

Thomas A. Holme
Doctor of Philosophy in Chemistry

Personal Data:

Work Address: Department of Chemistry; Iowa State University, 0205 Gilman Hall, Ames, IA, 50011

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Born: July 1961; Green Bay, Wisconsin

Education:

Rice University, Houston, Texas; August 1983 - March 1987
Doctor of Philosophy in Chemistry

Loras College, Dubuque, Iowa; August 1979 - May 1983
Bachelor of Science in Chemistry and Physics - *Magna Cum Laude*

Honors and Awards:

National & Regional Awards:

Outstanding Service Award, Division of Chemical Education, American Chemical Society, 2017

Pimentel Award – (Chemical Education) American Chemical Society, April 2017

James Flack Norris Award for Chemistry Education, Northeastern Section of the ACS, 2016

Fellow, American Association for the Advancement of Science, 2011

Fellow, American Chemical Society, 2011

Great Lakes Regional Award for Volunteer Service – American Chemical Society, 2006

Milwaukee Section Award – American Chemical Society, 2005

Helen M. Free Award for Public Outreach, American Chemical Society, 1999

Biography Listings

- Who's Who in American Education, first listed in 2005
- 2000 Top Scientists of the 21st Century, 2004
- America's Registry of Outstanding Professionals, (2003-2008)
- Who's Who in Science and Engineering, first listed in 2002
- Who's Who in America, first listed in 2001

National Deans List, Loras College, 1983

Who's Who Among American College Students, Loras College, 1982

Local Awards:

Margaret Ellen White Graduate Faculty Award, Iowa State University, 2021

Cassling Award for Outstanding Achievement in Teaching, Liberal Arts and Sciences, Iowa State University, 2014

Iowa State University Award for Distinguished Undergraduate Teaching, 2014

Louis Thompson Distinguished Undergraduate Teaching Award, University-wide award, Iowa State University, 2014

Liberal Arts and Sciences Award for Teaching in Introductory Courses, Iowa State University, 2013

Distinguished Teaching Award, University of Wisconsin-Milwaukee, 1998

Inducted, Loras Players (Theatre) Hall of Fame, Loras College, 1997

Elected as Faculty Member of Omicron Delta Kappa, University of South Dakota 1994

Belbas-Larson Award for Excellence in Teaching, University of South Dakota, 1993

Fulbright Scholar, University of Zambia, 1989

MuCullom Fellow, Rice University, 1986

- (award for outstanding contribution to fundamental knowledge)

Harry E. Weiser Teaching Fellow, Rice University, 1985

Delta Epsilon Sigma Honor Society, Loras College, 1982

NSF Undergraduate Research Fellow, North Dakota State University, 1981

Regents Scholar, Loras College, 1979-1982

Professional Affiliations:

American Association for the Advancement of Science

American Chemical Society

Sigma Xi

Professional Experience:

Editor in Chief, Journal of Chemical Education, 2020 – present

Morrill Professor, Iowa State University, 2017 – present

Professor, Iowa State University, 2008 – 2017

Director, ACS Examinations Institute, 2002 – 2015

Professor and Director of General Chemistry, University of Wisconsin – Milwaukee, 2002–08

Exchange Professor, Ajou University, Suwon, South Korea, Spring 2000

Associate Professor and Director of General Chemistry, University of Wisconsin – Milwaukee, 1994 - 2002

Assistant Professor, University of South Dakota, 1989–94

Fulbright Lecturer, University of Zambia, 1989–90

Research Assistant, University of Pennsylvania, 1988–89

Research Assistant, Hebrew University of Jerusalem, 1987–88

Research Assistant, Rice University, 1984–87

Teaching Assistant, Rice University, 1983–84

Teaching Assistant, North Dakota State University, 1983

Research Assistant, North Dakota State University, Summer 1982, 1983

NSF Undergraduate Research Participant, North Dakota State University, 1981

Funded Grant Activity (as PI or co-PI):

“Transforming undergraduate STEM education: Improving student persistence and motivation in large undergraduate courses through game-based learning”, with Elgin Johnston (Math); Larysa

Nadolny (Education) and John Pleasants (Biology), Letters & Science, Strategic Research Incubator Program, \$163,594.

“Collaborative Research: Interactive Online Support for Open-ended Problem Solving Spanning Science Practices and Domain Topics”, with David Yaron, Carnegie Mellon University, NSF-IUSE, 9-1-2017 – 8-31-2020, Project Budget: \$550,000: Iowa State Budget: 98,343.

“Developing Augmented Reality Applications for Chemistry Laboratory”, Budget: \$243,014, NSF-IUSE, 9-1-2017 – 8-31-2019

“Enhancing Comparative Assessment for Chemistry with or without Standardized Testing” Collaborative Project with co-PI, David Hart, UMass-Amherst, Amherst, MA. Total Budget: \$595,000, ISU Budget: \$184,000, NSF-CCLI, Phase 2, 9-15-2013 – 8-31-2017.

“Electronic Delivery of Scaffolded Visualization Tutorials and Assessment in Chemistry”, Budget: \$172,759, NSF-CCLI (type 1) 9-15-2013 – 9-14-2015. 9-15-2013 – 8-31-2017.

“Visualizing the Chemistry of Climate Change”, with co-PI Peter Mehaffay, Kings University College, Edmonton, AB; co-PI Marcy Towns, Purdue University, West Lafayette, IN, Role: Evaluator. ISU Budget: \$42,000, NSF-CCLI, Phase 2, 9-1-2010 through 8-31-2013.

“Needs Assessment of Chemistry Instructors for Educational Measurement Professional Development Materials.” with Kristen Murphy, University of Wisconsin – Milwaukee, NSF-CCLI: \$168,872, 9-1-2009 through 8-30-2011.

“Collaborative Research: A Data-Driven Model for Chemistry Education Reform” (lead PI) with Stacey Bretz, Univ. of Miami, Melanie Cooper, Clemson, Jennifer Lewis, Univ. of South Florida, Norbert Pienta, Univ. of Iowa, Ron Stevens, IMMEX, Marcy Towns, Purdue, Project Budget: \$499,860: Iowa State Budget: 310,000 9-15-2008 through 3-14-2012

“Collaborative Research: Electronic Delivery and Criterion Referencing of Assessment Materials in Chemistry” (lead PI) with Dave Hart, UMass Amherst and John Moore, UW-Madison, Project budget: \$499,881: UWM Budget: \$199,997 9-15-2007 through 1-31-2012

“Using Cognitive Load Theory to Design and Assess Questions and Problem Solving Strategies in Chemistry” with Norbert Pienta (lead PI), University of Iowa and Melanie Cooper, Clemson University, National Science Foundation, CCLI Project Budget: \$481,686 UWM Budget, \$98,840 2006-2008

“Adapting IMMEX to Provide Problem Solving Assessment Materials from the ACS Exams Institute”, Collaborative Project with Melanie Cooper, Clemson University and Ron Stevens, UCLA. National Science Foundation, CCLI Project Budget: \$459,198 UWM Budget \$193,323. 2005- 2007

“NUE: Nanoscience Based Supplementary Items for ACS Exams Institute Assessment Materials”, National Science Foundation – Nanotechnology Undergraduate Education, 2004-2006, \$100,894

“Gateway Examinations in General Chemistry for Engineers”, National Science Foundation - Course and Curriculum Development, 1998-2001, \$120,000.

“Chemical Toxicology for Fire Department Hazardous Materials Teams Through Distance Learning”, Camille and Henry Dreyfus Foundation, 1998-1999, \$25,000

“Using Technology to Enhance Learning in Large Lecture Science Courses”, UWM Student Technology Competition, 1996, \$50,000

“ Theoretical Studies of Boronated Biomolecules”, UWM Graduate School Grants Competition, 1995, \$5,740

Note: I contributed to several major proposals from the UWM School of Education to the Department of Education, the National Science Foundation and the Carnegie Foundation. I was not a PI or co-PI on these grants, but received funding from 2001-2003 from them.

“Computational Studies of Boron Containing Heterocycle Compounds”, American Chemical Society Project SEED II, 1993, \$1,700.

“Increasing Faculty Involvement in Undergraduate Research”, USD Bush Mini Grant, 1993, \$9,945.

“Improving the Large Lecture General Chemistry Course”, USD Faculty Development Grant, 1992, \$1,378.

“Computational Studies of Cluster Chemistry as a Model of the Gas-Surface Interface”, National Science Foundation-EPSCoR, 1992-95 \$239,935.

“Computational Studies of Boron Containing Heterocycle Compounds”, American Chemical Society Project SEED, 1992, \$1,200.

