Evolution of C₃PO: Customizable Computer Coaches for Physics Online

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**Background**
We are developing online computer coaches (Hsu & Heller, 2004) within the framework of cognitive apprenticeship (Brown, Collins & Duguid, 1989) to support the processes of modeling, coaching, and fading, all in the context of expert practice. The coaches emphasize the decision-making in problem solving.

**Goal**
Test the usage and usability of computer programs designed to provide students with individualized coaching while solving problems.

**Questions**
Q1: What are the characteristics of the users?
Q2: Do students perceive the coaches to be useful?
Q3: How do the students use the coaches?

**Experimental Conditions**
- Computer coaches for 35 problems were incorporated into 2 sections of a calculus-based introductory mechanics course (148/103 students) in Spring 2013.
- Students were required to complete their homework using WebAssign (coaches were available to help with some problems).
- Data collected included:
  - Keystroke data from student use of the coaches.
  - Standardized pre/post assessments (FCI/Math/CLASS).
  - Mid- and end-of-semester surveys about the coaches.
  - Student background and expectations survey.

**Results**
Q1: What are the characteristics of the users?
- L group (light/non users) 0-20% (of total coaches attempted)
- M group (medium users) 40-60% (of total coaches attempted)
- H group (heavy users) 80-100% (of total coaches attempted)

**References**

**Shortcomings**
- Some students think the coaches take too long or are too repetitive.
- Instructors find it too time-consuming or difficult to modify these coaches.

**Development of V.2.0**
- Make the coaches easier to modify by instructors.
- Make the grain size of the help adjustable to better serve users.

**Q2: Do students perceive the coaches to be useful?**
- Students rated statements about the coaches on a 5-point Likert scale.
  - A: Strongly agree
  - B: Agree
  - C: Neither
  - D: Disagree
  - E: Strongly disagree

**Q3: How do students use the coaches?**
- Students ranked 10 class components from most (10) to least (1) useful.
- H users seem more dependent on the coaches.
- M users show a dramatic decrease in their coach usage.

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