:45 917. Collaborative workshops in introductory organic chemistry: Empowering students to solve chemical biology research questions. **J.L. Kiappes**

12:05 918. Peer-led small group discussions facilitate improved student learning in organic chemistry. **J.A. Martinez**, **S. Davis**, **S.A. Dandekar**

12:25 Closing Remarks.

STEW
307

Overarching undergraduate curriculum reform

B. B. Harmon, N. L. Powell, *Organizers*
D. R. Mulford, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 932. Implementation and assessment of a merged organic and general chemistry four-semester sequence for a health science degree. **X. Prat-Resina**

8:25 933. Chemistry Unbound at Emory University: Implementation and initial assessment results. **D.R. Mulford**, T.L. McGill, L.C. Williams

8:45 934. Flexible curricular reform: How different implementations can achieve the same goals. **D.R. Mulford**, N.L. Powell, B.B. Harmon

9:05 Panel Discussion.

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 935. The INSPIRE program: creating STEM undergraduate cohorts to promote interdisciplinary research and collaborations. **W.E. Schatzberg**

11:25 936. Adapting Creative Exercises to an Undergraduate Biochemistry Course Sequence. **C. Nix**, Y. Gerasimova, J.D. Caranto, D. Kolpashchikov, E. Saitta

11:45 937. Applied Science, an Alternative Approach to Chemistry Education. **J. Frost**

12:05 Panel Discussion.

12:25 Closing Remarks.

PMU
North Ballroom

General Posters 5

M. T. van Opstal , *Organizer, Presiding*

9:30 - 10:30

1007. Is the glassware “rinse three to four times with deionized water” clean enough?. **K. Qiu**, S. Wang

1008. Modes of undergraduate research; Which one serves students the best?. **C.A. Barta**

1009. Using in-class activities in a 1-semester biochemistry class to improve student engagement and learning. **R. Bouley**

1010. Withdrawn

1011. Practical examples of constructively responsive reading instruction to promote metacognition when learning industrial and environmental chemistry. **S.R. Esjornson**

1012. Is classroom engagement a predictor of overall course performance?. **R. Rosa Tavares Rodrigues**, D. King

1013. Team Science in Undergraduate Education. **C. Andersen**, J.P. Walker

1014. Learning Diversity, Equity, and Inclusion Through General Chemistry: Course Materials Development via Renewable Assignments. **S. Sun**, J. Kaiser, A. Meier

1015. Stakeholder Interpretations of Scientific Information Literacy: Surveying Orange and Seminole County K-16 Educators. **B. Chiu**, C. Randles

1016. Testing feedback: translating chemistry education research into classroom practice. **J.L. Schneider**, M.A. Teichert, D.G. Schreurs, J.M. Trate, C.J. Luxford, K.L. Murphy

1017. Minoritized Students' Sense of Belonging in Post-secondary General Chemistry. **T. Hanson**

1018. Project CASE (Collaborating Around STEM Engagement), An Outreach Program. **W.C. Deese**

1019. 3D IMAGINE - Creating 3D tactile images to teach STEM courses to visually impaired. **E. Hasper**

1020. Determining the Color Changes of pH Indicators Using a Spectrophotometer. **H. Lee**, H. Kim

1021. General chemistry students' perceptions of remote/online v. in-person education during the COVID-19 pandemic. **A. Ly**, M. Orgill

1022. Engineering interactive learning in the general chemistry laboratories at Texas A&M University (TAMU). **A.C. Songok**, E. Lee, A. Altemose

1023. Meaningful contrasts - Investigating the Potential of Task Formats to Promote Students' Mechanistic Reasoning in Organic Chemistry. **D. Kranz**, M. Schween, N. Graulich

1024. Teaching Organic Chemistry Undergraduate Laboratory Curriculum by theme-based sunscreen project. **D. Butani**, M. Nelson, R.S. Muthyala

1025. Using POGIL and 3D Models to Teach Orbital Hybridization in Undergraduate General Chemistry. **R.S. Thompson**, S.A. Toledo

1026. Meeting students' needs? Implementing reading interventions in introductory chemistry and its impact on student performance. **F. Diawara**

