A Tutoring Page Markup Suite for Integrating Sharable Knowledge Objects (SKO) with HTML

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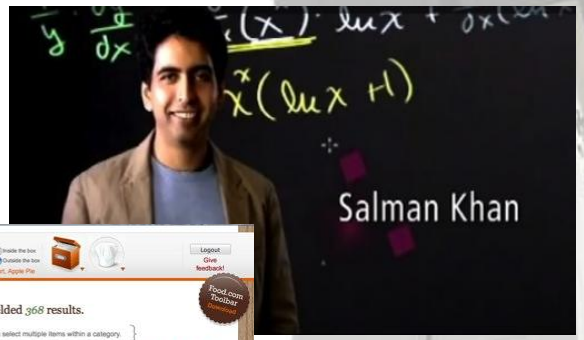
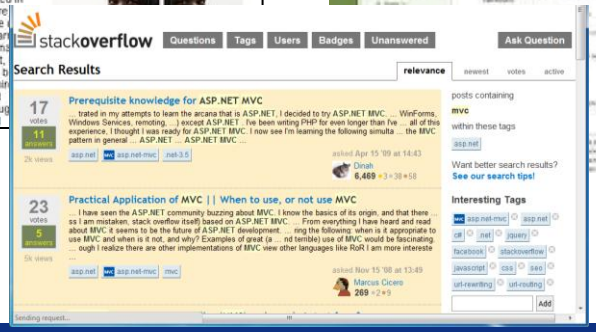
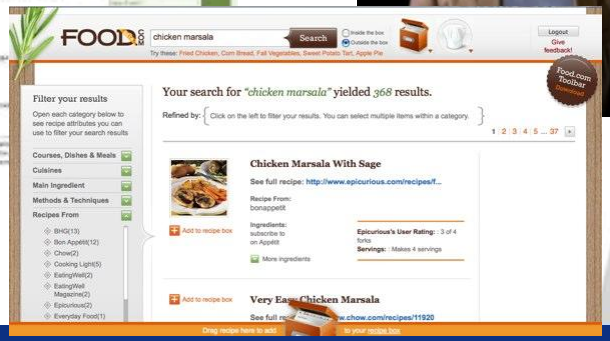
Goal: Add Tutoring to Web Content

- Current Situation
  - The Internet has **vast learning resources**
  - Almost all of these are **non-interactive**
  - Some of these are **high-quality**
  - Wide range of domains (STEM, medicine, how-to…)



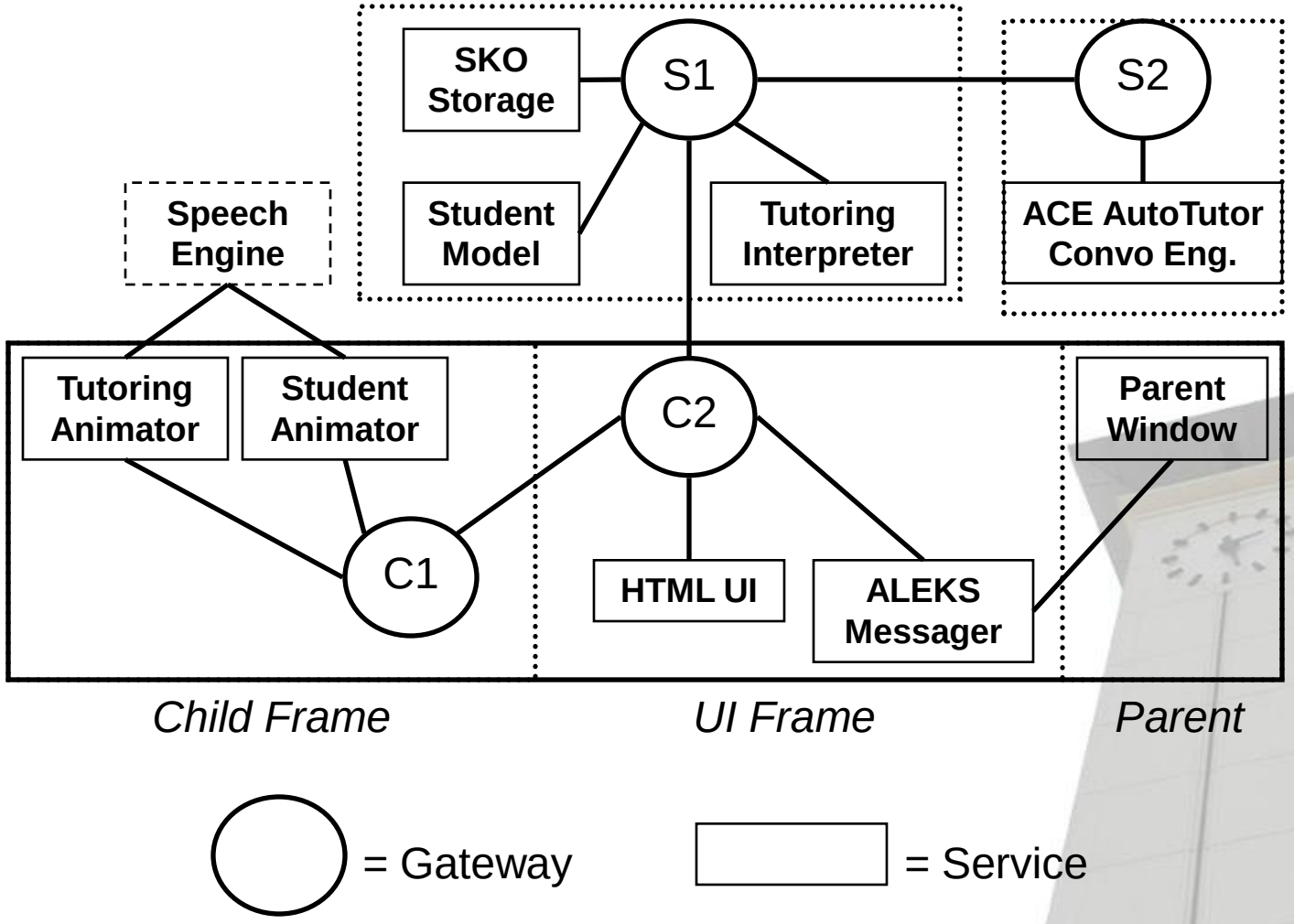




Goal: Add Tutoring to Web Content

- Approach: Tutoring as a Service
  - Mark up existing HTML with targeted ITS activities
  - Use natural language ITS to talk about content
  - Enhance and assess knowledge simultaneously
  - Simplify authoring for domain and pedagogy experts

