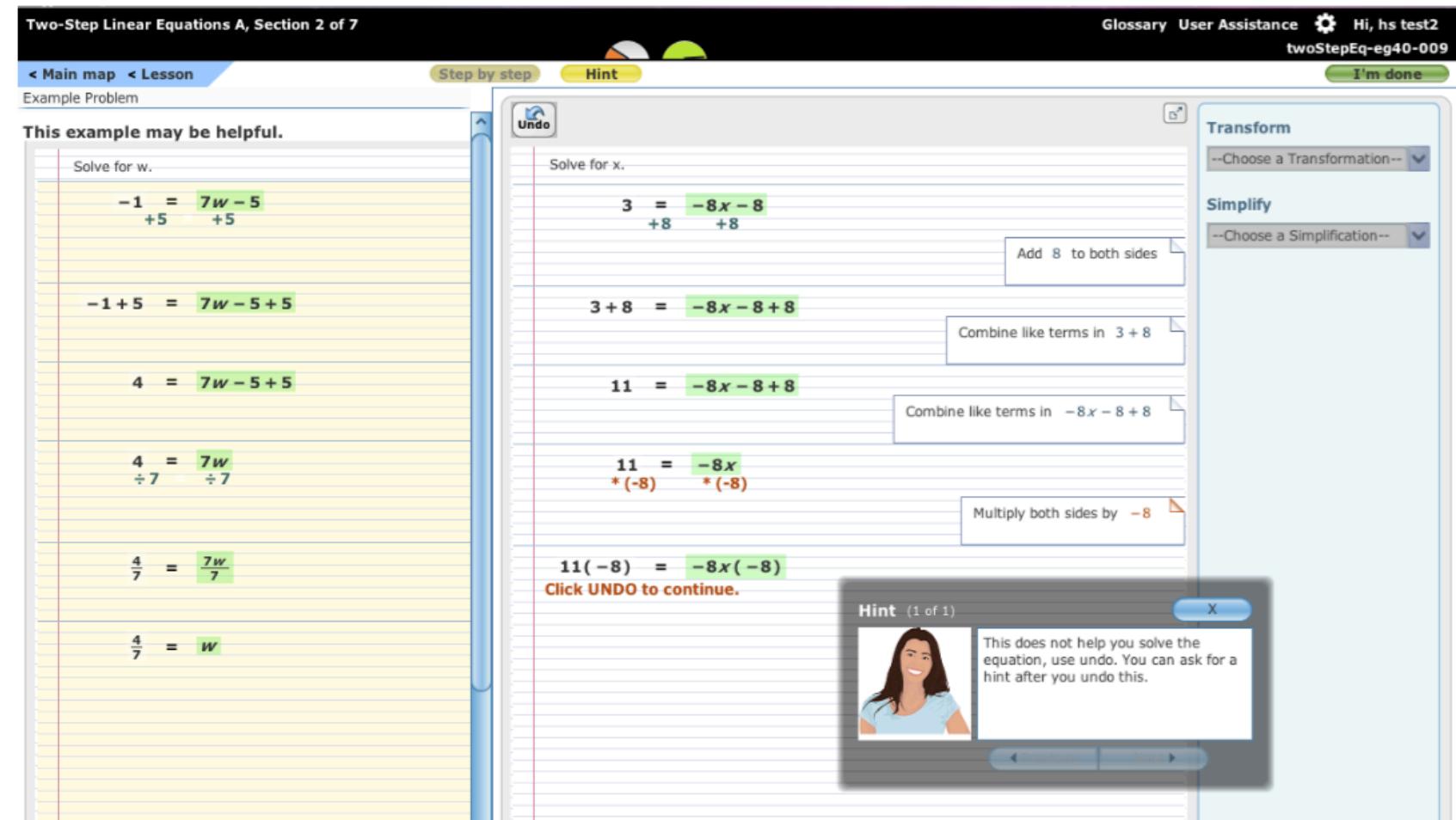


The Impact of Instructional Intervention and Practice on Help-Seeking Strategies within an ITS

