CHARACTERISTICS AND TYPES OF POGIL ACTIVITIES

There are a number of student-centered instructional techniques that can be effective for achieving valid learning goals in the classroom, including Peer Led Team Learning (PLTL) and Problem Based Learning (PBL). For those interested in learning more about these approaches and how POGIL is different (and similar) to them, see Eberlein *et al.*[1]

Characteristics of a POGIL Activity

There are three particular characteristics of POGIL materials that differentiate POGIL from other student-centered instructional approaches:

- A POGIL activity is designed for use with self-managed teams that employ the instructor as a facilitator of learning rather than as a source of information.
- A POGIL activity guides students through an exploration to construct, deepen, refine and/or integrate understanding of relevant disciplinary content.
- The application and development of at least one of the targeted process skills is embedded in the structure and/or content of a POGIL activity, and is not solely dependent upon the facilitation of the activity in the classroom or laboratory.

In addition, POGIL activities are designed for use in a classroom setting that uses the Basic POGIL Classroom Implementation structure (see separate document) or slight variations of that structure.

General Types of POGIL Activities

The intended outcomes of student engagement with a POGIL activity are the mastery of content knowledge and the development of important process skills. One of the important tenets of the POGIL approach is the emphasis on the use of the *Learning Cycle* (as described by Abraham2) as the primary structure for the development of content knowledge. However, in some cases, the Learning Cycle structure is not appropriate or well-suited for the content being addressed. This could be because the content does not lend itself to development through the Learning Cycle structure (e.g., the postulates of quantum mechanics). Another possibility is that the content provides an especially good opportunity for the development of a specific process skill; this can be particularly appropriate in upper level courses in which the students are expected to integrate many concepts that have been developed earlier in the term or in previous courses, rather than explicitly develop new content knowledge. In cases such as these, the development of one or two process skills can be considered the emphasis of the activity. Still, the activity should adhere to the three characteristics described above.

Thus, in this context, there are two broad categories of POGIL activities, each defined below with a brief description of the typical structure:

a. *Learning Cycle Activities*: These activities predominantly guide the student to develop content knowledge through a Learning Cycle structure of Exploration, Concept Invention/Term Introduction, and Application. They generally begin with a model (diagrams, figures, tables, graphs, simulations, text, etc.) that provides sufficient exemplars for students to draw appropriate inferences or conclusions. A series of questions leads students to explore the model (Exploration) and then to develop the appropriate conclusion; new terms related to the central concept are typically introduced at this point (Concept Invention/Term Introduction). At least one question then follows which requires the use of this new concept (Application). In some cases, this application may also serve as a component (Exploration and/or Concept Invention) of the next Learning Cycle.

b. *Application Activities*: These activities deepen, refine, and/or integrate the understanding of one or more previously developed or presented concepts through application of relevant process skills. The structure of these activities is less uniform than for the Learning Cycle activities because the appropriate structure can depend heavily on the process skill that is being emphasized. In some cases (particularly for more advanced courses), some review of background knowledge prior to class is

appropriate. Students are then prepared for the in-class activity that focuses on synthesis and application of that prior knowledge. For introductory courses, however, the activity begins by presenting a model (definition, equation, diagram, figure, etc. or some combination of these things) containing the main concept that is to be further developed or better understood. A series of questions leads the student to explore the important components of the model and then deepen or refine their understanding through further questions that further probe the model and its implications. As mentioned above, the nature of the questions will depend strongly on the process skill that is being developed. The activity ends with at least one question in which the central concept is applied to a new situation.

Thus, *Learning Cycle* activities are intended to develop new concepts while *Application* activities build on content that has already been presented, or that is presented in the activity and is then explored. Although in general an activity will fall into one of these two categories, in some cases there may be roughly equal emphasis on these two components.

References

1. *Pedagogies of Engagement in Science: A Comparison of PBL, POGIL, and PLTL*, T. Eberlein, J. Kampmeier, V. Minderhout, R. S. Moog, T. Platt, P. Varma-Nelson, H. B. White, *Bioc, and Mol. Biol. Educ.* 2008, *36*, 262-273.
2. *Inquiry and the learning cycle approach.* Abraham, M. R. In N. J. Pienta, M. M. Cooper and T. J. Greenbowe (Eds.) *Chemists' Guide to Effective Teaching.* Upper Saddle River, NJ: Prentice Hall, 2005.