Rashi: An Interactive Case-Based Computer Program for Inquiry Teaching in Science

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Overview

- **Human Biology class**: cases and inquiry
- **Rashi**: for case-based inquiry learning
- **Rashi Authoring Tool**
- Formative Evaluations
Rashi Inquiry Tutors: Subject Areas:

- Human Biology: Selected Topics in Medicine
- Geology: Earthquakes, meandering rivers, glaciers
- Forest Ecology: “Reading the Forest Landscape”
NS 121 Human Biology: Case Approach

Team roles are assigned

Teams receive and read page one
  What do we know?
  What do we think we know?
  What do we need to know?

Teams assign learning tasks
  Carry out individual assignments
  Report findings to team

Repeat cycle until case is solved

Each student writes a case report

Rashi 2004
As a team, make three lists

1. What do we know as fact?

2. What do we think we know or suspect?

3. What more do we need to know?
   - Patient history?
   - Definition of terms?
   - Anatomy/physiology?
   - Test results?

For each of the questions you ask, explain why you want to know.

Rashi 2004
X-based learning
(fuzzy, overlapping)

Constructivist ...
Discovery ...
Inquiry ...
Collaborative ...
Problem-based ...
Anchored instruction
Exploratory ...
Experiential (by doing)
Case-based...
Project-base ...

Rashi 2004
Progressive Educ. Goals (also overlapping)

- Student control
- Ownership
- Customized
- Collaborative
- Flexible/adaptable knowledge
- Constructivist

- “Deep” understanding (reflection, explanation)
- Authentic tasks
- Sustained engagement
- Metacognition & self-regulatory skills

Rashi 2004
Inquiry Cycle Variations

*Question  *Hypothesis / prediction

Plan / Design Experiment

*Observe, Collect data

Data anal/ Conclusions, Induce rule/model

Summarize & Report

Refine the H/Q

Redesign experiment

‘*’ == Start here?

Rashi 2004
Key Skills for Inquiry Learning

- **Develop** hypotheses and formulate questions
- **Explain** inferences and hypotheses
- **Distinguish** observation (and data) from inferences
- **Justify** hypotheses with evidential relationships to data
- **Explore** observation, measurement, and information spaces
- **Cite** source documents
- **Systematically** gather, interpret, and organize information
- **Compose** a summary of conclusions and arguments
Tools to support doing and learning inquiry

- **Case** orientation/instructions
- **Info-gathering** tools:
  - Interview
  - Data from images (Physical Exam)
  - Data from list of data (Lab Test)
  - External sources: Books, web sites, etc.
- **Inquiry** Notebook (organize data)
- **Argument**/Hypothesis Editor
- Scratch Pad (for **Planning**)
- **Report** Editor
- Coach (in development)

Rashi 2004
Rashi

RASHI
intelligent inquiry tutor

Rashi 2004
Rashi Case Description

Using Rashi for Differential Diagnosis:

1. ☐ Read the Case Statement
2. ☐ Use the Notebook to add New items to record what you *know*.
3. ☐ Use the Argument Editor to enter what you think the diagnosis may be.
4. ☐ Use the Scratch Pad to take informal notes to keep track of "What I need to know (and where to look) " to help you plan what examinations, interview questions, and lab tests you need, and what other sources you need to look at.
5. ☐ Use the Interview tool, the Examination tool tool, and the Lab Tests to gather information. Save information in the Notebook. When you order tests with the Lab tool you will have to type in your "justification", as these tests can be expensive.
6. ☐ Use the inquiry Notebook to save and organize your data. You can click

March 20, 2004 Rita is a 15 year old girl who has complained recently of feeling tired during the day. She hasn't been participating at her usual level in sports she used to enjoy. Her parents are concerned and asked you to see if you could find out if something is medically wrong with her. Rita arrives for her appointment on time. She looks fresh and clean in jeans and a t-shirt but appears tired. She is 61" tall and weighs 98 pounds. Your job is to find out what's wrong with Rita....
Rashi Interview Tool

Type in a question here:

have you been physically active?

