Medical Problem Solving in Case-Based Instruction

TEACHING CLINICAL REASONING THROUGH MEDICAL PROBLEM-SOLVING

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Today’s Workshop: Medical Problem-Solving Skills

I. Defining them  Paul St. John
II. Teaching them  Herman Gordon
III. Assessing them  Susan Ellis
Goals of Case-Based Instruction (CBI)

Students
- Medical problem-solving skills
- Interpersonal & communication skills
- Practice-based learning & improvement
- Medical knowledge

Faculty & Administration
- Evidence-based curriculum design

How would you define medical problem-solving skills?
## Dual-process theory of decision-making

<table>
<thead>
<tr>
<th>Intuitive</th>
<th>Analytical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiential-inductive</td>
<td>Hypothetico-deductive</td>
</tr>
<tr>
<td>Bounded rationality</td>
<td>Unbounded rationality</td>
</tr>
<tr>
<td>Heuristic</td>
<td>Normative reasoning</td>
</tr>
<tr>
<td>Gestalt/pattern recognition</td>
<td>Robust decision-making</td>
</tr>
<tr>
<td>Modular responsivity</td>
<td>Critical, logical thought</td>
</tr>
<tr>
<td>Recognition-primed</td>
<td>Multiple branching</td>
</tr>
<tr>
<td>Unconscious thinking</td>
<td>Deliberate, purposeful</td>
</tr>
</tbody>
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## Dual-process theory of clinical reasoning

<table>
<thead>
<tr>
<th>Cognitive feature</th>
<th>Intuitive/heuristic</th>
<th>Analytical/systematic</th>
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<tbody>
<tr>
<td>Capacity</td>
<td>High</td>
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<td>Low</td>
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<td>Rate</td>
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<td>Cognitive awareness</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Reliability</td>
<td>Lower</td>
<td>Higher</td>
</tr>
<tr>
<td>Errors</td>
<td>More</td>
<td>Fewer</td>
</tr>
<tr>
<td>Scientific rigor</td>
<td>Lower</td>
<td>Higher</td>
</tr>
<tr>
<td>Users</td>
<td>Experts</td>
<td>Experts &amp; Novices</td>
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<tr>
<th>Problem-solving activity</th>
<th>High-level performance</th>
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<tr>
<td>Define Problem</td>
<td>Demonstrates the ability to construct a clear and insightful problem statement with evidence of all relevant contextual factors.</td>
</tr>
<tr>
<td>Identify Strategies</td>
<td>Identifies multiple approaches for solving the problem that apply within a specific context.</td>
</tr>
<tr>
<td>Propose Solutions/Hypotheses</td>
<td>Proposes one or more solutions/hypotheses that indicates a deep comprehension of the problem. Solution/hypotheses are sensitive to contextual factors as well as all of the following: ethical, logical, and cultural dimensions of the problem.</td>
</tr>
<tr>
<td>Evaluate Potential Solutions</td>
<td>Evaluation of solutions is deep and elegant (for example, contains thorough and insightful explanation) and includes, deeply and thoroughly, all of the following: considers history of problem, reviews logic/reasoning, examines feasibility of solution, and weighs impacts of solution.</td>
</tr>
<tr>
<td>Implement Solution</td>
<td>Implements the solution in a manner that addresses thoroughly and deeply multiple contextual factors of the problem.</td>
</tr>
<tr>
<td>Evaluate Outcomes</td>
<td>Reviews results relative to the problem defined with thorough, specific considerations of need for further work.</td>
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*From Association of American Colleges & Universities – Problem Solving VALUE Rubric*
### Problem-solving skills – Medical

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<tr>
<td>Define Problem</td>
<td>Identifies &amp; labels problem&lt;br&gt;Collects &amp; accurately reports data&lt;br&gt;Distinguishes normal from abnormal&lt;br&gt;Demonstrates awareness of relevant differences</td>
</tr>
<tr>
<td>Identify Strategies</td>
<td>Identifies sources of information&lt;br&gt;Compares &amp; evaluates sources of information&lt;br&gt;Identifies tests and explains tests&lt;br&gt;Identifies pertinent positives/negatives</td>
</tr>
<tr>
<td>Propose Solutions/Hypotheses</td>
<td>Offers reasonable possibilities&lt;br&gt;Uses pertinent positives/negatives&lt;br&gt;Identifies key findings that affect the differential diagnosis</td>
</tr>
<tr>
<td>Evaluate Potential Solutions</td>
<td>Prioritizes problem list&lt;br&gt;Identifies case elements that are not consistent with given diagnosis</td>
</tr>
<tr>
<td>Implement Solution</td>
<td>Reaches conclusions that are not a repetition of the findings&lt;br&gt;Actively considers/includes perspectives of others</td>
</tr>
<tr>
<td>Evaluate Outcomes</td>
<td>Reflects on different elements of own process&lt;br&gt;Recognizes cognitive errors committed in analyzing case</td>
</tr>
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**How would you define medical problem-solving skills?**
What problems do students have with problem-solving?