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The Tutoring Conditions

Two Step Linear Equation Solving Tutor



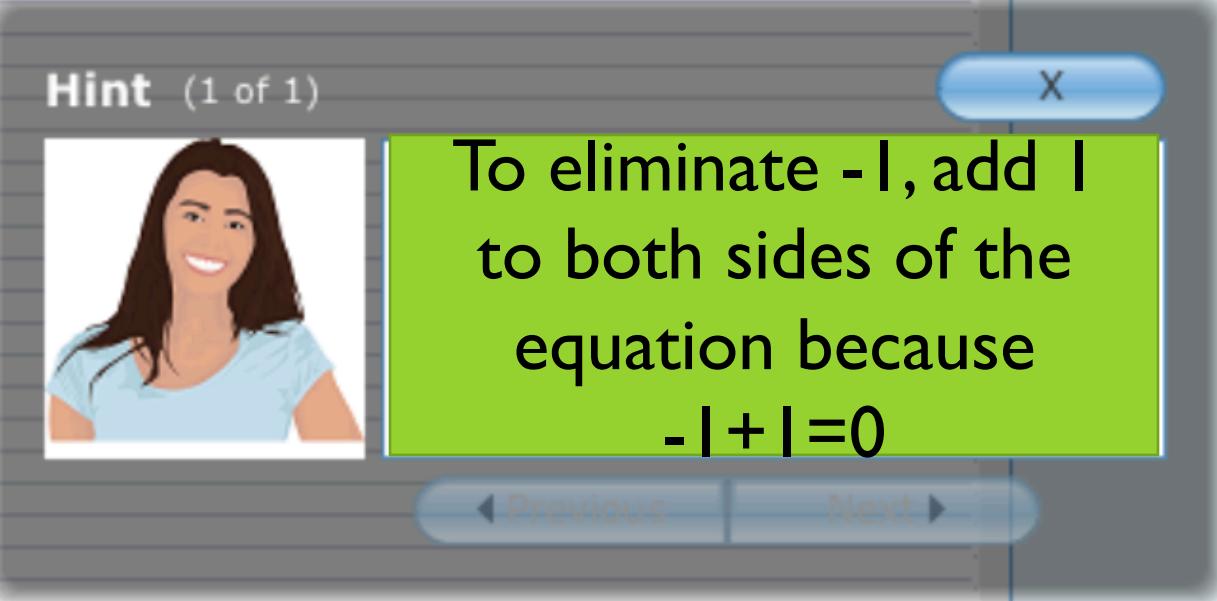
Discovery Method (DM) Condition

Students place more value on knowledge taught when discovering it themselves

Fewer opportunities for gaming the system

Requires Scaffolding

Direct Instruction (DI) Condition



164 High School students

Impact of Instructional Intervention

Looking at average actions per problem Lee et al found students in the DM condition showed higher proportion of mastered skills, but effects did not persist in later units of the tutor.

