Student Learning Objectives

1. Identify the organs of the digestive tract and describe each organ’s function.
2. Define diarrhea and list common causes. Distinguish between pathogenic and non-pathogenic causes of diarrhea.
3. Explain how diarrhea and dehydration are related. Discuss how this connection relates to the medical advice given for managing/treating diarrhea.
4. Define the following terms: pathogen, infection, outbreak, parasitic disease, food poisoning, sanitation.
5. Identify common diarrhea-causing water-borne pathogens in the US and how people can be infected.
6. Identify common pathogens that cause food poisoning in the US and how people can be infected.
7. List general recommendations to prevent food poisoning and waterborne diseases. Evaluate the effectiveness of these recommendations.
8. Use a microscope and taxonomic key to identify organisms in a water sample.
9. Distinguish between members of the following kingdoms/groups: Viruses, Monerans, Fungi, Protista. Discuss detrimental and beneficial contributions of each group.
10. Research learning issues using a variety of appropriate sources and evaluate the validity of the sources.
11. Present learning issue findings in a clear, concise manner to their teams.
12. Translate knowledge learned into an educational pamphlet for public health use.

The Waterworks Case
We created a case about a giardia outbreak to introduce 7th grade life science students to the PBL method while simultaneously covering Georgia science standards related to the digestive tract, sanitation and food poisoning, and microorganisms. As part of the case, students “became” CDC field epidemiologists and tracked the history of the index case, used web and text based resources to research possible causes of disease, analyzed water samples in a microscope lab, and interpreted medical tests to identify the causative agent. Student teams created investigative journals that tracked their progress through the case and each team member developed an educational pamphlet on a specific waterborne disease.

Table 1: What We Learned from This First Case: Traditional PBL and PBL in the Middle Schools—Comparisons Based on Student/Teacher/Facilitator Evaluations

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>TRADITIONAL</th>
<th>MIDDLE SCHOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ideal Group Size</td>
<td>5-7</td>
<td>4-5; Students benefit from smaller groups and more focused attention;</td>
</tr>
<tr>
<td>Researching Learning Issues</td>
<td>Very open-ended; unguided</td>
<td>Students must recognize valid references</td>
</tr>
<tr>
<td>Facilitation</td>
<td>Hands off</td>
<td>More guided and probing; extra “silent” facilitator per group helps with student desire for attention, behavior problems and note-taking</td>
</tr>
<tr>
<td>Hands-On Activities</td>
<td>Not traditionally a part of PBL</td>
<td>Students prefer to have hands on projects as a part of the case – Maintains interest and motivation</td>
</tr>
<tr>
<td>Group Organization</td>
<td>Not emphasized with the exception of student roles (data keeper, writer, manager)</td>
<td>Identifying team roles and student roles critical at beginning of case – students prefer to maintain roles instead of switching midstream</td>
</tr>
<tr>
<td>Wrap-Up</td>
<td>Can be left open ended</td>
<td>Students want wrap up; want to know how it all ends</td>
</tr>
</tbody>
</table>

In Summary...
- Students enjoyed the PBL process, especially the more intimate learning environment.
- Students and facilitators found smaller groups (4-5) more effective than larger groups (5-7).
- Students preferred case-related hands-on activities and labs to classical learning issue research.
- Students were frustrated with the process of research due to material constraints and insecurity about expectations – providing starting points and references and allowing students to share topics helped students engage.
- Students were more engaged with facilitation occurring twice a week rather than once a week.
- Keeping groups the same throughout an entire semester rather than case by case may allow for improved rapport building with facilitator and each other.

Funding
This material is based upon work supported by the Emory University PRISM Program under Grant No. PRISM-04-01-01. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation or Emory University.