1027. Investigating Doctoral Student-Advisor Relationships in the Chemical Sciences via Cluster Analysis and The Effect on Students' Career Plans. **T. Stevens**, M. Eagle, J. Schlatterer

1028. Discourse analysis of student thinking about molecular polarity when offered sequential or simultaneous exemplars with and without electrostatic potential maps. **C.L. Lavoie**, C.F. Bauer

1029. Analysis of Chemistry Card Games impact on student exam performance. **M. Clark**, J. Cotter

1030. Beyond the teaching lab: A lecture teaching fellowship for graduate students. **S. Moon**

1031. Culturally Relevant and Socially Responsible Design of Organic Chemistry Laboratories Curriculum. **C.L. Velez**

1032. A Physical Chemistry course for non-Physical Chemists. Active learning strategies using Python and Jupyter Notebooks. **X. Prat-Resina**

1033. Vitamin C kinetics: Using time-release tablets to rethink a classic experiment. **D.E. Gardner**, N. Mugande

1034. Investigating the differences in use of Learning Assistants on students' chemistry identity development. **G.S. Rophail**, J.H. Carmel

1035. Speed and Accuracy vs. Cost: A Solids Analysis Investigation. **D.F. Fraley**

1036. Teaching and Encouraging Science Scholars through Social Justice. **M. Harrison**, K. Boyd, M. Magrakvelidze, C. Nielsen

1037. Using case studies in Chemistry Education: The examples of Water Resources and Mining. **M. Silva de Lima**, S. Queiroz, L.L. Pozzer

1038. Creating a Course-based Undergraduate Research Experience (CURE) for the Inorganic Lab. **L.C. Williams**, A. Saha

WALC
1018

Assessment Instruments: Design, Development, and Evaluation

M. Atkinson, J. Barbera, *Organizers, Presiding*

11:00 Introductory Remarks.

11:05 1039. Exploring the factor structure of the Meaningful Learning in the Laboratory Instrument (MLLI). **E.B. Vaughan**, J. Barbera

11:25 1040. An investigation of the internal structure of the Meaningful Learning in the Laboratory Instrument. **K.J. Linenberger Cortes**, R. Spruiell, M.L. Head, G. Taasoobshirazi

11:45 1041. Extending the Utility of the Chemistry Self-Concept Inventory in the Urban High School Setting Using Rasch Modeling. **Y. Chen**, S.M. Werner, M. Stieff

12:05 1042. Evaluation of the Academic Motivation Scale-Chemistry via contrasting Likert-scale and rank-sort approaches. Y. Wang, **S.E. Lewis**

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 1043. Design and evaluation of a measure of student engagement in active learning activities. **N. Naibert**, J. Barbera

2:25 1044. Development of a chemistry-specific mindset instrument. **D. Santos**, S. Mooring, J. Barbera

2:45 1045. Developing the Intelligence Mindset in the Chemistry Laboratory Assessment. **S. Fullington**, S. Bretz

3:05 1046. Developing and Validating a Survey on Students' Experiences and Understanding of the Culture of Scientific Research and Racial Identity. **P. Vincent-Ruz**, K. Hosbein, J.L. Dewey, R.S. Phillips

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 1047. Collecting response process validity evidence in chemistry education research. **J.M. Deng**, N. Streja, A.B. Flynn

4:10 1048. Instrument development and use in Chemistry Education Research and Practice (2010 - 2021). **K. Lazenby**, T. Marcroft, K. Tenney, R. Komperda

4:30 1049. BioMolViz: A collaborative community for designing assessments of biomolecular visual literacy. **D.R. Dries**, R. Acevedo, P.S. Mertz, W.R. Novak, S. Engelman, J.T. Beckham, K. Procko

4:50 1050. Building Assessment Capacity in Chemistry Education - The CHemistry Instrument Review and Assessment Library (CHIRAL) Project. **J. Barbera**, **J. Harshman**, **R. Komperda**

5:10 Closing Remarks.

STEW
202

Moving towards anti-deficit framing in our research and practice (#AdvancingEquityinCER)

K. Hosbein, M. E. Howe, C. Stachl, *Organizers*
V. R. Ralph, S. M. Werner, *Presiding*

11:00 Introductory Remarks.

