



PROCESS-ORIENTED GUIDED INQUIRY LEARNING

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WHAT IS POGIL?

POGIL combines:

Process - Oriented Learning

Guided Inquiry Approach

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Employment Criteria

Your team has been assembled as an employment committee for your institution and charged with filling a new position.

The Human Resources Department requests a list of the top ten criteria that a successful candidate will need to meet.

- *Individually* identify four criteria in the form of characteristics or skills you see as essential for this position.
- *As a team*, share these and develop a ranked list of the top ten criteria your committee will use in the selection process.

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Sample Responses

What qualities do students need to be competitive in the marketplace?

- Knowledgeable
- Good problem solvers
- Communication skills
- Self-Motivated
- Management Potential

What issues do you consider when preparing to teach a course?

- Textbook to use
- Topics to cover
- Quality of lectures
- Homework to assign
- Questions for exams
- How to assign grades

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PROCESS-ORIENTED CLASSROOM

Students work in small groups on specially designed activities intended to develop mastery of both course content and key process skills.

TARGETED PROCESSES

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

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Guided Inquiry Learning

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Conventional Pedagogy

- Teaching is telling
- Knowledge is facts
- Learning is recall

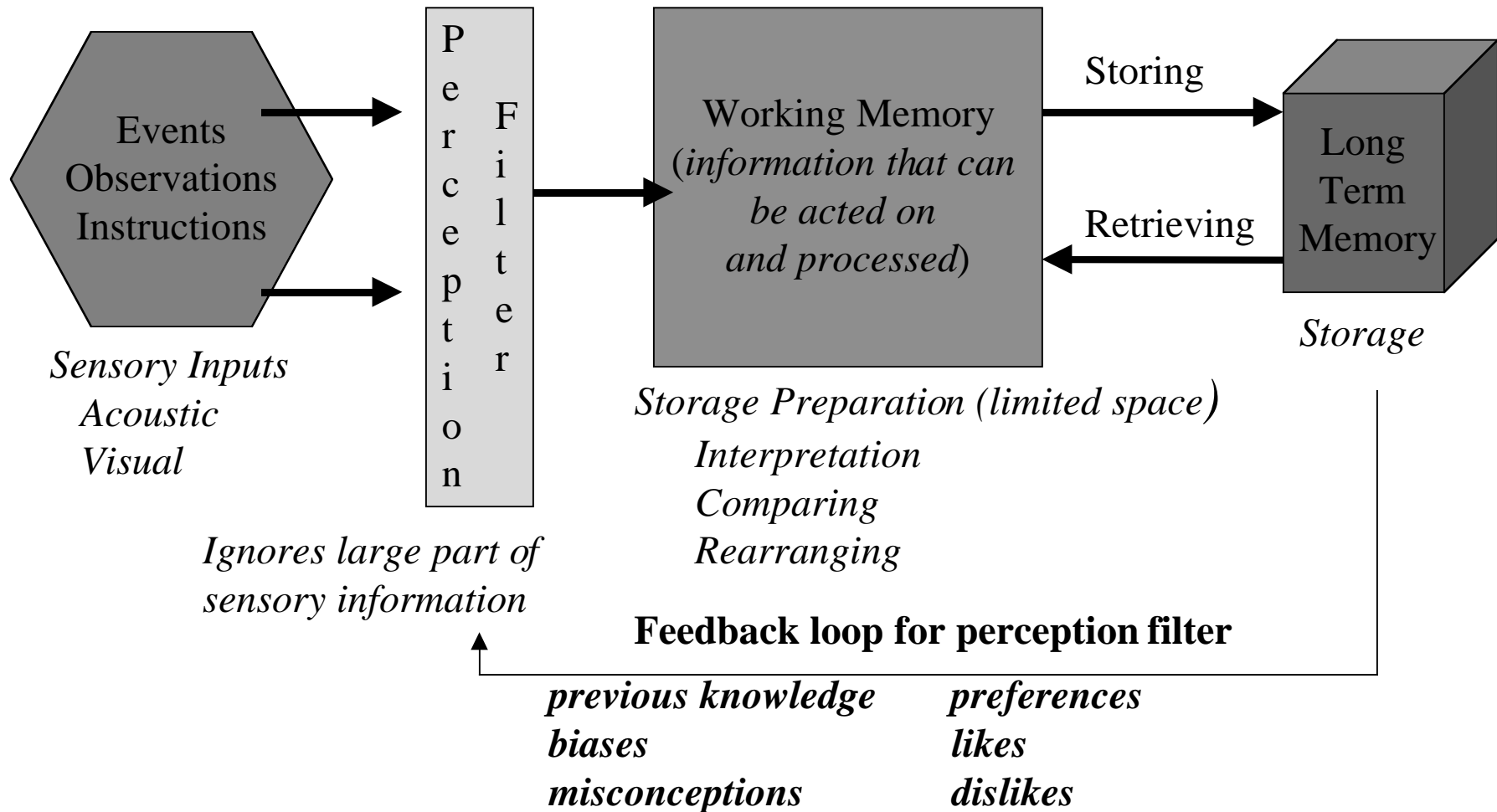
D.K. Cohen in *Contributing to Educational Change*, Philip W. Jackson, Ed. McCutchan: Berkeley, CA, 1989.