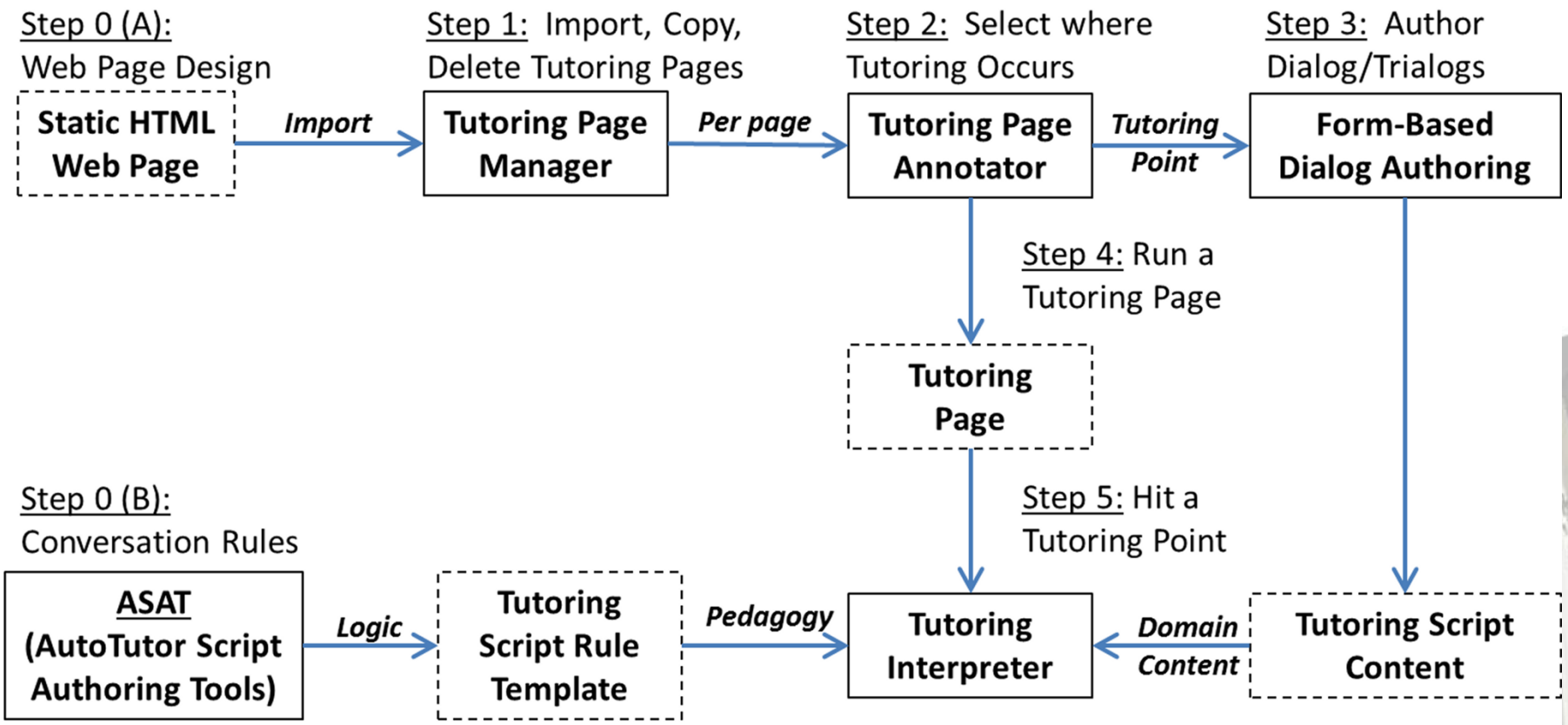
Services Under the Hood



Tool Suite

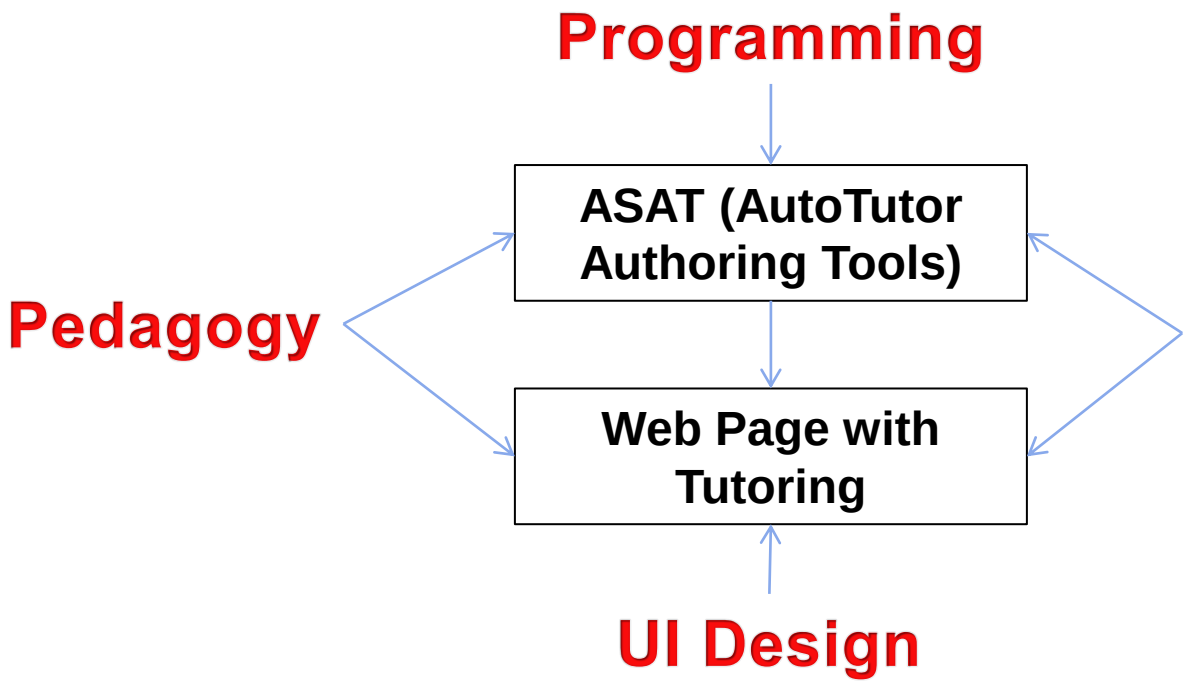
- Tutoring Page Manager: Create/Import/Delete Pages
- Tutoring Page Annotator: Tutoring Locations
- Form-Based Authoring Tool: Tutoring Content
- (ASAT): Tutoring Logic Template
- (Python Scripts): Content pre-processing for templates
- (HTML/CSS Editors): Display Formatting