Questions that match:

1) Are you or have you been sexually active?
2) Are you sexually active?
3) Do you exercise regularly?
4) Are you involved in sports or other regular physical activity?
5) Have you lost interest in friends or stopped partaking in social activities?
6) Have you noticed a loss of interest or pleasure in daily activities?
7) Are you more tired at certain times of the day or during the week?

I'm tired a lot of the time and I just don't do as much active stuff as I used to.

Rashi 2004
Rashi Exam Tool

Examine the Patient: examine the patient

Zoom Level
examine the patient – top

neck
Neck
Thyroid gland: palpate
Heart: pulse rate
Lymph nodes
Mouth: throat

Rashi 2004
Rashi Lab Test Tool

Results of the skin prick test are shown in the accompanying image.

Rashi 2004
# Rashi Inquiry Notebook

<table>
<thead>
<tr>
<th>Name</th>
<th>Matched</th>
<th>Source</th>
<th>User Tags</th>
<th>GoTo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight: current: 98 lbs.</td>
<td>✓</td>
<td>Examine the Patient</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>Heart: pulse rate: regular at 89 beats/min</td>
<td>✓</td>
<td>Examine the Patient</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>Height: height: 5'1&quot;</td>
<td>✓</td>
<td>Examine the Patient</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>Stool test: parasites</td>
<td>✓</td>
<td>Lab Results for Patient</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Mononucleosis spot (Monospot) test</td>
<td>✓</td>
<td>Lab Results for Patient</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Blood: red blood cell color</td>
<td>✓</td>
<td>Lab Results for Patient</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Do any of your friends or family have si...</td>
<td>✓</td>
<td>Interview the Patient</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Do you have the symptoms all day long?</td>
<td>✓</td>
<td>Interview the Patient</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Antibody: IgG</td>
<td>✓</td>
<td>Lab Results for Patient</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood: MCV of RBC's</td>
<td>✓</td>
<td>Lab Results for Patient</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Are your menstrual periods regular?</td>
<td>✓</td>
<td>Interview the Patient</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Blood iron: total</td>
<td>✓</td>
<td>Lab Results for Patient</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Blood: MCH (mean corpuscular hemoglobin)</td>
<td>✓</td>
<td>Lab Results for Patient</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Blood: hemoglobin</td>
<td>✓</td>
<td>Lab Results for Patient</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>What is your diet like? Has it changed l...</td>
<td>✓</td>
<td>Interview the Patient</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Stool electrolytes: potassium</td>
<td>✓</td>
<td>Lab Results for Patient</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Stool electrolytes: chloride</td>
<td>✓</td>
<td>Lab Results for Patient</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Blood iron: TIBC</td>
<td>✓</td>
<td>Lab Results for Patient</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Temperature: temp is 98.6 degrees F</td>
<td>✓</td>
<td>Examine the Patient</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>Blood: Vitamin B12</td>
<td>✓</td>
<td>Lab Results for Patient</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

Rashi 2004
Rashi Argument Editor

- Protein Deficiency
- Mononucleosis
  - How long have you had these symptoms?
  - Do any of your friends or family have similar symptoms?
  - Are you more tired at certain times of the day or after particular...
  - Have you ever had mono?
  - Antibody: heterophil
  - Temperature: temp is 98.6 degrees F
- Electrolyte deficiency
  - Stool: electrolytes: potassium
  - Stool: electrolytes: chloride
  - What is your diet like? Has it changed lately?
  - Are you more tired at certain times of the day or after particular...
- Microcytic Hypochromic anemia due to prolonged Iron deficiency
- parasitic infection
  - Stool test: parasites
  - hepatitis
  - Abnormal hormone activity

Rashi 2004
Rashi--Authoring

- **Cases:** “Janet Stone”
- **Data types:** “Patient’s Temperature”
  - Interview, exam, lab tests, med. files
- **Case-values:** her temp “= 98 degrees”

--- to allow coaching: ---

- **Inferences:** “Patient has a fever”
- **Hypotheses:** “Patient has Grave’s Disease”

- **Relationships:** “Fever SUPPORTS Grave Dis.”
- **Other:** image maps, ref. Libr, glossary, coach rules

Rashi 2004
Authoring Tool -- Cases

RASHI-Auther Cases

name: Stephanie's Big Move

modification: 9/28/2004 2:02:33 PM
domain: 1
author: mb

First load in CaseID^: 4 -> NormalAdultFemale

case Description

When Bill Castle got a promotion, it meant moving to a new city a hundred miles away. He knew it was going to be disruptive for his wife and teenage daughter Stephanie, but he never guessed that the move would make his daughter truly sick.