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Information Processing Model

A. H. Johnstone, *J. Chem. Educ.* 1997, 74, 262.

Gazzaniga *et al. Cognitive Neuroscience*, 1998.





Constructivist Model of Learning

“Learning is not the transfer of material from the head of the teacher to the head of the learner intact, [but] the reconstruction of material in the mind of the learner.”

“It is an idiosyncratic reconstruction of what the learner...thinks she understands, tempered by existing knowledge, beliefs, biases, and misunderstandings.”

-A.H. Johnstone

J. Chem. Ed., (1997) 74, 262.

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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.

R. F. Elmore in *Education for Judgment*, Harvard Business School, Boston, MA. Edited by C. R. Christensen, D. A. Garvin, and A. Sweet, 1991.

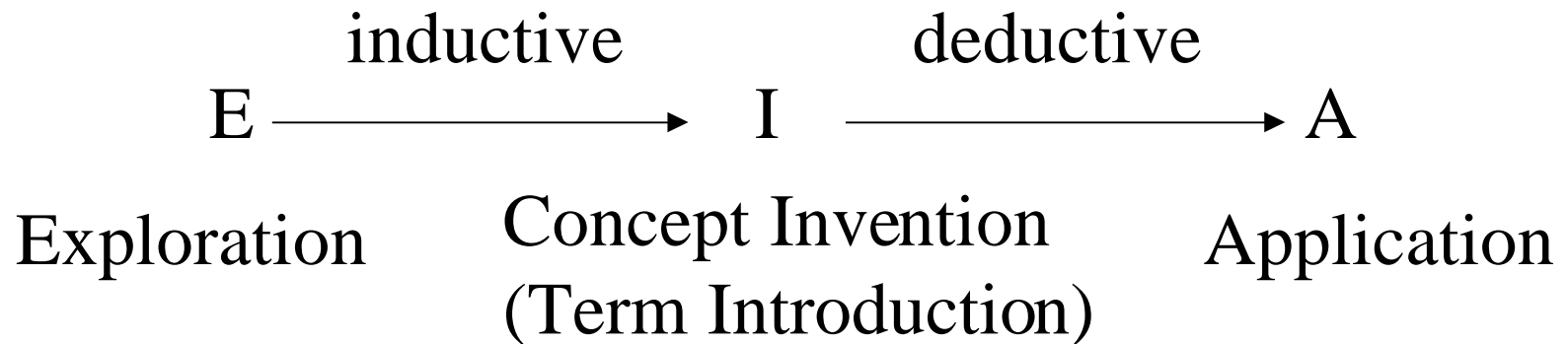


Guided Inquiry Approach

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

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Learning Cycle (Karplus, Piaget)



- Parallels the scientific method
- Being wrong is a stage on the way to being more right
- Ideas do not appear in your brain fully formed
- Learning is a process wrought with effort, frustration and error

Karplus and Thier, *A New Look at Elementary School Science*, Chicago:Rand McNally (1967).
Piaget, J. *J. Res. Sci. Teach.* 1964, 2, 176.