11:05 1051. One scholar's journey to reframe previous work to anti-deficit, equity-centered research. **S.M. Werner**

11:25 1052. Integrating asset-framing with ungrading in introductory chemistry courses: A growth-filled journey. **C. Sorensen-Unruh**

11:45 1053. Thinking with agential realism and variation theory to investigate representational practices in biochemistry teaching and learning. **S. Wang**, R. Sung, T.J. Bussey

12:05 Panel Discussion.

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 1054. Asset-Based and Anti-Deficit Methods for the Iterative Evaluation of a Professional Development Workshop. **J. Tashiro**, S. Pazicni

2:25 1055. Using Intersectionality as a heuristic in an Institutional Ethnographic Investigation: Implications for equity research in STEM education. **C.E. Wright**

2:45 1056. Society's educational debts due to racism and sexism in chemistry student learning. **J. Nissen**, B. Van Dusen, R. Talbot, H. Huvard, M. Shultz

3:05 Panel Discussion.

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 1057. Promoting an equity-minded Approach to Advancing racial equity in chemistry education. **j. collins**

4:10 1058. Investigating chemistry culture from the perspective of PEERs. **C. Ngai**

4:30 1059. Impact of science specialized first-year course in the development of first-year Science students. **Z.S. Wilson-Kennedy**, J. Zhan, **R. Davis**

4:50 Panel Discussion.

5:10 Closing Remarks.

STEW
206

Process Oriented Guided Inquiry Learning (POGIL) in the classroom & laboratory

M. D. Perry, *Organizer*
L. E. Parmentier, *Presiding*

11:00 Introductory Remarks.

11:05 1060. The POGIL Project: Exploring new frontiers. **M.D. Perry**

11:25 1061. POGIL Activity Clearinghouse. **B.M. Fetterly**, M. Dubroff, C.L. Fish, M.P. Garoutte, S. Garrett-Roe, E.M. Kowalski, M.S. Reeves, T.D. Shepherd, C.M. Teague, M.T. van Opstal

11:45 1062. Implementation and assessment of the flipped classroom enhanced POGIL curriculum on learning outcomes and attitudinal constructs of first-generation underrepresented minority (URM) students in gateway undergraduate college chemistry courses to decrease equity gaps. **M. Shapiro**, D.M. Solano, J. Bergkamp, G.A. Lopez, S. Waller, D.R. Rosenthal, X. Da Silva Tavares, C. Butler

12:05 1063. Gamified Process Oriented Guided Inquiry Learning Activities (GpA) in a Large Enrollment Chemistry Course. **N. Turner**, T. Gupta, M.E. Jewell

12:25 Closing Remarks.

12:30 Lunch.

2:00 Introductory Remarks.

2:05 1064. Implementing cyber POGIL and PLTL to improve resilience of teaching chemistry in Puerto Rico. **C. Rivera-Maldonado**, C. Peraza González, L. Méndez-Torres

2:25 1065. Small group interactions in a hybrid POGIL-based general chemistry class. **S. Fateh**, Z. Kirbulut, J. Reid, O. Ayangbola, A.J. Phelps, G. Rushton

2:45 1066. Student centered collaboration online in an introductory chemistry course. **L. Eaton**

3:05 1067. Synchronous hybrid POGIL teamwork: Implementation and impact on student learning in General Chemistry. **S.U. Dunham**

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 1068. Flipping a traditional 'cookbook' style lab manual into a POGIL style lab manual. **T. Hanson**

4:10 1069. Melting thermodynamics and molecular structure: a POGIL laboratory activity. **J.P. Hagen**

4:30 1070. Creating Engaging General Chemistry Polymer Laboratories: POGIL Model and Student Voice. K. Mardis, **A.G. Van Duzor**

4:50 Panel Discussion.

5:10 Closing Remarks.

STEW
302

Active Learning in Organic Chemistry

A. Leontyev, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 1071. Development of a poly(lactic acid)/nylon 6-6 polymer synthesis experiment for organic chemistry. **S.A. Henrie**, J.H. Davis, N.C. Dalton

2:25 1072. Gamification in the Organic Laboratory as an Answer for Apathy and Pandemic. Going Full Circle. **C. Arias**

2:45 1073. Chem101 in Organic Chemistry II: Part of the Kitchen Sink approach. **P. Wiget**

3:05 1074. Augmented reality tools for teaching organic chemistry mechanisms. **M. McColgan**, N. Stagnitti, J. Marotta, L.J. Tucker

3:25 Closing Remarks.

