



**Process Oriented Guided Inquiry Learning (POGIL):**  
**A Student-Centered Approach to Instruction**

Chicago Symposium Series on Excellence in Teaching Mathematics and Science: Research and Practice  
 Northwestern University  
 April 12, 2014


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**The POGIL Project**

- Launched by sequential grants from National Science Foundation (2003-2012)
- Based on curricular work done by a variety of like-minded people in the mid-1990s
- Became a not-for-profit organization in 2010
- The mission of The POGIL Project is to connect and support educators from all disciplines interested in implementing, improving, and studying student-centered pedagogies and learning environments.

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**A POGIL Classroom Experience**




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**Student Outcomes**

Other than content knowledge, what might your students gain from this type of learning environment?


- Individually: 1 minute
- Group: 3 minutes
- Presenters report out

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**What is POGIL?**

Process Oriented  
(Cooperative Learning):  
Develop Key  
Process Skills


Process Oriented  
Guided Inquiry  
Learning

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### Process Skills

- Information Processing
- Critical Thinking
- Problem Solving
- Communication
- Teamwork
- Management
- Assessment

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### What is POGIL?

Guided Inquiry (Constructivism): Learning Cycle Activities

Process Oriented Guided Inquiry Learning

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### Learning Cycle Activities

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deduce

Orient

Close

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### What is POGIL?

Process Oriented (Cooperative Learning): Develop Key Process Skills

Guided Inquiry (Constructivism): Learning Cycle Activities

Process Oriented Guided Inquiry Learning

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### Constructivist Model of Learning

- "Learning is not the transfer of material from the head of the teacher to the head of the learner intact, [but] the reconstruction of material in the mind of the learner."
- "It is an idiosyncratic reconstruction of what the learner . . . thinks she understands, tempered by existing knowledge, beliefs, biases, and misunderstandings."

Johnstone, A.H. (1997). Chemistry Teaching—Science or Alchemy? *J. Chem. Educ.*, 74, 262–268.

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### Guided Inquiry Approach

- Students work in groups
- Students construct knowledge
- Activities use the Learning Cycle paradigm
- Students teach, discuss and learn from other students
- Instructors facilitate learning

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## Analysis of Student Outcomes

Data on the use of POGIL  
in a variety  
of academic settings

13

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## General Chemistry at Franklin & Marshall College

- "Lecture": F1990–S1994: n = 420
- POGIL: F1994–S1998: n = 485
  - Sections of approximately 24 students
  - Same instructors
- Students randomly placed Fall semester and designate preference Spring semester (but not guaranteed to get their choice)
- Compare course grades (ABC's vs. DFW's)

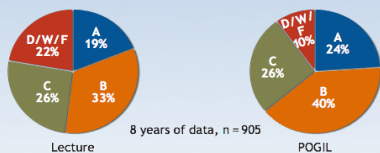
14

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## General Chemistry at Franklin & Marshall College

Data from classrooms of Moog, Farrell, and Spencer



Chi-squared = 40.9; alpha < 0.005

Farrell, J.J., Moog, R.S., & Spencer, J.N. (1999). A Guided Inquiry Chemistry Course. *J. Chem. Educ.*, 76, 570–574.

15

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## Organic Chemistry at a Regional Liberal Arts College

- Two sections--one lecture style, one POGIL--taught at the same time
- Students randomly placed in sections
- Common exams prepared and graded by both instructors
- Compare course grades (ABC's vs. DFW's)

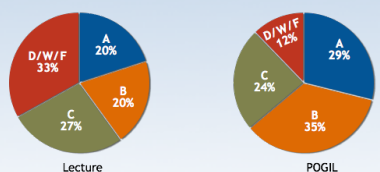
16

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## Organic Chemistry at a Regional Liberal Arts College

Randomized enrollment, different instructors, single exam given concurrently, prepared and graded by both instructors



Chi-squared = 70.1; alpha < 0.01

17

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## Organic Chemistry 2 Pre-Quiz at a Large Public University

- Classes of about 250
- Unannounced quiz given on first day of Organic 2 (written by a non-POGIL instructor)
- Students had taken Organic 1
  - With lecture (two different instructors)
  - With POGIL

18

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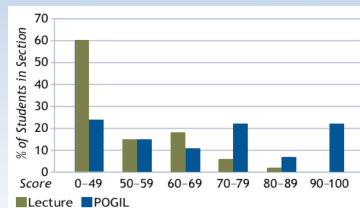
19

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### Organic Chemistry 2 Pre-Quiz at a Large Public University

Organic 2 Pre-quiz Results (Lecture vs. POGIL Organic 1)



Ruder, S.M., & Hunnicutt, S.S. (2008). POGIL in Chemistry Courses at a Large Urban University: A Case Study. In R.S. Moog, & J.N. Spencer (Eds.), *Process-Oriented Guided Inquiry Learning: ACS Symposium Series 994* (pp. 133-147). Washington, D.C.: American Chemical Society.

20

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### Available Materials

John Wiley & Sons  
 – General Chemistry  
 – GOB  
 – Analytical Chemistry  
 – Quantum Chemistry  
 – Calculus I

Cengage/Brooks Cole  
 – Organic Chemistry  
 – Prep Chemistry

Pacific Crest  
 – Biochemistry  
 – Physical Organic Chemistry

Pearson  
 • Intro to Materials Engineering

The POGIL Project  
 • Thermo and Kinetics  
 • Anatomy & Physiology

Flinn Scientific  
 • HS Chemistry  
 • HS Biology  
 • AP Biology

Coming Soon:  
 • Computer Science  
 • AP Chemistry  
 • Pre-Calculus

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### 2014 POGIL Regional Workshops

- Mon June 30 – Wed July 2: Tacoma, WA
- Wed July 9 – Fri July 11: Colorado Springs, CO
- Mon July 14 – Wed July 16: St. Paul, MN
- Tue July 15 – Thu July 17: Conway, AR
- Fri July 25 – Sun July 27: Easton, MA
- Tue July 29– Thu July 31: Johnson City, TN
- Apply at [www.pogil.org](http://www.pogil.org) \$375 plus \$100 for housing

Numerous workshops at BCCE also!

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## Thank You

23

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