A POGIL CLASSROOM EXPERIENCE

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Analysis of Student Outcomes

What is “success”?

- We define “success” as the achievement of a grade of C- or higher (ABC)
- “Lack of success” includes grades in the D range, F, and withdrawals (DFW)
- More detailed grade distributions will be shown, but analysis will be based on this definition of “success”
- Statistical significance is determined by chi-squared analysis using these two groupings: ABC and DFW



POGIL General Chemistry at Franklin & Marshall College

- Sections of about 24 students
- “Lecture” F1990 - S1994: n = 420
- POGIL F1994 - S1998: n = 485
- Students randomly placed Fall semester
- Students designate preference Spring semester
(but not guaranteed to get their choice)
- Same instructors “before” and “after”

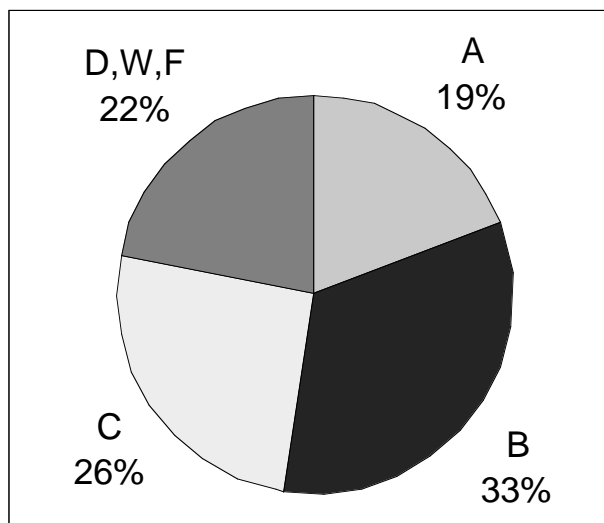
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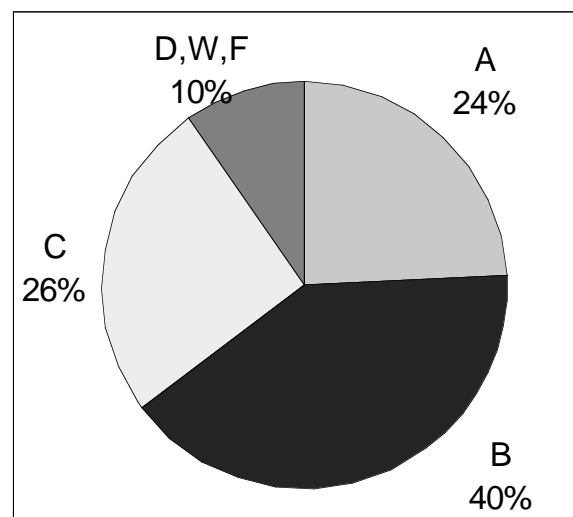
POGIL General Chemistry at Franklin & Marshall College

8 years of data (n = 905)

Lecture



POGIL



Data from classrooms of Moog, Farrell and Spencer

Chi-squared = 40.9 alpha < 0.005

Farrell, J.J.; Moog, R.S.; Spencer, J.N. *J. Chem. Educ.* 1999, 76, 570.

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POGIL Organic Chemistry at “2nd Tier” Liberal Arts College

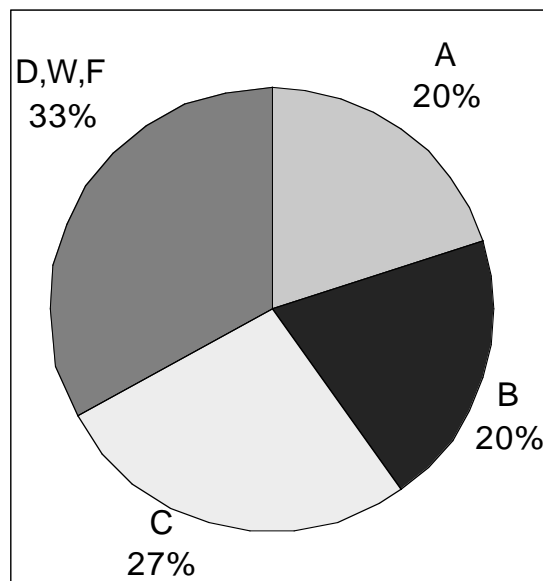
- Two sections - one “lecture”, one POGIL - taught at the same time
- Students randomly placed in sections
- Common exams - prepared and graded by both instructors