BRWN
1154

Beyond the Laboratory Teaching Assistantship: How can we prepare our graduate students for teaching outside of the laboratory?

R. Broyer, *Organizer*
S. N. Knezz, J. A. Parr, *Presiding*

2:00 Introductory Remarks.

2:05 1075. Creating professional development to mitigate teaching anxiety and discomfort in graduate teaching assistants. **A. Sona**, M. Kwaschyn, E. Saitta

2:25 1076. The influence of community on graduate student socialization as teachers in the chemical sciences. **C. Schnoebelen**, N. Suarez, S. Brydges

2:45 1077. Teaching More than Teaching: Evolving Our General Chemistry TA Training Program to Address the TA's Role in the Student's Holistic Experience. **J.J. Weaver**, S. Block, L.B. Lamont, L. Gustin, J.S. Hamers, t. pesavento, J.M. Trate, C. Wilkinson

3:05 1078. Pandemic policies bring endemic effects: Lasting changes in the post-COVID classroom. **C. Barrett**, R. Broyer

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 1079. AcademiNext: Emerging Faculty Development Program. **R. Broyer**, J.A. Parr

4:10 1080. A classroom teaching fellowship: The graduate student's perspective. **S. Moon**

4:30 1081. The Institute for Future PUI Faculty: A case study about participants' career motivations and perceptions during Lafayette College's new professional training program. **M.A. Bertucci**

4:50 Panel Discussion.

5:10 Closing Remarks.

STEW
204

Cognitive resources for understanding students: How to and what for?

A. C. Moon, S. Mooring, *Organizers, Presiding*

2:00 Introductory Remarks.

2:05 1082. Why Assumptions About the Nature and Structure of Knowledge Matter for Research and Teaching. **J. Rodriguez**

2:25 1083. Organic chemistry students' cognitive resources for making inferences about stability. **F. Rotich**, C.C. Onokalah, L. Wright Ward, M. Popova

2:45 1084. Investigating undergraduate chemistry students' cognitive resources for reasoning about graphical representations. **N.M. Becker**, J. Rodriguez, S.J. Hansen

3:05 1085. Exploring Epistemic Resources in Research and in Teaching. **R.M. Kelly**, J. Kim

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 1086. Investigating how molecular orientation affects students' cognitive resources for identifying reflection and rotation symmetry elements. **O. Crandell**, S. Pazicni

4:10 1087. How students predict SN1, SN2, E1, and E2 reaction mechanisms through the lens of coordination class theory. **K. Hunter**, N.M. Becker

4:30 1088. "To Be Honest, I Didn't Even Use the Data": Organic Chemistry Students' Engagement in Data Analysis and Interpretation. **J. Zhou**, A.C. Moon

4:50 1089. Exploring Student Mechanistic Reasoning through the Evidence-Based Design of Carbonyl Activation Case Studies. **S. Petritis**, E.L. Day, M. Cooper

5:10 Closing Remarks.

STEW
311

Exploring the implementation of Peer-Led Team Learning and the diverse outcomes that result

C. F. Bauer, K. A. Bowe, S. E. Lewis, *Organizers, Presiding*

2:00 Introductory Remarks.

2:05 1090. Born in the USA - Exploring the PLTL Model in U.K Higher Education. **L. Howell**, R. Shahid

2:25 1091. Transferrable skills gained from experience as a peer-leader in a PLTL program: A mixed-methods study of LinkedIn users. **A. Chase**, D. Maric, A.S. Rao, G. Kline, P. Varma-Nelson

2:45 1092. Using Undergraduate Peer Leaders in Establishing an Inclusive Classroom. **R. Frey**, M. Jareczek, H.L. Torres

3:05 1093. PLTL students as partners in creating learning activities for cross-disciplinary scientific and mathematical practices. **C.F. Bauer**, M. Aikens, J. Kustina, D. Meredith, K.A. Bowe, A. Gaudreault, N. Altindis