Questions left unanswered

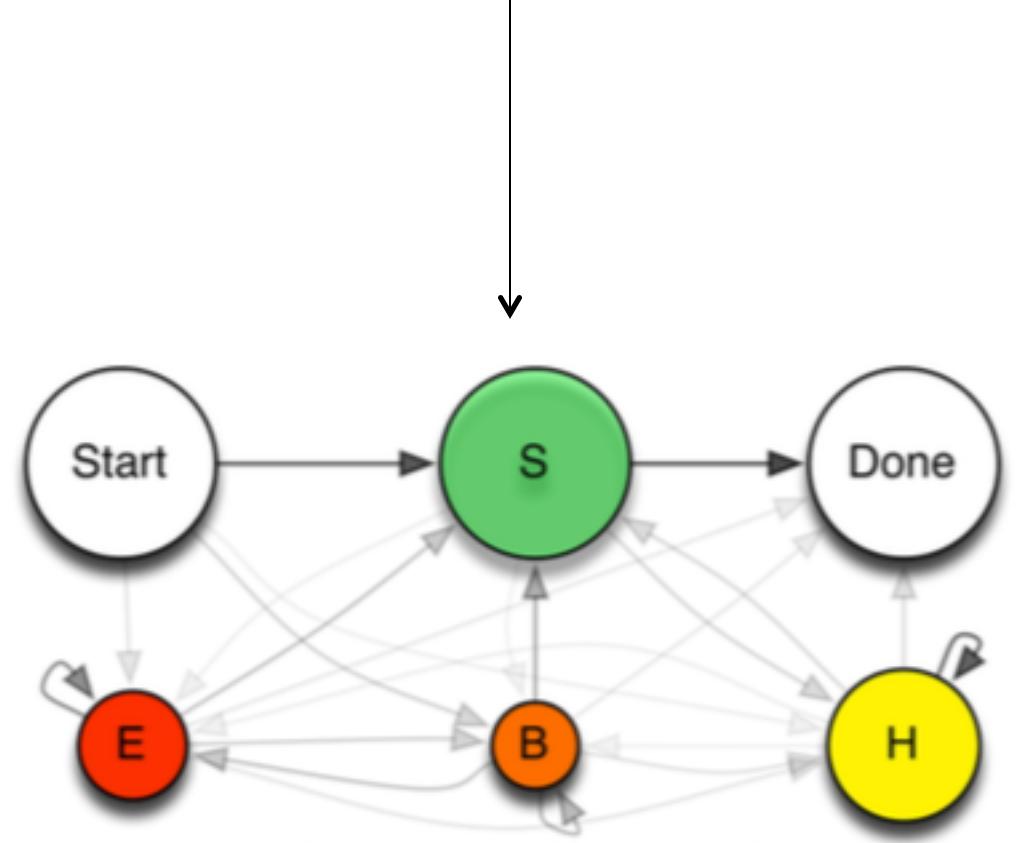
How might different instructional conditions influence the use of strategies?

How does practice change the use of strategy?

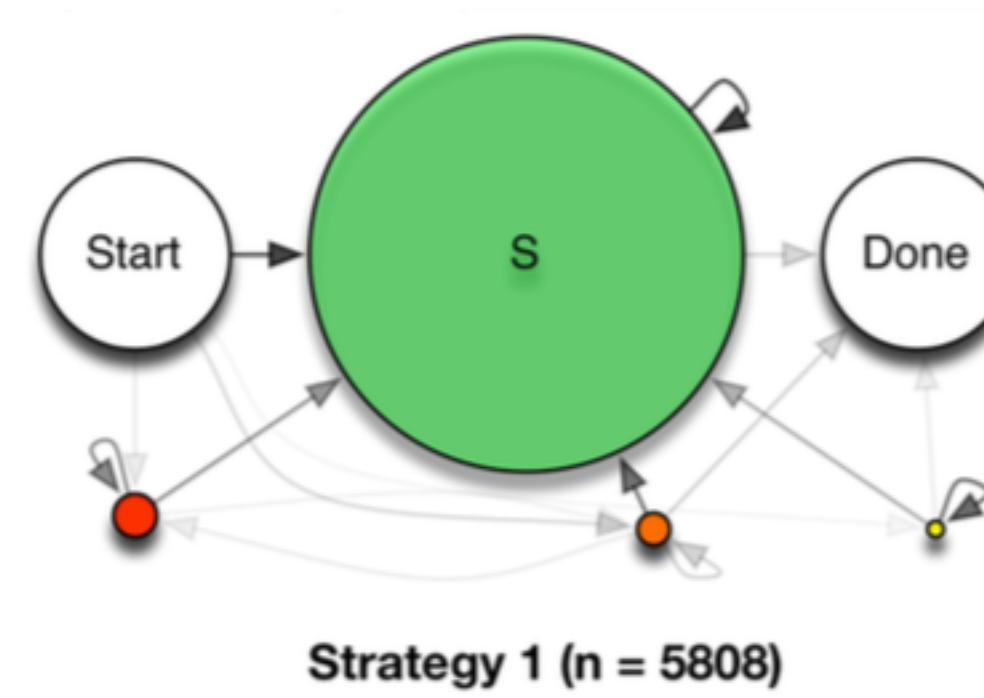
Strategy Detection Method

- Code the data for the meaningful actions action sequences
- Initialize an HMM capturing all actions and transitions between
- Compute the pairwise distance between the action sequences
- Identify clusters within this distance matrix

