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Journal of Chemical Education Call for Papers: Special Issue on New Visions for Teaching Chemistry Laboratory

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ABSTRACT: The *Journal of Chemical Education* announces a call for papers for an upcoming special issue on New Visions for Teaching Chemistry Laboratory.

KEYWORDS: *First-Year Undergraduate/General, Second-Year Undergraduate, Upper-Division Undergraduate, Curriculum, Laboratory Instruction, Chemical Education Research, Collaborative/Cooperative Learning, Inquiry-Based/Discovery Learning, Problem Solving/Decision Making*

■ INTRODUCTION

It has been more than 35 years since the National Science Foundation Division of Undergraduate Education (NSF-DUE) began funding projects to improve undergraduate science laboratories through the Instrument and Laboratory Improvement Program (ILI).[1] At that time, the biggest issue in most teaching laboratories was how to introduce state-of-the-art equipment and methods in the undergraduate curriculum as research-level instrumentation became more affordable for teaching purposes. But these efforts were localized and focused primarily on putting equipment into teaching laboratories. In the intervening years, a large shift has occurred whereby faculty seek to improve the pedagogical approaches to laboratory teaching based on what has been learned from advances in chemical education research while continuing to modernize the experiments in the laboratory curriculum. Faculty now seeking to improve their teaching laboratories are considering not only the experimental techniques students experience but also the chemical concepts students are learning and how they are learning from the processes they use in the laboratory.

In recent years, there has been renewed interest in revitalizing the chemistry teaching laboratory with a focus on inquiry-based explorations. The *Journal of Chemical Education* announces a call for papers for an upcoming special issue to describe innovations related to inquiry-based teaching in the chemistry laboratory and education research on how laboratory teaching practices influence what and how students learn.

This special issue is being informed by projects undertaken in the past 20+ years that have advanced the teaching of both laboratory and classroom aspects of chemistry. Near the turn of the century, the Physical Chemistry Online (PCOL) group,[2] spearheaded by Theresa Zielinski and George Long, brought together faculty and students from different institutions to engage in multipart, context-rich experiments in the physical chemistry laboratory. This team developed teaching materials and also engaged in research[3] on how students worked together and interacted to develop their own conceptual understanding based on their laboratory work. Not long after, the Center for Authentic Science Practice in Education (CASPiE)[4,5] developed a model for using research projects (among other methods) to engage students in collaborative and inquiry-based learning in the undergraduate laboratory. More recently, we have seen the use of Course-Based Undergraduate Research Experiences (CUREs) become a prominent means to bring research and inquiry into the chemistry laboratory.[6,7] These experiences have been primarily focused on the use of research activity as a means to generate student inquiry and interest in the laboratory; at their core, they introduce students to research-style inquiry.

The early incarnations of the POGIL Project[8] appeared as an inquiry-based classroom method in a general chemistry course by Farrell, Moog, and Spencer[9] that quickly spread to other disciplines, including organic, physical, and analytical chemistry and other STEM fields. In a return to the roots of inquiry-based laboratory development, a group of POGIL practitioners (including the lead editor of this special issue) have built a growing community of faculty from a variety of institutions to develop physical chemistry experiments using a POGIL framework.[10−12] This work has resulted in publications in this *Journal* and others, a number of chapters in ACS Symposium Series books, and numerous presentations at ACS regional and national meetings. More importantly, this community has developed new experiments and revised old ones *and* is examining how students learn in the physical

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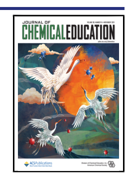

chemistry laboratory when inquiry-based methods are used. However, we also know that other individuals and teams are developing experiments in multiple chemistry disciplines as well, utilizing modern tools and new pedagogical understanding for laboratory instruction. Furthermore, several research groups are studying how student experiences in the laboratory affect their learning of chemical concepts. Clearly, chemistry educators are engaged in developing inquiry-based laboratory experiences. With this special issue, we would like to highlight the more recent developments, specifically exploring different ways that inquiry is incorporated in the laboratory curriculum, from brief-yet-effective activities and single experiments to entire laboratory courses or curricula that have a significant foundation in inquiry-based experiences for students.

SPECIAL ISSUE SCOPE AND CONTENT

In this special issue on New Visions for Teaching Chemistry Laboratory, we seek manuscripts from the chemistry education communities that explore inquiry-based methods of teaching in the laboratory setting. For the purposes of this issue, we are defining inquiry-based laboratory teaching with the following criteria:

- Experiments will have outcomes that are not fully known to the students. Such experiments should go well beyond the verification of published values.
- Students are involved at some level with the experimental design, or students will make decisions about the experimental protocol in the course of the experimentation process.

