

Jonathan Miorelli

Colorado School of Mines

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Education

B.S. Chemistry and Physics, Metropolitan State University of Denver, 2009

Magna Cum Laude

Ph.D. Applied Chemistry, Colorado School of Mines, 2010–2016

Teaching Philosophy

I feel that it should be the goal of science educators to increase the scientific literacy of their students, regardless of the student's level or aspirations. Scientific literacy in this case being defined not only as the knowledge of various scientific facts and theories but also the ability to use logic and thoughtful questioning to tackle any number of problems a student may encounter, whether they be "scientific" in nature or not. I am a firm believer in utilizing active learning methods in the classroom which often rely on using group learning and guided inquiry. Active learning forces students to be more engaged in the learning process, provides continuous assessment of student performance, and emphasizes that learning is a collaborative effort between the students and the instructor. Active learning has been empirically shown to boost student performance in general as well as close socio-economic achievement gaps in STEM fields. Student engagement is sought in various ways such as effective use of questions, peer-instruction, and thought provoking demonstrations. Finally, I feel that instructors should actively seek to foster diversity within the classroom which involves maintaining an environment conducive to learning and a willingness to modify instruction methods to better accommodate the individual needs of any given student.

Teaching Experience

Colorado School of Mines, 2010–Present.

Molecular Engineering and Materials Chemistry — Teaching Post-Doc

Managed the laboratory sections of the course

Updated/revised lab and course materials

Oversaw instruction by the course TAs

Duties also included lecturing and grading assignments

General Chemistry and Organic Chemistry Material Development

Developed classroom activities and labs that employed computational techniques that sought to make advanced topics in bonding and chemistry more accessible at lower-division chemistry courses.

Bonding, Structure, and Crystallography T.A.

Primary duties included grading and gathering / generating class materials. Occasionally lectured as needed (e.g. — in cases of professor's absence).

Introductory Chemistry T.A.

Taught a remedial chemistry lab intended to assist provisionally-accepted students to acclimate to college life

Physical Chemistry T.A.

Taught and assisted in designing upper-division physical chemistry labs. This eventually came to include the generation of a series of computational labs, comprising both Mathematica and ADF dry-labs.

Principles of Chemistry T.A.

Taught introductory chemistry labs and proctored the exams for the course

Trefny Institute for Education Innovation, 2013–2015.

Duties varied over my two year fellowship with the program and can be roughly categorized as “outreach” and “education research”

Education Research

Analyzed the impact of STEM outreach on the faculty and student body based on survey data gathered from a university in Texas. This was done in conjunction with a program that is similar to the Trefny Institute based at the Texas school.

Outreach

Worked with science and mathematics teachers at two local middle schools, providing STEM related demonstrations and activities with an emphasis on fostering positive attitudes towards STEM disciplines.

Did continuous outreach in the form of demonstrations at local elementary school “science nights” as well as assisting with numerous science fairs.

University of Colorado Denver, 2009–2011.

Upward Bound Instructor

Developed and taught high school level chemistry and physics courses

General Chemistry T.A.

Similar to CSM Principles of Chemistry T.A. position

Metropolitan State University of Denver, 2007–2010.

Lead Tutor — Chemistry and Physics

Tutored chemistry, physics, and mathematics at all levels

Supervised and trained tutors; managed tutor schedules

College Reading and Learning Association (CRLA) Certified

Research Experience

Colorado School of Mines, 2011–Present.

Molecular Theory Group — Post Doctoral Researcher

Performed quantum chemical calculations on material systems using DFT computational packages, including both cluster and periodic DFT suites (e.g. ADF, BAND, and VASP).

Investigated how topological elements of electron density relate to the properties of systems common to materials and chemistry.

Collaborated with various group, this included both providing computational support (e.g. modeling chemical systems) as well as offering mathematical insights (e.g. deriving probability distribution functions to assist in experimental design)

Developed and assessed educational materials for introductory chemistry courses. Specifically continued work on the "Bond Explorer" activity which focuses on how to best teach bonding at the freshmen level.

Metropolitan State University of Denver, 2009–2010.

Undergraduate Research Assistant for Russell Barrows

Analyzed natural water sources (primarily local creeks) for concentrations of Mg^{2+} , Ca^{2+} , Na^+ , and K^+ via ICP-MS.

