

# The POGIL Inquirer

## In the Spotlight Dan King

*Q&A with Drexel's Dan King (3<sup>rd</sup> from left) on his NSF Grant  
"Collaborative Research: Climate Change Concepts and POGIL"*

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## From The POGIL Project Director



*"One of the problems I have during math class is not understanding the reasoning behind what we are doing...The teachers are sometimes reluctant to explain it because they think we won't understand. But if something doesn't make sense to me, I can't do it. I'd rather understand than just memorize formulas."*

Naomi Mburu, high school senior

*Ideas for Improving Science Education, The New York Times,  
9/3/2013*

Dear Friends,

I hope that this letter finds you well as we begin the new year. Here at The POGIL Project, we have just completed our second year as an independent 501(c)3 organization, and are eagerly looking ahead to the exciting opportunities that 2014 holds.

From the highest offices of the Department of Education to local PTO meetings across the country, the question of how to best help students master the concepts and skills that they will need to be successful in life has engendered considerable debate. For me, however, a strikingly accurate take on this issue has not come from a specialist, or even someone with a high school degree. The quote above from Naomi articulates quite clearly what truly empowers students to take on whatever challenges may come before them. What Naomi and all her fellow students need is an opportunity to experience this approach to learning.

Over the past two years, The POGIL Project has reached thousands of

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## Upcoming POGIL Events

Spring/Summer 2014

March 5	1-Day Pre-Conference Workshop - ACM
March 7	3-Hour – ACM Special Interest Group
April 26	1-Day Private at Washington St. U – Tri-Cities
May 31 – June 3	POGIL National Meeting
June 15	1-Day Intro Workshop - ASEE
June 30-July 2	NW Regional Workshop
July 9-11	SW Regional Workshop
July 14-16	NC Regional Workshop
July 25-27	NE Regional Workshop
July 29-31	SE Regional Workshop

**For more information on  
upcoming POGIL workshops,  
visit [www.pogil.org](http://www.pogil.org)**

## Ask The Mole

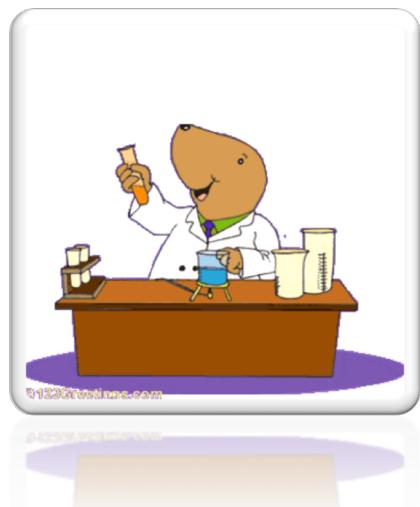
**Q:** Can I get formative feedback on the POGIL activities I have written?

**A:** Yes!

The *activity feedback* process is for authors who wish to receive formative feedback on one or more POGIL activities that they have written. Authors will receive formative feedback from experienced POGIL practitioners in order to revise and improve the quality of submitted activities. Using the Content Rubric Feedback Form, feedback about content learning objectives, the learning-cycle structure, and the clarity and flow of the activity will be given. In addition, using the Process Skills Feedback Form, feedback on the process-skills goals and the cooperative structure of the activity will be given. To receive feedback, authors should submit one activity at a time to Sarah Rathmell: [sarah.rathmell@pogil.org](mailto:sarah.rathmell@pogil.org).

This submission should contain the student activity and any accompanying handouts, an answer key for the activity, a classroom implementation plan if appropriate, and the Activity Submission Form. Before submitting an activity for feedback, authors often find it very helpful to check their activity using the Elements of a Typical Classroom, Activity and Author Guidelines for Developing Activities. Visit <https://pogil.org/resources/writing-submitting-pogil-activities> for more information.

*If you have any questions regarding inquiry learning, POGIL materials, or any POGIL-related knowledge, email us at [mdubroff@pogil.org](mailto:mdubroff@pogil.org).*



## POGIL Workshop at U. Texas Medical Branch



POGILers (from left) Marty Perry, Kristin Plessel, Michael Garoutte and Gina Frey conducted a successful introductory workshop for the University of Texas Medical Branch in December.

