The POGIL Project
&
Active Learning at SBU

Teaching more by lecturing less!

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Please form teams of 3,
and pick up 1 report form for your team.

Today's Issues

- What is POGIL?
- What does POGIL look like?
- How we know that POGIL works?
- Use a workshop not presentation format!
- Requires compromise!

Agenda

- Introduction to Stony Brook University
  - Tension between research and teaching.
- What is POGIL all about?
- Manifestations of active learning at SBU.
- What evidence is there that POGIL and active learning works?
- Your issues and concerns.

Stony Brook University

- One of 4 university centers of the SUNY system.
  - Buffalo, Binghamton, Albany
  - SBU established in 1957

- Located on Long Island
  - 45 miles east of NYC

- 22,500 students
  1,860 faculty
  - 13,900 undergraduates
    8,600 graduate students

- An internationally recognized research university.

Recognition

- Member of the Association of American Universities.
- Ranked in top 50 public US and top 150 in World.
  - US News & World Report & London Times
- Top 3 (UC Berkeley, UC Santa Barbara, SBU)
  - *The Rise of American Research Universities* (Graham & Diamond, Johns Hopkins Press, 1997).
  - Research dollars and publications/number of faculty.
- 19th in Doctoral Programs
  - Academic Analytics, reported in the *Chronicle of Higher Education* (1/12/2007)

Providing a Small College Experience

All freshmen are affiliated with six undergraduate colleges organized under six different themes.

Arts, Culture, & Humanities

Global Studies

Human Development

Information & Technology

Leadership & Service

Science & Society

Every freshman takes a freshman seminar to explore interests, meet top professors, and discover research opportunities.

Activity #1

- Your team is the employment committee of a start-up technology company.
- Identify the area that you are hiring in (1 minute), and then 10 characteristics you will be looking for in the successful candidate (9 minutes).

Employment Characteristics

- Good thinker
- Problem solver
- Team player
- Articulate
- Good writer
- Creative
- Knowledgeable
- Management skills

Instructional Plans

- Textbook to use
- Content to include
- Homework to assign
- Sequencing material
- Quality of the lectures
- Evaluation process
- Composition of exams
- Provisions for tutorials

Process-Oriented Guided-Inquiry Learning

- Why Process-Oriented?
  - Pogil develops skills essential for success in the course, college, and careers.

What are these essential skill areas?

- Information Processing
- Critical and Analytical Thinking
- Problem Solving
- Oral & Written Communication
- Teamwork
- Mestacognition
  - Reflection on learning
  - Self and peer assessment
  - Self-management & self-regulation.

Are implicit in the structure, but can also be explicit.

Activity #2

- Your team is charged with designing a new course and needs to identify general principles for the different instructional components.
- Consider a daily lesson, class session, or activity. What structure for a daily class would provide the most effective learning experience for the students?

The Learning – Research Cycle

- How do we do research?
  - Identify a need to know.
  - Explore possibilities.
    - Form and test hypotheses.
  - Develop some conclusions, concepts, or theories.
  - Apply these ideas in simple situations.
    - Builds confidence and understanding.
  - Apply these ideas in new situations.
    - Extends knowledge.
    - Continues grant funding.

Process-Oriented Guided-Inquiry Learning

- Why Process?
  - Develop essential skills for success in the course, college, and careers.

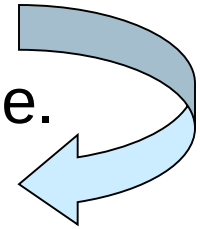
- Why Guided – Inquiry?
  - Incorporates the learning – research cycle of exploration, concept formation, & application.
    - Learning cycle was identified by UC Berkeley physicist Robert Karplus, 1962.

POGIL is based on research: people learn by -

- Constructing their own understanding and knowledge in a process involving prior knowledge, experiences, skills, preconceptions, attitudes, and beliefs.
- Following a learning cycle of exploration, concept formation, and application.
  - Guided Inquiry.
- Discussing and interacting with others.
  - Learning teams.
- Reflecting on their progress.
- Assessing their performance.
  - Reflector's or Strategy Analyst's Report.
- Visualizing concepts in multiple representations, for chemistry macroscopic, nanoscopic, and symbolic.
- Interconnecting conceptual and procedural knowledge in order to solve problems in new contexts.
  - Learning Teams & Specific Lessons

Research-Based Activity Design
Stages of a POGIL Activity

- Orientation
  - Motivation, cognitive hooks, overview, prerequisites.
- Exploration
  - Generates a need to conceptualize.
- Concept Formation
  - Invention, Introduction, Term Introduction.
- Application
  - Exercises (familiar contexts). Problems (new contexts).
- Closure
  - Reflection on learning. Assessment of performance.

