

LSC Roadmap Collection III: Pedagogical Practices That Work

1. Process Orientated Guided Inquiry Learning (POGIL)
2. Active Learning Classrooms (ALCs)
3. Problem Based Learning (PBL)
4. Reshaping Space to Facilitate Learning: Student-Centered Active Learning Environment with Upside-Down Pedagogies (SCALE-UP)

PROCESS ORIENTED GUIDED INQUIRY LEARNING

The POGIL Project

- POGIL (Process Oriented Guided Inquiry Learning) is a student-centered team learning approach that can be used effectively within a variety of existing classroom spaces.
- POGIL is based on research indicating that students learn best when they are actively engaged and constructing their own understanding of content while developing key skills.
- In a POGIL classroom, students work cooperatively in teams of three or four using specially designed activities to guide them to construct new knowledge.
- Students are assigned specific roles within the teams to ensure every student is actively engaged.
- Optimally, student teams gather around a table to facilitate interaction and exchange.
- POGIL has been effectively implemented in any classroom space, from small conference rooms to large lecture halls and labs.
- Instructors facilitate student-to-student interactions, responding to student questions by guiding the team to find the answer themselves.
- In a POGIL learning environment, there is an emphasis on helping students develop higher-order skills such as critical thinking, problem-solving, teamwork, and communication through cooperation and reflection.



ABOUT POGIL

POGIL uses guided inquiry—a learning cycle of exploration, concept invention, and application that is the basis for the carefully designed materials that students use. POGIL activities focus on core concepts and encourage a deep understanding of the course material while developing process skills that help students become lifelong learners and prepare them to be more competitive in a global market. POGIL originated in college chemistry departments in 1994.

The POGIL Project became a 501 (c) (3) nonprofit organization in 2012 and has evolved into a professional development organization for educators whose mission is to connect and support educators from all disciplines interested in implementing, improving, and studying student-centered pedagogies and learning environments. There are now well more than 1600 implementers in a wide range of disciplines in high schools and colleges around the country.

"I'm a firm believer, that essentially everyone is capable of learning. One of the issues we have with the way the educational system is set up, is that students are not asked to think and interact with other people. There's a great deal of evidence that student-centered, active learning environments provide a better educational experience than more traditional instructor-centered environments. POGIL focuses on the instructor as someone who is helping students learn, as opposed to being an instructor who is teaching something to students."

— Richard S. Moog, Professor of Chemistry at Franklin & Marshall College and Director of The POGIL Project

RESEARCH & RESOURCES

- <https://pogil.org/>
- <https://serc.carleton.edu/sp/pkal/pogil/index.html>



ACTIVE LEARNING CLASSROOMS

University of Minnesota

- ALC's support increased learning and equity: students outperform peers in a traditional classroom on the same course/instructor/exam; success of women and at-risk students improve the most.
- Special training of instructors is not needed, but not all instructors implement active learning to the same level.
- Active learning classrooms provide flexible space for activities beyond classes, including study groups, club meetings, and education workshops.
- Active learning classrooms are an important tool for recruiting new students.
- Team teaching in an ALC is the most effective strategy for improving instruction and increasing pedagogical innovation.
- The proximity of instructors and students enables effective mentoring in scientific process skills.
- Interest in evidence-based pedagogy has paralleled the building of active learning classrooms.



"The best indicator of ability is the quality of work that is asked of someone. You respected us to ask the hard questions, and I appreciate it. Thanks for a great course and keep doing what you are doing."

— Anonymous Freshman in Intro Biology

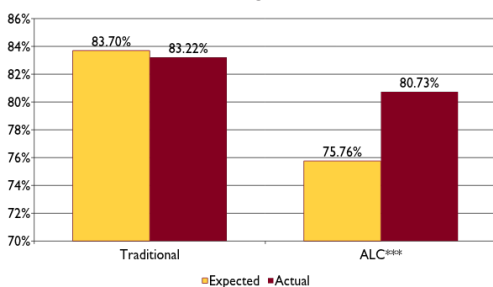
ABOUT ALCs

"Active Learning Classrooms invite faculty to demand more from students and make it easier for faculty to support students in achieving ambitious learning goals. Since opening Bruininks Hall, which houses ten Active Learning Classrooms (ALCs), nearly every undergraduate at the University of Minnesota has taken at least one course in an active learning space."

More than 17,000 students each year take one of the ~500 courses taught in an ALC. We find that the space is terrific for students (they enjoy the space and outperform expectations in it) and for faculty, who begin to implement more evidence-based strategies in their teaching, without special training. The space facilitates working in collaborative teams to apply their newly forming knowledge, practicing 21st century skills of teamwork, and problem-solving. Students are becoming agents of their own learning."