“Elements of Research in Entry Level Science Courses”, USD Faculty Development Grant, 1991, \$956.

“Computer Interfacing Training for the Physical Chemistry Laboratory”, USD Faculty Development Grant, 1991, \$1,592.

“Simulation Studies of the Gas-Surface Interface: Laser Induced Thermal Desorption,” South Dakota Future Fund-EPSCoR, 1991, \$94,324.

National and International Professional Service:

1. **Editor in Chief**, Journal of Chemical Education, January 2020 - present
2. **Member**, Review Panel for the National Science Foundation, Division of Undergraduate Education, 2021
3. **Member**, Review Panel for the National Science Foundation, Division of Undergraduate Education, 2020
4. **Symposium Organizer**, “Assessment for employability in undergraduate chemistry education”, 9th Green Chemistry and Engineering Conference, Reston, VA, June 2019.
5. **Symposium Organizer**, “Reimagining Chemistry Education Through Systems Thinking”, with Madeleine Schulz, Alison Flynn and Siegbert Schmid, Honolulu, HI, December 2020.
6. **Symposium Organizer**, “Chemistry for global challenges: A role for Systems Thinking in Chemistry Education”, with Peter Mahaffy, Mei-Hung Chiu, Tina Overton and Suzanne Boniface, Honolulu, HI, December 2020.
7. **Symposium Organizer**, “Reimagining Chemistry Education Through Systems Thinking”, 9th Green Chemistry and Engineering Conference, Reston, VA, June 2019.
8. **Symposium Organizer**, “Innovative Assessments in Chemistry Education” 102nd Canadian Chemistry Conference and Exhibition, Quebec City, QC, June 2019.
9. **Associate Editor**, (Editor-in-Chief designee) Journal of Chemical Education, November 2018 – 2019
10. **Member**, IUPAC Project on Systems Thinking in Chemistry Education, June 2017 – Present
11. **General Chair**, 2018 Midwest Regional Meeting of the American Chemical Society, 2016 – 2018.
12. **Member**, Green Chemistry Education Roadmap Steering Committee, 2016 – 2018
13. **Discussion Leader**, Gordon Conference on Chemistry Education Research and Practice, June 2017
14. **Co-Editor**, ACS Symposium Series Book: Technology and Assessment Strategies for Improving Student Learning in Chemistry, 2015 – 2016
15. **Member**, Content Development Team, “You be the Chemist Challenge” Chemical Education Foundation, 2015 – 2018.

16. **Symposium Organizer**, “Technology and Assessment Strategies for Improving Student Learning in Chemistry, International Chemical Congress of Pacific Basin Societies, Honolulu, HI, December 2015
17. **Symposium Organizer**, “Educational Approaches to Help Students Connect Chemistry to World Issues of Sustainability and Climate”, International Chemical Congress of Pacific Basin Societies, Honolulu, HI, December 2015
18. **Member**, Task Force for Performance Expectations in General Chemistry, Society Committee on Education and Division of Chemical Education, American Chemical Society November 2015 – July 2016.
19. **Symposium Organizer**, “Current Practice and Research Using ACS Exams” National Meeting of the American Chemical Society, Denver, CO March 2015
20. **Symposium Organizer**, “Questioning the Unquestionable: Content Coverage in General Chemistry” National Meeting of the American Chemical Society, San Francisco, CA August 2014
21. **Co-Editor**, ACS Symposium Series: Trajectories of Chemistry Education Reform
22. **Lead-Editor**, Laboratory Manual for AP Chemistry, College Board, 2011-2013
23. **Reviewer**, “Discipline-Based Education Research: Understanding and Improving Learning in Undergraduate Science and Engineering”, report prepared by the National Research Council, National Academy of Sciences, 2012.
24. **Symposium Organizer**, “Assessment and Measurement of Student Learning in Chemistry”, *International Conference on Chemistry Education*, Rome, Italy, July 2012.
25. **Symposium Organizer**, “Guiding the Trajectory of Chemistry Education Reform: A Symposium in Honor of Susan Hixson”, ACS National Meeting, Philadelphia, PA, 2012.
26. **Member**, General Chemistry Learning Objectives Task Force, American Chemical Society Committee on Education, 2010 – 2015.
27. **Member**, Advisory Board, American Chemical Society Office of Professional Education, 2009 – present.
28. **Chair**, Review Panel for the National Science Foundation, Division of Undergraduate Education, July, 2010
29. **Member**, Curriculum Development and Assessment Committee, for AP Chemistry, College Board, 2008 – 2009
30. **Member**, Domain Analysis Panel for Reinventing AP Chemistry, College Board, 2008

31. **Member**, Domain Model Development team for Evidence Centered Design: AP Chemistry, College Board, 2007 – 2008
32. **Chair**, Review Panel for the National Science Foundation, Division of Undergraduate Education, July, 2008
33. **Member**, Editorial Review Board: Journal of Nano Education, 2007 – 2017.
34. **Member**, ACS Award Selection Committee, 2007 – 2009, 2010 – 2015 (Committee chair, 2009)
35. **Conference co-organizer**, “Practicing Chemistry with Theoretical Tools”, Maui, HI, January 2007.
36. **Member**, Review Panel, National Science Foundation, REC Division, 2006.
37. **Member**, Panel for Content Domain Analysis of the Reinventing AP Chemistry Project, College Board, 2006 – 2009
38. **Symposium Organizer**, “Models for Contextualizing General Chemistry Course Content” National Meeting of the American Chemical Society, Atlanta, GA March 2006
39. **Symposium Organizer**, “Accreditation of Chemical Engineering and Chemistry Education”, International Conference on Chemical Education, Seoul, Korea, August, 2006
40. **Member**, Search Committee for Editor, Journal of Chemical Education, 2005 – 2006
41. **Chair**, Review Panel for the National Science Foundation, Division of Undergraduate Education, July, 2005
42. **Discussion Leader**, Gordon Conference on Innovations in Chemistry Education, June 2005
43. **Feature Editor**, Resources for Student Assessment, Journal of Chemical Education, 2003 – 2009.
44. **Director**, Examinations Institute of the Division of Chemical Education, 2002 – 2015
45. **General Chair**, 2006 Great Lakes Regional Meeting of the American Chemical Society, 2003 – 2006
46. **Associate Member**, Society Committee on Education (SOCED), American Chemical Society, 2004 - 2007
47. **Councilor**, Milwaukee Section of the American Chemical Society, 2000 - 2006

48. **Member, Steering Committee**, NSF Workshop on Cyber-enabled Chemistry, October 2004.
49. **Associate Editor**, Thompson/Gale Encyclopedia of Chemistry, 2001 – 2004
50. **Member**, Committee on Public Relations and Communication, American Chemical Society, 2001- 2003 (member of the Helen Free Award for Public Outreach selection subcommittee).
51. **Grant Advisory Board Memberships**, (1) FIPSE Grant, Youngstown State University, 2002-2004; (2) NSF-ASA Grant, SUNY – Stony Brook, 2003.
52. **Symposium Organizer**, “Can we talk? Communication in Chemistry Education.” National Meeting of the American Chemical Society, New Orleans, LA 2003
– Designated as a Presidential Event
53. **Chair**, Review Panel for the National Science Foundation, Division of Undergraduate Education, August, 1999
54. **Member**, Review Panel for the National Science Foundation, Division of Undergraduate Education, February, 1999
55. **Symposium Organizer**, with Dr. Cathy Middlecamp (UW-Madison) “Peer Review: It’s Role in Chemistry Education”, National Meeting of the American Chemical Society, Anaheim, CA, 1999
56. **Speaker**, ACS Speaker Service for Local Section meetings, 1998 – 2010
57. **Symposium Organizer**, “Students Then and Now: Opportunities and Challenges”, Joint Symposium in Chemistry Education and History of Chemistry, National Meeting of the American Chemical Society, San Francisco, CA, 1997
58. **Public Relations Chairman**, Division of Physical Chemistry, American Chemical Society 1996-2001
59. **Editor**, Users Newsletter for Chemistry in Context, William C. Brown Publishers, 1995 – 1998
60. **Chairman**, Committee to Develop National Exam for Chemistry in Context, ACS Exams Institute, 1995 – 1996
61. **Symposium Organizer**, “Reform When We’re Not Singing to the Choir”, National Meeting of the American Chemical Society, New Orleans, LA March 1996
62. **Discussion Leader**, Gordon Conference on Innovations in Chemistry Education, January 1995

