Using POGIL to Teach Students To Be Better Problem Solvers
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POGIL: Process Oriented Guided Inquiry Learning

- Process Oriented: a conscious commitment to the development of seven process skills:
  - Information Processing
  - Critical Thinking
  - Problem Solving
  - Communication
  - Teamwork
  - Management
  - Assessment

- Guided Inquiry: activities leading students to reconstruct materials for themselves (Constructivist Model of Learning)

How POGIL Works in the Classroom

HOW students learn is as important as WHAT students learn
- Students work in groups
- Students complete Pre-Activity Questions before class
- Scripted in-class activities guide students through inquiries (investigations) to help them construct their own knowledge
- Students teach/discuss/learn from other students
- Instructors facilitate learning

How POGIL Teaches Problem Solving

POGIL instructors think explicitly about what process skills we want our students to gain, and how we are going to create an environment for them to further develop those skills.

POGIL students learn to:
- Examine and process information
- Ask good questions
- Construct their own understanding
- Build their problem-solving skills

POGIL activities might ask students to:
- Work an algorithm first with paper & pencil
- Develop an algorithm (with guidance)
- Design test cases before coding
- Write out pseudocode
- Use problem-solving skills to deduce

POGIL Increases Student Success

Developed in 1994 by chemistry professor and supported by 20+ NSF grants
Multiple studies have shown POGIL:
- Lowers student attrition
- Improves student mastery of content
- Improves learning skills
- Results in better student attitude and motivation

POGIL Example Activities

While Loop Activity
- Before class, students complete an iteration exercise (Newton’s method) by hand. Answers will be used in activity to test code.
- Short critical thinking questions lead students to understand:
  - Swapping variable values
  - Incrementing variables (including ↓↓ versus ↑↑)
- Experimentation with an example while loop program
  - Modify initialization and condition to change number of iterations
  - Introduce different errors, including infinite loops
- Use while-loops in two applications
  - Simple count down method
  - Newton’s method: step-by-step, adding code to a “walking skeleton”

Recursion Activity
- Before class, students implement iterative factorial methods
- Critical thinking questions lead students to develop a recursive definition for factorial and summation (on paper first)
- Critical thinking questions prompt students to consider if a method can call itself, and what this recursive behavior might look like.
- Experimentation with an example recursive method (factorial)
  - Identify distinct method calls and their outputs
  - Write recursive and iterative summation methods
- Critical thinking questions comparing recursion and iteration
- Remainder of activity guides students to develop a recursive algorithm for printing each digit in a number (123 → "one two three")

Learn More

Try out a POGIL activity at SIGCSE
Promoting Student-Centered Learning with POGIL
Saturday 10:55 AM - 12:10 PM  room 305B

Online resources:
- The POGIL Project http://pogil.org
- POGIL Instructor’s Guide available under Resources section
- POGIL in Computer Science http://cspogil.org

POGIL activities for CS 1, CS 2, and Software Engineering
Regional POGIL workshops:
- July 10-12, 2012: Connecticut, Texas, Washington, Utah
- July 23-25, 2012: Minnesota, North Carolina