— Robin Wright, Professor, Departments of Biology Teaching & Learning and Genetics, Cell Biology & Development, Editor-in-Chief, CourseSource—University of Minnesota

Students Earn Higher than Predicted Course Grades in Active Learning Classrooms



From Cotner, et al, Journal of College Science Teaching 2013

RESEARCH & RESOURCES

- <https://classroom.umn.edu/space/classroom-types/active-learning-classrooms-alc>

PROBLEM-BASED LEARNING (PBL)

University of Delaware

- In the PBL pedagogical approach, student learning is motivated using a problem, puzzle, or complex scenario presented in the same context as it would be in real life, with little information not provided at the start.
- Students organize their ideas and existing knowledge, attempting to define the broad nature of the problem, brainstorming initial hypotheses, identifying missing information to fill in conceptual “holes.”
- PBL is a cyclical process of learning; students continue to define and work through the problem, reconvening to share what they are learning from researching and experimenting, ideally integrating their new knowledge and skills into the context of solving the problem.
- The PBL approach provides a forum for students to hone their ability to think critically, find and process new information, communicate effectively, and become influential members of productive teams.
- The primary role of an instructor is to facilitate group process and learning—not to provide easy answers. By relinquishing the control of answers, instructors are able to learn with students, and they often find renewed interest and excitement in teaching.



ABOUT PBL

Pioneered at the University of Delaware in the early 1990's, the PBL pedagogical approach has continued to evolve in ways that influence how learning happens and how spaces for learning are planned on that campus.

Why PBL? *Learning begins with a problem.*

Planning for a new interdisciplinary science and engineering at U Delaware built on their established PBL environment, recognizing the significant opportunity to have new physical spaces in which to focus on the many dimensions of problem solving—as it is learned and practiced.

The vision of planners (see logo below) was realized in laboratory spaces that support PBL strategies, enable the integration of intro biology and chemistry and other disciplines, and an expanded learning team of students, faculty, and preceptors. The full teaching team, through close interactions with their students, is able to promote experimental design, data analysis, visualization, and presentations of scientific investigations.

The vision of integrated, inclusive learning and learning environments is realized also in the visible connections between learning laboratories and PBL classroom. The collaborations among faculty, administration and staff required to realize the Interdisciplinary Science Learning Center significantly contributes to the sustainability of PBL at the University of Delaware.



RESEARCH & RESOURCES

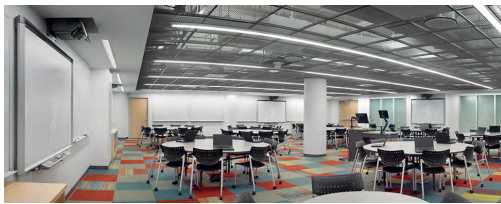
- <http://www1.udel.edu/inst/>



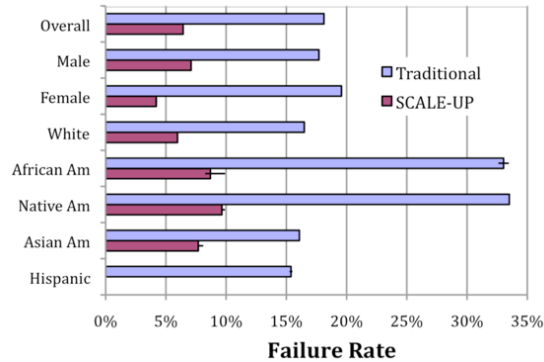
STUDENT-CENTERED ACTIVE LEARNING ENVIRONMENT WITH UPSIDE-DOWN PEDAGOGIES (SCALE-UP)

North Carolina State University

- The title of this pedagogical reform signals that it gives equal attention to space and instruction.
- The design of the space is based on more than two decades of research into ways spaces can facilitate active learning.
- A substantive research agenda has been a critical and central part of the evolution of SCALE-UP.
- SCALE-UP spaces are designed so teachers can combine separate activities like lecture, lab, and recitation into a single, unified learning experience to meet higher standards for student success as learners.
- Through close interactions with students, teachers get much better feedback on who understands and who does not understand the material.



SCALE-UP Classroom
Boston University



“Students were learning the material at a deeper conceptual level...The contributing factors were the hands-on nature of the classroom experience, the collaborative work-format, and the availability of faculty and TA’s for interaction during the class-period....”

— Abridged from an external review

ABOUT SCALE-UP

“This graph represents our research over a five-year period working with more than 16,000 students at NCSU. It is a simple comparison of students taking a version of physics with students taking a lecture form of the same class. Even though the demands on learners in the setting were higher, this analysis documented that these students did substantially and significantly better than their peers. This was so even though there was no difference between the groups at the beginning.

For me, the single most exciting piece of data from the research I and others have undertaken is that demographics are washed out. It does not matter anymore if a student was a member of an underrepresented group. This is important data, and I am continuing to pursue this research, including exploring how the learning of students with documented learning disabilities is influenced in the SCALE-UP environment, one in which:

- *Separate lecture and lab classes are replaced with a single course that meets in a space designed and outfitted specifically for this upside-down pedagogy.*
- *Students study with each other to support their learning of the foundational underpinnings of the material.*
- *The space facilitates working in collaborative teams to apply their newly forming knowledge, practicing 21st century skills of teamwork, and problem-solving. Students are becoming agents of their own learning.”*

— Robert J. Beichner, Professor of Physics and Director of the NCSU STEM Education Initiative - North Carolina State University

RESEARCH & RESOURCES

- <http://scaleup.ncsu.edu/>
- <http://www.pkallsc.org/assets/files/NorthCarolinaStateUniversity-SCALE-UP.pdf>
- <https://serc.carleton.edu/sp/library/scaleup/index.html>

