

Designing for metacognition

Applying cognitive tutor principles to the tutoring of help seeking

Group E

Astury Gardin

César Juárez

Ravneet Kaur Banwait

Vanessa Zervogianni

Introduction:

- Develop and evaluate a set of empirically-based design guidelines for metacognitive tutoring in ITS
- Anderson's principles for cognitive tutoring
- Help-seeking in Cognitive Tutors
- Teach metacognitive skills

Method:

- Evaluate Anderson's principles
- Experiment on Help Tutor: 4 complete studies, 1 on going study
- Formulate the new principles: 10 principles sort into three groups
 - ✓ **Goals**, describe the design of appropriate metacognition learning objective for ITS
 - ✓ **Instruction**, discuss the design of the instructional means, interaction style, pedagogy to be used
 - ✓ **Assessment**, discuss the evaluation of the metacognitive tutoring

Study	Goal	Methodology	Main findings	Further details
1	Design the help-seeking model	Log-file analysis	73% of students' actions were classified as different types of help-seeking errors. These errors were significantly negatively correlated with learning ($p=-0.65, p<0.0005$)	(Alevan et al. 2006)
2	Evaluate the model across domains and cohorts	Log-file analysis	Students' errors in two different Cognitive Tutors were highly correlated ($r=0.89, p<0.01$)	(Roll et al. 2005)
3	Implement and pilot the Help Tutor	Pilot	Students improved the help-seeking behavior while working with the tutor	(Alevan et al. 2005)
4	Evaluate the Help Tutor	Randomized experiment with 60 students	Students improved several aspects of their help-seeking behavior. No improved learning at the domain level was observed	(Roll et al. 2006)
5	Evaluate the combination of the Help Tutor, preparatory Self-assessment sessions, and help-seeking classroom instruction	Experiment with 80 students	Under analysis	(Roll et al. 2007)

Help Tutor experiment result

Decision:

**WEAKLY
ACCEPT**

Pros:

- Clear goal: Design of principles
- Justification of work: Lack of guidelines available
- Evaluation strategy: Help Tutor
- Implication:
 - Help Tutor: Help-seeking behavior
 - Guidelines: Applied to other environments
 - Learning at the domain level
- Methodology: Studies using Cognitive Tutor
- Evidence that support the principles: Studies 1 to 5
- Clear how Help Tutor works: Add-on, help-seeking model
- Clear Help Tutor result: Mixed outcomes
- Propose improvements: Both Help Tutor and principles
- Conclusions supported by data: Improvement and evaluation. Can help as a baseline

Decision:

**WEAKLY
ACCEPT**

Cons:

- The evaluation of the principles presented is rather scattered
- The new principles are partially supported due to incomplete results of study 5
- Some methodologies used might not be clear to non-experts
- The conclusion of the paper is written as a summary but does not states any result of their work. It rather states that the work is "incomplete".