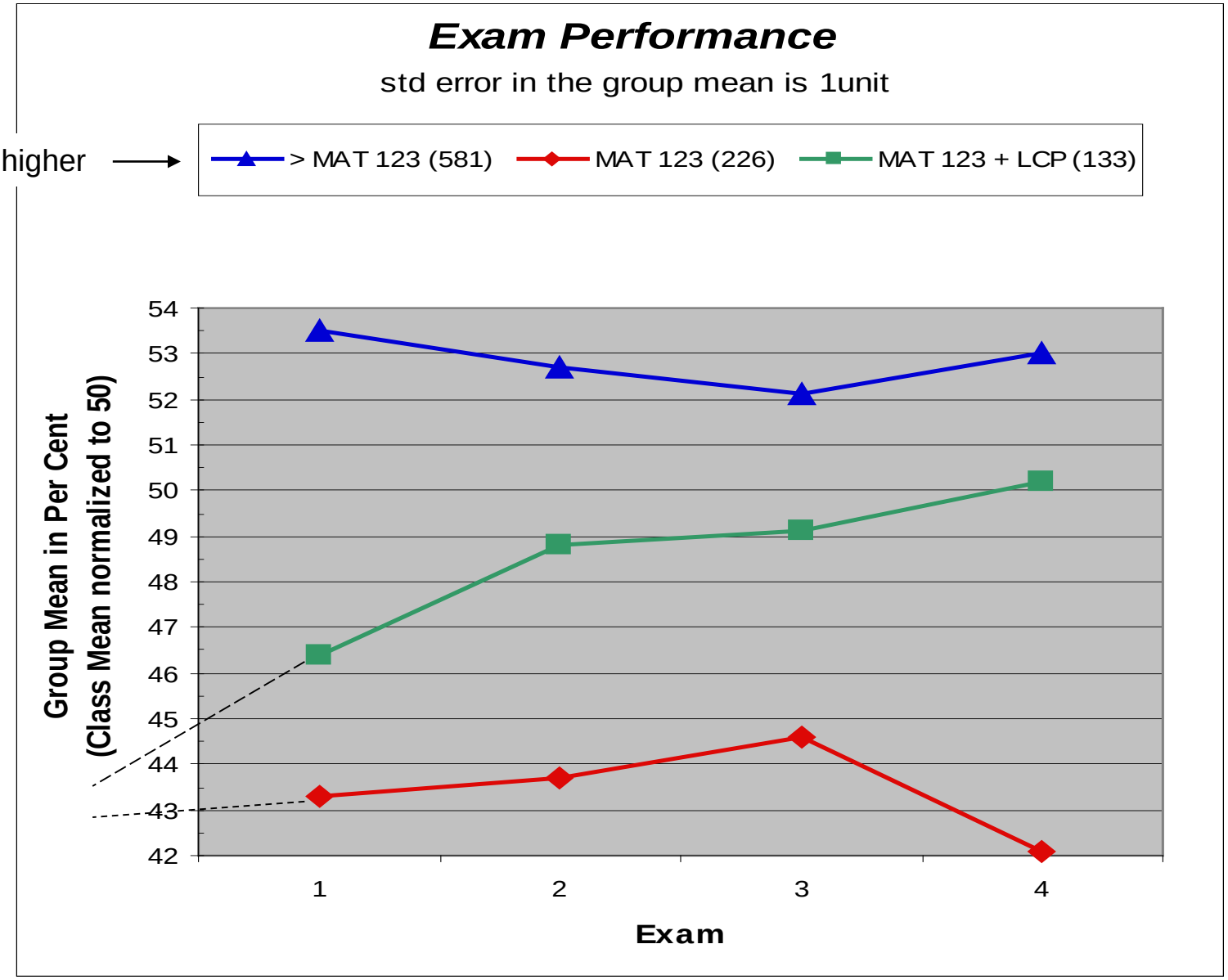


Key Questions

Activity #3

- Analyze the data on the graph that you will be shown.
- Keep track of the questions that you ask yourself as you work your way to identifying conclusions.
- State your most important conclusion in no more than 3 sentences.
- Time: 10 minutes

CHE 131 General Chemistry



Activity #3

- Analyze the data on the graph that you will be shown.
- Keep track of the questions that you ask yourself as you work your way to identifying conclusions.
- State your most important conclusion in no more than 3 sentences.
- Time: 10 minutes

Responses

- What is LCP?
- What does each set of data actually represent?
- What are the axes?
- How is the normalization of the mean being figured?
- Is LCP data integrated with the non-LCP data?
- What patterns are there?
- What are the dotted lines?
- Why are the lines spaced this way and how does this connect?
- What is meant by the different course numbers?