Regional Service

1. **Secretary**, Ames Local Section, 2018 – 2020
2. **Chair**, Ames Local Section, 2012 – 2013
3. **Chair**, Chemistry Olympiad Program, Ames Local Section, 2009 – 2011
4. **Member**. UW-Milwaukee University Committee (executive committee of the Faculty Senate.) 2005 – 2006.
5. **Member**. Review Panel for Eisenhower Grant Program – State of Wisconsin, 1997 – 2001.
6. **Coordinator**. National Chemistry Week. Milwaukee Local Section, 2000 – 2002
 - a. recipient of Chemluminary Award for web-based scavenger hunt for high school students
7. **Co-Organizer**, High School Program, Great Lakes Regional Meeting of the American Chemical Society, 1998.
8. **Associate Coordinator**, Southwest Theoretical Chemistry Conference, 1984

Summary of Scholarly Activity:

112 refereed/invited publications

- 91 in chemistry/science education

- 21 in chemistry research (theoretical/computational chemistry)

4 textbooks (first, second, third and fourth edition)

1 laboratory curriculum (AP Chemistry) textbooks (for teachers and students) – lead editor

2 symposium series books – lead editor

1 Chemistry Encyclopedia, Associate Editor

27 National / International Workshops directed

64 Nationally normed chemistry exams released (secure exams are not “published”)

169 contributed papers at conferences

- 118 in chemistry/science education

- 51 in chemistry research

- 24 of these research papers given by undergraduate students

264 invited presentations

- 203 in chemistry/science education

- 61 in chemistry research

Publications:

1. “Measuring the impact of incorporating systems thinking into general chemistry on affective components of student learning”, Jiwoo An, Glen R. Loppnow, Thomas A. Holme, *Canadian Journal of Chemistry*, Ahead of Print, **2021**.
2. Technology, Molecular Representations, and Student Understanding of Chemistry, Jack D. Polifka, John Y. Baluyut, Thomas A. Holme, in *Problems and Problem Solving in Chemistry Education: Analysing Data, Looking for Patterns and Making Deductions*, Ed. G. Tsaparlis, Royal Society of Chemistry, London, **2021**
3. “Evaluation of Augmented Reality Application Usage and Measuring Students’ Attitudes toward Instrumentation”, Jiwoo An, Thomas Holme, *Journal of Chemical Education*, **2021**, ASAP, DOI: 10.1021/acs.jchemed.0c01268
4. “Using the chemistry of pharmaceuticals to introduce sustainable chemistry and systems thinking in general chemistry”, Thomas Holme, *Sustainable Chemistry and Pharmacy*, **2020**, *16*, 100234.
5. “The American Chemical Society Exams Institute Undergraduate Chemistry Anchoring Concepts Content Map V: Analytical Chemistry, Thomas A. Holme, Christopher Bauer, Jaclyn M. Trate, Jessica J. Reed, Jeffrey R. Raker, Kristen L. Murphy, *Journal of Chemical Education*, **2020**, *97*, 1530-1535.
6. “Adapting the Anchoring Concepts Content Map (ACCM) of ACS Exams by Incorporating a Theme: Merging Green Chemistry and Organic Chemistry”, Thomas A. Holme, Jennifer MacKellar, David J.C. Constable, Olga R. Michels, Jaclyn M. Trate, Jeffrey R. Raker, Kristen L. Murphy, *Journal of Chemical Education*, **2020**, *97*, 374-382. doi: 10.1021/acs.jchemed.9b005664
7. “Usability Testing and the Development of an Augmented Reality Application for Laboratory Learning”, Jiwoo An, Laila-Parvin Poly, Thomas A. Holme, *Journal of Chemical Education*, **2020**, *97*, 97-105. doi: 10.1021/acs.jchemed.9b00453
8. “Benefits to students of team-based learning in large-enrollment calculus”, Travis Peters, Elgin Johnston, Heather Bolles, Craig Ogilvie, Alexis Knaub, Thomas Holme, *PRIMUS (Problems, Resources and Issues in Mathematics Undergraduate Studies)* **2020**, *30*, 211-229. DOI: 10.1080/10511970.2018.1542417
9. “Integrating the Molecular Basis of Sustainability into General Chemistry through Systems Thinking”, Peter G. Mahaffy, Stephen A. Matlin, J. Marc Whalen, Thomas A. Holme, *J. Chem. Educ.*, **2019**, *96*, 2730-2741.
10. “Graphical Tools for Conceptualizing Systems Thinking in Chemistry Education”, Katherine B. Aubrecht, Yehudit Judy Dori, Thomas A. Holme, Rea Lavi, Stephen A. Matlin., MaryKay Orgill, Heather Skaza-Acosta, *J. Chem. Educ.*, **2019**, *96*, 2888-2900.

11. “Investigating the Content Connections of General Chemistry and Chemistry in the News”, Annabelle Lolinco, Christina Kindle, Thomas Holme, in *Communication in Chemistry*, Crawford, G., Singiser, R., Kloepper, K., Myers, J, eds., ACS Symposium Series, 1327, 215-227, **2019**.
12. “Incorporating elements of green and sustainable chemistry in general chemistry via systems thinking”, Thomas Holme, in *Integrating Green and Sustainable Chemistry Principles into Education*, Dicks, A., Bastin, L. eds, Elsevier, Amsterdam, **2019**, 31-47.
13. “Ensuring That Test Takers Can Use New Chemistry Assessments Made Possible by Technology” Jack Polifka, Thomas Holme, in *Technology Integration in Chemistry Education and Research (TICER)*, eds. Gupta, T. and Belford, R.E., ACS Symposium Series, 1318 , 167-175, **2019**.
14. “Systems Thinking for Education about the Molecular Basis of Sustainability”, Peter Mahaffy, Stephen A. Matlin, Thomas A. Holme, Jennifer MacKellar, *Nature Sustainability*, 2, 362-370, **2019** DOI: 10.1038/s41893-019-0285-3
15. “Systems Thinking as a Vehicle To Introduce Additional Computational Thinking Skills in General Chemistry”, Thomas Holme, in, *It's Just Math: Research on Students' Understanding of Chemistry and Mathematics* , Towns, M., H., Bain, K., Rodriguez, J-M.G. eds. ACS Symposium Series, 1316 , 239-250, **2019**
16. “Eye tracking student strategies for solving stoichiometry problems involving particulate nature of mater diagrams”, John Y. Baluyut, Thomas A. Holme, *Chemistry Teacher International*, DOI: 10.1515/cti-2018-0003, **2019**
17. “Alignment of ACS Inorganic Chemistry Examination Items to the Anchoring Concepts Content Map”, Keith A. Marek, Jeffrey R. Raker, Thomas A. Holme. Kristen L. Murphy, **2018**, *Journal of Chemical Education*, 95, 1468-1476.
18. “Impacts of the 2018 Division of Chemical Education Bylaw Changes on the Division’s Executive Committee Composition and Work”, Marcy H. Towns and Thomas A. Holme, **2018**, *Journal of Chemical Education*, 95, 1448-1450.
19. “The ACS Exams Institute Undergraduate Chemistry Anchoring Concepts Content Map III: Inorganic Chemistry”, Keith A. Marek, Jeffrey R. Raker, Thomas A. Holme. Kristen L. Murphy, **2018**, *Journal of Chemical Education*, 95, 233-237 + Supplemental material DOI: 10.1021/acs.jchemed.7b00498.
20. “The ACS Exams Institute Undergraduate Chemistry Anchoring Concepts Content Map IV: Physical Chemistry”, Thomas A. Holme, Jeffrey R. Raker, Kristen L. Murphy, **2018**, *Journal of Chemical Education*, 95, 238-241 + Supplemental material DOI: 10.1021/acs.jchemed.7b00531.