The highlight of the event though, was this photo, supplied by the team. They wrote ...  
“Our pathologist host couldn’t believe that we all had periodic table apps. So she took this picture and titled it ‘Chemistry nerd dinner.’  
(She asked if we minded the label first, and of course, we didn’t!)”



## Amanda Zullo Named New York Master Teacher

Amanda Zullo of Saranac Senior High School was one of 105 math and science teachers who were named to the first list of New York State Master Teachers. The announcement came in the fall of 2013 by Gov. Andrew Cuomo.

The New York State Master Teacher Program was established by Cuomo to identify, reward and support the top math and science teachers throughout state. Teachers participating in the program each receive a \$15,000 stipend per year for four years and are involved in peer mentoring and professional development. They also closely work with new teachers to support their development.

Each regional program is paired with a State University of New York campus to give the participants additional content exposure. The 21 Master Teachers in North Country, which is where Zullo is located, will be paired with SUNY Plattsburgh.

"As part of our efforts to build a world-class education system in New York, the Master Teachers program will allow this first group of talented teachers to assist their peers in the classroom, further develop their own expertise, and enhance the overall learning experience of our students for years to come," Cuomo said in a press release.

### Truly Awesome POGIL Activity Showcase (TAPAS) – It's Not Just for Dinner!

The TAPAS project will facilitate the solicitation and compilation of exemplary POGIL activities for a wide variety of disciplines. These activities will be posted on the POGIL website and used freely to give future workshop participants and other interested parties examples of how POGIL can be used in their classroom. The name TAPAS (or the TAPAS bar) serves as an analogy for the small portions of well-prepared food (or activities) that are served, shared and encourage conversation. The TAPAS project will serve to demonstrate the breadth of POGIL implementation and provide an additional tool for practitioners to find and share with each other.

Three activities are currently being vetted, including going through Activity Endorsement, and will be posted on the TAPAS page of the POGIL website by the 2014 POGIL National Meeting.

If you have questions or comments, please contact Shawn Simonson, TAPAS Curator, at [ShawnSimonson@BoiseState.edu](mailto:ShawnSimonson@BoiseState.edu).

## The POGIL Project Says THANK YOU to 2013 Annual Appeal Donors



The POGIL Project would like to thank those who responded to its 2013 annual appeal.

To date, we have raised more than \$20,000 from almost 100 donors.

Your backing is crucial to ensuring that we can continue to provide quality professional development to educators from a variety of backgrounds and disciplines, as well as publish materials that are used in classrooms around the country and the world. Most important, your continued support will help thousands of students experience a type of learning that gives them the confidence to succeed not just in school, but in their future careers. We are grateful to have you as an ongoing partner in these efforts.

## A&P Book Now Available!

Murray Jensen's new Anatomy & Physiology activity collection "Fifteen POGIL Activities for Introductory Anatomy and Physiology Activities" is now available for purchase. Please contact Sarah Rathmell at [sarah.rathmell@pogil.org](mailto:sarah.rathmell@pogil.org) or 717-358-4684 for an order form. Books are \$25 plus shipping.

## Third POGIL Facilitator Training Workshop in Myrtle Beach a Success!



The third POGIL facilitator training workshop was held in Myrtle Beach, S.C., in January and was, by all accounts, a huge success. There were 18 participants from both the U.S. and abroad, and the workshop was facilitated by Andy Bressette (Berry College) and Suzanne Ruder (VCU), as well as facilitator in training Tim Herzog (Weber State). The participants were all actively engaged throughout the workshop, and all reported they found the experience to be highly valuable. All the participants are now expected to lead an introductory POGIL workshop at their home institutions during the coming months.

The main objectives of the workshop were to prepare participants to facilitate the "Introduction to POGIL," "Writing Activity Structure," "Classroom Facilitation: Implementing Activities," "Effective Responses," and "Robust Models" standard workshops. During this training session, the participants were given the opportunity to facilitate some aspect of the activities that are currently part of those workshop sessions. In addition, participants explored the workshop slides and annotated facilitator agendas and developed an understanding of the goals of the various workshops and they link to the overall Mission, Vision and Values of The POGIL Project.

The workshop culminated in a fishbowl that was run and debriefed entirely by the workshop participants.