Tool Suite


Step 0 (A):
Web Page Design
Static HTML Web Page
Import
Step 1: Import, Copy, Delete Tutoring Pages
Tutoring Page Manager
Per page
Step 2: Select where Tutoring Occurs
Tutoring Page Annotator
Tutoring Point
Step 3: Author Dialog/Trialogs
Form-Based Dialog Authoring
Step 4: Run a Tutoring Page
Tutoring Page
Step 0 (B):
Conversation Rules
ASAT (AutoTutor Script Authoring Tools)
Logic
Tutoring Script Rule Template
Pedagogy
Step 5: Hit a Tutoring Point
Tutoring Interpreter
Domain Content
Tutoring Script Content

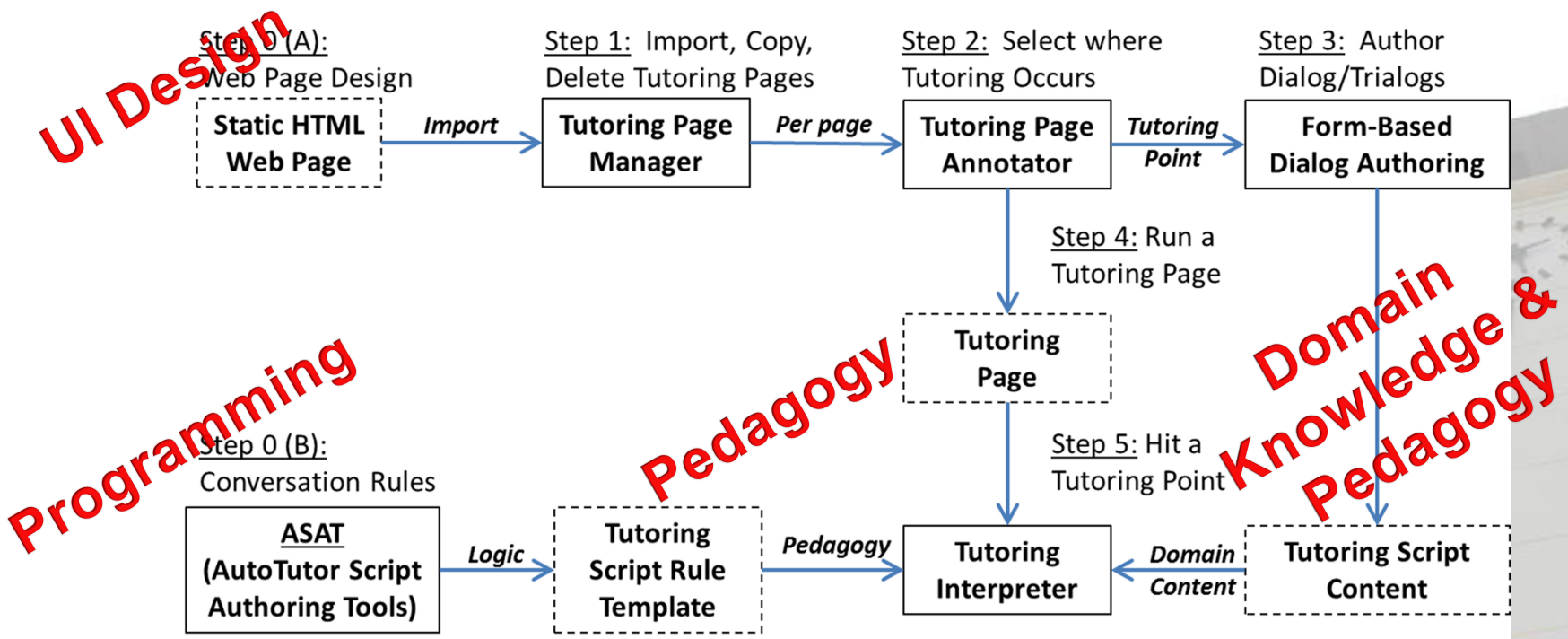
Theoretical Underpinnings

- Our Traditional Approach
  - Super-Experts: Specialized graduate-level researchers
  - Close Team Collaboration: Combine expertise