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 1094. Can artificial intelligence (AI) be used to monitor and enhance cPLTL workshops?. **P. Varma-Nelson**, K. DSouza, S. Mukhopadhyay, S. Fang, L. Zhu

4:10 1095. An evaluation of online Peer-Led Team Learning to promote student success. **J. Young**, S.E. Lewis

4:30 1096. Embedding Peer Educators into the General Chemistry Classroom. **R.W. Clark**, K.E. Leach, T.E. Goyne, J.S. Holt, T.K. Armstrong

4:50 1097. If all you have is covalent bonding, every substance is a molecule: Longitudinal study of student enactment of covalent and ionic bonding models. **K.A. Bowe**, C.F. Bauer, Y. Wang, S.E. Lewis

5:10 Closing Remarks.

STEW
313

Molecular-Level Animations in Secondary Chemistry: VisChem Teacher Showcase

R. Tasker, E. J. Yezierski, *Organizers*
K. Q. Magnone, M. M. Wu, *Presiding*

2:00 Introductory Remarks.

2:05 1098. Why does ice float? Using VisChem animations to prompt deeper thinking about an everyday phenomenon. **K. Dempsey**, M.M. Wu, K.Q. Magnone, J. Ebert, E.J. Yezierski

2:25 1099. What's in the bubble: Connecting macroscopic observations to changes in particle arrangement. **J. Hansen**, M.M. Wu, K.Q. Magnone, J. Ebert, E.J. Yezierski

2:45 1100. Connecting the intermolecular dots: Using the VisChem Approach to address student misconceptions of intermolecular interactions and particulate chemical modeling. **R. Johnson**, M.M. Wu, K.Q. Magnone, J. Ebert, E.J. Yezierski

3:05 1101. May the force be with you: Using VisChem animations to teach intermolecular forces. **A.J. Hanson**, M.M. Wu, K.Q. Magnone, J. Ebert, E.J. Yezierski

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 1102. Inquiry, electrolytes, and particle-level animations: Helping students represent ions in aqueous solutions. **K. Curtis**, M.M. Wu, K.Q. Magnone, J. Ebert, E.J. Yezierski

4:10 1103. Helping students visualize and understand precipitation reactions using drawings and animations. **S. Richardson**, M.M. Wu, K.Q. Magnone, J. Ebert, E.J. Yezierski

4:30 1104. Using the VisChem Approach to help students understand the role of electrostatic attractions between oppositely charged ions in ionic substances. **A. Mital**, M.M. Wu, K.Q. Magnone, J. Ebert, E.J. Yezierski

4:50 1105. Exploring the logistics of implementing the VisChem Approach in a chemistry curriculum: Start with misconceptions. **C.E. Rutter**, M.M. Wu, K.Q. Magnone, J. Ebert, E.J. Yezierski

5:10 Closing Remarks.

STEW
307

Why and/or how do the flipped classroom influence student learning and faculty success in chemistry classes and laboratories?

R. S. Perera, *Organizer, Presiding*

2:00 Introductory Remarks .

2:05 1106. Flipping the Large (and Small) Undergraduate Lecture: Strategies and Lessons Learned. **A. Herring**, M.J. Bojan, L. Funari

2:25 1107. Flipped Classroom, Active Learning, and Enhanced Feedback – A Classroom to Laboratory and Back Approach. **D.M. West**

2:45 1108. Using PhET Simulations as Exploratory Models: Leveraging the Flipped Classroom Structure to Build Conceptual Understanding in a Large Enrollment General Chemistry Course. **J.F. Eichler**, E.J. Yezierski

3:05 1109. Exploring Student perspectives of the flipped classroom pre-class video. **N. Burrows**

3:25 Closing Remarks.

3:30 Break.

3:45 Introductory Remarks.

3:50 1110. Flipped Across the Curriculum. **L.M. Ponton**

4:10 1111. How to Look for Flippable Moments in Your Class and Backward Design Process.. **R.S. Perera**

4:30 Panel Discussion.

5:10 Closing Remarks .

STEW
302

Equitable and Student-Centered Assessments

J. Brown, M. Farabaugh, *Organizers, Presiding*

3:45 Introductory Remarks.