# Berea College's Megan Hoffman Earns Honors from KY Academy of Science



*Photo courtesy of Berea College*

Megan Hoffman of Berea College was recently honored at the Kentucky Academy of Science's 99<sup>th</sup> annual meeting as the 2013 Outstanding College/University Teacher. Hoffman was one of 17 Berea College faculty and students who earned accolades.

Hoffman, a former POGIL Steering Committee member, has taught introductory and upper-level biology and general education courses at Berea College for more than 20 years. She has been active in campus governance and served for four years as the director for Learning, Teaching Communication and Research at Berea College.

## From the Director

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educators in a range of disciplines, promoting more effective learning and deeper understanding of course concepts. With POGIL, students like Naomi don't have to feel alienated in their coursework, and don't have to rely on the instructor alone to gain understanding and develop important skills. POGIL puts students at the center of the learning experience and puts them in the driver's seat of their success.

Yet POGIL isn't a magic formula, and it isn't a catchall solution to the many problems facing our education system. What POGIL represents is an opportunity-a chance for students to approach thinking and learning in a more accessible way. Where students may have once struggled or been discouraged in math and science classes, POGIL provides a way of exploring and understanding the material that can be affirming and supportive. POGIL gives students the opportunity not only to understand, but also to excel and succeed in their lives far beyond the classroom.

### **I now offer you an opportunity; one that will make a difference in thousands of students lives.**

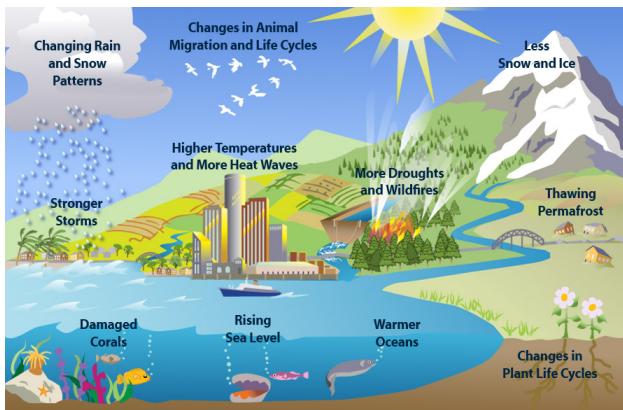
With your support, The POGIL Project can grow and expand as an organization farther than ever before, reaching new populations of educators and students. Your backing will help lay the foundation for lasting and effective reform, as well as provide the chance for students to experience a new style of learning that plays to their strengths and teaches them to succeed in the world around them. We want to foster an educational system where students like Naomi are no longer asked to memorize formulas, but instead are given the opportunity to understand, and to fulfill their true potential.

We sincerely thank those who have given already. And I hope all of you will join us in our mission to make this a reality.

*Richard S. Moog*

## In the Spotlight: Dan King

# Climate Change Concepts and POGIL



Drexel University's Dan King and his colleagues are using an NSF grant to write a set of POGIL activities that use climate change topics to teach general chemistry concepts. These in-class activities cover topics distributed throughout a typical general chemistry curriculum. An additional component of this project is the incorporation of questions and models that relate to socio-scientific issues, e.g., the economic and social effects of climate change policies. The goal is for students to use evidence-based arguments in situations where opinion-based arguments are common. The final component of this project involves video-recording students working on the activities. Analysis of student discourse during the activities has been used to inform revisions of the activities so that they better promote both development of scientific concepts and substantive discussion of related socio-economic and environmental issues.

**Q:** Why did you choose climate change?

A: The goal has been to develop activities that would engage students. Climate change is a timely issue that affects students now and will continue to affect them in their future lives and careers. It is also an application that matches well with a variety of topics in the general chemistry curriculum. On a personal note, my Ph.D. is in marine and atmospheric chemistry, so I have a natural connection to and interest in climate change issues.

**Q:** How will your approach to learning in a classroom environment differ from a traditional lecture based approach?

A: It is expected that these activities will be implemented using typical POGIL classroom facilitation, where

students complete the activities in groups and the faculty member acts as a facilitator.

**Q:** Who else is working on this project and why did you choose them?

A: Jennifer Lewis (University of South Florida) and Karen Anderson (Madison College) are co-PIs. Doug Latch (Seattle University), Sue Sutheimer (Green Mountain College) and Gail Webster (Guilford College) are members of the authoring team. Rick Moog (Franklin & Marshall College) and Cathy Middlecamp (University of Wisconsin, Madison) served as writing and content coaches. The members of the authoring team were chosen based on experience writing POGIL activities and/or environmental expertise. Knowing that the identification of appropriate environmental models was important for these activities, we decided to include authors with expertise in this area.