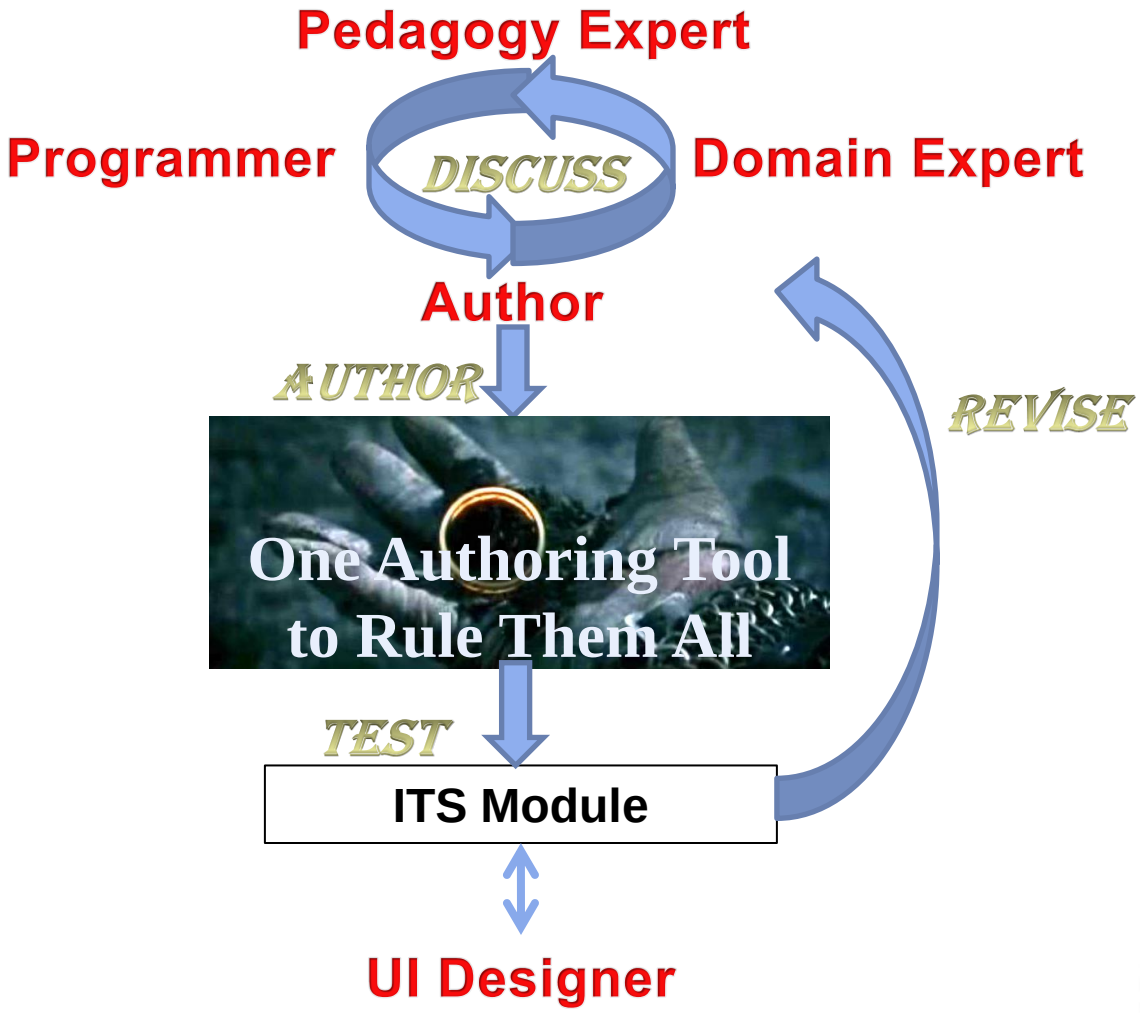


Theoretical Underpinnings

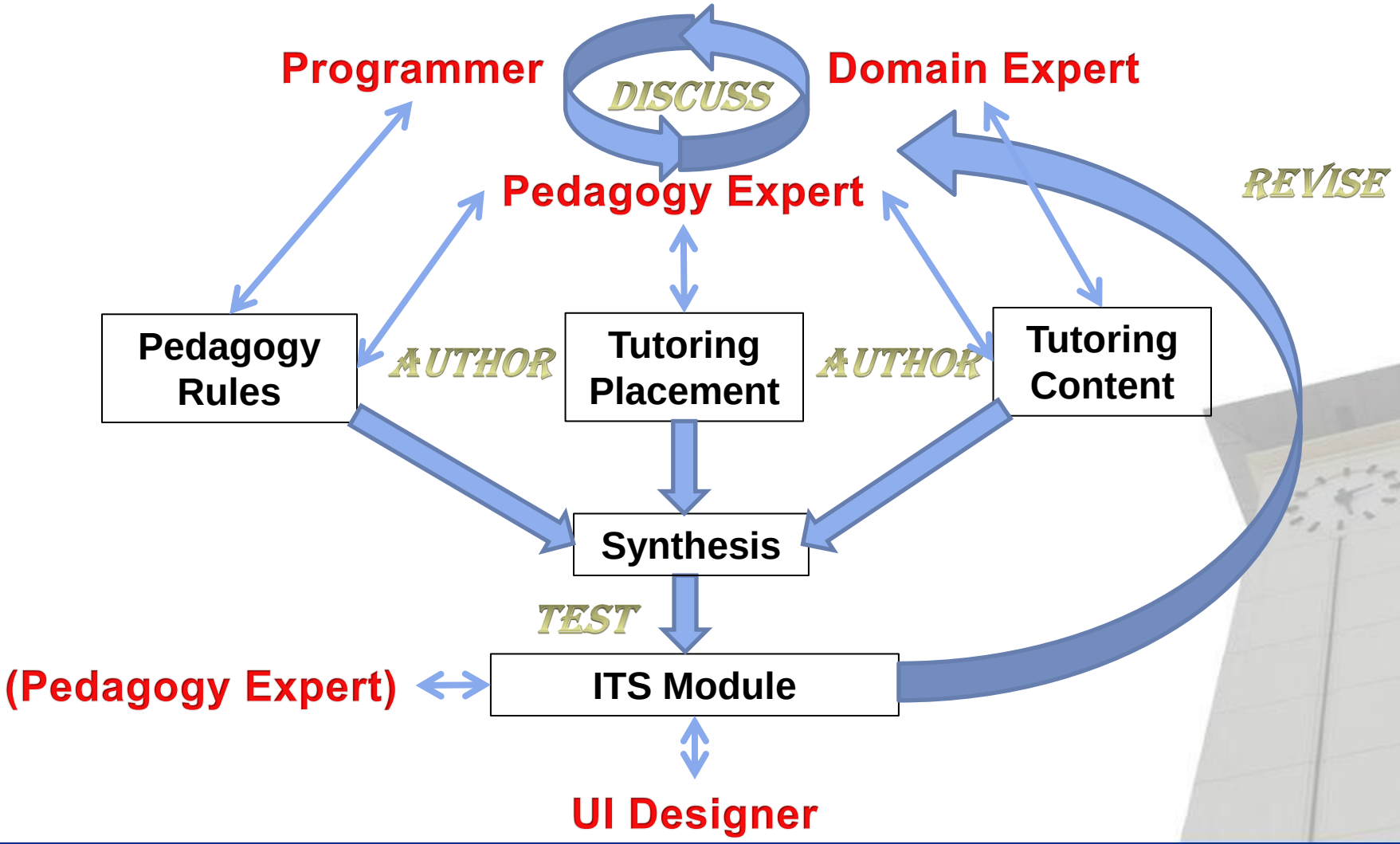
- Assembly-Line Division of Expertise
  - UI Design (Communication, Pedagogy)
  - Tutoring Content (Domain Knowledge, Pedagogy)
  - Tutoring Logic (Pedagogy)



