Investigating Students’ Transfer of Problem Solving Skills in Physics Across Multiple Representations

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Motivation

Gain insights into…
- the processes by which students’ transfer their…
- problem solving skills across multiple representations in physics
- mathematical knowledge and skills to physics problems.
- the ways in which we can facilitate these transfer processes.

Methodology

- Individual Teaching/Learning Interviews (N=20)
- Students solved problems in different sequences of representations.
- Scaffolding (hints, questions) provided when difficulties encountered.
- Data analyzed to gauge effectiveness of scaffolding to facilitate transfer.
- Ongoing: Develop appropriately sequenced problems to facilitate transfer.

Research Questions

- RQ1: What kinds of barriers do students encounter when transferring their problem solving skills across multiple representations?
- RQ2: What kinds of scaffolding are useful in facilitating students to transfer their problem solving skills across multiple representations?
- In what ways does the sequence in which representational scaffolding is presented affect students’ ability to transfer their problem solving skills?

Theoretical Perspective

Vygotsky’s (1978) Zone of Proximal Development (ZPD)
- ZPD is the distance between what learners can accomplish by themselves and what they can accomplish with assistance (scaffolding) from another more experienced individual.

Research Context

- Undergraduate Engineering majors at K-State
- Longitudinally follow students …
- from calculus course sequence
- to calculus-based physics course sequence.

Some Early Results

- After verbal problem, fewer difficulties on graphical problem compared to equation problem ($\alpha = 0.1$ significance).
- Solving the graphical problem before the equation problem decreased the difficulties in solving the equation problem ($\alpha = 0.1$ significance), but converse not true.

Graphical

What is the speed of the ball at launch point A? First Problem (Verbal)

Equation

$F(x) = 1000x + 3000x^2$

Beyond Students’ ZPD

Students’ ZPD

(Problems they solve with assistance)

Scaffolding provided to learner in form of verbal hints and Socratic dialog

Students’ Zone of Capabilities

(Problems they solve without assistance)

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