- Conclusions
- Biggest class had the best scores
- Blue team did the best because they got less help and worked on their own
- Students in highest math course did the best.
- Students in the same math course that got the LCP preformed better
- Red had a cumulative final and did not retain the information
- Math not as important on the third exam
- Demographic variance they started at different places

Exercises

- Arrange the questions that you used in your analysis in the following classes, or invent questions now that fit these categories.
  - Directed – points to specific information in the graph.
  - Convergent – requires the synthesis of information or ideas.
  - Divergent – goes beyond what is in the graph, addresses broader more general issues or a different situation.
- If this classification scheme doesn’t work for you, invent one of your own.

Problem - Homework

- Identify a model that contains everything you would like the students to learn from that activity.
- Construct a series of no more than 10 questions that guides them in the exploration of the model and leads them to a conclusion.
- Identify exercises to reinforce their learning, and problems to integrate their learning with prior knowledge.

Congratulations!

You have just completed your first POGIL activity.

How important is changing the way we teach?

- We are losing a lot of good students!
- What fraction of the students really learn?
- Students are getting short changed.
  - They are not developing the understanding and skills that they need.
- We pretend to teach them, and they pretend to learn.
- Shouldn’t we take advantage of recent findings in the cognitive sciences have about “*How People Learn*” and “*How the Brain Works*”?
  - Just as we take advantage of new knowledge in our research.

What can be done?

A POGIL Classroom

- Students work in self-managed teams
- on specially designed guided-inquiry activities
- to develop learning process skills in key areas
- and master course content
- with an instructor who is a coach or facilitator not dispenser of information.

What about in large classrooms?

- Clickers!
- Organic Chemistry
- General Chemistry
- Introductory Biology
- Also in Physics, Economics, Psychology, and others.

Clickers In General Chemistry

- What do you think?
  - Connect to prior knowledge, stimulate interest and curiosity.
- Concept Question
  - Elicit discussion regarding some concept, its use and consequences in order to promote understanding.
- Problem
  - Can guide students step by step through problem analysis and problem solving. Students are active participants in the process not passive observers.

What do you think? What is energy?

- A) A mysterious thing that no one really understands.
- B) A fundamental component of the universe.
- C) A way to keep track of the ability to do work.
- D) All of the above.

CHE 123 → almost all C

CHE 129 → mostly C

CHE 132 → mostly D

Introductory Biology Video

a creative use of clickers

Does POGIL Work?

- Measures of success.
  - Increased student satisfaction.
  - More A, B, C grades.
  - Fewer D, F, W grades.
  - More students continuing in the course sequences.

Indicators of Success at Stony Brook

- Traditional recitation sessions were converted into, POGIL classrooms (aka *Process Workshops)*.
- The Fall semester that the POGIL format was instituted was compared with the previous Fall semester.
- About 1000 students were involved each semester.
- The lecturers were the same, the text was the same, the assignments were the same, and the exams were constructed to be similar.
- Details in David Hanson and Troy Wolfskill, J. Chem. Ed. 77, 120 (2000).

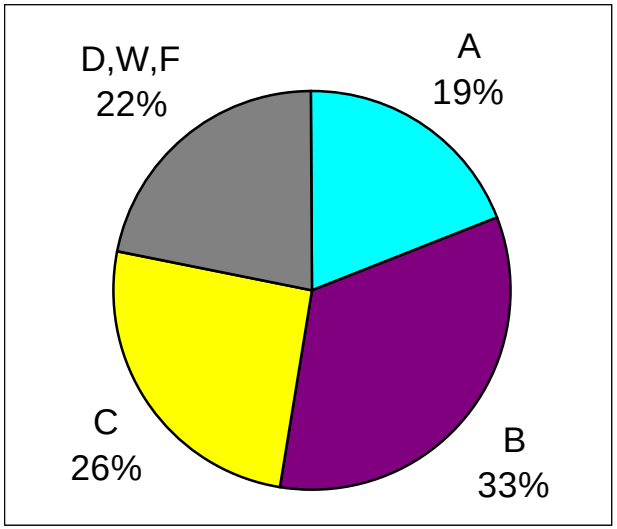
Indicators of Success at Stony Brook

- Recitation attendance increased dramatically.
  - 10 – 20% to 80 – 90%
- Retention through Organic Chemistry increased.
  - Enrollment in Organic increased by 20%
- Students claimed that the workshops improved their exam performance.
- Students provided readable/understandable answers to questions and solutions to problems.
- Students requested more time, from 55 to 80 minutes, for the sessions.
- Students had to be driven out of the room for the next class.
- Performance on exams improved.
  - More students received A's, B's, and C's.
  - 200/1000 students moved from the D,F,W range to the A,B,C range.

