Future of C_3PO: Customizable Computer Coaches for Physics Online

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Background

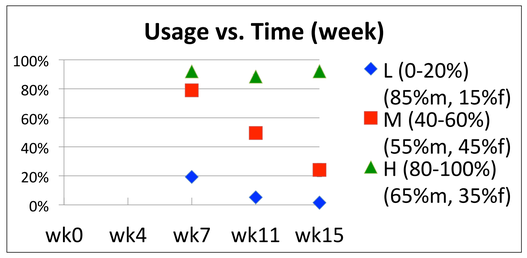
- We are developing online computer coaches for physics problem-solving (Hsu & Heller, 2004), designed within the framework of **cognitive apprenticeship** (Brown, Collins & Duguid, 1989) to support the processes of **modeling**, **coaching**, and **fading**.
- The coaches emphasize the process of **decision-making** in solving problems.
- For a more detailed analysis of the coach design, see **PST2C13**

Goal

To apply the results from usage and usability testing of Version 1 coaches to direct the development of Version 2

Usage and Usability (V1.0)

- L group (light/non user): 0-20% (of total coaches attempted)
- M group (medium user): 40-60% (of total coaches attempted)
- H group (high user): 80-100% (of total coaches attempted)



Positives

- On an end-of-term survey, 66% of the 135 responses to the statement "The computer coaches did not help improve my problem solving in this class" were "disagree" or "strongly disagree."
- On a midterm survey, 23% of 183 responses to the question "What do you like most about the computer coaches?" mentioned "step by step [help]" or "guide from beginning to end"

Shortcomings

- On a midterm survey, 49% of the 183 responses to the statement "Using the computer coaches made the homework take too long" were either "agree" or "strongly agree."
- On a midterm survey, 37% of the 183 responses to the questions "What do you like least about the computer coaches?"" mentioned either that they were "too long" or "too repetitive".
- Modifying the coaches required some facility with Flash programming; very time-consuming/difficult for typical physics instructors.

One of our design goals is for the coaches to be adaptable to the diverse needs and desires of students and instructors.

- They should reduce repetition for students who desire it.
- The student should be able to control the "grain size" of the coach
- Instructors should be able to modify coaches to suit their preferences and environments.

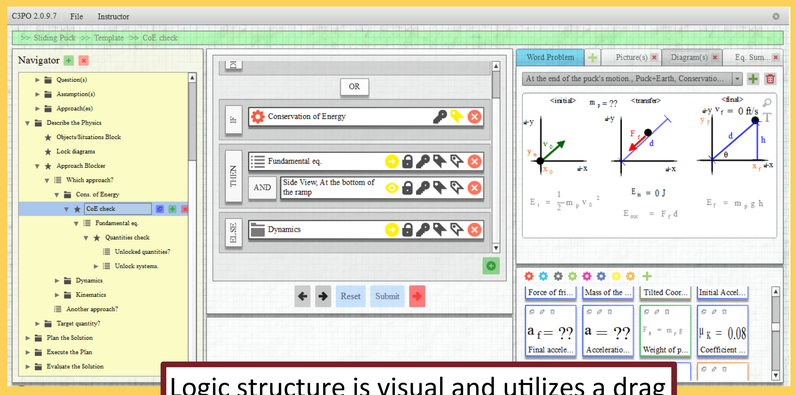
References

- J. S. Brown, A. Collins, & P. Duguid, Educational Researcher 18(1), 32-42 (1989)
- L. Hsu & K. Heller in AIP Conference Proceedings 790: 2004 PERC (pp. 197-200). Melville, NY: American Institute of Physics.

Improving Usability for Instructors

Modifying coaches

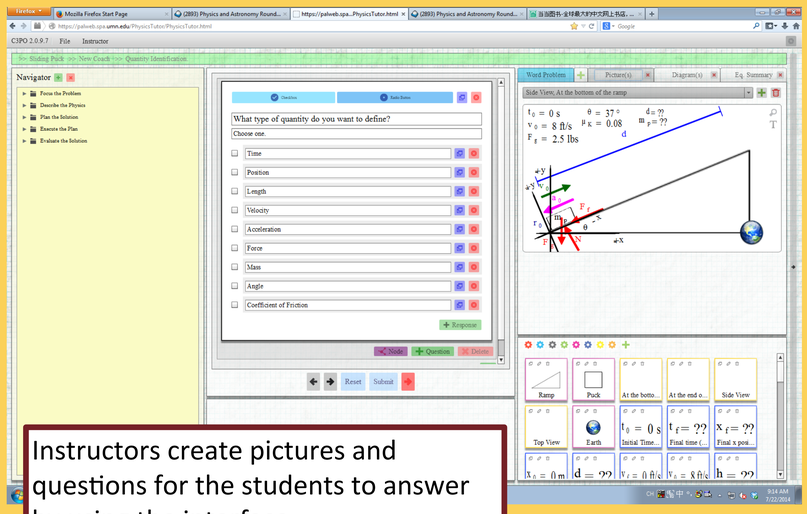
- In version 1, instructors needed programming skills to modify coaches.
- In version 2, coaches can be built and modified using a graphical user interface (GUI). Anything from simple text changes to major revisions in the logical flow of the coach can be made using the GUI.