Subject43 item2:	Subject57 item6:
Success	Success
Bug	Success
Hint	Done
Success	
Done	



Identified Help Seeking Strategies

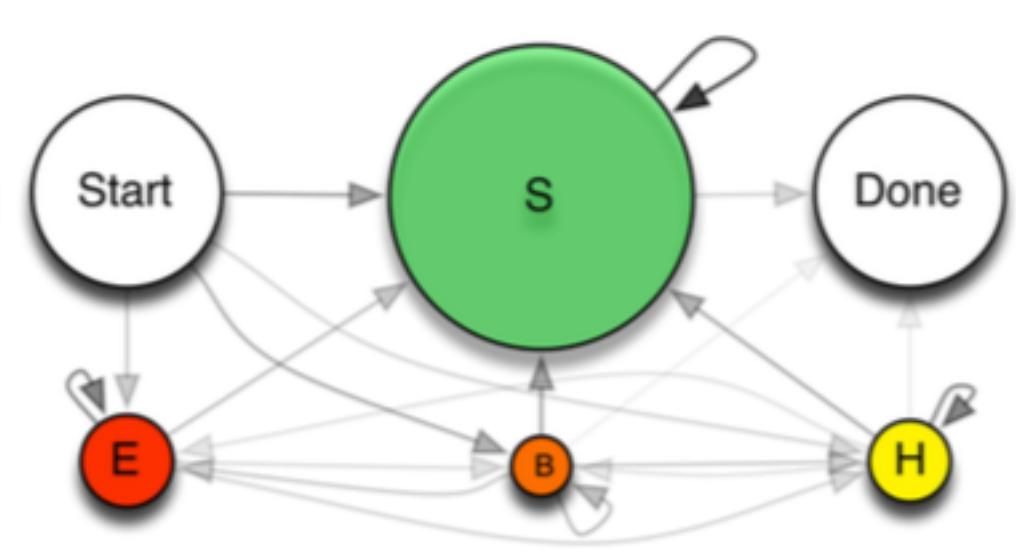


(DI= 2886, DM=2922)

Strategy 1:

Problem solving sequences in which most actions are successful.

Use of errors, bugs, and hints feature a high rate of immediate return to successful actions