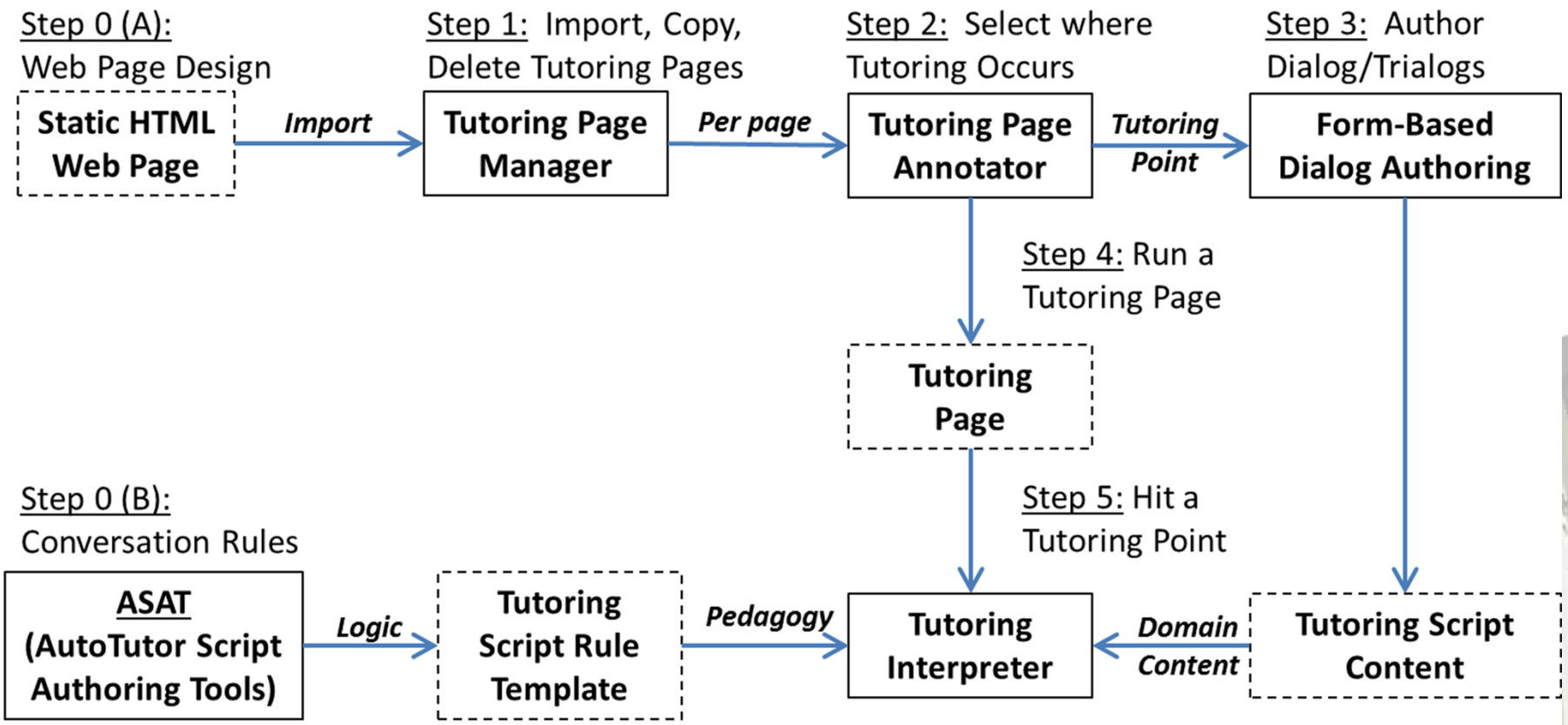
Workflow: Iterative Team Collaboration



Workflow: Suite-Based Collaboration



Tool Suite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Tutoring Script Content

Tool Suite

- Tutoring Page Manager (Domain Expert)
- Tutoring Page Annotator (Domain Pedagogy Expert)
- Form-Based Authoring Tool (Domain Pedagogy Expert)
- ASAT(Pedagogy Expert w/some Programming Concepts)
- Python Scripts (Programmer w/NLP skills)
- HTML/CSS Editors (Programmer w/HCI skill)

Tutoring Page Manager

Name	Weblink	Template
Algebra 512	./location.html	layout.html

New | Copy | Remove | 3 Save | 4 Edit | View

Name: 2

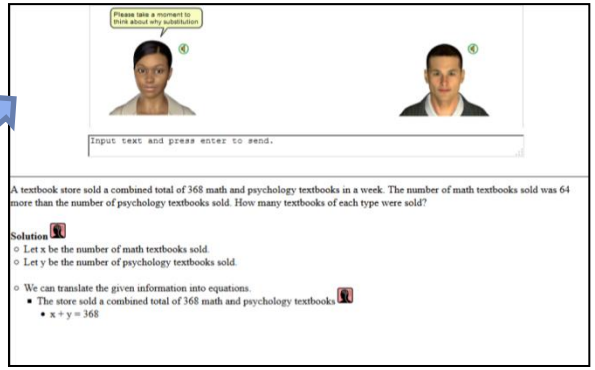
Weblink:

Template:

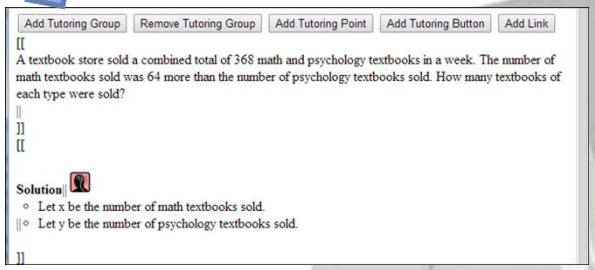
Content: www.somepage.com/ 1 Import

```
<ul style='padding:0;margin:0;padding-
left:20px'>
<li type=circle>Let x be the number of math
textbooks sold.</li>
<li type=circle>Let y be the number of
```