**Q:** In your proposal, you spoke of "transforming climate change education through socio-scientific argumentation." Could you please elaborate on this?

A: We wanted to take this opportunity to address one of the issues that is common to climate change discussions: the tendency for people to use emotion-based arguments. A strength of POGIL activities is the incorporation of questions that promote evidence-based argumentation. Students are often prompted to provide data and/or explanations to support their answers. We hope to promote this same data-based discussion with topics that were not strictly chemistry content-based. Also, by incorporating socio-scientific models and questions into science content-based activities, we hope to help students to recognize the connection between the science content and social aspects of climate change.

**Q:** Environmentally informed students will soon become contributing members to a green-thinking society. How will using the POGIL approach convey the seriousness of our global climate situation?

A: I doubt that these activities are going to have much of an impact on a student's overall thoughts about climate change. These activities are not designed to increase the social awareness of our students, especially given that most courses would only use a few of these activities per term. They are designed to help students see the connection between the content they learn in

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class and the world around them. That said, if the use of POGIL pedagogy has any effect, it would likely be related to the process skills more than the content objectives associated with each activity. These activities rely on and reinforce the importance of information processing, communication and teamwork, and these skills will help students to evaluate data and arguments presented by each side of the climate change debate, and help them to solve the environmental problems we are likely to face in the future.

**Q:** Could you discuss a few of the 12 climate change activities you mention in your proposal?

**A:** Here are brief descriptions of some of the activities. The global carbon cycle is used as the climate change context for several activities. In one activity, conservation of mass and balanced chemical equations are applied to the pools and fluxes within the global carbon cycle. In another activity, students learn about unit conversions and use that information to calculate the carbon footprint associated with several different cars. In a different activity, students learn how to interpret a phase diagram and use the phase diagram to help identify locations where deep aquifer carbon sequestration could be done. Finally, in another activity, students learn about dipole moment and that information is used to explain the characteristics of greenhouse gases.

**Q:** In your proposal you mentioned that your previous research with POGIL activities strongly suggests that your current project has the right components to be successful. What exactly are these components?

**A:** One goal of this project is to use the analysis of student discourse to inform revisions of the activities to improve discussion of chemistry and socio-scientific concepts. Since POGIL activities are known to promote argumentation, these activities utilize a format that facilitates the analysis of discussion. The incorporation of climate change contexts into POGIL activities should promote student engagement. Activities that promote engagement and discussion are likely to generate feedback and data that can be used to effectively improve subsequent versions of the activities.

## Problems with Ordering Quantum and Calculus Books

The POGIL Project and Wiley extend our sincere apologies to anyone who has tried to order books with the Wiley CustomSelect website and has encountered problems. There were serious technical issues that proved more difficult to resolve than either The POGIL Project or Wiley anticipated. Rest assured, we understand the frustrations that you are experiencing and we have worked hard to fix the problems as quickly as possible. Because of this inconvenience, we will offer PDF downloads of *Calculus I: A Guided Inquiry* and *Quantum Chemistry & Spectroscopy: A Guided Inquiry* to faculty members who planned to use one of these books during the spring semester and have not had an order fulfilled, or who have received a copy of the book with formatting errors. Please note that both corrected books *are* also available at <http://customselect.wiley.com/collection/pogil> if you would prefer to order the traditional way.

The process for obtaining a PDF download is as follows:

1. If you don't already have one, please sign up for a username/password at [pogil.org/apply](http://pogil.org/apply). PLEASE COMPLETELY FILL OUT YOUR INFORMATION PROFILE, OR YOU WILL NOT BE GRANTED ACCESS to the website.
2. Next, email [mdubroff@pogil.org](mailto:mdubroff@pogil.org) requesting access to the desired textbook. Please include the following: your name, institution, course name, and the number of students who will be using the book, and which book you need
3. Once that information is received, we will add you to a groups page for the book and inform you of the URL where you will be able to download a copy of the book.
4. You will have permission to make ONE print copy for yourself and for each of your students in the relevant class for the Spring 2014 semester (or the Winter and Spring 2014 quarters). You may not share the PDF with anyone else, and you may not make additional print copies for anyone else. You may not make copies for any students in a course that begins after May 15, 2014.