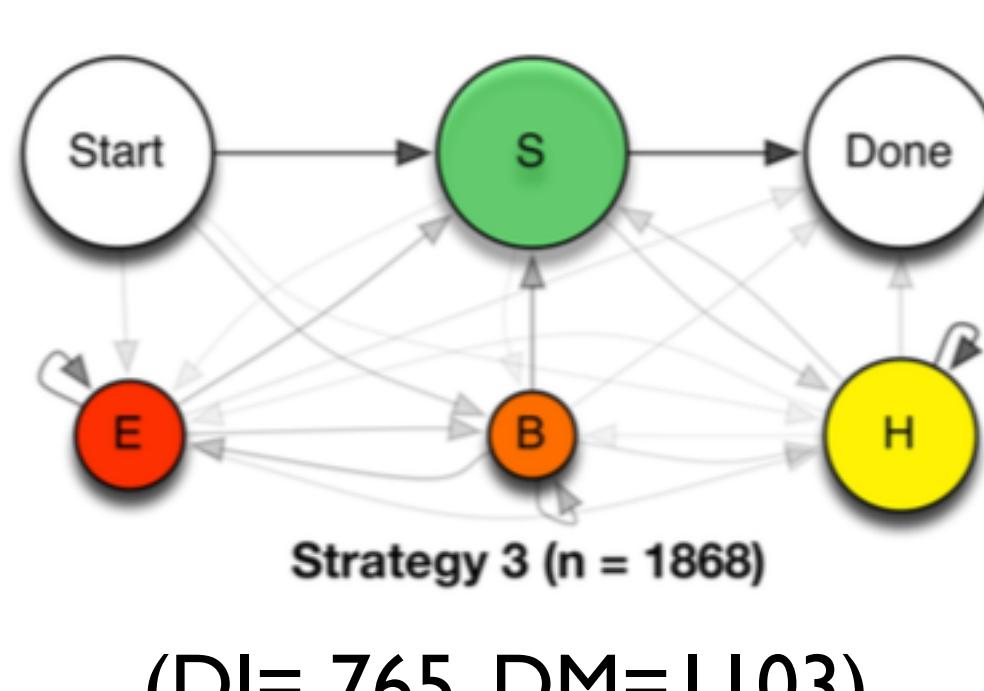


(DI= 1890, DM=1405)

Strategy 2:

Problem solving sequences that have a high likelihood of starting with the student asking for a hint or producing a bug or error.

High rate of return to success suggests that these students benefit from the help they receive



(DI= 765, DM=1103)

Strategy 3:

