Peer Leading at USF: Process Oriented Guided Inquiry Learning

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University of South Florida

A STEP to Grow in Science-Engineering-Mathematics Undergraduate Degrees
What is Peer Leading at USF?

• Students in Calculus I (Life Sciences and Engineering) have 1 hour a week in which they work in groups on guided inquiry activities.

• Facilitated by 1 or 2 undergraduates, who are trained weekly by a faculty member and graduate students.

• Goal of the activities is to introduce calculus concepts.

• Structure of the activities is based on the POGIL (Process Oriented Guided Inquiry) classroom strategy, which originated in chemistry departments in the 1990s, funded by NSF.
A POGIL Classroom Experience
Credit Swap Activity: Roles

- **Manager**: actively participates, keep team focused and on task, assures all members participate and understand.

- **Recorder**: actively participates, keep a record of what the team has done and prepares a report in consultation with team.

- **Spokesperson**: actively participates, presents results to the class.

- **Strategy analyst (reflector)**: actively participates, identifies strategies and methods for problem solving, identifies what the team is doing well and what needs improvement.
“Clicker” Question

Assume that in Model 2 the Pension Fund purchases insurance for $2 billion/year from Bank B. In this case, how much profit or loss will the pension fund have made at the end of five years, assuming that Bank A fulfills its obligation?

1. $10 billion profit
2. $5 billion profit
3. $2.5 billion profit
4. $0 profit
5. $10 billion loss
“Clicker” Question

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Whole Class Discussion

Ways to incorporate reporting out of answers in a POGIL classroom.
Reflectors, report to your group:

• One strength of the group and why that is an important characteristic for an effective group to have
• One area of improvement for the group and a suggestion of how that improvement can be made (2 minutes total)
Reflector’s Report Sharing

Any volunteers to share your Reflector’s Report with the workshop participants?
Other than content knowledge, what might your students gain from this type of learning environment?

- Individually: 1 minute
- Group: 3 minutes
- Presenters report out
What is POGIL?

Process Oriented Guided Inquiry Learning
What is POGIL?

Process Oriented (cooperative learning): conscious commitment to development of important process skills
Process Skills

- Information Processing
- Critical Thinking
- Problem Solving
- Communication
- Teamwork
- Management
- Assessment
What is POGIL?

- Guided Inquiry (constructivism): learning cycle activities
- Process Oriented Guided Inquiry Learning
Learning Cycle Activities

- Exploration
- Application
- Concept invention

POGIL
What is POGIL?

- **Process Oriented (cooperative learning):** conscious commitment to development of important process skills
- **Guided Inquiry (constructivism):** learning cycle activities

Process Oriented Guided Inquiry Learning
Information Processing Model

Instructor

Events
Observations
Instructions

Perception Filter

Working Memory

Storing
Retrieving

Long-Term Memory

Students

Previous knowledge
Preferences
Misconceptions

Biases
Likes
Dislikes


Data on the use of POGIL in a variety of academic settings.
# Results at USF

## Life Science Calculus I Passing Rates

<table>
<thead>
<tr>
<th>Group</th>
<th># of Students</th>
<th># of Sections</th>
<th>Pass Rate (C or better)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Historical Comparison (2003-2008)</td>
<td>2550</td>
<td>84</td>
<td>50.0%</td>
</tr>
<tr>
<td>B: Peer Led (2009-12)</td>
<td>1512</td>
<td>54</td>
<td>68.0%</td>
</tr>
<tr>
<td>C: Non peer led, current comparison group (2009-12)</td>
<td>595</td>
<td>19</td>
<td>59.8%</td>
</tr>
</tbody>
</table>

