Mass Producing Example-tracing Tutors

• **Goal**
  – Use problems from the National Assessment of Educational Progress (NAEP) released items
  – Create a user interface to permit middle school students to practice NAEP Math problems

• **What I did?**
  – Used one problem (Given two similar triangles, find one side)
  – Created two versions of the problem: with and without decimals in the related arithmetic
1. Created Student Interface in Flash

a) Created **Student Interface** in Flash with the diagram of the triangles:
   - In the first iteration, I used numerical values for the lengths of the given sides
   - In the second iteration I used input areas for the lengths of the given sides to permit mass production

b) Added CTAT components (Shell, Input Areas, Button)
Developed Student Interface in Flash

The following are similar triangles. What is the length of side BC?

\[
\frac{BC}{EC} = \frac{CA}{CD} = \frac{AB}{DE}
\]

\[
BC = \frac{CA \times EC}{CD}
\]

\[
BC = \frac{CA \times EC}{CD}
\]

Done
2. Authored Example-tracing Tutor

Used completed Flash student interface with CTAT’s Behavior Recorder to author **Example-tracing Tutor:**

a) Set Start-State

b) Demonstrated correct and incorrect paths

c) Annotated solution steps with appropriate bug messages and hints

- In the first iteration I used numerical values in the hint and bug messages
- In the second iteration I used variables to dynamically generate appropriate “numerical values” in the hint and bug messages
Entered Variables in CTAT Behavior Graph
3. Created and Merged Problems Table

a) Created a “Problems Table” in the CTAT behavior recorder

b) Entered information relevant to problems in the problems table using Microsoft Excel and saved it as a text file

c) Merged the problems table (text file version) with the behavior template to create the mass-produced behavior graphs for multiple problems
Entered Problems in Problems Table

<table>
<thead>
<tr>
<th>Problem Name</th>
<th>Similar_triangles_1</th>
<th>Similar_triangles_naep</th>
</tr>
</thead>
<tbody>
<tr>
<td>%DE_diagram%</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>%EC_diagram%</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>%CD_diagram%</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>%CA_diagram%</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>%AB_diagram%</td>
<td>6</td>
<td>12.8</td>
</tr>
<tr>
<td>%CAtimesEC%</td>
<td>36</td>
<td>48</td>
</tr>
<tr>
<td>%BC%</td>
<td>12</td>
<td>9.6</td>
</tr>
<tr>
<td>%CAtimesEC_error%</td>
<td>12</td>
<td>40</td>
</tr>
</tbody>
</table>
4. Published “HTML” Interface from Flash

a) Published **HTML Student Interface** from Flash

b) Edited HTML file to permit sequencing of multiple similar problems

c) Implemented HTML student interface (that are embedded with the .swf / Flash movie files)
Published HTML Student Interface

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\]

\[
BC = \frac{CD}{EC} \times \frac{AB}{DE}
\]

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Next Steps... 

I would like to use a selection of problems from the NAEP Math released items where data about students’ correct & incorrect responses and percent students who answered the problem in various ways are available. This gives us some background on the predicted responses.

Using these data, I would like to develop a Cognitive Tutor to compare students’ thinking about the selected problems with the cognitive models I develop from the NAEP data.