PBL:
Problem-Based Learning and Problem-Solving Skills

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The Beginnings

The Place
McMaster University
Hamilton, Canada

The Time
The ‘60’s
1965 First Dean, John Evans
1969 First class enters
Historical Antecedents

- 400 B.C. Socrates
- 1900 John Dewey
- 1950 Jerome Bruner
- 1969 Woodstock
And it shows…..
McMaster MD Program
Class of 1972
The Goals

1) To create a more humane and relevant learning environment in the pre-clinical years

2) To create a graduate who is better able to keep up with changes in medicine (self-assessment, self-directed learning)

3) To create a graduate who is better able to relate to teams, patients, etc.
And from this emerges…

- Problem-Based
- Self-directed
- Small Group Learning

(PBL)
“All we want is for students to get their MD and have some fun doing it”

Bill Walsh, Dean
McMaster Medical School
ca. 1972
<table>
<thead>
<tr>
<th>GOAL</th>
<th>STRATEGY</th>
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<tbody>
<tr>
<td>Humane</td>
<td>No lectures, no exams</td>
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<tr>
<td></td>
<td>Tutor, advisor</td>
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<tr>
<td>Relevant</td>
<td>Problem-based</td>
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<tr>
<td>Keeping up</td>
<td>Self-assessment, SDL</td>
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<tr>
<td>Interpersonal</td>
<td>Small groups, peer-assessment</td>
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Why small group?
Why self-directed?
self-directed learning

A Guide for Learners and Teachers

malcolm knowles

A new approach to the modern practice of adult education
'Good radical stuff.' — The Observer
Teaching as a Subversive Activity

A no-holds-barred assault on outdated teaching methods—with dramatic and practical proposals on how education can be made relevant to today’s world

NEIL POSTMAN & CHARLES WEINGARTNER
Why problem-based?
The Central Premise of PBL

- By encouraging students to actively “problem-solve”, they will more effectively acquire “clinical problem-solving skills”

So what’s a clinical problem-solving skill?
Unemployed ex-physicist enters stage left

U Ex Ph  “I got lots of problem-solving skills. Maybe I can work it out for you.”
The beginnings -
The clinical reasoning process

“Hypothetico-deductive method”  
(Elstein, Shulman, Sprafka, 1977)

Expert (and novice) clinicians generate multiple diagnostic hypotheses early in the encounter then gather data to confirm (usually) these hypotheses
1989 and the Synthesis

A Cognitive Perspective on Medical Expertise
Henk G. Schmidt, Geoffrey R. Norman, Els P. Boshuizen
Academic Medicine, 1990; 65: 611-621

The Psychological Basis of Problem Based Learning
Geoffrey R. Norman, Henk G. Schmidt
Academic Medicine, 1992; 67: 557-65
What is the role of experience in expert reasoning?

Basic Science Mechanisms → Clinical Rules → Examples

Clinical Rules ↔ Basic Science Mechanisms

Novice Intermediate Expert
Schmidt & Norman, 1991

Novice Intermediate Expert

Basic Science Mechanisms \rightarrow Clinical Rules \rightarrow Examples

(How) Do experts use basic science?
How do experts coordinate analytical and experiential processes?
What is the developmental role of basic science in student reasoning?
How can we facilitate student’s ability to apply basic science? (Transfer)
Schmidt & Norman, 1991

How does this change approach to PBL curriculum design?
What is the role of experience in expert reasoning?
The Role of Experience

In the course of becoming an expert, one requires an extensive stable of examples which guide diagnosis and management of new problems.

Show that recent specific examples have an influence on subsequent similar problems.
Effect of Similarity
(Allen, Brooks, Norman, 1992)

- Medical students
- Learn rules for 6 dermatology conditions
- See examples of each (with experimental manipulation)
- Show effect of specific examples
Accuracy by Bias Condition

- Bias Corr: Correct (90), Incorrect (5), Other (20)
- Bias Incorr: Correct (40), Incorrect (35), Other (20)
How can we help student’s learn and apply basic science?

- Strategies to improve initial learning, examples, practice -- transfer
Use of Mechanical Analogy in Teaching Concepts

(Dore, Brooks, Norman)

Teach 3 cardio concepts with / without a mechanical analogy

Look at explanations of new problems
What are implications for PBL curriculum design?

- Careful integration of analytical and experiential knowledge
- Central role of concepts as “scaffolding” framework
- “Constructivist” approach
COMPASS CURRICULUM
A new direction for the new millennium
Draft Curriculum Outline

• MF 1 - Oxygen supply (resp / heme / cardio)
• MF 3 - Homeostasis I - Energy (GI, endo, nutrition)
• MF 4 – Homeostasis II - (renal, acid-base, repro, genetics)
• MF 5 – Host defense - (immunology, neoplasia, genetics)
• MF 6 - Movement Control, Thinking (neuro, ortho, psych)

CLERKSHIP
Oxygen Unit

Concept

- Gross anatomy of chest
- Bronchial tree
- Alveoli & gas exchange
- O2 transport
- Circulation
- The Heart Pump (I)
- The Heart Pump (II)

Problem

- Kyphoscoliosis
- Asthma
- C.O.P.D
- Fe deficiency anemia
- Peripheral vascular disease
- Mitral valve disease
- Coronary Artery Disease
DOES IT WORK?

- LICENSING EXAM PERFORMANCE
  - Class of 2006/7 vs. Class of 2008/9

Part 1:
- Disciplines, Clinical Decision Making,
- CLEO, PHELO
Hypotheses:

- COMPASS should lead to sig higher scores in “basic science” heavy areas
  - Medicine, surgery, Ob/Gyn, Fam Med, Peds

- COMPASS should lead to smaller gains in “basic science” light areas
  - PHELO, CLEO, psychiatry
SDs above/below Canada 2006-7 and 2008-9

Comparison of SDs between 2006-07 and 2008-09.

- ** indicates significant difference at the p < 0.01 level.
- *** indicates significant difference at the p < 0.001 level.
- + indicates an increase.
- - indicates a decrease.
- * indicates a trend towards significance (p < 0.1).

- PGELO
- CLEO
- MEDI
- Surg
- Obs
- Peds
- Psych
- Fammed
- MCQ
- CDM
- TOTAL

The graph shows the comparison of SDs for various medical fields and disciplines, indicating the changes from 2006-07 to 2008-09.
The End