Professional Affiliations

Molecular Theory Group, Research Associate, 2011–Present

American Chemical Society, Member, 2009–Present

Publications

Peer-Reviewed Articles

9. J. Miorelli and M. E. Eberhart, "The Nearsightedness of Oxygen-Containing Functional Groups", *J. Phys. Chem. A*, Submitted
8. J. Miorelli, A. Caster, M. E. Eberhart, "Guiding First-Year Chemistry Students Through the Chemical Bond", *J. Chem. Ed.*, Submitted
7. A. Morgenstern, C. Morgenstern, J. Miorelli, T. Wilson, and M. E. Eberhart, "The Influence of Zero-Flux Surface Motion on Chemical Reactivity", *Phys. Chem. Chem. Phys.*, **18** (7), 5638-5646 (2016). DOI: 10.1039/c5cp07852k
6. J. Miorelli, N. Stambach, B. Moskal, and J. Dwyer, "Improving Faculty Perception of and Engagement in STEM Education", *2015 IEEE Frontiers in Education Conference*, El Paso, TX, 1-6 (2015). DOI: 10.1109/FIE.2015.7344220
5. J. Miorelli, B. Moskal, and J. Dwyer, "Impacts of Outreach on entering College Students' Interest in STEM", *Proceedings of the American Society for Engineering Education*, Seattle, WA (2015).
4. T. Yoder, J. Cloud, G. Leong, D. Molk, M. Tussing, J. Miorelli, C. Ngo, S. Kodambaka, M. Eberhart, R. Richards, and Y. Yang, "Iron Pyrite Nanocrystal Inks: Solvothermal Synthesis, Digestive Ripening, and Reaction Mechanism", *Chem. Mater.*, **26** (23), 6743-6751 (2014). DOI: 10.1021/cm5030553
3. A. Morgenstern, T. Wilson, J. Miorelli, T. Jones, and M. E. Eberhart, "In Search of an Intrinsic Chemical Bond", *Comp. Theo. Chem*, **1053**, 31-37 (2015). DOI: 10.1016/j.comptc.2014.10.009
2. J. Miorelli, T. Wilson, A. Morgenstern, T. Jones, and M. E. Eberhart, "A Full Topological Analysis of Unstable and Metastable Bond Critical Points", *ChemPhysChem*, **16** (1), 152-159 (2014). DOI:10.1002/cphc.201402641
1. T. E. Jones, J. Miorelli, and M. E. Eberhart, "Reactive cluster model of metallic glasses", *J. Chem. Phys.*, **140**, 084501 (2014).

Presentations and Seminars

Transferring the Functional Group to Metallic Systems

Colorado School of Mines, Department of Chemistry and Geochemistry, April 18, 2016.

Chemistry as the Central Science — Uncovering Chemistry's Fundamental Structure to Broaden the Applicability of Chemical Concepts

Colorado School of Mines, Department of Chemistry and Geochemistry, March 21, 2016.

Improving Faculty Perception of and Engagement in STEM Education

IEEE Frontiers in Education, 45th Annual Conference, October 23, 2015.

Impacts of Outreach on entering College Students' Interest in STEM

American Society for Engineering Education, 122nd Annual Conference Exposition, June 16, 2015.

Completing the K-12 Engineering Pipeline by Creating College Pathways¹

American Society for Engineering Education, 122nd Annual Conference Exposition, June 16, 2015.

Utilizing the Bond Bundle for Material Design

3rd World Congress on Integrated Computational Materials Engineering, June 2, 2015.

Uncovering Topological Signatures of Instability and Metastability

American Chemical Society, 249th National Meeting and Exposition, March 24, 2015.

Conference on Earth and Energy Research, Colorado School of Mines, February 26, 2015.

Quantum Mechanical Investigation of Metal Glasses

Conference on Earth and Energy Research, Colorado School of Mines, March 29, 2012.

Structural Analysis of Bulk Metal Glasses — A Quantum Approach

Colorado School of Mines, Department of Chemistry and Geochemistry, February 14, 2012.

Utilization of Computational Tools in Research

Metropolitan State University of Denver, Metro State Experimental Society, October 31, 2011.

Awards and Honors

Trefny Institute Graduate Fellowship, 2013–2015

Outstanding Teaching Assistant Award in Chemistry and Geochemistry, 2011–2012

Departmental Award for Best Chemistry Presenter, March 2012

Vice President's Honor Role, 2006–2009

Hypercube Scholar Award, May 2009

Purdue's Big Ten Graduate Exposition Travel Award, Sept 2009

¹This was a presentation of a poster on behalf of Dr. Barbara Moskal of the Trefny Institute

Miscellaneous

Outreach

Demonstrations and Public Talks

"Chemistry Magic Show". Skinner Middle School, Denver, CO. December 2013

"Columbine Hills Science Night". Columbine Hills Elementary, Littleton, CO. November 2013

Science Fair Judge

Adams County School District No. 50, Denver, CO. February 2014

Skinner Middle School, Denver, CO. December 2013

Vanderhoof Elementary, Arvada, CO. March 2013 and February 2014

Metz Elementary, Denver, CO. November 2012

Last updated: September 30, 2016