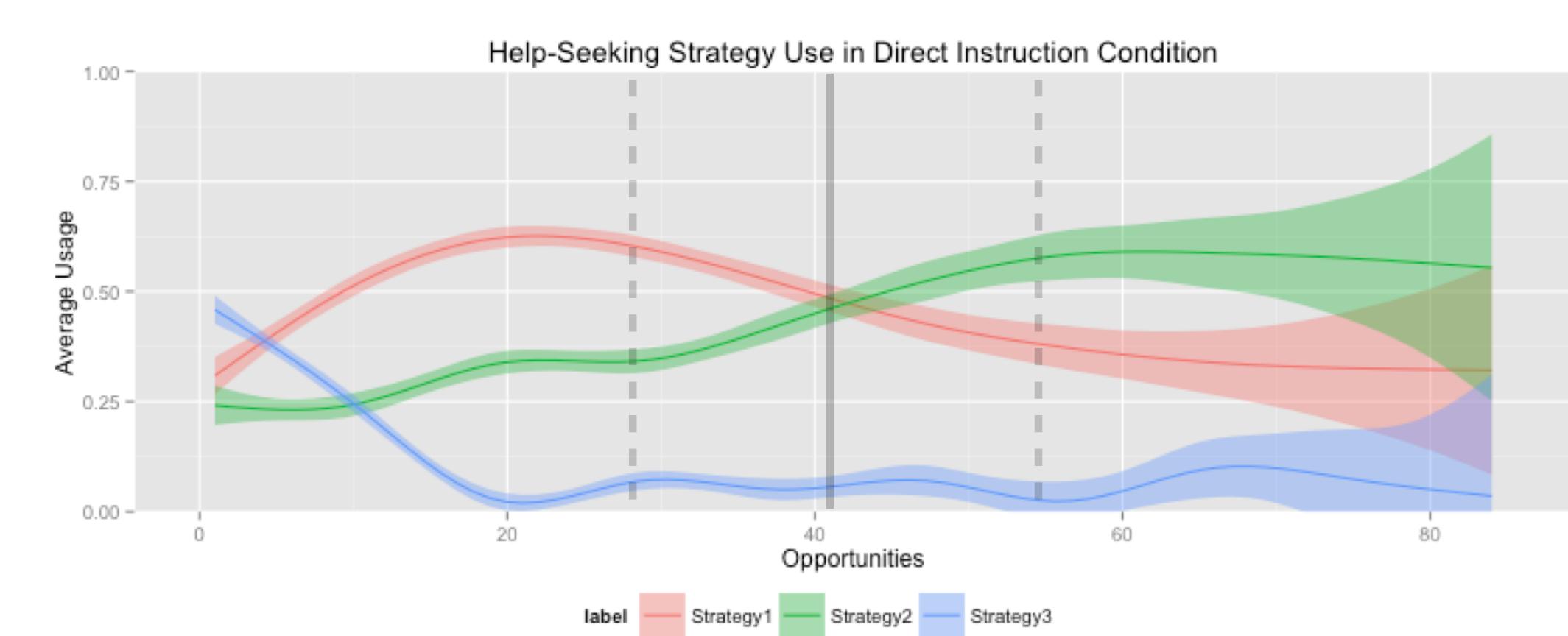
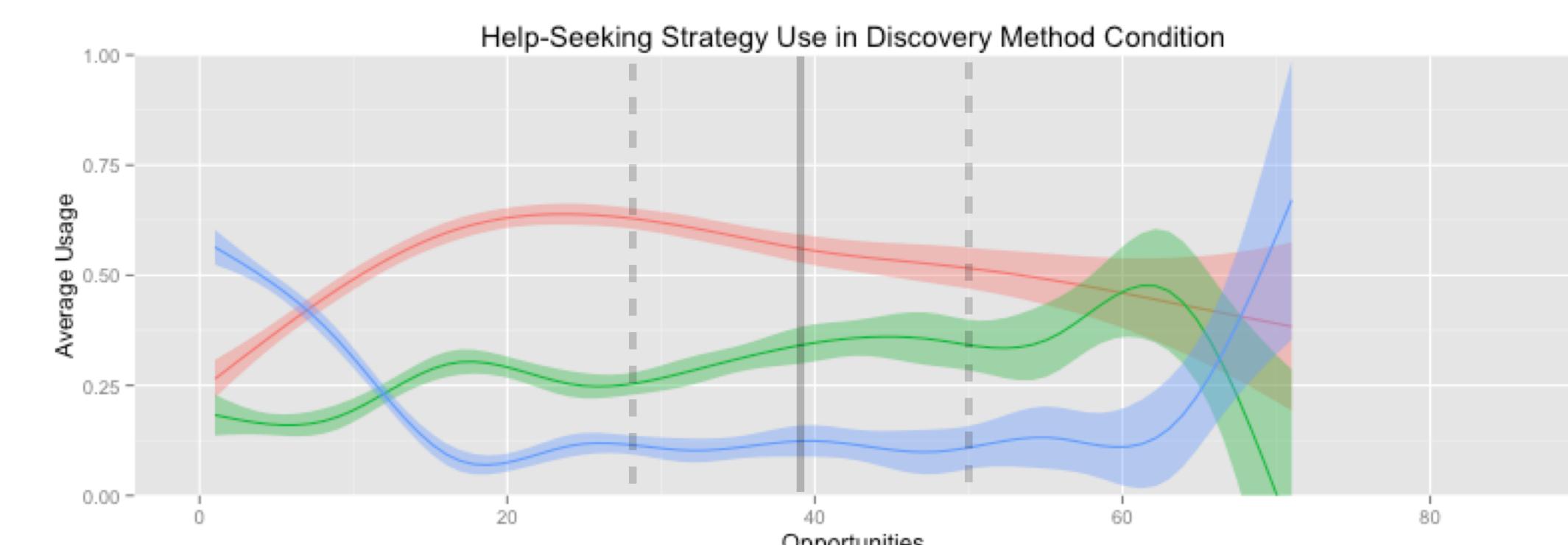
Captures early review of one-step equation solving

Later problems represent students floundering between errors, bugs and hints.

Strategy Use Over Time

Mixed-effects modeling

$$\text{Strategy} \sim \text{Condition} * \text{Practice opportunity} + (\text{I}|\text{Student}) + (\text{I}|\text{Problem})$$



Strategy 1: The rate at which SI is used in the tutor differs between conditions, increasing more with practice in the DM condition than the DI condition

Strategy 2: The significant increase of this strategy with practice suggests that as problems in the unit become more difficult students require help in how to start solving the problem

Strategy 3: The significant difference with more students in the DM condition using this strategy than the DI condition may be an indication of floundering

Acknowledgements

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*** Carnegie learning statement too