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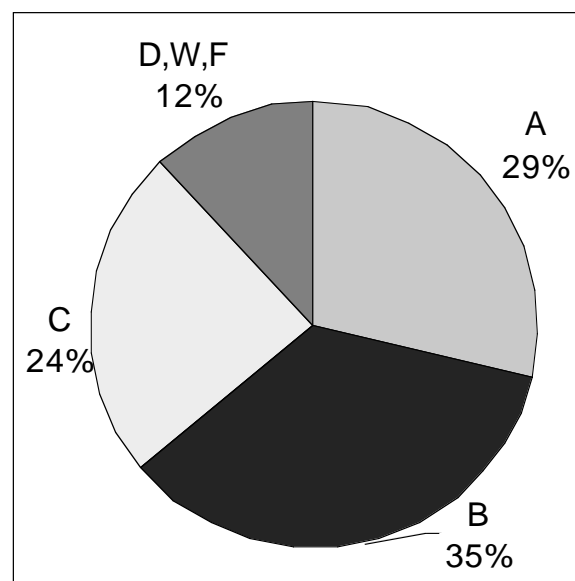
POGIL Organic at “2nd Tier” Liberal Arts College

1998-1999, n = 40

Lecture



POGIL



Randomized enrollment, different instructors, single exam
given concurrently, prepared and graded by both instructors

Chi-squared = 7.1 alpha < 0.01



POGIL Organic I at Large Public University

- Two sections - one “lecture”, one POGIL - taught at the same time
- Students randomly placed in sections
- Midterm exams (not part of study) created and graded independently
- Final exam (studied) created solely by “lecture” instructor

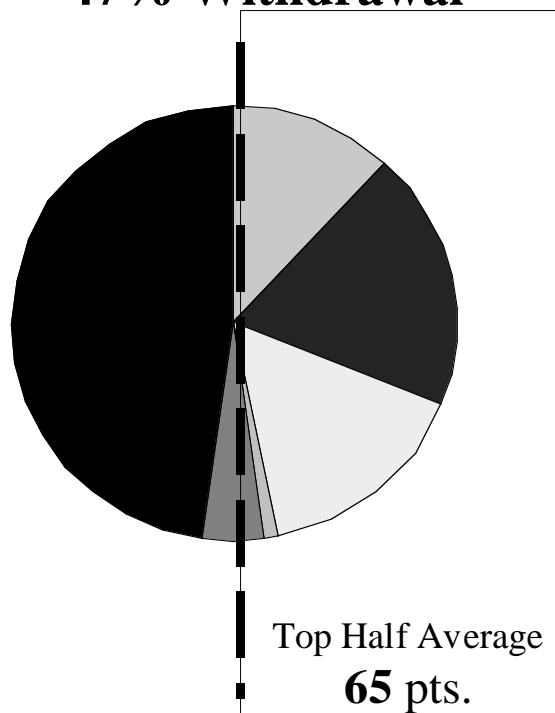
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Organic I at Public University