3:50 1112. Assessment Design in General Chemistry II. **P. Muisener**

4:10 1113. Mastery-based grading across a first-year chemistry sequence at Grand Valley State University. **B.K. DeKorver**, S. Clark, J. Henderleiter, N.J. Barrows

4:30 1114. Ungrading in the Chemistry Lab: Using Digital Notebooks and Team Dashboards to Improve Formative Feedback. **P. Gittins**

4:50 1115. Toward Equitable Assessment of English Language Learners in Chemistry: Identifying Challenging Features in Assessment Items. **E. Lee**, M. Orgill

5:10 Closing Remarks.

STEW
306

Methods for Characterizing Epistemology in Chemistry Education Research

K. DeGlopper, *Organizer*
R. Stowe, *Organizer, Presiding*

3:45 Introductory Remarks.

3:50 1116. Characterizing organic chemistry instructors' teaching-related epistemologies. **K. DeGlopper**, R. Russ, P. Sutar, R. Stowe

4:10 1117. Characterizing In-the-Moment Learning in General Chemistry through Practical Epistemology Analysis. **J. Karch**, J. Pierre-Louis, D. Strange, I. Caspari

4:30 1118. Using a scaffolded critiquing task to promote engagement in metamodeling knowledge: Analyzing how students reason with and about chemical bonding models. **V. Bapu Ramesh**, J. Rodriguez, N.M. Becker

4:50 1119. A research methodology to explore students' guiding epistemology and conceptualization of disciplinary context when problem solving. **A.P. Parobek**, P.M. Chaffin, M.H. Towns

5:10 Closing Remarks.

THURSDAY

WALC
3138

Oral communication in the chemistry curriculum

G. Crawford, K. D. Kloepper, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 1150. Communication skills enhancement through a variety and progression of presentations. **R. Morgan Theall**

8:25 1151. Enhancing oral communication: Storytelling in the chemistry classroom. **E. Vickers**

8:45 1152. Developing informal technical communication: Oral lab reports in organic chemistry. **L. Wysocki**, S. Drury

9:05 1153. Reflecting on increasing oral communication opportunities and assessments in an inorganic chemistry laboratory. **J.L. ODonnell**, J.W. Karr

9:25 Closing Remarks.

WALC
3122

3D Printing in Chemical Education: Engaging Students and Creating Tools for Active Learning

L. A. Porter, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 1120. 3D Printing Workshops: A fun and hands on way of aiding student understanding of representation, shape and chirality. **R. Blackburn**, R. Britton

8:25 1121. 3D Printed Models of Atomic, Hybrid, and Molecular Orbitals. R. De Cataldo, K.M. Griffith, S. Flagg, R. King, **K.H. Fogarty**

8:45 1122. Training Exercises for 3D Printed Space-Filling Molecular Models. N. Nolan, H. Martin, **J.K. Klosterman**

9:05 1123. Integration of 3D-Printed Optomechanics Kits into an Advances Instrumental Analysis Course. **T.J. Bixby**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 1124. Improving laboratory education with 3D-printable smartphone spectrophotometers. **A.W. Smith**

11:25 1125. MakerLab: A New Course in Computer-Aided Design, Coding, and 3D Printing for Chemistry Students. **L.A. Porter**

11:45 1126. Developing an Entrepreneurship Infused Digital Fabrication Course at Millikin University. **K.N. Knust**

12:05 Panel Discussion.

12:25 Closing Remarks.

WALC
1132

Active learning implementation

D. B. King, *Organizer*, *Presiding*

8:00 Introductory Remarks.

8:05 1127. Orgo for the 21st Century: A Student-Centered Course on Advanced Reactivity. **A. Neuman**, A. Scharf

8:25 1128. Lessons from flipped classroom incorporation in a large enrollment inorganic lecture course. **M.R. Porter**

8:45 1129. Withdrawn

9:05 1130. Precursor to Active Learning: Engaging Students with Lightboard Videos. **B. Woods**, R. Perkins

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 1131. The use of surveys to identify self-learned material to open time for in-class activities. **M. Delgado**, F. Germain

11:25 1132. Using Quasi-active Learning to Improve Students' Learning in Chemistry. **Y. He**

11:45 1133. What can we learn from the personal characteristics of instructors who implement evidence-based instructional practices?. **B. Morgan**, M. Weinrich

12:05 1134. Using national survey data to transform department instructional practices: Adoption of active learning. **B.J. Yik**, J.R. Raker, M.N. Stains, N. Apkarian, C. Henderson, M.H. Dancy, E. Johnson

12:25 Closing Remarks.