21. *General Chemistry for Engineering Students, 4E*, Lawrence Brown and Thomas Holme, Cengage Publishing, © 2019 – published December **2017**
22. “Comparing Student Performance Using Computer and Paper-Based Tests: Results from Two Studies in General Chemistry”, Anna A. Prisacari, Thomas A. Holme, Jared Danielson, **2017**, *Journal of Chemical Education*, 94, 1822-1830, DOI: 10.1021/acs.jchemed.7b00274
23. “Beyond ‘Inert’ Ideas to Teaching General Chemistry from Rich Contexts: Visualizing the Chemistry of Climate Change”, Peter G. Mahaffy, Thomas A. Holme, Leah Martin-Visscher, Brian E. Martin, Ashley Versprille, Mary Kirchhoff, Lallie McKenzie, Marcy Towns, **2017**, *Journal of Chemical Education*, 94, 1027-1035, DOI: 10.1021/acs.jchemed.6b01009 - **article designated an “ACS Editors Choice”**
24. “What we don’t test: What an analysis of unreleased ACS Exam items reveals about the content coverage in general chemistry assessments.” Jessica Reed, Sachel Villafane, Jeffrey Raker, Thomas Holme, Kristen Murphy, **2017**, *Journal of Chemical Education*, 94, 418-428 DOI: 10.1021/acs.jchemed.6b00863
25. “Assessing Student Knowledge of Chemistry and Climate Science Concepts Associated with Climate Change: Resources to Inform Teaching and Learning”, Ashley Versprille, Adam Zabih, Thomas A. Holme, Lallie McKenzie, Peter Mahaffy, Brian Martin, Marcy Towns, **2017**, *Journal of Chemical Education*, 94, 407-417, DOI: 10.1021/acs.jchemed.6b00759
26. “How do Chemistry Educators View Items That Test Conceptual Understanding?” Cynthia Luxford, Thomas Holme, **2016**, *ACS Symposium Series*, 1235, 195-210.
27. “Using the ACS Anchoring Concepts Content Map (ACCM) To Aid in the Evaluation and Development of ACS General Chemistry Exam Items”, Jessica J. Reed, Cynthia J. Luxford, Thomas A. Holme, Jeffrey L. Raker, Kristen L. Murphy, **2016**, *ACS Symposium Series*, 1235, 179-194.
28. “Analyzing the Role of Science Practices in ACS Exam Items”, Jessica J. Reed, Alexandra, R. Brandriet, Thomas A. Holme, *Journal of Chemical Education*, **2017**, 94, 3-10, DOI: 10.1021/acs.jchemed.6b00659 - **article designated an “ACS Editors Choice”**
29. “The Division of Chemical Education Executive Committee, Board of Publication, and ACS Examinations Institute Board of Trustees: A Historical Perspective from 1985 to 2015”, Marcy H. Towns, Thomas A. Holme, *Journal of Chemical Education*, **2016**, 93, 1163-1169. DOI: 10.1021/acs.jchemed.6b00050
30. “A Quantum Chemistry Concept Inventory for Physical Chemistry Classes” Marilu Dick-Perez, Cynthia J. Luxford, Theresa L. Windus, Thomas Holme, *Journal of Chemical Education*, **2016**, 93, 605-612. DOI: 10.1021/acs.jchemed.5b00781
31. “Are Content Tests All the Assessment We Need?” Thomas Holme, Mary Emenike, Solomon Hughes, Kimberly Linenberger, Cynthia Luxford, Jeffrey Raker, in *Sputnik to*

Smartphones: A Half-Century of Chemistry Education - ACS Symposium Series, **1208**, 257-275, **2015**.

32. “Development of the Exams Data Analysis Spreadsheet as a Tool To Help Instructors Conduct Customizable Analyses of Student ACS Exam Data”, Alexandra Brandriet and Thomas Holme, *Journal of Chemical Education*, **2015**, 92, 2054-2061 DOI: 10.1021/acs.jchemed.5b00474
33. “A Historical Investigation into Item Formats of ACS Exams and their Relationships to Science Practices”, Alexandra Brandriet, Jessica J. Reed and Thomas Holme, *Journal of Chemical Education*, **2015**, 92 1798-1806 DOI: 10.1021/acs.jchemed.5b00459
34. “Methods for Addressing Missing Data with Applications from ACS Exams”, Alexandra, Brandriet and Thomas A. Holme, *Journal of Chemical Education*, **2015**, 92, 2045-2053 DOI: 10.1021/acs.jchemed.5b00180
35. “Defining Conceptual Understanding in General Chemistry”, Thomas A. Holme, Cynthia J. Luxford, Alexandra Brandriet, *Journal of Chemical Education*, **2015**, 92, 1477-1483 DOI: 10.1021/acs.jchemed.5b00218 – *article designated an “ACS Editors Choice”*
36. “What do Conceptual Holes in Testing Say about the Topics we Teach in General Chemistry”? Cynthia J. Luxford and Thomas A. Holme, *Journal of Chemical Education*, **2015**, 92 993-1002 DOI: 10.1021/ed500889j
37. “Updating the General Chemistry Anchoring Concept Content Map”, Thomas Holme, Cynthia Luxford, Kristen Murphy, *Journal of Chemical Education*, **2015**, 92 1115-1116 (+ supplemental materials) DOI: 10.1021/ed500712k
38. "Building a database for the historical analysis of the General Chemistry curriculum using ACS General Chemistry Exams as artifacts", Cynthia J, Luxford, Kimberly J. Linenberger, Jeffrey R. Raker, John Y. Baluyut, Jessica J. Reed, Chamila DeSilva, Thomas A. Holme, *Journal of Chemical Education*, **2015**, 92 230-236 DOI: 10.1021/ed500732q
39. “Biochemistry Instructors’ Views towards Developing and Assessing Visual Literacy in Their Courses”, Kimberly J. Linenberger and Thomas A. Holme, *Journal of Chemical Education*, **2015**, 92 23-31. DOI: 10.1021/ed500420r
40. “Exploring the Apparent Motivational Impact of Resurrection Points from Final Exam Performance”, Jeffrey R. Raker and Thomas A. Holme, in *Innovative Uses of Assessment for Teaching and Research - ACS Symposium Series*, 1182, 115-131, **2014**.
41. “The Role of Non-Content Goals in the Assessment of Chemistry Learning”, Jessica R. Reed and Thomas A. Holme, in *Innovative Uses of Assessment for Teaching and Research - ACS Symposium Series*, 1182, 147-160, **2014**.

42. "Infusing Sustainability Science Literacy through Chemistry Education: Climate Science as a Rich Context for Learning Chemistry", Peter G. Mahaffy, Brian E. Martin, Mary Kirchoff, Lalie McKenzie, Thomas Holme, Ashley Verspille, Marcy Towns, *ACS Sustainable Chemistry and Engineering*, **2014**, 2, 2488-2494 DOI: dxdoi.org/10.1021/sc500415k
43. "Improving instructional design with better analysis of assessment data", Kristen L. Murphy and Thomas A. Holme, *Journal of Learning Design*, **2014**, 7, 28-46.
44. "Comparing Recent Organizing Templates for Test Content between ACS Exams in General Chemistry and AP Chemistry", Thomas Holme, *Journal of Chemical Education*, **2014**, 91 1352-1356 DOI: 10.1021/ed400856r
45. "Investigating Faculty Familiarity with Assessment Terminology by Applying Cluster Analysis to Interpret Survey Data", Jeffrey R. Raker and Thomas A. Holme, *Journal of Chemical Education*, **2014**, 91, 1145-1151 DOI: 10.1021/ed500075e
46. "Results of a National Survey of Biochemistry Instructors to Determine the Prevalence and Types of Representations Used during Instruction and Assessment" Kimberly J. Linenberger and Thomas A. Holme, *Journal of Chemical Education*, **2014**, 91 800-806 DOI: 10.1021/ed400201v
47. *General Chemistry for Engineering Students, 3E*, Lawrence Brown and Thomas Holme, Cengage Publishing, © 2014 – published November 2013.
48. "A Historical Analysis of the Curriculum of Organic Chemistry using ACS Exams as Artifacts" Jeffrey R. Raker and Thomas A. Holme, *Journal of Chemical Education*, **2013**, 90 1437-1442 DOI: 10.1021/ed400327b
49. "Adaptation of an Instrument for Measuring the Cognitive Complexity of Organic Chemistry Exam Items", Jeffrey R. Raker, Jaclyn M. Trate, Thomas A. Holme and Kristen Murphy, *Journal of Chemical Education*, **2013**, 90, 1290-1295 DOI: 10.1021/ed400373c
50. "Polytomous versus Dichotomous Scoring on Multiple-Choice Examinations: Development of a Rubric for Rating Partial Credit", Megan L. Grunert, Jeffrey R. Raker, Kristen L. Murphy and Thomas A. Holme, *Journal of Chemical Education*, **2013**, 90, 1310-1315 DOI: 10.1021/ed400247d
51. "The ACS Exams Institute Undergraduate Chemistry Anchoring Concepts Content Map II: Organic Chemistry", Jeffrey Raker, Thomas Holme and Kristen Murphy, *Journal of Chemical Education*, **2013**, 90, 1443-1445 DOI: 10.1021/ed400175w
52. "Importance of considering longitudinal trajectories in education reform efforts", Thomas Holme, Melanie Cooper and Pratibha Varma-Nelson, in *Trajectories of Chemistry Education Innovation and Reform, ACS Symposium Series*, 1145, 3-10, **2013**.