Withdrawals and Common Final Exam Scores, Fall 2000

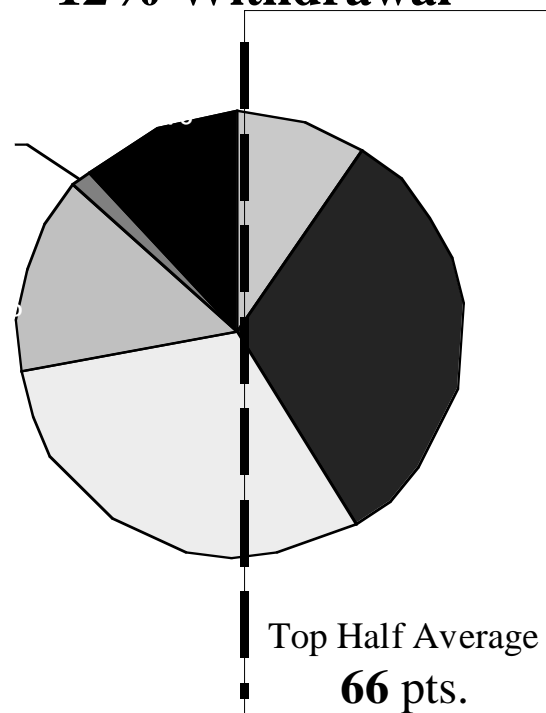
Lecture n = 109

47% Withdrawal



POGIL n = 75

12% Withdrawal



(Organic I Average Attrition = 38%)

Chi squared = 19.1

Alpha < 0 .005



GI Organic at 1st Tier Liberal Arts College

- This one is complicated
- Comparison is of grades in a single section of Organic II
- Some students took Organic I with GI
- Some students took Organic I with “lecture”
- Not all students from Organic I enrolled in this section of Organic II

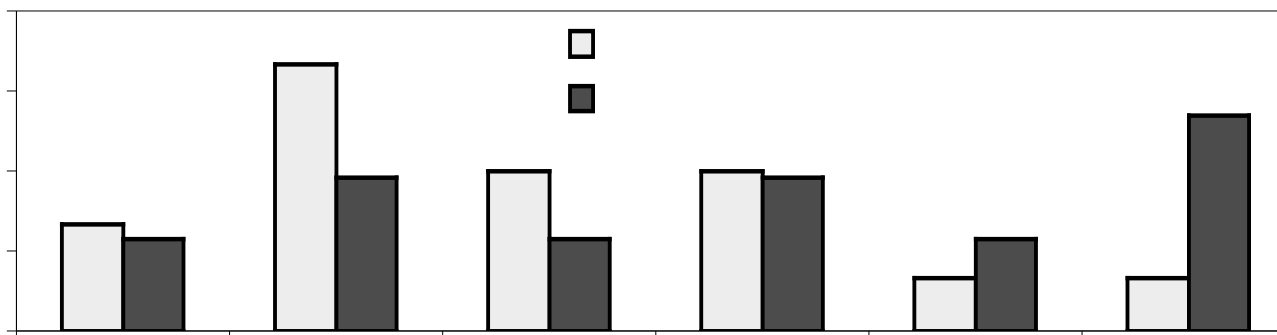
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Coverage Issue

*Is Guided Inquiry Organic I preparation for
Organic II Lecture?*

GI Section (*Instructor A*)

Lecture Section (*Instructor B*)





Performance in Org II

(of those enrolled in Section X)

- Traditional Org I: 16 ABC 3 DFW
- POGIL Org I: 13ABC 1 DFW
- Chi-squared = 0.8
- No significant difference in “success”

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Conclusions

- Students achieved greater “success” in POGIL classes
- Students were prepared for subsequent course taught in traditional style

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WHAT CAN THE POGIL PROJECT DO FOR YOU?

- Introductory One Day Workshops
- In-Depth Three Day Workshops
- On Site Visits and Consultancies
- Ongoing Support and Advice via Phone and Email

– PROCESS - ORIENTED GUIDED INQUIRY LEARNING

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UPCOMING ONE DAY WORKSHOPS

- Mar. 13 Towson University, MD
- Apr. 24 Grand Valley State Univ., MI
- mid-July BCCE, Iowa State University, IA

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3 DAY WORKSHOPS SUMMER, 2004 (tentative)

- June 3-5 Stony Brook University
New York City campus
- June 24-26 Univ. of Redlands, CA
- July 26-28 Christian Brothers College,
Memphis, TN
- Aug 5-7 University of New Hampshire

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AVAILABLE MATERIALS

- Printed full-course activities
- Printed modular activities
- Web-based activities
- Quantum states CD

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