From the moment they moved into their new house, a lovely colonial about ten minutes from his new office, his daughter Stephanie started coughing and sneezing, and his wife Martha assumed it was a cold brought on by the move. They knew Stephanie was sad about leaving her friends, and she was run down after

< strong > Using Rashi for Differential Diagnosis: </strong>

<li>Read the <strong>Case Statement</strong></li>

<li>Use the <strong>Notebook</strong> to add New items to record what you *know*. </li>

<li>Use the <strong>Argument Editor</strong> to enter what you think the diagnosis is</li>

scratchPad

List things you need to find out (and why) below:

Significant things you learned doing this case:

Other notes:

authorNotes

- mold allergy

Rashi 2004
Authoring Tool - Propositions

RASHI-Author Tool - Propositions  

Proposition Type:   
Widget (or Source):   
Case Binding Type:   
Media File:   

Author Notes:   
Author Notes: Adult normal: 0.2-5.4 mU/L or μU/ml   

Explanatory Info:   
Key Words:   
Thyroid: thyroid stimulating hormone (TSH)   

Set Relationship Type:   
Set Left Side to this prop #21   
Set Right Side to this prop #21   

Relationships:   
This Prop, #21, is found in relationships:   

One-Case Values:   
Focus Case: 3 Stephanie's Big Move   

Inference:   
mFile&wDirs   

Multi-Case Values:   

My Possible Inferences:   

Rashi 2004
<table>
<thead>
<tr>
<th>ID</th>
<th>Statement</th>
<th>value_calc</th>
<th>widgetname</th>
<th>exportType</th>
<th>casebind</th>
<th>nu</th>
<th>num</th>
<th>myCaseID</th>
<th>flag</th>
<th>modified</th>
</tr>
</thead>
<tbody>
<tr>
<td>276</td>
<td>Urine: ketones</td>
<td>negative</td>
<td>no widget</td>
<td>data</td>
<td>multCase</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>270</td>
<td>Urine: bilirubin</td>
<td>none</td>
<td>no widget</td>
<td>data</td>
<td>multCase</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>210</td>
<td>Abdomen palpation</td>
<td>no pain</td>
<td>no widget</td>
<td>data</td>
<td>multCase</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2396</td>
<td>Stool: pus</td>
<td>No Put</td>
<td>Lab Results</td>
<td>data</td>
<td>multCase</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2480</td>
<td>Skin prick test</td>
<td>No bumps or wheals raised all</td>
<td>Lab Results</td>
<td>data</td>
<td>multCase</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2446</td>
<td>Has anyone every told you you were</td>
<td>No</td>
<td>interview</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2467</td>
<td>Have you ever had mono?</td>
<td>No</td>
<td>interview</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2460</td>
<td>Are you involved in sports or other activities</td>
<td>No organized sports, but I often play</td>
<td>interview</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2472</td>
<td>Are you concerned about your</td>
<td>Not particularly</td>
<td>interview</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2474</td>
<td>Do you have a sore throat?</td>
<td>No</td>
<td>interview</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2475</td>
<td>Are you experiencing with steroid therapy</td>
<td>No</td>
<td>interview</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2478</td>
<td>Have you sought medical consultation</td>
<td>No</td>
<td>interview</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2479</td>
<td>Have you had any acute illness</td>
<td>No</td>
<td>interview</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2480</td>
<td>Do you have muscle weakness o</td>
<td>No</td>
<td>interview</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2482</td>
<td>[Vague question ] Could you please ask that q</td>
<td>Not sure I can answer that one</td>
<td>interview</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2483</td>
<td>Do you have allergies or have your</td>
<td>No</td>
<td>interview</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1318</td>
<td>Abdomen palpation: pain</td>
<td>No pain on palpation</td>
<td>examine</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1320</td>
<td>Abdomen: bowel sounds</td>
<td>Irregular quiet clicks and gurgling</td>
<td>examine</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4503</td>
<td>Abdomen: contusion</td>
<td>Abdominal exam: Tip of the x</td>
<td>examine</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>176</td>
<td>Abdomen: Spleen</td>
<td>Normal on palpation</td>
<td>examine</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1178</td>
<td>Abdomen: Liver</td>
<td>9 cm span at mid-clavicular line</td>
<td>examine</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>524</td>
<td>Blood pressure</td>
<td>160/70 mmHg</td>
<td>examine</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>455</td>
<td>Neurological examination</td>
<td>symmetrical hyperreflexia</td>
<td>examine</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>80</td>
<td>Skin: feel</td>
<td>Skin: warm and sweaty</td>
<td>examine</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>507</td>
<td>Arm upper arm muscles</td>
<td>A physical examination of the arm</td>
<td>examine</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>504</td>
<td>Arm X-Ray</td>
<td>Arm X-Ray revealed no breaks</td>
<td>examine</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>503</td>
<td>Arm: forearm muscles</td>
<td>A physical examination of the forearm</td>
<td>examine</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>474</td>
<td>Ears</td>
<td>An exam with an Otoscope rev</td>
<td>examine</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>476</td>
<td>Ears: Hearing</td>
<td>Both otostastic emissions test</td>
<td>examine</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>510</td>
<td>Arm: elbow joint</td>
<td>A physical examination of the elbow</td>
<td>examine</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>81</td>
<td>Eye</td>
<td>Eye exam: Presence of a lid for</td>
<td>examine</td>
<td>the sta</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
</tbody>
</table>
Funding