53. "A trajectory of reform in general chemistry for engineering students", Thomas Holme and Heather Caruthers, in *Trajectories of Chemistry Education Innovation and Reform, ACS Symposium Series*, 1145, 65-78, **2013**.
54. "Lessons learned from collaboration in chemistry assessment across universities: Challenges in transfer and scale", Pamela Paek and Thomas Holme, in *Trajectories of Chemistry Education Innovation and Reform, ACS Symposium Series*, 1145, 157-169, **2013**.
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Book review of "Pioneers of Quantum Chemistry", edited by Strom & Wilson, *Journal of Chemical Education*, **2014**, *91* 773-775. DOI: 10.1021/ed500184t

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Assessment Data and Decision Making in Teaching, Editorial, *Journal of Chemical Education*, **2011**, *88*, 1017.

Assessment of Student Learning (Chapter 11): Thomas Holme and Laura Slocum, in *Chemistry in the National Science Standards*, ed. S.L. Bretz., American Chemical Society, **2008**

The Official Guide: ACS Exam for Physical Chemistry. Richard Schwenz, editor, Kristen Murphy co-editor, **2009**.

Book Review of Quantum Chemistry, 2nd Edition by Donald McQuarrie, *Journal of Chemical Education*, **2010**, *87*, 586.

Standardized Examinations for the Division of Chemical Education of the American Chemical Society (Note: Officially, exams are released for purchase and use but are not "published" under the legal definitions related to secure exams.) :

- | | |
|--|---|
| - 2002 First Term General Chemistry | - 2002 Second Term General Chemistry |
| - 2002 Inorganic Chemistry | - 2003 Biochemistry |
| - 2003 High School Chemistry | - 2003 General Chemistry |
| - 2004 Organic Chemistry | - 2004 Advanced High School Chemistry |
| - 2004 First Term General Chemistry (ACS Text) | - 2005 General Chemistry |
| - 2005 High School Chemistry | - 2005 First Term General Chemistry |
| - 2005 1st Term General Chemistry Paired Questions | - 2006 Physical Chemistry – Thermodynamics |
| - 2006 Physical Chemistry – Quantum Mechanics | - 2006 Physical Chemistry – Dynamics |
| - 2006 Physical Chemistry – Comprehensive | - 2006 Physical Chemistry – Combined Semester |
| - 2006 General Chemistry – Brief Exam | - 2006 Second Term General Chemistry |

- 2006 High School Advanced Exam
- 2007 General Chemistry Exam
- 2007 2nd Term General Chemistry Paired Questions Exam
- 2007 Biochemistry Exam
- 2008 Organic Chemistry
- 2008 General Chemistry (Conceptual)
- 2009 Inorganic Chemistry
- 2009 Chemistry in Context
- 2009 General Chemistry
- 2009 Instrumental Analysis Exam
- 2010 High School Advanced Exam
- 2011 General Chemistry Exam
- 2012 Organic Chemistry Exam
- 2013 Analytical Chemistry Exam
- 2013 Diagnostic of Undergraduate Chemistry Knowledge Exam
- 2013 Physical Chemistry – Thermodynamics Exam
- 2014 First Term Organic Chemistry Exam
- 2014 Second Term General Chemistry Exam
- 2014 Inorganic Chemistry Exam
- 2015 General Chemistry Exam
- 2006 California Diagnostic Exam
- 2007 High School Chemistry Exam
- 2007 Analytical Chemistry Exam
- 2008 General Chemistry (Spanish Version)
- 2008 Organic Chemistry (Spanish Version)
- 2008 Diagnostic of Undergraduate Chemistry Knowledge Exam
- 2009 High School Chemistry
- 2009 Toledo Placement Exam
- 2009 First-term General Chemistry Exam
- 2010 Second-term General Chemistry Exam
- 2010 First-term Organic Chemistry Exam
- 2011 High School Chemistry Exam
- 2012 Biochemistry Exam
- 2013 General Chemistry Exam
- 2013 High School Chemistry Exam
- 2013 Physical Chemistry – Quantum Mechanics Exam
- 2014 General Chemistry Brief Exam
- 2014 Physical Chemistry – Comprehensive Exam
- 2014 Physical Chemistry – Modular Exam
- 2015 General Chemistry First Term Exam

Encyclopedia Articles: (in Chemistry: Foundations and Applications, Thompson/Gale, 2004)

- Active Site
- Amino Acids
- Cortisone
- Denaturation
- Fibrous Protein
- Neurochemistry
- Neurotoxins
- Neurotransmitters
- Luis Pasteur
- Photosynthesis
- Proteins
- Protein Synthesis
- Terpenes
- Transmembrane Protein
- Venom

National and International Workshops Directed (past 10 years):

1. “Constructing opportunities for systems thinking within traditional general chemistry content.” Thomas Holme and Peter Mahaffy, *25th IUPAC International Conference on Chemistry Education*, Sydney, Australia, July, 2018
2. “Incorporating Green Chemistry Concepts into the Anchoring Concepts Content Map”, Thomas Holme and Kristen Murphy, *National Meeting of the American Chemical Society*, Washington, DC, August 2017
3. “Building a map of the undergraduate chemistry content: Physical Chemistry”, Thomas Holme, *Great Lakes Regional Meeting of the American Chemical Society*, Fargo, ND, June 2017
4. “Machine Assisted Test Item Alignment”, Thomas Holme, April Zenisky, Dave Hart, *National Meeting of the American Chemical Society*, Denver, CO, March 2015
5. “Mapping the content of Inorganic Chemistry to anchoring concepts for ACS Exams and Criterion Referencing”, Thomas Holme and Kristen Murphy, *National Meeting of the American Chemical Society*, Denver, CO, March 2015
6. “Comparing Personally Written Test Items with ACS Exams Items”, Thomas Holme and David Hart, *Biennial Conference on Chemical Education*, Allendale, MI, August 2014
7. “Mapping the content of Analytical Chemistry to anchoring concepts for ACS Exams and Criterion Referencing”, Thomas Holme and Kristen Murphy, *National Meeting of the American Chemical Society*, Philadelphia, PA, August 2012
8. “Mapping the content of Physical Chemistry to anchoring concepts for ACS Exams and Criterion Referencing”, Thomas Holme and Kristen Murphy, *National Meeting of the American Chemical Society*, Anaheim, CA, March 2011
9. “Mapping the content of Biochemistry to anchoring concepts for ACS Exams and Criterion Referencing”, Thomas Holme and Kristen Murphy, *National Meeting of the American Chemical Society*, Anaheim, CA, March 2011
10. “Mapping the content of Analytical Chemistry to anchoring concepts for ACS Exams and Criterion Referencing”, Thomas Holme and Mary Emenike, *Pittsburgh Conference*, Atlanta, GA, March 2011
11. “Complexity Analysis of Organic Chemistry Test Items”, Kristen Murphy and Thomas Holme, *National Meeting of the American Chemical Society*, Anaheim, CA, March 2011

Invited Presentations (past 10 years):

1. "Sustainability conversations to connect general chemistry to Earth and societal systems". *Texas Community College Teachers Association Conference* (online) Houston, TX, February 2021
2. "Complexity and Chemistry Content when Teaching in Interesting Times" *Education Seminar*, Department of Chemistry, University of York, York, England, October 2020.
3. "Complexity and Chemistry Content when Teaching in Interesting Times" *Seminar, Wisconsin Initiative for Science Literacy*, University of Wisconsin - Madison, Madison, WI, September 2020.
4. "Expanding boundaries in general chemistry to build a systems thinking approach to life cycle analysis for a pharmaceutical molecule", *Green Chemistry and Engineering Conference*, Thomas A. Holme, on-line, June 2020.
5. "Using Systems Thinking Concepts in General Chemistry to Combat Compartmentalized Knowledge Acquisition", Thomas Holme, *Gomberg Seminar, Department of Chemistry*, University of Michigan, Ann Arbor, MI, February 2020.
6. "Helping Foundations Flourish: Systems Thinking as a Means to Connect Introductory Chemistry to Broader Science Studies", Thomas Holme, *Colloquium, Department of Chemical and Physical Sciences*, University of Toronto - Mississauga, Toronto, ON, January 2020
7. "Gauging Chemistry Learning by Measuring More Than the Final Answer", Thomas Holme, *Departmental Seminar, Department of Chemistry*, North Dakota State University, Fargo, ND November 2019.
8. "Gauging Chemistry Learning by Measuring More Than the Final Answer", Thomas Holme, *Departmental Seminar, Department of Chemistry*, Indiana University - Purdue University Indianapolis, Indianapolis, IN September 2019.
9. "Using Systems Thinking Concepts in General Chemistry to Combat Compartmentalized Knowledge Acquisition", Thomas Holme, *Departmental Seminar, Department of Chemistry and Biochemistry*, University of Nebraska – Lincoln, Lincoln, NE, September 2019.
10. "Assessment Considerations for Implementing New Educational Technology in Chemistry", Thomas Holme, *Gordon Research Conference on Chemistry Education Research and Practice*, Lewiston, ME, June 2019.
11. "Bigger boundaries: Systems thinking and incorporating green concepts in gateway chemistry classes", Thomas Holme, *9th Green Chemistry and Engineering Conference*, Reston, VA, June 2019
12. "Expanding the boundaries of students' chemistry knowledge through systems thinking", Thomas Holme, *102nd Canadian Chemistry Conference and Exhibition*, Quebec City, QC, June 2019