Again, this process is ONLY for courses offered during the spring semester or winter/spring quarters for the above two books. The problems have been resolved so that printed materials will be available for use during the summer and fall terms. Again, we want to express our sincerest apologies for this temporary setback. We know that the beginning of the semester is a hectic time, and hope that this has not added to the stress.

# POGIL Summer Regional Workshops Announced

The POGIL Project is pleased to announce its 2014 summer regional workshop lineup. These 3-Day Regional Workshops provide instructors from both high schools and colleges/universities with all levels of POGIL experience, significant opportunities to enhance their professional development by gaining new insights into teaching and learning.

There will be a sequence of workshops, some specifically designed for those who are new to POGIL (offering an Introductory track) and other workshops specifically designed for those with previous POGIL experience (Introductory, Intermediate and Advanced tracks). At each workshop location, you will learn about POGIL's philosophy and methodology. You will also learn about different facilitation techniques and have opportunities to write and review activities, as well as attend informative poster and plenary sessions. All locations will include some new components for 2014.

Whether you are an experienced POGIL practitioner, new to the methods, or somewhere in between, these workshops will provide a wealth of opportunities to gain new insights, grow professionally, and take home tangible skills. While the workshops' focus is on STEM disciplines, attendees from all disciplines are encouraged to attend.

## TRACK DESCRIPTIONS

**Introductory Track:** This track is designed for participants to experience the POGIL methodology and to learn to facilitate POGIL activities. No prior workshop attendance is required.

**Intermediate Track:** This track is designed to improve participant's facilitation skills and to introduce POGIL activity structure. **Prerequisite:** You must have attended at least a 3-hour POGIL workshop to attend this track.

**Advanced Track:** This track is designed to focus on improving participant's facilitation skills, writing and receiving feedback on POGIL activities, and developing a scholarship of teaching and learning project. **Prerequisite:** You must have previously attended a 3-day workshop in order to sign up for this track.

While the workshops' focus is on STEM disciplines, attendees from all disciplines are encouraged to attend.

## OTHER WORKSHOP INFORMATION

**Workshop Fee:** \$375 (registration, materials, lunches/dinners). On-campus housing for two nights is provided for an additional \$100 and includes two accompanying breakfasts. Space is limited, and early registrations are encouraged. Payment in full is required at the time of registration.

**CEUS Available:** For an additional fee of \$50, participants in the POGIL regional workshops can choose to receive CEUs (Continuing Education Units) through Millersville University. There is an attendance requirement if you choose to pursue CEUs.

## TRACK LOCATIONS

The Introductory and Intermediate tracks will be offered at ALL six regional workshop locations in 2014. **The Advanced track will only be offered in the Northeast, South Central and Southwest Regions.**

June 30-July 2	NW Region – University of Puget Sound
July 9-11	SW Region – Colorado College
July 14-16	NC (formerly Great Lakes Region) – Univ. of St. Thomas
July 15-17	SC Region – Univ. of Central Arkansas
July 25-27	NE Region – Stonehill College
July 29-31	SE Region – E. Tennessee State Univ.

## 2013-14 POGIL Regional Coordinators

North Central Region (Formerly Great Lakes)  
(IA, IL, IN, MI, MN, ND, NE, OH, SD, WI)  
Tracey Murray, Capital University  
(tmurray2@capital.edu)

Northeast Region  
(CT, DC, DE, MA, MD, NH, NJ, NY, ME, PA, RI, VT, WV)  
Kris Lantzky-Eaton, St. John Fisher College  
(lgalligan@jsu.edu/klantzky@sjfc.edu)

Northwest Region  
(AK, ID, MT, OR, WA)  
Lori Stanton, Bellevue Christian School  
(lstanton@bellevuechristian.org)

South Central Region  
(AR, KS, LA, MO, OK, TX)  
Marty Perry, Ouachita Baptist University  
(perrym@obu.edu)

Southeast Region  
(AL, FL, GA, KY, MS, NC, SC, TN, VA)  
Patrick Brown, East Tennessee State University  
(brownp@etsu.edu)