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End

- Human Biology Class
  carbon.hampshire.edu/~cjarvis/NS121

- Rashi Home page
  ccbit.cs.umass.edu/RashiHome/

- carbon.hampshire.edu/~mbruno/
- cs.umass.edu/~tmurray/

Rashi 2004
Rashi Evaluation

1. Survey questionnaire
2. Inquiry Skills test
3. Computer logs
   - Number of data items, hypotheses...
   - Range/variety of data sources
   - Ratio of supporting/refuting arguments
   - ....
Inquiry Skill Evaluation

- **Goals:** not too hard or easy for students; relatively easy to analyze data
- **Questionnaire:** too easy
- **Full inquiry task:** too hard
- **Middle ground:** have students evaluate partial problem solving solutions
  - A. Initial hypotheses and questions
  - B. Data collection
  - C. Argument explanation
  - D. Final report
- **Reverse-engineer the items to have certain strengths and weaknesses**

Rashi 2004
A. The **Case Description**: Jean Rockford, a 26-year-old woman, comes to see you with a 6-month history of....

After reading the case statement, the investigator lists **the following items** for "hypotheses" "reasons" and “want to know”:.....

**List 2 or more strengths and 2 or more weaknesses** in the way the investigator described and organized his/her hypotheses, reasons, and "needs to know"....
Inquiry Skill Evaluation Steps B & C

- **B. Data Collection:** After more work, the investigator has additional information and has added to his/her notebook the following items....
  - List 2 or more strengths and 2 or more weaknesses in the way the investigator collected and organized case data...

- **C. Diagnosis Justification.** After gathering this information the investigator creates the following arguments...
  - List 2 or more strengths and 2 or more weaknesses in how the investigator listed hypotheses and evidence supporting and refuting them
# Rashi Survey