Logic structure is visual and utilizes a drag and drop interface to create the coach.

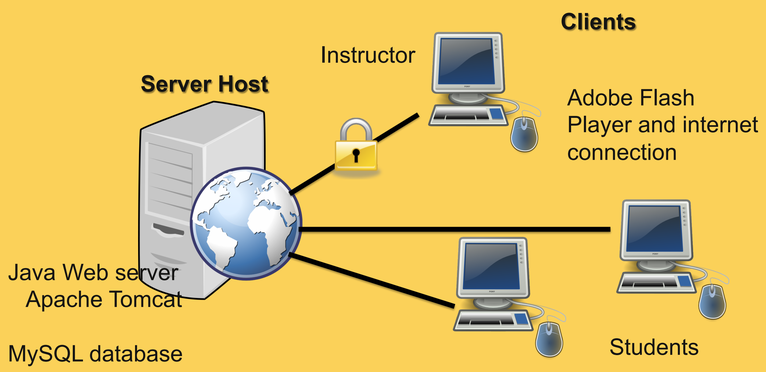
Manipulating graphics

- In version 1, adding and manipulating graphics was difficult and done externally.
- In version 2, all pictures and diagrams are stored in the SQL database and manipulated using the GUI interface.



Instructors create pictures and questions for the students to answer by using the interface.

New technology structure

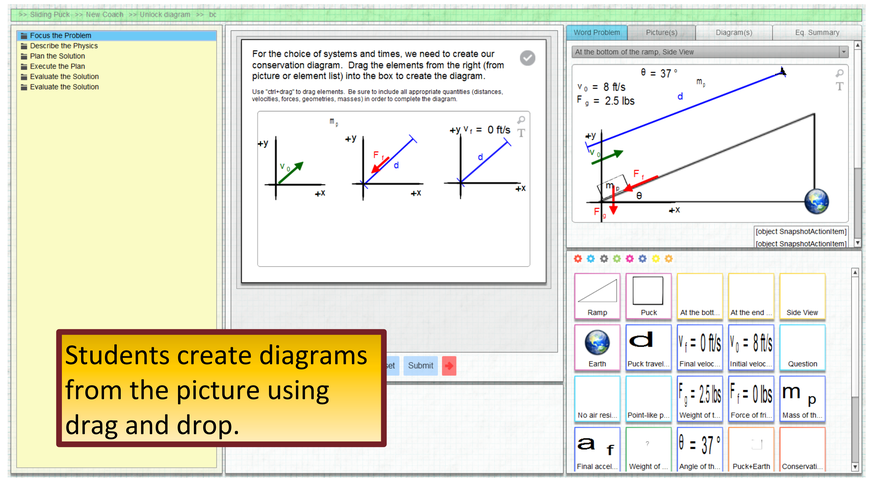


All information is stored in a SQL database. Students and instructors use a Flash frontend to access the Java host server.

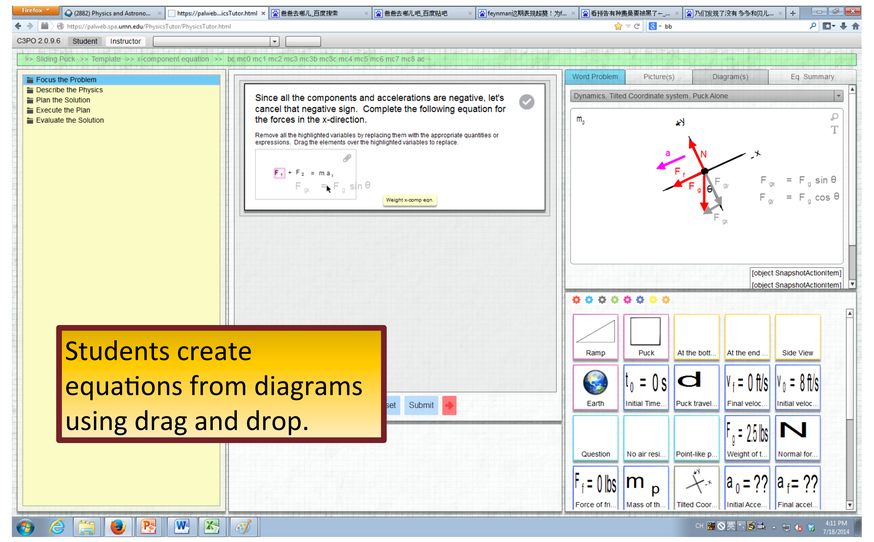
Improving Usability for Students

Newer interactions:

- In version 1, students simply clicked on elements in the picture to make them appear on the diagram and clicked on elements in the diagram to create equations.
- In version 2, students drag and drop elements from the picture to create a diagram and drag and drop quantities from the physics diagram into equations. This type of interaction could help students make a more explicit connection between representations.



Students create diagrams from the picture using drag and drop.



Students create equations from diagrams using drag and drop.

Increased solution flexibility:

- In version 1, students must solve the problem in a rigid order.
- In version 2, students can choose how to solve the problem from the set of paths specified by the instructor.

Adjustable grain size:

- In version 1, the level of help students receive is essentially fixed.
- In version 2, the instructor can use the GUI to easily modify the amount of help students receive while solving a problem.

- **Related posters: PST2C14 and PST2C15**

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