

Introduction to POGIL:
The Fundamentals

Introduction to POGIL: Process Oriented Guided Inquiry Learning

International Conference on Education in Chemistry
Homi Bhabha Centre for Science Education
December 12, 2014

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The POGIL Project 2013

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The POGIL Project

- Launched by sequential NSF (2003-2011) and other grants
- Based on curricular work done by a variety of like-minded people in the mid-90's
- Became a not-for-profit organization in 2010
 - The mission of The POGIL Project is to connect and support educators from all disciplines interested in implementing, improving, and studying student-centered pedagogies and learning environments.
- The POGIL Project is run by
 - A 6-member Board of Directors
 - Executive Director (*Rick Moog, Franklin & Marshall College*)
 - Steering Committee of 9 experienced practitioners (college and high school faculty)
 - 8 part-time and full-time staff in POGIL National Office, Lancaster, PA

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The POGIL Project

- Offers faculty development
 - Twenty to thirty workshops each year for high school and university faculty
 - Institutes for workshop facilitators
- Actively involves over 1000 individuals each year
 - Workshop attendees
 - Workshop facilitators
 - Curriculum developers
- Has touched 1000's of people
 - More than 1000 people are implementing POGIL pedagogy across multiple disciplines
 - In Hyderabad: International Institute for Information Technology, VNR Vignana Jyothi Institute of Engineering and Technology; Sandhya Kode, Director, EnhanceEdu

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A POGIL Classroom Experience



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Periodic Table

IUPAC Periodic Table of the Elements

1 H Hydrogen																	18 He Helium																	
2 Li Lithium	3 Be Beryllium	Periodic Table										10 Ne Neon																						
11 Na Sodium	12 Mg Magnesium	13 Al Aluminum	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon	19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton									
37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon	55 Cs Cesium	56 Ba Barium	57 La Lanthanum	58 Ce Cerium	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium	63 Eu Europium	64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67 Ho Holmium	68 Er Erbium	69 Tm Thulium	70 Yb Ytterbium	71 Lu Lutetium
87 Fr Francium	88 Ra Radium	89 Ac Actinium	90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium	104 Rf Rutherfordium	105 Db Dubnium	106 Sg Seaborgium	107 Bh Bohrium	108 Hs Hassium	109 Mt Meitnerium	110 Ds Darmstadtium	111 Rg Roentgenium	112 Cn Copernicium	113 Nh Nihonium	114 Fl Flerovium	115 Mc Moscovium	116 Lv Livermorium	117 Ts Tennessine	118 Og Oganesson			

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Student Outcomes

Other than content knowledge, what might your students gain from this type of learning environment?

- Individually: 1 minute
- Group: 3 minutes
- Discussion

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What is POGIL?

Process Oriented Guided Inquiry Learning

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What is POGIL?

Process Oriented (cooperative learning): conscious commitment to development of important process skills

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Process Skills

- Information Processing
- Critical Thinking
- Problem Solving
- Communication
- Teamwork
- Management
- Assessment

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What is POGIL?

Guided Inquiry (constructivism): learning cycle activities

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Learning Cycle Activities

Exploration

Concept invention

Application

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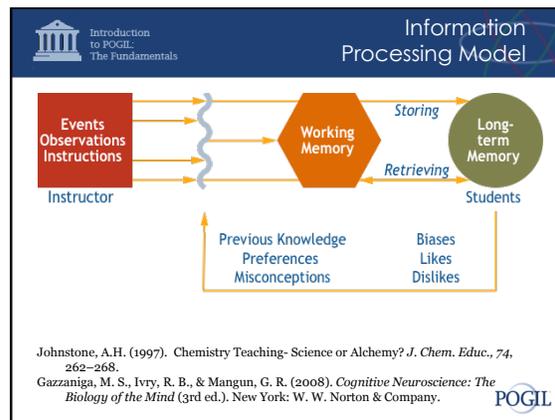
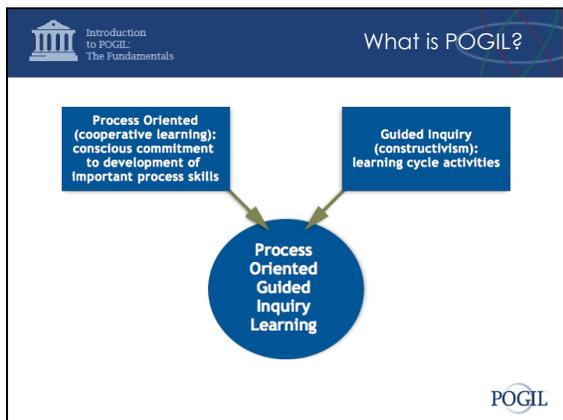
Learning Cycle

Exploration → INDUCTIVE → Concept Invention (Term Introduction) → DEDUCTIVE → Application

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

Karplus, K. & Thier, H.D. (1967). *A New Look at Elementary School Science*. Chicago: Rand McNally and Co.
 Piaget, J. (1964). Part I: Cognitive development in children: Piaget development and learning. *J. Res. Sci. Teach.*, 2, 176–186.

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New Paradigm

- Knowledge results only through active participation in its construction.
- Students teach each other and they teach the instructor by revealing their understanding of the subject.
- Teachers learn by this process...by steadily accumulating a body of knowledge about the practice of teaching.

Teaching is enabling.
Knowledge is understanding.
Learning is active construction of subject matter.

Elmore, R. F. (1991). Foreword. In C.R. Christensen, D.A. Garvin, & A.Sweet (Eds.), *Education for Judgment* (pp. ix–ixi). Boston, MA: Harvard Business School Press.

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Guided Inquiry Approach

- Students work in groups
- Students construct knowledge
- Activities use Learning Cycle paradigm
- Students teach, discuss, and learn from other students
- Instructors facilitate learning

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Analysis of Student Outcomes

Data on the use of POGIL in a variety of academic settings

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General Chemistry at Franklin & Marshall College

- "Lecture": F1990–S1994: n = 420
- POGIL: F1994–S1998: n = 485
 - Sections of ~24 students
 - Same instructors
- Students randomly placed Fall semester & designate preference Spring semester (but not guaranteed to get their choice)
- Compare course grades (ABC's vs. DFW's)

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