Examination of students' self-monitoring in problem solving

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For solving problems, especially ill-structured ones, a solver must employ metacognitive strategies, especially self-monitoring, to be successful. To better understand this self-monitoring process, as well as improve class activities, we examined students' recorded think alouds and thus far have identified three categories.

Introduction

Employers rate problem solving as one of the top five "very important" skills for job success; yet only 28% classify college graduates' problem solving as excellent.

In class, students tend to be presented with questions that are well-structured, but later in the workforce they are often tasked with solving problems that are missing necessary information, or contain ambiguous information. Most textbooks and instructors do not model the non-linear thinking and decision-making required to solve ill-structured problems.

Planning, monitoring, analyzing errors and adjusting one's own work, are essential skills for navigating through complex solutions. Self-monitoring is perhaps the most important subprocess as it initiates self-regulation.

Self-monitoring can...
... focus a solver's attention on specific tasks.
...generate feedback of what is working and what could be revised.
...guide a solver to a more efficient pathway.

Methods

Students enrolled in an algebra-based mechanics course were asked to periodically submit recorded problem solutions where they verbalized their thought process. Each student was given a Livescribe smartpen and accompanying notebook with which to record their these solutions. We examined the recorded think-aloud solutions for evidence of self-monitoring events. Using grounded theory, we put these events into categories.

Self-Monitoring 1: Checking for external consistency

This is when a solver compares an element of her problem solution (eg a value or a step) with something that she has done previously in another problem or with a real-life scenario.

- "It makes sense to me though… I mean all the static of coefficients we have been dealing with seem to be in this range… "
- "I guess we're not dealing with world class sprinters. I know a little track and I'm pretty sure that's pretty slow."

Self-Monitoring 2: Checking for internal consistency

In these monitoring events, a solver compares an element of her solution to something that has been done previously in the same solution.

- "The negative doesn't matter because of the way I set up the axes."
- "hmmm… interesting… 81.25m… interesting… how to reconcile these two…"
- "That actually kinda makes sense since his top speed is 11.7 and the average is going to be between zero and his top speed."

Self-Monitoring 3: Assessing readiness

Solvers can evaluate whether the solution path is the correct or most efficient. Essentially, they pause before stepping forward so they may imagine what will happen next.

- "We could figure out angular acceleration. Does that help us? Is the question. Does angular acceleration help us? Yes! It does….'cause the net force is also equal to…"
- "Oh we don't know v_f either. So there's two variables in here. Let's see if we can find one where we just have one."
- "We don't have change in y, I wonder if that would be helpful…maybe that would help us find an angle."

Conclusions

These self-monitoring categories allow us to compare the differences in expert and novice problem-solvers' self-monitoring types. By better understanding the self-monitoring process we also expect to provide improved instruction for students as we can now identify specific, and effective, ways that they can make decisions.

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Work supported by NSF
TUES-1044062