Southwest Region  
(AZ, CA, CO, HI, NM, NV, UT, WY)  
Tim Herzog, Weber State University  
(timothyherzog@weber.edu)

*Please contact any of the Regional Coordinators if you have any questions about events or workshops in your region.*



## Building relationships to strengthen student-centered learning

### The POGIL Mentors Program

The new POGIL Mentors program is off to a good start in the Northwest region. We rolled out the pilot project at the Northwest Regional Workshop in June 2013 at Linfield College in McMinnville, Ore. Experienced POGIL practitioners volunteered to be a point of contact and mentor to instructors who were either new to POGIL or who wanted extra support. We developed a list of instructors and their areas of teaching and expertise as well as a list of mentees. Pairs were assigned during the Workshop so that the mentors and mentees could talk face to face to get a real sense for what the issues might be as they spent time working together. This was really fun for everyone because it established the relationship on a solid foundation and allowed people to really talk in depth about their issues. Have a specific mentor allows instructors new to POGIL to have a chance to be really specific about their potential problems and their ideas for how to get started.

How does the POGIL Mentors program work in practice? The POGIL project already does a great job of staying in touch with instructors that attend workshops but the POGIL Mentors program takes this one step further by developing relationships amongst POGIL practitioners, new and old. POGIL mentors and mentees interact at least once a month with conversations about their use of POGIL and teaching in general. How this dialogue is maintained is up to the mentor-mentee pair but from our first year of experience this seems to be primarily over email as some pairs were fairly distant from each other geographically.

Mentor-mentee reports were overwhelmingly positive. These reports followed a standard format and only took a few minutes to put together. They have targeted questions that allow the mentor and mentee to focus at least a few minutes of their conversation on strengths, insights, and improvements of their POGIL practice for that month or term. Feedback from these pairs generally dealt with very specific questions such as "how can I get a copy of the Chemistry book" to "how can I convince my Principal that they should embrace POGIL and give me a chance to get this started." Overwhelmingly, the relationships gave confidence to the new practitioners to incorporate more student-centered learning activities in their classrooms. But, they also allowed mentees to get an idea of what might or might not work for them based on their mentors' experience. We even had one mentee go so far as to be invited to the POGIL Facilitators Workshop in Myrtle Beach in 2014. It's likely she would have been an early adopter and POGIL practitioner anyway, but it must not have hurt to have a POGIL Mentor.

This year we hope to do more work on the POGIL Mentors program and offer it to more regions. This program can be as small or as large as needed. What we hope to provide with this program is a way to build relationships and get more people focused on student centered learning in their classrooms.

— Laura Lavine, Washington State University

## VCU Medical College Workshop Enhances Learning

On Oct. 24, 2013, Suzanne Ruder conducted an Introduction to POGIL workshop for faculty at the school of medicine at VCU Medical College. Approximately 20 faculty participated with the goal of enhancing their understanding of guided inquiry learning and to gain skills related to writing POGIL activities.

Participants were encouraged to prepare activities in their area of expertise and submit their activities for review. This workshop was offered as part of the graduate course "Instructional Strategies for Teaching in Medicine." The course, which is required for the post-baccalaureate graduate certificate in medical education is designed to enhance the depth and breadth of faculty expertise in curriculum design, theory and practice of adult learning, instructional strategies, teaching as scholarship in conducting medical education research, performance feedback and simulation, small group facilitation, reflective practice, and use of digital media technologies to support teaching and learning in medical education.

One participant enthused, "I really liked the way that Dr. Ruder kept us on task without being overbearing or creating a frantic environment...basically because she modified her usual package to fit the time... demonstrating what good teachers are supposed to do!"