WALC
3127

Encoiling Research and Practice to Understand and Improve Inorganic Chemistry Education

J. M. Pratt, J. L. Stewart, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 1135. An Alternative to Using *d*-orbitals to Describe Bonding in Main Group Compounds. **S. Pazicni**

8:25 1136. Supporting the inclusion of solid-state chemistry in introductory courses. **J.T. Race**, P. Woodward, T.M. Clark

8:45 1137. Students conceptions on conductivity in solids in foundations level inorganic chemistry. **A.K. Bentley**, B.A. Reisner, J.M. Pratt, J.L. Stewart, J. Hallers, J.R. Raker, S. Lin, S.R. Smith

9:05 Panel Discussion.

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 1138. Quick Writes for High Level Comprehension. **J.F. Dunne**

11:25 1139. Literature-based problem sets and exams questions in the inorganic curriculum. **J.L. ODonnell**

11:45 1140. Lessons learned from a utility-value intervention in inorganic chemistry. Y. Wang, **S.E. Lewis**

12:05 1141. A preliminary study on the strategies that students use to solve complete-the-reaction inorganic tasks. **H.P. Lundien**

12:25 Closing Remarks.

WALC
1018

Fun-tastic Games and How to Make/Use Them

T. D. Gaines, *Organizer, Presiding*
R. M. Doughty, P. Lee, Z. Thammavongsy, *Presiding*

8:00 Introductory Remarks.

8:05 1142. Acids to acids: An Apples to Apples™ inspired game to aid in pKa identification. **A.L. Courtney**

8:25 1143. Escape Room Mania! Incorporating escape rooms in the classroom and the teaching laboratory. **M.J. Vergne**

8:45 1144. Atoms to Atoms: A game-based classroom activity to check for understanding prior to a formal exam. **B. Miller**

9:05 1145. Project Lockbox: Adapting an escape-room-style activity to different content types, course levels, and class sizes. **R.M. Doughty**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 1146. Chemistry Games Tailored for the Inorganic Chemistry Classroom. **Z. Thammavongsy**

11:25 1147. Catalyzing Chemical Education with REACT!™ - The Organic Chemistry Board Game. **K.C. Wong**, P.V. Juthani, B. Ahmed, D.A. Rosenthal, J. Wang, K.H. Chan, M. Chen, A. Gupta, M.O. Mostaghimi, H. Pan

11:45 1148. Development of GpA: An Active Learning Matching Card Game. **N. Turner**, T. Gupta, M.E. Jewell

12:05 1149. Use of Chemistry Card Games in the classroom to enhance learning and retention. **M. Clark**, J. Cotter

12:25 Closing Remarks.

WALC
3087

Research in Chemistry Education

M. Anzovino, J. H. Carmel, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 1154. Deploying 21st century skills in the learning and teaching of chemistry: where do Nigerian serving and preservice teachers stand?. **K. Oloruntegbe**

8:25 1155. An Analysis of the Teaching Experiences of Instructors Within One Chemistry Department During the COVID-19 Pandemic. **L. Wright Ward**, J. Hoang, M. Popova

8:45 1156. Understanding of Virtuosity in Science Teaching and Developing Virtuoso Science Teacher: A Comparative Case Study Of Understanding Excellence In Teaching Practice. **e. ozyurek**

9:05 Panel Discussion.

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 1157. Use Of Advance Organiser On Gender Variables In Teaching Chemistry In Secondary Schools In Nigeria. **A.O. OMONIYI**

11:25 1158. Network analysis to investigate citation and assessment instrument networks. **K. Lazenby**, T. Marcroft, K. Tenney, R. Komperda

11:45 1159. Results from a national survey on instrumentation use in undergraduate laboratory courses. **M. Connor**, J.R. Raker

12:05 1160. Does a spectrum of STEM Education Research exist?. **R. Lindell**

12:25 Closing Remarks.