13. "Including systems thinking in general chemistry", Thomas Holme, *STEM Education Seminar*, Rutgers University, New Brunswick, NJ, November 2018
14. "Systems thinking, planetary boundaries and the possibilities of a more connected chemistry curriculum", Thomas Holme, *Chemistry Seminar, University of Iowa*, Iowa City, IA, September 2018
15. "ARiEL: Augmented Reality in Educational Laboratories", Thomas Holme, Poly Laila-Parvin, Jiwoo An *25th Biennial Conference on Chemistry Education*, Notre Dame, IN, August 2018
16. "Adding Systems Thinking to the Anchoring Concepts Content Map", Thomas Holme, Kristen Murphy, Jeff Raker *25th IUPAC International Conference on Chemistry Education*, Sydney, Australia, July 2018
17. "Connecting green chemistry topics to the Anchoring Concepts Content Map", Thomas Holme and Kristen Murphy *22nd Annual Green Chemistry & Engineering Conference*, Portland, OR June 2018
18. "The importance of teaching systems thinking and the role that green chemistry can play", Thomas Holme *22nd Annual Green Chemistry & Engineering Conference*, Portland, OR June 2018
19. "A template for constructing green chemistry related content that promotes systems thinking opportunities for students." Thomas Holme, James Hutchison, Julie Haack, David Constable, Mary Kirchhoff, Jenifer MacKellar *22nd Annual Green Chemistry & Engineering Conference*, Portland, OR June 2018
20. "The Primary Outcome: What should the highest level learning outcome be for General Chemistry?" Thomas Holme, James Hutchison, Julie Haack, Mary Kirchhoff, David Constable, Jenny MacKellar, *101st Meeting of the Canadian Society of Chemistry*, Edmonton, AB, May 2018.
21. "Addressing issues in Chemistry Education Research projects", Thomas Holme, *Conference for Connecting the Canadian Chemistry Education Research Community*, Edmonton, AB, May 2018.
22. "ARiEL: Augmented Reality in Educational Laboratories", Thomas Holme, Poly Laila-Parvin, *ACS National Meeting*, New Orleans, LA, March, 2018
23. "Rigor in general chemistry doesn't equal math: The role of systems thinking" Thomas Holme *ACS National Meeting*, New Orleans, LA, March, 2018

24. “What is the Venn diagram of the chemistry curriculum and the chemistry most often in the news?” Thomas Holme, Annabelle Lolinco, Christina Kindle, *ACS National Meeting*, New Orleans, LA, March, 2018
25. “Three key factors for successful reform efforts in chemistry education”, Thomas Holme, *101st Meeting of the Canadian Society of Chemistry*, Edmonton, AB, May 2018.
26. “Assessing Student Learning of Climate Change after Adding Sustainability Concepts to General Chemistry”, Thomas Holme and Marcy Towns, *Great Lakes Regional Meeting of the American Chemical Society*, Fargo, ND, June 2017.
27. “Does the Undergraduate Chemistry Curriculum Help or Hinder the Inclusion of Cross-cutting Scientific Principles as Learning Objectives?”, Keynote Speaker, *100th National Meeting of the Canadian Society of Chemistry*, Toronto, ON, May, 2017.
28. “The Roles of Assessment in Chemistry Education”, Keynote Speaker, *Georgia General Chemistry Network Annual Meeting*, Athens, GA, May 2017.
29. “Evidence and Change, or Lack Thereof” Pimentel Award Address, *National Meeting of the American Chemical Society*, San Francisco, CA, April 2017.
30. “Flavors of Assessment in Chemistry Education and Chemistry Education Research”, *National Meeting of the American Chemical Society*, San Francisco, CA, April 2017.
31. “What do our measures of student learning miss?” *James Flack Norris Award Lecture*, meeting of the Northeastern Section of the American Chemical Society, Boston, MA, November 2016.
32. “Research on measurements in the classroom and what it tells us about teaching and learning chemistry.” *Departmental Colloquium*, Brandeis University, Newton, MA, November, 2016.
33. “The sometimes surprising evolution of undergraduate student understanding of chemical bonding”, *Physical/Analytical Chemistry Seminar*, The Ohio State University, Columbus, OH, September 2016.
34. “Engaging Students by Including Chapter 18 in First Semester General Chemistry”, Thomas Holme and Marcy Towns, *Northwest Regional ACS Meeting*, Anchorage, AK, June 2016.
35. “Enhancing Comparative Assessment in Chemistry with the QMAP System”, Thomas Holme, David Hart, Steve Battisti, April Zenisky, Kristen Murphy. *Envisioning the Future of Undergraduate STEM Education: Research and Practice*. Washington, DC April 2016.

36. "Understanding student problem solving by measuring more than the final answer." *L. Carroll King Lecture*, Department of Chemistry, Northwestern University, Evanston, IL, April 2016.
37. "Role of homework in the 'grade game'", Thomas Holme, *National Meeting of the American Chemical Society*, San Diego, CA, March 2016.
38. "Using needs analysis in the development of tools to help instructors enhance their content assessment", Thomas Holme and David Hart, *National Meeting of the American Chemical Society*, San Diego, CA, March 2016.
39. "How do Educational Measurements Affect the Teaching and Learning of Chemistry?" *L. Carroll King Lecture*, Department of Chemistry, Northwestern University, Evanston, IL, January 2016.
40. "Assessing assessment: How instructors use and understand information that chemistry tests provide", *International Chemical Congress of Pacific Basin Societies*, Honolulu, HI, December 2015
41. "Using local environmental concerns to provide contexts to raise student interest in General Chemistry topics", *International Chemical Congress of Pacific Basin Societies*, Honolulu, HI, December 2015
42. The challenge for scientists of parsing personal vs. organizational social media obligations and observations, ", *International Chemical Congress of Pacific Basin Societies*, Honolulu, HI, December 2015
43. "Assessing student habits related to representing chemistry at the particulate level" Thomas Holme, *Chemistry Department Colloquium*, Michigan State University, October, 2015.
44. "The measuring of student learning in chemistry and the clues it gives us about the curriculum." Thomas Holme, *Chemistry Department Seminar*, University of Arizona, October, 2015.
45. "Do we measure what we value when our students take our tests?", Thomas Holme, *Chemistry Department Seminar*, University of Iowa, April, 2015.
46. "The Trajectory of Testing in Chemistry Education", Thomas Holme, *National Meeting of the American Chemical Society*, Denver, CO, March 2015.
47. "Measuring Learning in Chemistry: What We Want and What We Do", Thomas Holme, *Chemistry Department Seminar*, University of Nebraska, February, 2015.

48. “Using ACS Exam data for decision making in our classroom and in our discipline”, Thomas Holme, *Chemistry Department Seminar*, University of South Florida, February, 2015.
49. “Using education research data to make teaching choices”, Thomas Holme, *Learning Innovation Seminar, Letters and Science*, University of Alberta, January, 2015.
50. Factors that influence the measurement of student learning”, Thomas Holme, *Chemistry Departmental Seminar*, University of North Carolina – Wilmington, November 2014
51. “Mentoring students in an emerging research field”, Thomas Holme, *Mentoring Symposium in Honor of Professors Pardee and Estee, Department of Chemistry*, University of South Dakota, October 2014.
52. “Thinking about Measuring Learning in Chemistry – What we Want and What we Do.” Thomas Holme, *Mary Beth Kramer Lecture – Department of Chemistry*, University of Delaware, October 2014.
53. “Making Choices about Teaching Based on Information from Discipline-Based Education Research”, Thomas Holme, *Departmental Seminar*, University of Tasmania, Sandy Bay, Tasmania, July 2014.
54. “Identifying Conceptual Understanding in General Chemistry”, Thomas Holme, John Baluyut, Cynthia Luxford, *International Conference on Chemical Education*, Toronto, ON, July 2014
55. “Plant biochemistry and the cognitive science of learning chemistry - asking the unasked questions” Thomas Holme, *Departmental Seminar*, St. Cloud State University, St. Cloud, MN, April 2014.
56. “Measuring what we value or valuing what we measure?” Thomas Holme, *National Meeting of the American Chemical Society*, Dallas, TX, March 2014.
57. “Pursuing evidence for the impact of chemistry education research on the teaching and learning of chemistry”, Thomas Holme, *National Meeting of the American Chemical Society*, Dallas, TX, March 2014.
58. “What can data from ACS Exams tell us about the trajectory of chemistry education?” Thomas Holme, *Chemistry Department Seminar*, Ohio State University, February 2014.
59. “Digging Deeper, What can data from ACS Exams tell us about chemistry education?”, Thomas Holme, **Keynote Speaker**, *UW System Chemistry Faculty Meeting*, River Falls, WI, October 2013
60. “Digging Deeper, What can data from ACS Exams tell us about chemistry education?”, Thomas Holme, *Departmental Seminar*, Miami University, Oxford, OH, October 2013