TEST

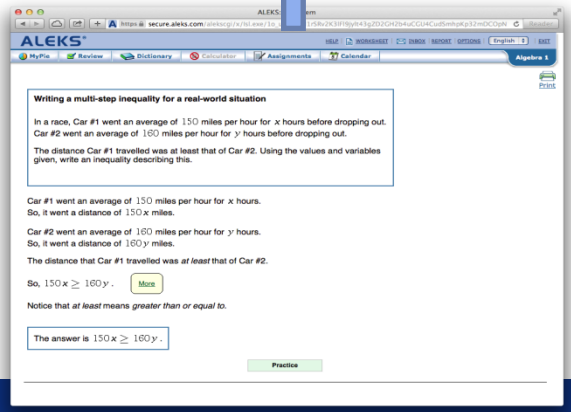


ANNOTATION



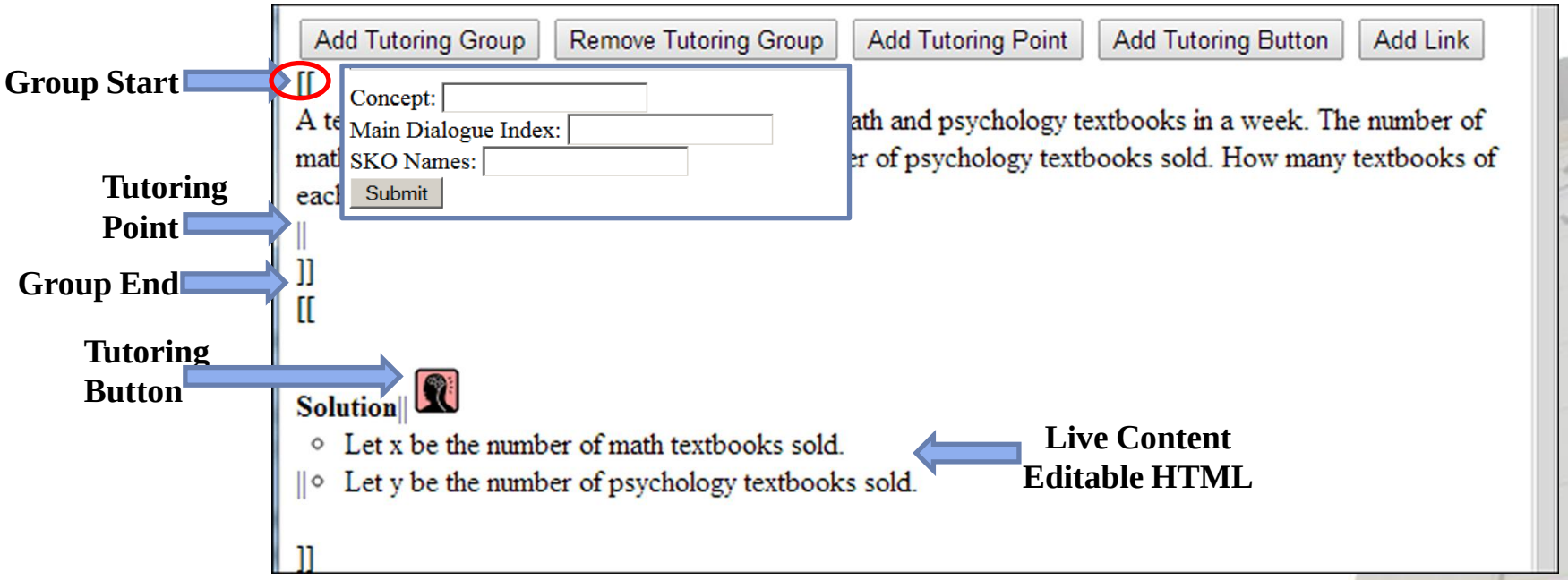
1. Import
2. Name
3. Save
4. Edit

www.somepage.com/math.html



Tutoring Page Annotator

- Author where tutoring happens in page
- Tutoring Group: One or more tutoring sessions
- Content-Editable: Delete/modify page text
- Sequencing: Rest of page hidden until group done



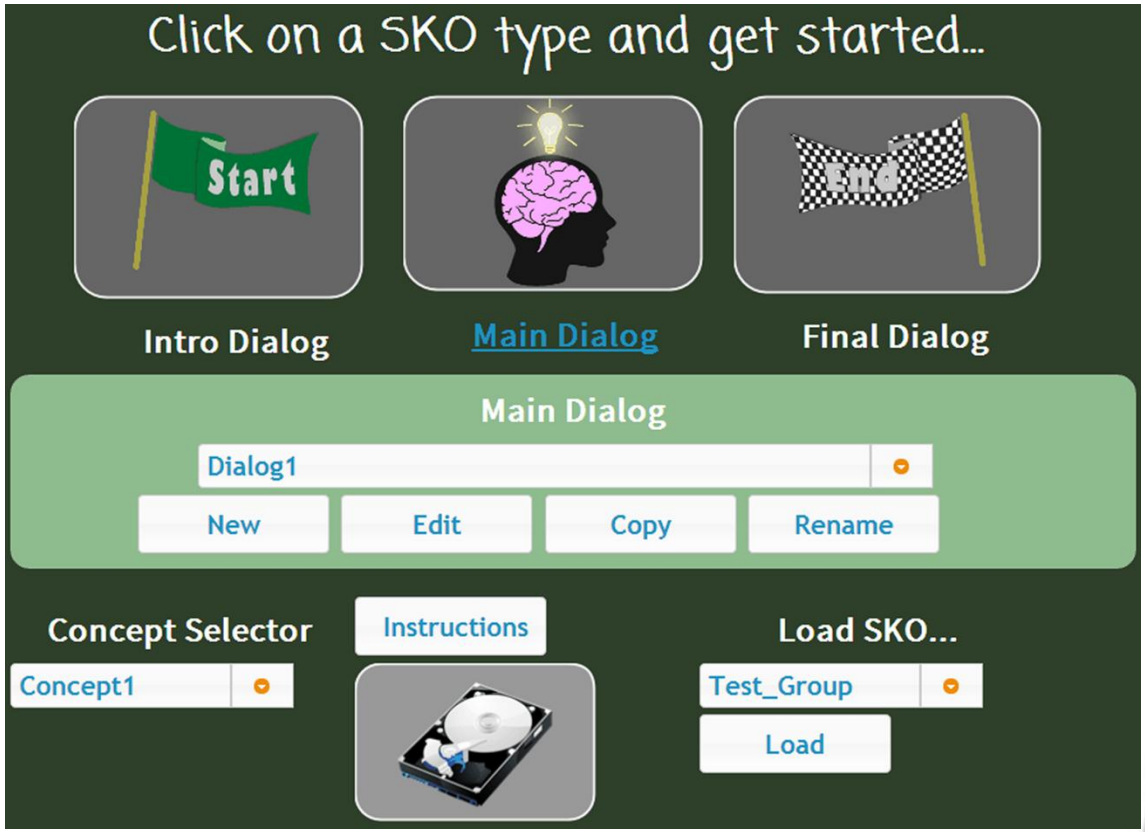
Tutoring Page Annotator

- Can import/export annotated HTML
- This HTML is combined with tutoring dialog by JavaScript inside “Tutoring Page” UI templates
- This is converted to JSON for storage and delivery

```
<body>
    <TutorGroupStart id="Reality Problem to Algebra " concept="RealProblemToAlg" SKO_names="['ALGE078_1','ALGE078_2']" maindialogindex="0"/>
        <span>A
        textbook store sold a combined total of 368 math and psychology
        textbooks in a week.</span>
        <span class='inline-block'>
        <span> </span>
        <span>The number
        of math textbooks sold was 64  more than the number of
        psychology textbooks sold</span>
        <span class='inline-block'>
    <TutorGroupEnd/>
    <TutorGroupStart id="Finding the Number of Solutions" concept="FindNumSolutions" SKO_names="['ALGE078_3']" maindialogindex="0"/>
        <span>. How many
        textbooks of each type were sold?</span>
        <span class='inline-block'>
    <TutorGroupEnd/>
  </p>
<p>
```

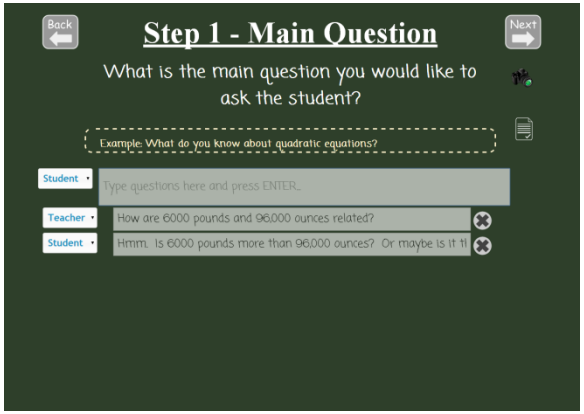
Form-Based Dialog Authoring Tool

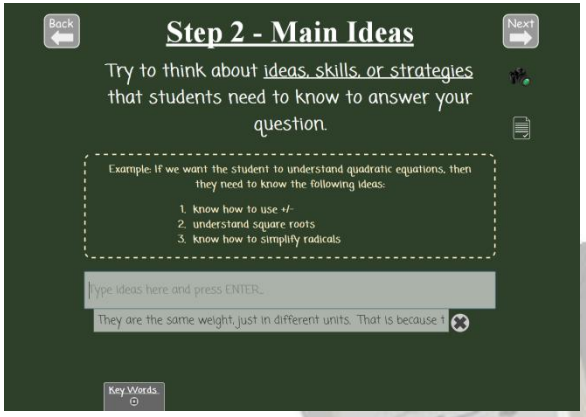
- Author content of tutoring trialogs (up to 3/group)
- Create new dialogs or select from existing ones

