Use of 3-D Models to Foster Perspective Taking
Answering Questions, Interpreting Data

Kim Kastens
14 January 2012
Lamont-Doherty Earth Observatory
Perspective Taking: Envisioning what an object or system would look like from different vantage points

(Piaget & Inhelder, 1948)
34 The diagram below shows the Moon at four positions in its orbit around Earth as viewed from above the North Pole. The date of one of the four positions has been labeled.

Which photograph shows the appearance of the Moon as viewed by an observer in New York State on May 17, 2000?
Another Regents question requiring perspective taking

Base your answers to questions 47 through 50 on the diagram below, which represents the Sun’s apparent paths and the solar noon positions for an observer at 42° N latitude on December 21, September 23, and June 21.

47 In which direction will sunrise occur on June 21?
   (1) north of due west   (3) south of due west
   (2) north of due east   (4) south of due east
Possible strategies:

(1) Avoid or minimize the need for perspective taking, while still achieving mastery of Earth Science concepts

(2) Strengthen students’ perspective taking ability

(3) Make perspective taking more salient
Strategy #1: Minimize need for perspective taking

From Bennett, et al., 2002, *The Cosmic Perspective*
From Bennett, et al., 2002, *The Cosmic Perspective*

<table>
<thead>
<tr>
<th>Model</th>
<th>Earth System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun</td>
<td>↔</td>
</tr>
<tr>
<td>Sphere</td>
<td>↔</td>
</tr>
<tr>
<td>Student’s Head</td>
<td>↔</td>
</tr>
<tr>
<td>Student’s Eyes</td>
<td>↔</td>
</tr>
</tbody>
</table>
From Bennett, et al., 2002, *The Cosmic Perspective*

<table>
<thead>
<tr>
<th>Model</th>
<th>Earth System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun</td>
<td>←→ Sun</td>
</tr>
<tr>
<td>Sphere</td>
<td>←→ Moon</td>
</tr>
<tr>
<td>Student’s Head</td>
<td>←→ Earth</td>
</tr>
<tr>
<td>Student’s Eyes</td>
<td>←→ Observer on Earth</td>
</tr>
</tbody>
</table>
Using 3-D Models to figure out the answer to questions they don’t yet know the answer to

- Which direction does the Moon go around the Earth?
Using 3-D Models to figure out the answer to questions they don’t yet know the answer to

• Given a moon calendar for the northern hemisphere, predict the moon calendar for the southern hemisphere:
Using 3-D Models to figure out the answer to questions they don’t yet know the answer to

• Given a moon calendar for the northern hemisphere, predict the moon calendar for the southern hemisphere:
Data + Model = Answers
Key Idea 2:
Models are simplified representations of objects, structures, or systems used in analysis, explanation, interpretation, or design.
• select an appropriate model to begin the search for answers or solutions to a question or problem.
• use models to study processes that cannot be studied directly (e.g., when the real process is too slow, too fast, or too dangerous for direct observation).
• demonstrate the effectiveness of different models to represent the same thing and the same model to represent different things.

• revise a model to create a more complete or improved representation of the system.
• collect information about the behavior of a system and use modeling tools to represent the operation of the system.
Possible strategies:

(1) Avoid or minimize the need for perspective taking, while still achieving mastery of Earth Science concepts

(2) Strengthen students’ perspective taking ability

(3) Make perspective taking more salient
Strategy #2: Strengthen student’s perspective taking ability through practice and discussion.

Sketch what your classroom would look like to a person coming in the door. Sketch what your table would look like from the other side.
Possible strategies:

(1) Avoid or minimize the need for perspective taking, while still achieving mastery of Earth Science concepts

(2) Strengthen students’ perspective taking ability

(3) Make perspective taking more salient
While practicing perspective taking, it is easier to imagine seeing from the vantage point of someone else than seeing from an abstract position:

“What would the doll see?”

…. seems easier than “What would you see from position A?”
• Use the model to explain the pattern of the data curve on 28 September.

• Use the model to explain the difference between the different data curves.
Possible strategies:

(1) Avoid or minimize the need for perspective taking, while still achieving mastery of Earth Science concepts

(2) Strengthen students’ perspective taking ability

(3) Make perspective taking more salient
How do you or how could you foster perspective taking by your students?

•
Next Session: Topographic maps

What are your learning goals in teaching topographic maps?

Seeking volunteers to bring in topographic map activities
<table>
<thead>
<tr>
<th><strong>Model</strong></th>
<th><strong>Earth System</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sphere</td>
<td>←→</td>
</tr>
<tr>
<td>Student</td>
<td>←→</td>
</tr>
<tr>
<td>Student’s Face</td>
<td>←→</td>
</tr>
<tr>
<td>Observer on Earth</td>
<td>←→</td>
</tr>
</tbody>
</table>
Perspective taking is required to envision what would be seen by an observer on the Earth.