WALC
B058

Using Computational Chemistry to Improve Student Understanding of Chemical Reactions

B. J. Esselman, N. J. Hill, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 1161. The Compute-to-Learn Pedagogy. **D.M. Hassan**, K. Lenn

8:25 1162. Molecular modeling of chemical reactions from high school to physical chemistry courses. **L. Tribe**

8:45 1163. Undergraduate Chemistry Lab - Using Ab Initio Calculations to Predict Chromatographic Outcomes. **R. Karugu**

9:05 1164. Analyzing infrared and NMR spectra of organic molecules with WebMO and Gaussian. **K. Range**

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 1165. Implementing computational chemistry in large organic chemistry laboratory classes: Methodology, exercises, and expanding usage to other courses. **L.M. Goldman**, A.B. McCoy, S. Stoll

11:25 1166. Determining and Rationalizing the Stereochemical Outcome of the Reduction of Benzoin with Spectroscopy and Computational Chemistry. **B.J. Esselman**, N.J. Hill, A. Ellison

11:45 1167. Integrating computational chemistry into organic lecture and problem solving sessions. **A. Ellison**, B.J. Esselman, R. Stowe

12:05 Panel Discussion.

12:25 Closing Remarks.

WALC
2087

Utilizing scientific literature to develop reading comprehension skills, writing efficacy, and content knowledge.

C. Johnson, M. M. Morgan, E. P. Wagner, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 1168. Tracking information literacy in science students: reinforcing skills through literature-based assignments in General Chemistry and Biochemistry. **J.D. Knight**, M. Bruehl, D. Pan, S. Budd

8:25 1169. Two Literature Review Projects for Organic Chemistry. **L.J. Silverberg**

8:45 1170. Teaching Students to Read the Primary Literature Using POGIL Activities. **T.A. Murray**

9:05 1171. Developing Scientific Writing Abilities Through Guided and Active Learning Cycles in the Physical Chemistry Laboratory. **C. Johnson**, E.P. Wagner

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 1172. Writing Skills Development in General Chemistry using Scientific Literature. **M.M. Morgan**, G. Murray, C. Johnson, E.P. Wagner

11:25 1173. Development of a scientific writing course for chemistry and biochemistry majors. **S. Pierce**

11:45 1174. A Long Term Project is an Excellent Way to Add the Primary Literature into a Lab Course.. **D.J. Slade**

12:05 1175. Switching to Specs: The Process of Modifying Writing-Intensive Upper Division Chemistry Courses to Use Specifications Grading. **S. Mang**

12:25 Closing Remarks.

WALC
2088

We want YOU for the US National Chemistry Olympiad!

M. Barranger-Mathys, J. Houck, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 1176. The first thirty years of service as the Local Section Coordinator for the National Chemistry Olympiad. **M.M. Kozik**

8:25 1177. The US National Chemistry Olympiad in the Philadelphia Section of the ACS - Progress and Challenges. **C.P. McClure**, L. Grande

8:45 1178. Annotating the past USNCO exams – a group volunteering project. **S. Chen**

9:05 Panel Discussion.

9:25 Closing Remarks.

9:30 Break.

11:00 Introductory Remarks.

11:05 1179. International Chemistry Olympiad theoretical tasks: Classroom tools and insights into assessment design. **J.L. Kiappes**

11:25 1180. Mentoring for the USNCO: Commitments and Rewards. **M. Barranger-Mathys**

11:45 Panel Discussion.

12:25 Closing Remarks.

WALC
3138

Media in Teaching and Learning Chemistry

W. J. Donovan, *Organizer, Presiding*

11:00 Introductory Remarks.

11:05 1181. Using the C-SPAN Archives in chemistry classes to build civic understanding and engagement. **A. Langrish**, **W.J. Donovan**

11:25 1182. Science Literacy and Real-World Chemistry Content. **C. Suh**

11:45 1183. Evolving with measurable impact from sage-on-a-stage to guide-on-the-side. **B. Meinzer**

12:05 1184. PowerPoint Reimagined: Fueling Student Engagement. **K.D. Revell**

12:25 Closing Remarks.