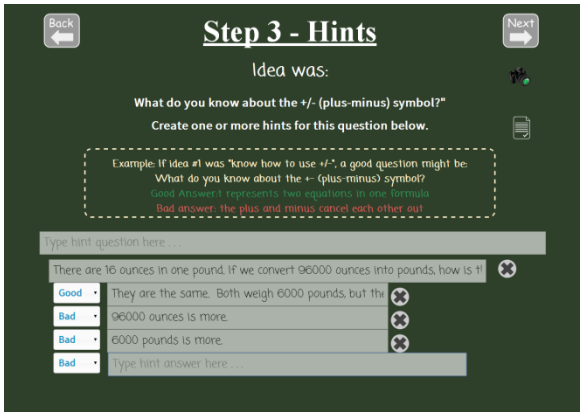


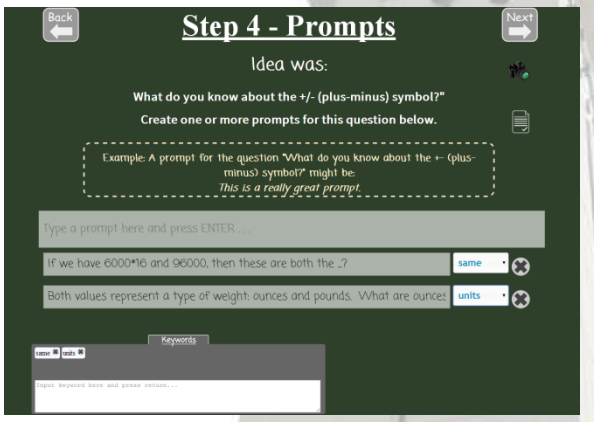
Form-Based Dialog Authoring Tool

- Author content one short form at a time
- Content is used for NLP and for agent speech
- Steps:
  1. Main questions
  2. Expectations
  3. Hints
  4. Prompts
  5. Misconceptions