- Disorganized
- Challenged by how to frame problems
- Prone to cognitive error(s)
- Ineffective at conceptual blockbusting
Teaching medical problem-solving skills
Herman Gordon & John Bloom

Cognitive errors committed by physicians & students:
  o Availability error / search satisficing
  o Diagnosis momentum
  o Anchoring and confirmation bias
  o Representativeness error
  o Attribution / stereotyping error
  o Affective error
  o Commission bias

Groopman, *How Doctors Think*
Teaching medical problem-solving skills

Herman Gordon & John Bloom

How do we teach students to be better problem-solvers?

- Teach a structured approach
- Promote life-long learning by encouraging reflective practices
- Work problems that push their envelopes
Structured Problem Solving in Case-Based Instruction, the ThinkSpace Way

- Makes students accountable to a structure
- Enables peer to peer learning

Graphic by Karen Spear Ellinwood
Teaching medical problem-solving skills

What features in a case promote reflection?

- Opportunities to get stuck
- Opportunities to go off track
  - Distractors
- Opportunities to make cognitive errors
Teaching medical problem-solving skills

How to write good cases to teach problem-solving?

✓ Appropriate to student's Zone of Proximal Development
  • Content appropriate, especially basic science
✓ Realistic (embedded in context)
✓ Requires and reinforces understanding of basic-science concepts
✓ Must have more than one plausible hypothesis
✓ Must require data-driven reasoning (must work with obtaining and applying data)
✓ “Land mines” invite students to make cognitive error(s)
An Example Case from the MSS Block:

- **Initial History:** Ms. Peltonen is a 47-year-old woman who comes to urgent care because of hip, leg and back pain and a fall earlier today
  - Fatigued for about 6 months.
  - Prior DXA scan T-scores of -3.1 in the spine and -3.4 in the hips
  - She travelled to Kenya on a photographic safari 10 months ago.
Teaching medical problem-solving skills

Case cont., Release A:

- Anemia @ 37
- Intermittent diarrhea for years

Release B:
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Case cont., Release C:

• CT chest/abdomen: no evidence of tumor; diffuse osteopenia
• Anti-tissue transglutaminase antibodies: positive
Teaching medical problem-solving skills

Student Reflections:

“It is important in these cases to not only look at what is clear--osteoporosis, but keep in mind what could be causing the nutritional deficiencies that care the underlying cause of the osteoporosis.”
Student Reflections:

“The intestinal malabsorption from Celiac could lend to the patient's hypocalcemia and hypovitaminosis, and the elevated PTH could be a compensatory response....cool. The chief issue with my problem solving skills in this case is that I was side-tracked by the notion of an underlying musculoskeletal abnormality and somewhat neglected the basic notion of intestinal absorption and it's influence on metabolic panels.
Very cool case, though.”
Teaching medical problem-solving skills

Student Reflections:

“I worked through this case a little differently than the first case. For the first case I tried to come up with a long list of differentials in the beginning and narrow it down towards the end. For this second case I came up with less differentials in the beginning and modified the list after each release. I felt that this method helped me to not focus on trying to make my initial hypothesis true and be more open to different possibilities.”
# Elements of Assessment

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Needs</th>
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<tbody>
<tr>
<td>Students</td>
<td>• Consistency</td>
</tr>
<tr>
<td></td>
<td>• Acknowledgement of progress/existing skills</td>
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<tr>
<td></td>
<td>• Accurate, informative feedback</td>
</tr>
<tr>
<td>Facilitators</td>
<td>• Feasible student assessment system</td>
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<td></td>
<td>• Training and support</td>
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<tr>
<td></td>
<td>• Foster common understanding of student progress/needs</td>
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<tr>
<td>Society Mentors &amp; Clerkship Directors</td>
<td>• Link to skills and knowledge being developed in CBI</td>
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<td></td>
<td>• Mechanism for building on those</td>
</tr>
<tr>
<td>Program Evaluation</td>
<td>• Map onto the competencies</td>
</tr>
<tr>
<td></td>
<td>• Ability to compare learning objectives and outcomes across blocks</td>
</tr>
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*AMES\OMSE Workshop in Faculty Instruction Development – May 24, 2012*
Challenges

- **Assessment/Evaluation must be**
  - Reliable & valid
  - Feasible
  - Must map onto competencies
  - Must allow for/support learner development

- **Logistical Unknowns**
  - Details of case format
    - Widely varied case structure
    - Timing
    - Content
Solution?

- RIME
What is RIME?

- Synthetic framework
- Describes student stage of competence & progression toward independent practice
  - Reporter
  - Interpreter
  - Manager
  - Educator
- Used in a clinical setting
  - Clinical reasoning skills are the extension of skills being developed in CBI
Why RIME?

- Clinical problem solving is an integrated behavior
  - Synthetic frameworks describe learning goals in terms of synthesis of knowledge, skills & attitudes (KSA)
- Developmental not sequential approach to assessment
  - Not a “stage” theory
- Valid, reliable & feasible
  - Easily assessed behaviors
  - Validated in a variety of settings
  - Simple to use
- Maps on to competencies
- Framework is a bridge to Societies and clerkships
  - Language of evaluation reflects KSA of clinical practice
Outcome Measures

- Student Performance in CBI
  - Grades
- Measures of clinical reasoning
  - Year 2 OSCE
- Measures of reflection
Feedback and Suggestions

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John Bloom, MD

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