# POGIL Published Works

## Argumentation and participation patterns in general chemistry peer-led sessions

Ushiri Kulatunga, Richard S. Moog, Jennifer E. Lewis

*Journal of Research in Science Teaching* 2013, 50 (10), 1207-1231

**ABSTRACT:** This article focuses on the use of Toulmin's argumentation scheme to investigate the characteristics of student group argumentation in Peer-Led Guided Inquiry sessions for a General Chemistry I course. A coding scheme based on Toulmin's [Toulmin 1958] The uses of argument. Cambridge: Cambridge University Press] argumentation model was used for identifying arguments during group work without instructor intervention. A modification of the framework developed by Erduran et al. [Erduran, Simon, & Osborne [2004] *Science Education*, 88(6), 915–933] for characterizing arguments was employed that considered both the strength of the argument and whether an argument contained contributions from one or more than one student. Data were collected by video recording weekly peer-led sessions with a focus on two small groups. Analysis of this video data with the coding scheme and the framework revealed that students were mostly engaged in co-constructed arguments, with more than one student providing evidence and reasoning during group activities. Students often supported their claims with data and warrants but rarely offered backings. That is, they supported their answers with evidence and reasoning but did not often elaborate on their reasoning or further validate their explanations. However, the percentage of arguments containing backings increased when arguments contained contributions from more than one student rather than being presented by one individual. Another significant finding is that students were able to resolve wrong claims through argumentation without peer leader intervention, an indication of independent learning.

## Process-oriented guided-inquiry learning improves long-term retention of information

Thea Vanags, Kristen Pammer, and Jay Brinker

*Advances in Physiology Education* 2013 37 (3), 233-241

**ABSTRACT:** Many chemistry educators have adopted the process-oriented guided instructional learning (POGIL) pedagogy. However, it is not clear which aspects of POGIL are the most important in terms of actual learning. We compared 354 first year undergraduate psychology students' learning in physiological psychology using four teaching

methods: control, POGIL, POGIL without reporting [no report out (NRO)], and POGIL run by untrained graduate students [new facilitator (NF)]. Student activities were identical across POGIL variations and highly similar for control. Participants' knowledge was evaluated before (pretest), immediately after (posttest), and 2 wk later (followup). Control and POGIL groups showed no improvement at posttest, whereas NRO and NF groups both recalled more material than at pretest ( $P = 0.002$  and  $P < 0.0005$ , respectively). In a surprise test 2 wk later, control ( $P < 0.0005$ ), NRO ( $P = 0.03$ ), and NF ( $P < 0.0005$ ) groups recalled less than at posttest. The POGIL group showed the smallest drop in knowledge ( $P = 0.05$ ). Importantly, the control group's knowledge was below pretest levels ( $P < 0.0005$ ), whereas the POGIL, NRO, and NF groups' knowledge was not. Self-assessment of knowledge was consistent across groups at pretest, but POGIL participants had the lowest confidence posttest and 2 wk later. At followup, the control, NRO, and NF groups showed greater confidence in their knowledge than the POGIL group ( $P = 0.03$ ,  $P = 0.002$ , and  $P = 0.004$ , respectively). POGIL and its variations appear to consolidate existing knowledge against memory decay even when student confidence does not match performance.

## Supporting Alternative Strategies for Learning Chemical Applications of a Group Theory

Daniel C. Southam and Jennifer Lewis

*Journal of Chemical Education* 2013, 90 (11), 1425–1432

**ABSTRACT:** A group theory course for chemists was taught entirely with process oriented guided inquiry learning (POGIL) to facilitate alternative strategies for learning. Students completed a test of one aspect of visuospatial aptitude to determine their individual approaches to solving spatial tasks, and were sorted into groups for analysis on the basis of their aptitude. Affective constructs from self-determination theory relating to motivation were also assessed. Students without strong visuospatial skills found the activities complete spatial tasks. Equally successful outcomes were observed on an assessment task, irrespective of visuospatial aptitude of the student. This illustrates that a pedagogy structured around multiple strategies for reasoning can successfully support alternative approaches to abstract concepts, such as chemical applications of group theory.

# Looking to Book a Workshop?

- If you would like to bring a POGIL workshop to your area, please get in touch with us! We are interested in teaching more instructors about POGIL at both the high school and post-secondary levels and want to help them make their classrooms and laboratories more student-centered.

Please visit our website and submit an event request at <https://pogil.org/contact/enter-request> or email Marcy Dubroff at [mdubroff@pogil.org](mailto:mdubroff@pogil.org).



## Send us your news!

We'd love to feature your news, your grant, or your video on the POGIL website and in the POGIL newsletter. Send news to Marcy Dubroff at [mdubroff@pogil.org](mailto:mdubroff@pogil.org). Get all the latest POGIL news by following us on Twitter or Facebook! Sign up to get our @POGIL tweets at [@twitter.com](http://twitter.com).



## The POGIL Inquirer

The POGIL Project  
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Lancaster, PA 17603