61. "Getting more than comparative information from student performances on Nationally-Normed ACS Exams in Chemistry", Thomas Holme and Kristen Murphy, *The Assessment Institute*, Indianapolis, IN, October 2013.
62. "The biogeochemistry of boron and the role of boron in plants", Thomas Holme, *Departmental Seminar*, Drake University, Des Moines, IA September 2013.
63. "The ACS High School Chemistry Exam: A Time to Recalibrate", Thomas Holme, *National Meeting of the American Chemical Society*, Indianapolis, IN, September 2013.
64. "Investigating the chemistry curriculum over time using ACS Exams and the anchoring concepts content map", Thomas Holme, *National Meeting of the American Chemical Society*, Indianapolis, IN, September 2013.
65. "Using chemistry education research data to construct evidence about teaching and learning", *School of Chemistry Seminar*, Monash University, Melbourne, Australia, August 2013
66. "Evaluating the general chemistry curriculum over time via ACS Exams and the anchoring concept content map", Thomas Holme, Jeffrey Raker, Kim Linenberger, Kristen Murphy, *IUPAC World Congress*, Istanbul, Turkey, July 2013.
67. "Should we be surprised at what our assessments measure?" Thomas Holme, *Chemistry Education Research Graduate Student Conference*, Oxford, OH, July 2013.
68. "Propagating Meaningful Reform in Chemistry Education and the Relative Roles of Enthusiasm and Evidence", Thomas Holme, *Workshop on Undergraduate Chemistry Education*, Chemistry Roundtable, National Research Council, Washington, DC May 2013.
69. "Risk benefit analysis of the online delivery option for ACS Exams", Thomas Holme and Kristen Murphy, *National Meeting of the American Chemical Society*, New Orleans, LA, April 2013
70. "The ACS Exams Institute content map for the undergraduate chemistry curriculum", Thomas Holme, *Midwest Regional Meeting of the American Chemical Society*, Omaha, NE, October 2012.
71. "Novice problem-solving of organic chemistry test items", Jaclyn Trate, Jeffrey Raker, Thomas Holme, Kristen Murphy, *National Meeting of the American Chemical Society*, Philadelphia, PA, August 2012.
72. "Cognitive Complexity and Student Performance on Chemistry Tests", Jeffrey Raker, Kristen Murphy, Thomas Holme, *International Conference on Chemical Education*, Rome, Italy, July 2012

73. “Facilitating Longitudinal Curricular and Program Assessment”, Thomas Holme and Kristen Murphy, *International Conference on Chemical Education*, Rome, Italy, July 2012.
74. “Nationally Normed Testing via ACS Exams: Research and Practice”. ChemEd 2012 Conference, Royal Australian Chemistry Institute, Adelaide, Australia, July 2012.
75. “ACS Exams as part of department programmatic assessment efforts”. Department Seminar, University of Sydney, Sydney, Australia, June 2012
76. “ACS Exams as an example of teacher-led assessment practices in chemistry”, Department Seminar, Macquarie University, Sydney Australia, June 2012
77. “Standardized exams and benchmarking in chemistry”, Department of Chemistry Education Roundtable, University of Queensland, Brisbane, Australia, June 2012
78. “ACS Exams as part of department programmatic assessment efforts”. Department Seminar, Queensland University of Technology, Brisbane, Australia, June 2012
79. “Data in education: Proof or wise action?” *Milwaukee Local Section Seminar*, UW-Milwaukee, May 2012.
80. “Plant biochemistry and the cognitive science of learning chemistry – asking the unasked questions.” *Karcher Seminar*, Department of Chemistry, University of Oklahoma, April 2012.
81. “Chemistry, Society and Science Fiction”, *Student Award Ceremony Lecture*, University of Oklahoma, April 2012.
82. “Research and development of enhanced assessment tools for chemistry education”, *Physics Education Research Conference*, Creighton University, Omaha, NE, August, 2011.

Contributed Papers (at conferences - past 10 years):

1. “Using systems thinking and earth and societal systems to enhance student learning in General Chemistry”, Thomas Holme, *IUPAC World Congress*, Paris, FR July 2019.
2. “A Cognitive Tutor for Open-Ended Problem-Solving in Chemistry”, David Yaron, Sandra Raysor, Max Benson, Jonathan Sewall, Kenneth Koedinger, Thomas Holme, *Gordon Research Conference on Chemistry Education Research and Practice*, Lewiston, ME, June 2019.

3. “Augmented Reality in Educational Laboratories”, Jiwoo An and Thomas Holme, *Gordon Research Conference on Chemistry Education Research and Practice*, Lewiston, ME, June 2019.
4. “Augmented Reality in Educational Laboratories”, Jiwoo An and Thomas Holme, *Midwest Regional Meeting of the American Chemical Society*, Ames, IA, October 2018.
5. “Green chemistry and the systems thinking connection”, Thomas Holme, James Hutchison, Julie Haack, Jenny MacKellar *25th Biennial Conference on Chemistry Education*, Notre Dame, IN, August 2018
6. “Ensuring test takers can use new chemistry assessments made possible by technology” Jack Polifka, Thomas Holme *25th Biennial Conference on Chemistry Education*, Notre Dame, IN, August 2018
7. “Measuring student planning as a way of understanding their strategies with multiple representations” Jack Polifka, Thomas Holme *25th Biennial Conference on Chemistry Education*, Notre Dame, IN, August 2018
8. “The importance of design features in education technology” Jiwoo An, Thomas Holme *25th Biennial Conference on Chemistry Education*, Notre Dame, IN, August 2018
9. “Considering earth and societal systems as ways to infuse systems thinking in chemistry education”, Thomas Holme, Peter Mahaffy, Stephen Matlin, Jenny MacKellar *25th IUPAC International Conference on Chemistry Education*, Sydney, Australia, July 2018
10. “Promoting Systems Thinking in Chemistry Education – Relevant Aspects of Chemistry Teaching and Learning” Felix Ho, Mei-Hung Chiu, Thomas Holme, Jenny MacKellar, Marcy Towns *25th IUPAC International Conference on Chemistry Education*, Sydney, Australia, July 2018
11. “Progress Report on a Roadmap for Green Chemistry Education”, Jenny MacKellar, Thomas Holme, James Hutchison *25th IUPAC International Conference on Chemistry Education*, Sydney, Australia, July 2018
12. “Systemigrams as Tools for Modelling Approaches to Systems Thinking in Chemistry Education”, Thomas Holme, Jan Apotheker, Felix Ho, Rea Lavi *25th IUPAC International Conference on Chemistry Education*, Sydney, Australia, July 2018
13. “Measuring student argumentation skills at scale: What would we want to know and how could it be measured?”, Thomas Holme, David Yaron, Ken Koedinger, Sandra Raysor, , *101st Meeting of the Canadian Society of Chemistry*, Edmonton, AB, May 2018.
14. “Allowing students to choose which molecular representations to use during an assessment”, Thomas Holme, Jack Polifka, John Baluyut, *Gordon Research Conference on Chemistry Education Research and Practice*, Lewiston, ME, June 2017
15. “Using Machine-Learning Technology Tools to Map Test Items to a “Big Ideas” Framework”, Thomas Holme and Kristen Murphy, *2-Year College Chemistry Consortium National Conference*, San Diego, CA March 2016

