5

L

Learning—The Evidence

Stanley M. Lo and Jonathan I. Mendez

I have been doing POGIL since 1997, long before it was really called POGIL, and I continue to learn things from my classes—about how to work with students and about how to think about course content.

—A POGIL practitioner of 20 years

A large body of POGIL activities, and primary research literature on their use in classrooms across academic disciplines and educational settings, has been developed in the past few decades since the inception of the POGIL method as a cooperative learning strategy. In this chapter, we use an empirical literature review to describe parameters examined in research studies of POGIL, such as demographics or institution types, academic disciplines, number of participants or study subjects, intervention modules, comparison types, data collected, and efficacy and effectiveness. Our goal is to provide an up-to-date summary of the existing evidence and to identify research areas that are currently underexplored in the literature, with the hopes of facilitating a reflective discussion in the POGIL community.

The POGIL method began in undergraduate general chemistry (Farrell, Moog, & Spencer, 1999) and is now widely implemented across disciplines. Textbooks of guided-inquiry activities are available for many courses in the chemistry major: general chemistry (Hanson, 2010; Moog & Farrell, 2015), organic chemistry (Ruder, 2015; Straumanis, 2008), analytical chemistry (Lantz & Cole, 2014), physical chemistry (Moog,

The contributors wish to thank Patrick J. P. Brown, Steven Gravelle, and Rob Whitnell for their contributions to this chapter.

Spencer, & Farrell, 2004; Shepherd & Grushow, 2014), and biochemistry (Loertscher, Minderhout, & Frato, 2015). Single activities can be found for inorganic chemistry as well (Luxford, Crowder, & Bretz 2012; Southam & Lewis, 2013).

The use of POGIL activities in chemistry courses has been supported by peer-reviewed studies, beginning with the original publication (Farrell et al., 1999). Minderhout and Loertscher (2007) reported the development and use of POGIL in their biochemistry courses, noting increased student performance on exam questions and self-reported student gains in understanding of the material, taking responsibility for their own learning, and respecting the opinions of other students and that POGIL activities, among other course elements, was beneficial (Bailey, Minderhout, & Loertscher, 2012; Minderhout & Loertscher, 2007).

These results extend to the development and use of a small number of activities instead of full courses. For example, Murray (2014) reported the development and use of POGIL activities to help students read and interpret articles from the primary biochemistry literature. Through pre- and post-surveys and tests, Murray found substantial improvement in students' perception of their learning gains and their actual learning about concepts discussed in the articles, as well as their ability to interpret primary literature. Similar gains in student learning were reported in a study of POGIL in the organic chemistry classroom (Hein, 2012), but such gains are not universally observed (e.g., in a general and organic chemistry classroom) (Chase, Pakhira, & Stains, 2013).

Within the life and health sciences, by far the greatest degree of POGIL implementation at the undergraduate level is within the field of anatomy and physiology (A&P). P.J.P. Brown (2010, 2015) described the efficacy of POGIL within an undergraduate A&P course using self-authored activities and a two-semester A&P course using a published activity collection. The field of kinesiology has also seen significant activity production and implementation. A large portion of the biomechanics course at Boise State University, an upper-division undergraduate course within the kinesiology program, has been reworked to include POGIL activities within the curriculum, improving student performance and creating a greater appreciation for the student-centered approach (Simonson & Shadle, 2013).

The inclusion of POGIL in pharmacy education was pioneered by S.D. Brown (2010) in a full-semester medicinal chemistry course. She observed an improvement in student grades from an average of B–C to an average of A–B, an increase in student engagement with course materials, and improvements in the instructor's own ability to provide real-time feedback to students (Brown, S.D., 2010). Pierce and Fox (2012) followed up with