<table>
<thead>
<tr>
<th>Inquiry Skill:</th>
<th>Success</th>
<th>Ease</th>
<th>Software Helped</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Understanding</strong> (what I was supposed to do to solve this problem)</td>
<td>1......2......3</td>
<td>1......2......3</td>
<td>1......2......3</td>
</tr>
<tr>
<td>2. <strong>Gathering</strong> data and other information</td>
<td>1......2......3</td>
<td>1......2......3</td>
<td>1......2......3</td>
</tr>
<tr>
<td>3. Keeping track of and <strong>organizing</strong> data and information</td>
<td>1......2......3</td>
<td>1......2......3</td>
<td>1......2......3</td>
</tr>
<tr>
<td>4. <strong>Citing</strong> the sources of data and information</td>
<td>1......2......3</td>
<td>1......2......3</td>
<td>1......2......3</td>
</tr>
<tr>
<td>5. Creating good <strong>arguments</strong> to support my hypotheses (and refute ruled out hypotheses)</td>
<td>1......2......3</td>
<td>1......2......3</td>
<td>1......2......3</td>
</tr>
<tr>
<td>6. Being able to consider several <strong>alternative</strong> hypotheses or solutions</td>
<td>1......2......3</td>
<td>1......2......3</td>
<td>1......2......3</td>
</tr>
<tr>
<td>7. Dealing with <strong>lots</strong> of information, dealing with <strong>conflicting</strong> information.</td>
<td>1......2......3</td>
<td>1......2......3</td>
<td>1......2......3</td>
</tr>
<tr>
<td>8. <strong>Planning</strong> ahead: keeping track of what I needed to know and how I was going to go about solving the problem</td>
<td>1......2......3</td>
<td>1......2......3</td>
<td>1......2......3</td>
</tr>
<tr>
<td>9. <strong>Monitoring</strong> my progress: knowing when I was getting closer to a solution; reflecting on my solution so far; stepping back to rethink or re-plan</td>
<td>1......2......3</td>
<td>1......2......3</td>
<td>1......2......3</td>
</tr>
<tr>
<td>10. Communication and <strong>reporting</strong>: writing up a final report.</td>
<td>1......2......3</td>
<td>1......2......3</td>
<td>1......2......3</td>
</tr>
<tr>
<td>11. My <strong>general understanding</strong> of the <em>entire</em> inquiry process.</td>
<td>1......2......3</td>
<td>1......2......3</td>
<td>1......2......3</td>
</tr>
</tbody>
</table>
Differential Diagnosis task model

- Hypothesis leads to search for confirming/disconfirming data
- Data lead to more hypotheses
- Ruling out alternatives and deciding when done
Extensible “least commitment” architecture

1. Generic Inquiry

2. Inquiry Paradigms
   - Diagn
   - Exp
   - Desn

3. Subject Domains
   - Bio

4. SME Customization

5. Tchr Customization
Rashi-Biomed author tasks

- develop medical diagnosis rules (inferential argument links)
- create descriptive scenarios and patient signs/symptoms for cases
- anticipate the expected level of knowledge of the target audience
- creation and sequencing of cases (levels of difficulty)
- anticipate other alternative hypotheses and tests that the students may propose
- articulate the details of a problem-based inquiry learning pedagogy,
- identify primary and secondary sources that students may go to for medical information
- helped set up formative (clinical and in-class) evaluative trials
- help with data interpretation from trial

Rashi 2004
Some Inquiry Sub-skills

- **Unbiased observations**: separate data/observations from inferences and make
- Pose **valid questions and hypotheses** (clear, confirmable)
- Clear **argumentation**: Supporting hypotheses and providing sources; chains of reasoning
- Shift between brainstorming or **divergent** work/thinking and focusing or **convergent** work/thinking
- **Systematicity** and representativness of data set (exploring data space)
- **Organizing** data and looking for patterns, trends, categories
- Dealing with errors, **noise, and outliers** in the data
- Avoiding "**confirmation bias**;" considering counter examples & data
- **Data analysis**. Many skills--graphing, statistical analysis, etc.
- **Metacognition**: Reflection, self-monitoring, evaluation, revising

Rashi 2004
Authoring Tools

- **Eon** - ITS authoring for domain, student, teaching models, and interface
- **MetaLinks** - hyperbook authoring tool
- **SimForest-G** - Glass box simulation authoring
- **Rashi** - Coached inquiry learning environment w/ authoring tool

Rashi 2004
Atool -- Images

About this Image
Use this screen to gather data available to a doctor in the exam room.

Rashi 2004
short description: Flat area

long description: This area seems really flat

type: observation

Rashi 2004
Rashi 200