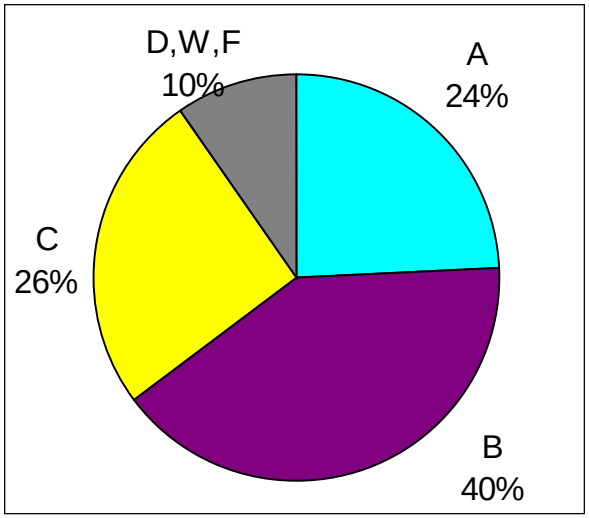
POGIL in General Chemistry at Franklin & Marshall College

- Sections of about 24 students
- Lecture format F1990 - S1994: n = 420
- POGIL format F1994 - S1998: n = 485
- Same instructors in both the lecture and POGIL formats.
- Students randomly placed Fall semester
- Students designated preference Spring semester
  (but not guaranteed to get their choice)

POGIL in General Chemistry at Franklin & Marshall College



Lecture format

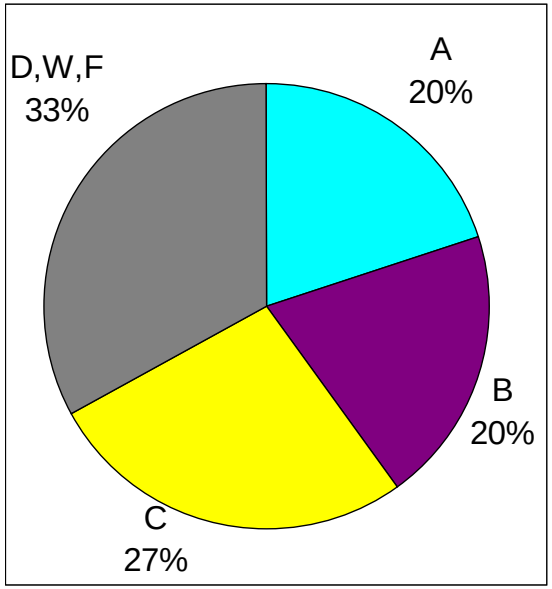


POGIL format

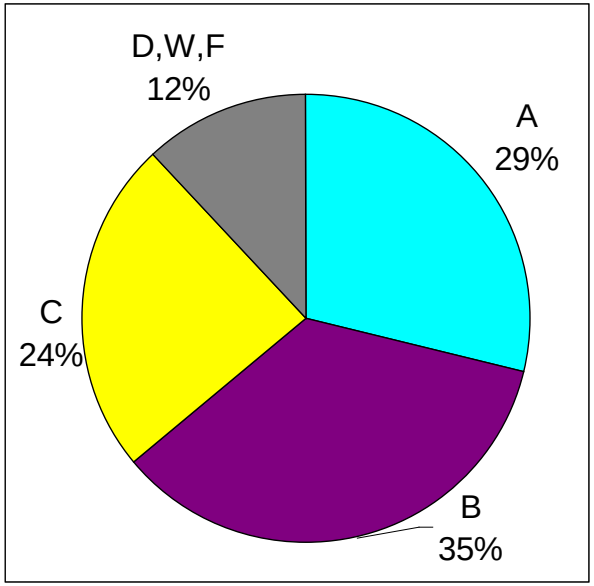
POGIL in Organic Chemistry at a Regional Liberal Arts College

- Two sections
  - one in lecture format, one in POGIL format
  - taught the same semester
- Students randomly placed in each section
- Common exams
  - prepared and graded by both instructors

POGIL in Organic Chemistry at a Regional Liberal Arts College



Lecture format



POGIL format

Other Evidence that Active Learning Works

- Andrei Straumanis, POGIL Chemistry
  - University of Charleston
- Jennifer Lewis, POGIL Chemistry,
  - University of South Florida
  - J. Chem. Ed. 83, 135-39 (2005)
- Physics Education Research Community
  - Hake, University of Indiana emeritus, meta-assessment of FCI
  - McDermott, University of Washington
    - Am. J. Phys. 69, 1127-37 (2001)
  - Redish, University of Maryland
  - Mazur, Harvard University
- Bill Woods, Biology
  - University of Colorado

Go to www.pogil.org for more information, various resources, POGIL activities, and the workshop schedule.

Instructor's Guide to Process-Oriented Guided-Inquiry Learning

Introductory POGIL workshop at Stony Brook on June 11 – 13, local expenses paid by the POGIL project (room & board). Register at the POGIL web site.

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