# Student Engagement in the Science Classroom

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## Topic Time Allotted

<table>
<thead>
<tr>
<th>Topic</th>
<th>Time Allotted</th>
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</thead>
<tbody>
<tr>
<td>Student Engagement</td>
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<tr>
<td>How do we measure it?</td>
<td>5 min.</td>
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<tr>
<td>How can we engage students?</td>
<td></td>
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<tr>
<td>Why work in groups?</td>
<td>25 min.</td>
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<tr>
<td>What could it look like?</td>
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<tr>
<td>What is Guided Inquiry?</td>
<td>25 min.</td>
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<tr>
<td>What is <em>Process Oriented</em> Guided Inquiry Learning?</td>
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<tr>
<td>Q &amp; A</td>
<td>5 min.</td>
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<tr>
<td>Basics of an Activity</td>
<td>15 min.</td>
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<tr>
<td>Student Success with Guided Inquiry</td>
<td>5-10 min.</td>
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<tr>
<td>Final Q &amp; A, wrap-up</td>
<td>5-10 min.</td>
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</tbody>
</table>
# Student Engagement

adapted from Chapman, 2003

<table>
<thead>
<tr>
<th>Engaged Student</th>
<th>Disaffected Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustained involvement in learning activities</td>
<td>Passive, do not try, give up easily when faced with a challenge</td>
</tr>
<tr>
<td>Emotionally positive</td>
<td>Emotionally withdrawn</td>
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<tr>
<td>Display enthusiasm, optimism, curiosity and interest</td>
<td>Display boredom, anxiety, anger or rebellion</td>
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## 5E’s Model of Instruction

- **Engage**
- **Explore**
- **Explain**
- **Elaborate**
- **Evaluate**

[http://faculty.mwsu.edu/west/maryann.coe/coe/inquire/inquiry.htm](http://faculty.mwsu.edu/west/maryann.coe/coe/inquire/inquiry.htm)
Measuring Student Engagement
adapted from Chapman, 2003

- Self-reports
  - National Survey of Student Engagement (NSSE)
- Teacher Checklist
- Direct Observation
- Assessment of Student Work
- Case Studies
  - Place observation of engagement within the total context of the classroom.
  - Reformed Teaching Observation Protocol (RTOP)

Lessons from the Parallelogram Activity

- Individually write down 3 ways the team drawing experience differed from the individual drawing experience.
- Individually write down one insight about how this may relate to teaching and learning.
As a team, share your experiences and insights
Be prepared to share one agreed upon insight from your team

Lessons from the Parallelogram Activity

One Approach to Engage – Guided Inquiry

An Inquiry-Based Approach
What is Inquiry Based Instruction?

“The creation of a classroom where students are engaged in essentially open-ended, student-centered, hands-on activities.” *Colburn 2000.*

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**Level of inquiry defined by the amount of information given to the student**

In the lab, Bell, Smentana and Binns define these levels as:

<table>
<thead>
<tr>
<th>Level</th>
<th>Question</th>
<th>Method</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirmation</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Structured</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td><strong>Guided</strong></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Open</td>
<td></td>
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</tbody>
</table>

Students working in groups

- Learn more
- Understand more
- Feel better about themselves
- Feel better about the class
- Have a more positive attitude regarding the subject area, course, and instructor


Slavin, R.E., “Research for the Future: Research on Cooperative Learning and Achievement: What we know, what we need to know”, Contemporary Educational Psychology, 21, 1996.

What do we know about teaching and learning?

- Teaching by telling does not work
- Students learn more when they construct their own understanding
- Discussion with peers is crucial
- Reflection is a key part of learning


Goals of a Guided Inquiry Approach

• Students are actively engaged and thinking in class
• Students discover concepts (rather than memorize facts)
• Students learn course content & key process skills

Information Processing Model

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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.”

Learning Cycle

- Parallels the “scientific method”
- Provides context for introduction of new terms
- Explicitly provides opportunities for critical thinking


The POGIL approach – ONE guided inquiry approach that works

Process Oriented Guided Inquiry Learning
www.pogil.org

Key Process Skills in Learning

- Cognitive
  - Information processing
  - Critical thinking
  - Problem solving
  - Research
- Social
  - Communication
  - Teamwork
  - Management
- Affective
  - Value development
  - Personal development
  - Esthetic development
Implementation Tools

- Learning teams
- Guided-inquiry activities to develop understanding
- Questions to promote critical thinking
- Problem solving
- Reporting
- Metacognition
- Individual accountability

Questions?

- Take one minute to write down any questions that you have, then think about which question is most important to you.

- As a group, take three minutes to discuss your questions and come up with a list of up to three questions you would like to ask, in rank order of importance.
Getting Started. . .

Identify Desired Results

Determine Acceptable Evidence

Plan Learning Experiences And Instruction


Creating a Guided-Inquiry Activity

- Model
- One to three concepts to be developed
- Key Questions that guide to desired concepts
- Application can be either within the key questions or exercises, or both.
- Process skill development takes place in the context of the activity.

*Note: This is a general template. There is no single correct way to write an activity. The subject matter often dictates how the activity is written.*
Types of Activities

- Learning Cycle Activities
- Application Activities

Which you choose depends on the topic
- Could be a combination of both

Key Questions

Learning Cycle Phase
- Exploration (E)
  - Examining the model, collecting information
- Concept Invention (I)
  - Finding patterns in data, converging on a concept, questions analyze, compare, contrast.
- Application (A)
  - Applying the newly developed concept to a new context.

Go back to the activity and identify questions 1-5 as either E, I, or A.
What is “Success”?

- We define “success” as the achievement of a grade of C- or higher (ABC)
- “Lack of success” includes grades in the D range, F range, and withdrawals (DFW)
- More detailed grade distributions will be shown, but analysis will be based on this definition of “success”

POGIL – Chemistry for Health Professions at Regional Comprehensive University

- Sections of about 48 students
- POGIL F2006 – S2012: n = 456
- No pre-req for course
- Same instructor “before” and “after”

Final Grade Distribution
Health Professions Chemistry

Final Grade Distribution

Lecture-Interactive  
(N=285 students)

Guided-Inquiry  
(N=456 students)

Watch more POGIL in action in the high school setting

- A day in the life of a POGIL classroom
  - http://www.youtube.com/watch?v=EyLeJ5jmtK8
- What’s a teacher to do in a POGIL classroom
  - http://www.youtube.com/watch?v=SIQAb6J_8Dc
Further Questions?

Thank You