We are looking for authors to share their work surrounding innovations in inquiry-based teaching in the chemistry laboratory and to describe the effects of these innovations on students' behavior toward learning chemistry, perceptions of laboratory work, or new conceptual understanding. Manuscript topics might include (though are certainly not limited to) one or more of the following:

- New pathways for students to explore chemistry phenomena either through new instrumentation or a novel method of analysis.
- Use of modern instrumentation and/or computational methods in the undergraduate teaching laboratory with an eye toward conceptual understanding as well as exposure to and practice with state-of-the-art or state-of-the-practice instrumentation and methods that may have been previously inaccessible due to cost or safety concerns.
- Applications of chemistry laboratory techniques to pressing societal issues, such as climate change.
- Use of modern computational tools to analyze experimental data, including new ways of using standard analysis methods or introduction of new tools to improve student understanding of data analysis methods.
- Implementation of research-based pedagogical methods in the teaching laboratory. In this area, we might expect authors to describe how an experiment is developed or modified so that students can explore the principles and methods of a chemistry topic in some form other than the traditional confirmation-style experiment.
- Descriptions of or assessment of effective methods for increasing the participation of women and underrepresented groups in the practice of chemistry.
- Chemical education research on inquiry-based student work in either the chemistry laboratory, or in chemistry concepts in general. This could be anything from an examination of the effects of a new implementation on student learning to a detailed study of what students are learning during any phase of an inquiry-based chemistry laboratory experience.

SUBMISSION, REVIEW, AND PUBLICATION PROCESS

Manuscripts should align with the principles outlined in the Author Guidelines for the *Journal of Chemical Education*[13] and can be submitted using these manuscript types: Activity, Article, Commentary, Communication, Demonstration, Laboratory Experiment, and Technology Report. Authors are strongly encouraged to use the *JCE*-specific manuscript template,[14] which contains prompts for required manuscript components; using the manuscript template aids in creating documents that are easier to review and publish. Authors considering submission of manuscripts to be considered chemical education research should take note of the content requirements outlined by the *Journal*.[15]

Manuscripts should be submitted to the *Journal of Chemical Education* through the online manuscript submission portal ACS Paragon Plus[16] by Tuesday, April 12, 2022, to receive full consideration for publication in the special issue. Manuscripts received after the deadline may still be considered for publication but, depending on the length of the peer-review process, may be included in an issue of the *Journal* subsequent to this special issue. When submitting your manuscript in the Paragon system, select "New Visions for Teaching Chemistry Laboratory"under the Special Issue Selection during "Step 1: Type, Title, & Abstract". Authors should also indicate in the cover letter during "Step 6: Details & Comments" that the manuscript is submitted for publication in the Special Issue: New Visions for Teaching Chemistry Laboratory.

As with all ACS journals, papers intended for the special issue will be available ASAP (as soon as publishable) online as soon as they are accepted and proofs have been checked, ahead of publication in the special issue itself.

GUEST EDITORS

The themed issue will be curated by Alexander Grushow, Sally Hunnicutt, Marc Muñiz, Barbara A. Reisner, Stephanie Schaertel, and Rob Whitnell.

Alexander Grushow is Professor of Chemistry and department chair at Rider University, Lawrenceville, New Jersey. He has worked with several teams (including, PCOL, The POGIL Project, and POGIL-PCL) to develop inquiry-based activities and experiments in physical chemistry. Most recently he coedited an ACS Symposium Series book, *Using Computational Methods to Teach Chemical Principles*.[17]

Sally Hunnicutt is Professor of Chemistry and Associate Dean in the College of Humanities and Sciences at Virginia Commonwealth University in Richmond, Virginia. She has been involved with the POGIL Project for many years. She is Principal Investigator on an NSF Grant that develops workshops and supports activity development for the POGIL-PCL group.[12]

Marc Muñiz is Assistant Research Professor in Chemistry and Chemical Biology at Rutgers University in New Brunswick, New Jersey. He works with the TRIAD Coalition

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J. Chem. Educ. 2021, 98, 3409−3411

in the field of STEM education research. Marc is also a Principal Investigator on an NSF Grant to examine student learning outcomes of students who use experiments developed by the POGIL-PCL group.[12]

Barbara A. Reisner is Professor of Chemistry at James Madison University where she mentors undergraduate researchers on inorganic materials and chemistry education projects. She is part of the leadership team of the Interactive Online Network of Inorganic Chemists (IONiC) and works with faculty to use classroom data to reflect on their teaching practice.[18]

Stephanie Schaertel is Associate Professor of Chemistry at Grand Valley State University in Allendale, Michigan. She has interests in greening the physical chemistry laboratory and developing low-cost alternatives to high-cost physical chemistry experiments. She was a co-Principal Investigator on an NSF grant for introducing computational chemistry into the physical chemistry curriculum[19] and served as Workshop Chair for the 2014 Biennial Conference on Chemical Education.

Rob Whitnell is Professor of Chemistry at Guilford College in Greensboro, North Carolina. He has worked extensively with the POGIL Project and POGIL-PCL[12] to develop and use inquiry-based teaching in both the physical chemistry and general chemistry classroom and laboratory.

■ INQUIRIES

Inquiries regarding the suitability of a manuscript topic can be directed to Alex Grushow at grushow@rider.edu. Questions regarding the submission process can be directed to eic@jce.acs.org.

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