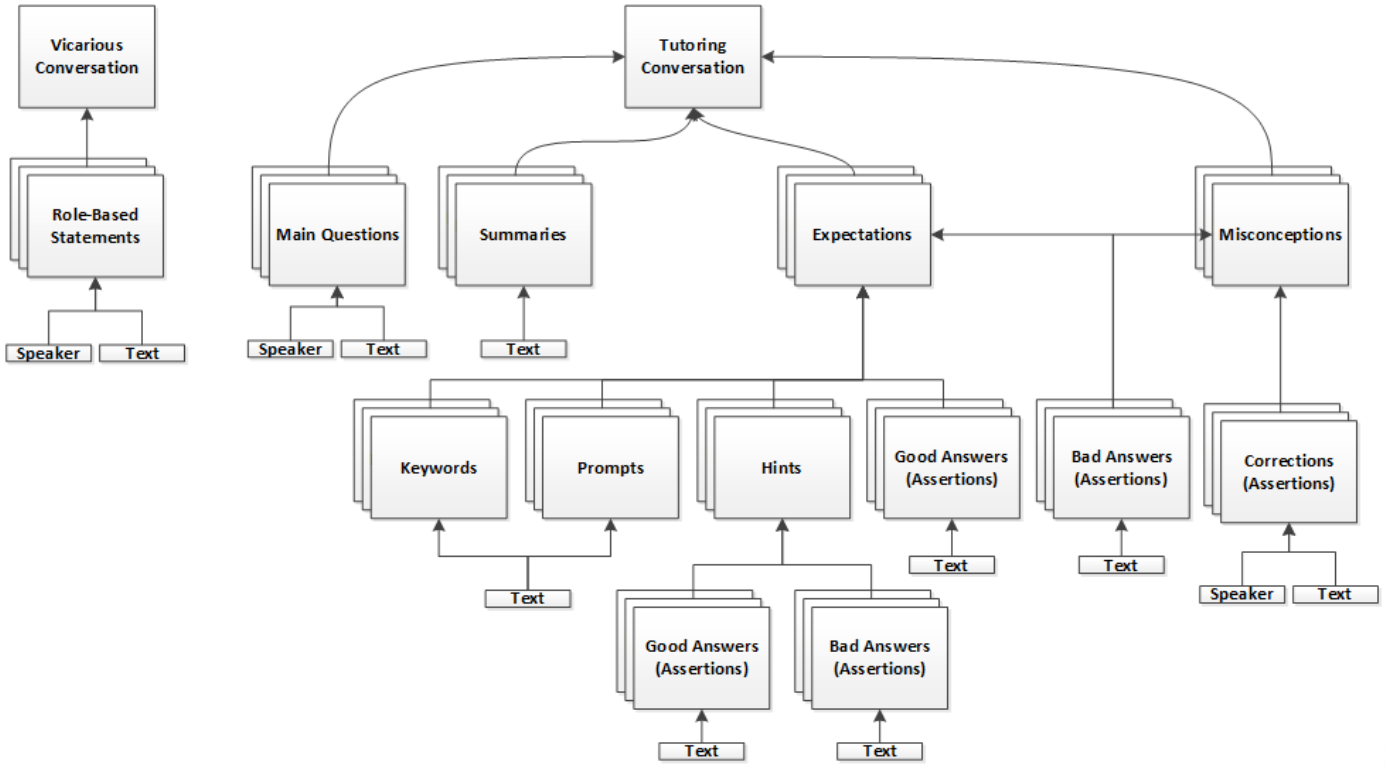






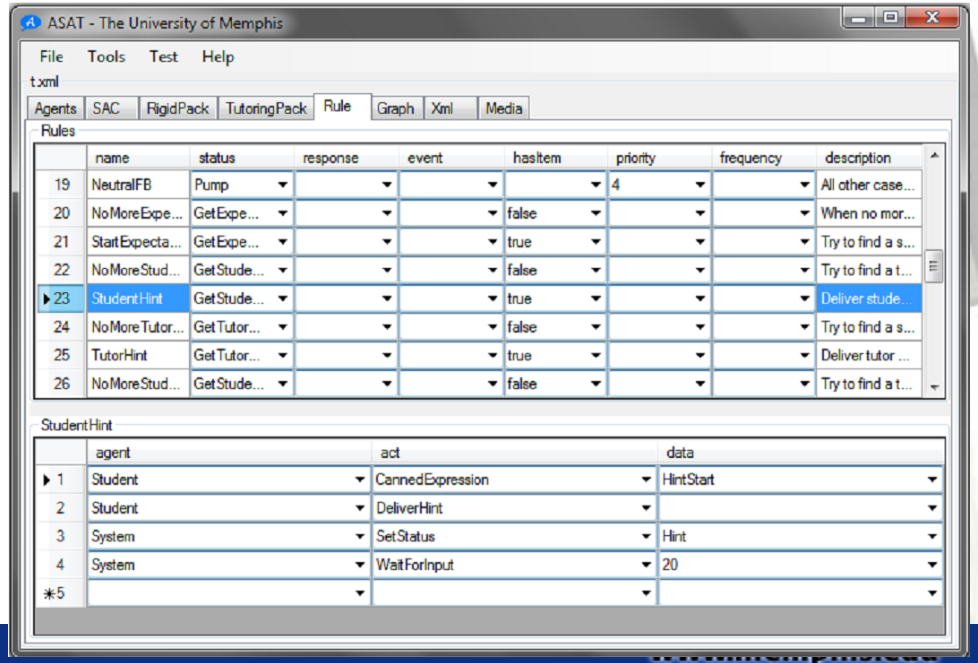
Form-Based Dialog Authoring Tool

- Content is authored in a minimal fashion
- Some elements **duplicated/pre-processed** before combining with an ASAT template



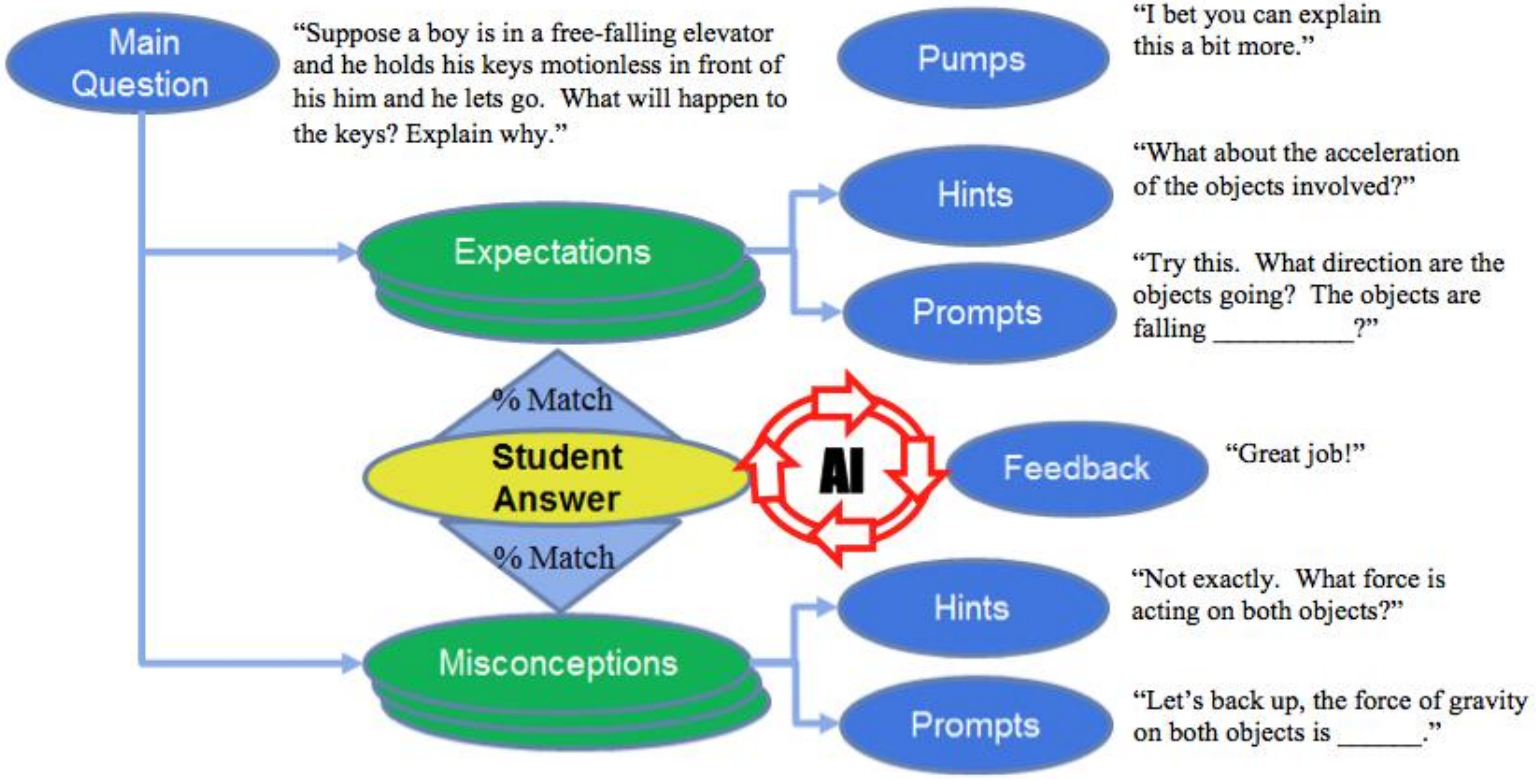
ASAT: Trialog Templates

- Form-based trialogs are content only, no logic
- Combined at run-time with ASAT rule templates
- Templates:
  - Vicarious: No human input, agents talk with each other
  - AutoTutor-style Expectation-Misconception Tutoring
  - Collaborative Lecturing (In Progress)
- Preprocessing Content
  - Depends on template type
  - Done with code scripts
  - Make speech-friendly text
  - Remove stopwords
  - Canonicalize keywords



ASAT: Trialog Templates

- AutoTutor-Style Expectation-Misconception Tailored (EMT) Dialog



Future Directions

- Suite online (internal use) starting this month
  - Form-based tool needs to be connected to cloud storage server
  - First use: Revising math tutoring dialogs
  - Bugfixes and usability checks will occur throughout the summer
- Enhancements on deck
  - Detect and flag semantically ill-formed content
  - Support authoring test inputs (good/bad responses)
  - Store rule templates in storage service(currently static)
  - New template for collaborative lecturing (e.g., linear lecture with checks for knowledge and attention)
  - Looking at better updating for collaborative editing: Multiple users on form-based tool could overwrite
  - This approach may work for interleaving w/video