ADAPTIVE LEARNING ENVIRONMENTS:
Metacognition and help-seeking

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Metacognition
Metacognition in brief

• Knowledge of knowledge, regulation of knowledge (Brown 1987)

• Knowledge *and beliefs* about cognition; monitoring and controlling your cognitive processes (Hacker, on Flavell 1979 and later adherents)

• Metacognition as conscious, non-automatised, controllable, and therefore *observable* to systems, researchers

• Metacognitive processes as a relative of *executive processes* (in cognitive psychology)

!!! For this course, don’t worry over the metacognition vs. metamemory distinction.
“To differentiate metacognitive thinking from other kinds of thinking, it is necessary to consider the source of metacognitive thoughts: Metacognitive thoughts do not spring from a person’s immediate external reality; rather, their source is tied to the person’s own internal mental representations of that reality, which can include what one knows about that internal representation, how it works, and how one feels about it.”

Do these count?

1. Asking your human tutor/ your pedagogical agent a clarifying question about the course material
2. Repeatedly asking questions until you get the tutor/ pedagogical agent to give you the correct answer or demonstrate the relevant procedure.
3. Recognising that you made a misspelling, or a simple arithmetic error in your work.
4. Recognising that you made an error because of a conceptual misunderstanding
5. Realising that you do not have enough information to work out the physics problem you have been assigned
6. Spending the majority of your revision time on material that you think you don’t know very well
Help seeking— is it a good sign?
“Many authors have taken the viewpoint that rather than being an activity signalling and promoting the dependence of the learner, help seeking is an important strategy and can be instrumental in the development of independent skill and ability (Ames, 1983; Nelson-LeGall, 1981; Newman, 1994). It is likely that learners’ help-seeking behavior reflects their metacognitive and domain-specific skills and knowledge (Newman, 1994, 1998a; Puustinen, 1998; Wood & Wood, 1999). It can be assumed also that learners’ help-seeking behavior reflects their attitudes about learning, their achievement goals...and their epistemological beliefs.”

Help-seeking model

A task analysis of the help-seeking process, and it comprises the following steps:
1. Become aware of need for help.
2. Decide to seek help.
3. Identify potential helper(s).
4. Use strategies to elicit help.
5. Evaluate help-seeking episode.

Are students good at asking for help?
The phrase you want is Blissful ignorance!!!

- As a group: students are quite poor at seeking help at the right time, and doing something *with* the help.
- Help-seeking is metacognitive, so...
  - Better students, with (usually) better metacognition may not need much domain help
  - Weak students may get burnt twice: not knowing they need help (poor self-assessment), and not being able to effectively seek it

→ See especially work from Cognitive Tutors researchers on (non-)use of help resources in their systems
Who should be responsible for helping?

• Almost all systems have “on-demand” help resources (students decide when needed)
• Some systems also intervene more actively
  • When student gets off-path in model tracing tutor
  • When specific factual error detected (AutoTutor)
• Often system “pushing” help is limited—why?
  • Incomplete diagnostic information
  • Relatively likely to be wrong
  • Maybe worse than doing nothing

➔ BUT...on-demand help creates extra student burden
Teaching vs. Supporting metacognition

• More common in ALEs to *encourage* students toward a range of metacognitive behaviours than to *overtly teach* metacognitive strategies.
  • Encouraging example: Betty’s Brain
  • Teaching example: Help Tutor (a cog. tutor)

• Roll et al. (2007 – the SSS1 paper) argue that the former is not enough. Will not transfer to other contexts, domains. MUST teach!

• BUT is this too much of an additional cognitive demand, or interference with domain learning?