16. "Creating the Exams Data Analysis Spreadsheet (EDAS) as a tool to help instructors conduct customizable analyses of student ACS exam data and compare that the results to national normative statistics", Alexandra Brandreit and Thomas Holme, *National Meeting of the American Chemical Society*, Denver, CO, March 2015.
17. "Exploring the use of the Anchoring Concepts Content Map as a programmatic assessment tool", Cynthia Luxford and Thomas Holme, *National Meeting of the American Chemical Society*, Denver, CO, March 2015.
18. "Constructing a consensus definition of conceptual understanding in chemistry from empirical data provided by instructors", Cynthia Luxford, Alexandra Brandreit and Thomas Holme, *National Meeting of the American Chemical Society*, Denver, CO, March 2015.
19. "Test-based learning with online vs. paper tests", Anna Priscari and Thomas Holme, *National Meeting of the American Chemical Society*, Denver, CO, March 2015.
20. "Incorporation and evaluation of science practices in multiple-choice items", Jessica Reed and Thomas Holme, *National Meeting of the American Chemical Society*, Denver, CO, March 2015.
21. "Using an on-line assessment tool to gain insight into students' usage of representations in chemistry", Jack Polifka and Thomas Holme, *National Meeting of the American Chemical Society*, Denver, CO, March 2015.
22. "Using missing data methods to address the problem of incomplete normative datasets at the ACS Examinations Institute", Alexandra Brandreit and Thomas Holme, *National Meeting of the American Chemical Society*, Denver, CO, March 2015.
23. "Numerical comparisons of eye fixation sequences from chemistry problem solving", John Baluyut and Thomas Holme, *National Meeting of the American Chemical Society*, Denver, CO, March 2015.
24. "Use of eye fixation sequence analysis to identify common cognitive processes among students solving conceptual stoichiometry problems", John Baluyut and Thomas Holme, *National Meeting of the American Chemical Society*, Denver, CO, March 2015.
25. "Constructing and Using an Anchoring Concepts Content Map that Spans the Undergraduate Chemistry Curriculum", Thomas Holme and Kristen Murphy, *European Conference on Research in Chemical Education*, Jyvaskyla, Finland, July 2014.
26. "Perceptions of Instructors on the Nature of Measuring Conceptual Understanding in Chemistry", Thomas Holme and Cynthia Luxford, *European Conference on Research in Chemical Education*, Jyvaskyla, Finland, July 2014.

27. "Characterizing Standardized Testing Practice in College Chemistry Education", Thomas Holme, *International Meeting of the National Association on Research in Science Teaching*, Pittsburgh, PA, March 2014.
28. "Geometric representations of atoms and molecules and the pervasiveness of student misconceptions in chemical stoichiometry", John Balayut and Thomas Holme, *National Meeting of the American Chemical Society*, Dallas, TX, March 2014.
29. "More than just content: Exploring general chemistry instructors non-content learning goals", Jessica Reed and Thomas Holme, *National Meeting of the American Chemical Society*, Dallas, TX, March 2014
30. "General chemistry faculty perceptions of assessing students' conceptual understanding", Cynthia Luxford and Thomas Holme, *National Meeting of the American Chemical Society*, Dallas, TX, March 2014
31. "Exploring the Motivational Impact of Resurrection Points", Jeffrey Raker and Thomas Holme, *Gordon Research Conference on Chemistry Education Research and Practice*, Newport, RI, June 2013
32. "Benefits of Using a Nationally Normed Biochemistry Exam", Kimberly Linenberger and Thomas Holme, *American Society for Biochemistry and Molecular Biology Annual Meeting*, Boston, April 2013
33. "Electronic delivery of ACS exams and the content map for the undergraduate curriculum: Merging how students perform with what students know", Kristen Murphy, Thomas Holme, Jeffrey Raker and April Zenisky, *National Meeting of the American Chemical Society*, New Orleans, LA, April 2013.
34. "Using advanced statistical analyses in chemical education research: Applications of structural equation modeling, cluster analysis and multinomial logistic regression", Jeffrey Raker, Kimberly Linenberger, Kristen Murphy, and Thomas Holme, *National Meeting of the American Chemical Society*, New Orleans, LA, April 2013 .
35. "Using eye-tracking to test the usability of a climate change website", Anna Prisacari and Thomas Holme, *Midwest Regional Meeting of the American Chemical Society*, Omaha, NE, October 2012.
36. "Representation use on biochemistry assessments: Where we are and where we should go", Kimberley Linenberger and Thomas Holme, *Midwest Regional Meeting of the American Chemical Society*, Omaha, NE, October 2012.

37. "Cluster analysis of national survey data of postsecondary faculty and departmental assessment practices" Jeffrey Raker and Thomas Holme, *Midwest Regional Meeting of the American Chemical Society*, Omaha, NE, October 2012.
38. "Validity and application of a pre/post survey assessing children's attitudes and motivation at informal chemistry outreach events", Christopher Bauer, Mary Emenike, Jessica Reed, Jeffrey Raker, Thomas Holme, *National Meeting of the American Chemical Society*, Philadelphia, PA, August 2012.
39. "Computational Chemistry Approaches to Borate Binding to Apiose", Thomas Holme, Michael VerHaag, Chamilla DeSilva, *Gordon Research Conference on Plant Cell Walls*, Waterville, ME August 2012.
40. "Influence of Grade-level Readability of ACS Examinations on Student Performance and Item Complexity", Kim Linenberger and Thomas Holme, *Biennial Conference on Chemical Education*, State College, PA, July 2012.
41. "Current Assessment Practices in Post-Secondary Chemistry Departments: Results from a National Survey", Jeffrey Raker, Mary Emenike, Kristen Murphy and Thomas Holme, *Biennial Conference on Chemical Education*, State College, PA, July 2012.
42. "Measuring the Effect of Informal Chemistry Education Experiences for Children, Jessica Reed, Mary Emenike, Chris Bauer, Thomas Holme, *Biennial Conference on Chemical Education*, State College, PA, July 2012.
43. "Chemistry Disciplinary Content Maps: Identification and Refinement of 'Anchoring Concepts' that Span the Undergraduate Curriculum", Jeffrey Raker, Kristen Murphy and Thomas Holme, *Biennial Conference on Chemical Education*, State College, PA, July 2012.
44. "Adding partial credit to multiple-choice ACS Exams: Process and results" Jeffrey Raker, Megan Grunert, Kristen Murphy, Thomas Holme, *National Meeting of the American Chemical Society*, San Diego, CA, March 2012.
45. "Instrument for reliable pre/post assessment of children's attitudes and motivation at informal chemistry outreach events" Christopher Bauer, Mary Emenike, Jessica Reed, Thomas Holme, *National Meeting of the American Chemical Society*, San Diego, CA, March 2012.
46. "Measurement of the relationship between self-efficacy beliefs and performance in a general chemistry course", Solomon Hughes and Thomas Holme, *National Meeting of the American Chemical Society*, San Diego, CA, March 2012.
47. "Understanding factors that influence engineering students performance in a one-semester vs. two-semester general chemistry course" Heather Caruthers and Thomas

- Holme, *National Meeting of the American Chemical Society*, San Diego, CA, March 2012.
48. "Formative assessment and the role of context in a one-semester general chemistry course for engineering students," Thomas Holme, *National Meeting of the American Chemical Society*, San Diego, CA, March 2012.
 49. "Results of a national survey of faculty familiarity with assessment terminology," Jeffrey Raker, Mary Emenike, Kristen Murphy, Thomas Holme, *National Meeting of the American Chemical Society*, San Diego, CA, March 2012.
 50. "Investigating the relationship between conceptual question complexity and student performance using ACS Exams," Megan Grunert and Thomas Holme, *National Meeting of the American Chemical Society*, San Diego, CA, March 2012.
 51. "Theoretical study of hydrolyzation of B_2O_3 ", Chamila De Silva and Thomas Holme, *Midwest Regional Meeting of the American Chemical Society*, St. Louis, MO, October 2011.
 52. "CREPES, a tool for conformational searching on a potential energy surface", Michael VerHaag and Thomas Holme, *Midwest Regional Meeting of the American Chemical Society*, St. Louis, MO, October 2011.
 53. "Applying the ACS Exams Institute Concept Map to Organic Chemistry", Heather Caruthers and Thomas Holme, *Gordon Research Conference on Chemistry Education Research and Practice*, Davidson, NC, July 2011.
 54. "Development and Psychometrics of Models to Support Partial Credit on ACS Exams", Megan Grunert and Thomas Holme, *Gordon Research Conference on Chemistry Education Research and Practice*, Davidson, NC, July 2011.
 55. "Needs Assessment: Snapshot of Assessment Efforts within Chemistry Departments", Mary Emenike, Jacob Schroeder, Kristen Murphy and Thomas Holme, *Gordon Research Conference on Chemistry Education Research and Practice*, Davidson, NC, July 2011.
 56. "Snapshots of student learning in upper-level chemistry courses via ACS Exams statistics", Thomas Holme and Kristen Murphy, *Gordon Research Conference on Chemistry Education Research and Practice*, Davidson, NC, July 2011.