Results are statistically significant.
## Results at USF

### Life Science Calculus I Retention

<table>
<thead>
<tr>
<th>Group</th>
<th># of Students</th>
<th># of Sections</th>
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<tbody>
<tr>
<td>A: Historical Comparison</td>
<td>2550</td>
<td>84</td>
<td>25.7%</td>
</tr>
<tr>
<td>B: Peer Led</td>
<td>1512</td>
<td>54</td>
<td>14.8%</td>
</tr>
<tr>
<td>C: Non peer led, current comparison group</td>
<td>595</td>
<td>19</td>
<td>16.1%</td>
</tr>
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Results statistically significant for peer leading vs. historical, but not for peer leading vs. current non peer led.
## Results at USF
### Life Science Calculus I Performance

<table>
<thead>
<tr>
<th>Group</th>
<th># of Students</th>
<th># of Sections</th>
<th>Grade Point Average for the Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Historical Comparison</td>
<td>2550</td>
<td>84</td>
<td>1.77</td>
</tr>
<tr>
<td>B: Peer Led</td>
<td>1512</td>
<td>54</td>
<td>2.25</td>
</tr>
<tr>
<td>C: Non peer led, current comparison group</td>
<td>595</td>
<td>19</td>
<td>2.03</td>
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Results are statistically significant.
Results at USF
Engineering Calculus I Passing Rates

<table>
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<th># of Sections</th>
<th>Pass Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Historical Comparison</td>
<td>2895</td>
<td>56</td>
<td>44.9%</td>
</tr>
<tr>
<td>B: Peer Led</td>
<td>1097</td>
<td>21</td>
<td>63.1%</td>
</tr>
<tr>
<td>C: Non peer led, current comparison group</td>
<td>690</td>
<td>13</td>
<td>59.0%</td>
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Results statistically significant for peer leading vs. historical, but not for peer leading vs. current non peer led.
### Results at USF
#### Engineering Calculus I Withdrawal

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>A: Historical Comparison</td>
<td>2895</td>
<td>56</td>
<td>26.2%</td>
</tr>
<tr>
<td>B: Peer Led</td>
<td>1097</td>
<td>21</td>
<td>12.4%</td>
</tr>
<tr>
<td>C: Non peer led, current comparison group</td>
<td>690</td>
<td>13</td>
<td>16.8%</td>
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Results at USF
Engineering Calculus I Performance

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<td>2.02</td>
</tr>
<tr>
<td>C: Non peer led, current comparison group</td>
<td>690</td>
<td>13</td>
<td>1.94</td>
</tr>
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Results statistically significant for peer leading vs. historical, but not for peer leading vs. current non peer led.
• Sections of about 24 students
• “Lecture”: F1990–S1994: n = 420
• Students randomly placed Fall semester
• Students designate preference Spring semester (but not guaranteed to get their choice)
• Same instructors before and after
POGIL—General Chemistry at Franklin & Marshall College

Data from classrooms of Moog, Farrell, and Spencer


Chi-squared = 40.9; alpha < 0.005
Assessment Pre-Quiz for Organic 2

- Large public university
- Classes of about 250
- Unannounced quiz given on first day of Organic 2
- Some students took Organic 1 with lecture; two different instructors
- Some students were in a POGIL section of Organic 1
Retention of Learning

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

Strategies for successful teams

• Simply saying “work together” doesn’t usually work!

• Good students find that they can more efficiently work on their own.

• Even for difficult tasks that require collaboration, students don’t always have the skills to work together.

• The structure of the activity is essential.
Strategies for successful teams

1. Structure the teams.
2. Motivate process.
3. Motivate learning teams and collaborative skills.
4. Promote positive interdependence.
5. Require individual accountability.
6. Provide closure.
For More Information

• Feel free to contact me: cbenetea@usf.edu

• For general information about the STEP grant, check out: http://math.usf.edu/resources/step/

• For information about process oriented guided inquiry, check out the POGIL website: www.pogil.org

• Activities developed at USF are available upon request – also another team, NSF funded, currently developing activities for Calculus and planning Pre-Calculus

• Look for workshops and talks
  • PREP - Summer 2013
  • Joint Meetings 2013 and 2014
Questions?

Feel free to write down your questions – you will have a chance to ask these later at the session in the afternoon.

Thank you!