Facilitating Strategies for Solving Work-Energy Problems in Graphical and Equational Representations

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This work is supported in part by the US National Science Foundation under grant 0816207.

1. MOTIVATION

- In our previous study [1], we found that:
  - Students encountered a variety of difficulties when solving problems in graphical and equational representations.
  - These difficulties were primarily due to students’ inability to activate the required mathematical knowledge in the context of a physics problem.

- In this study:
  - We developed problem sets aimed at facilitating the activation of required mathematical skills to solve physics problems in graphical and equational representations.

2. RESEARCH QUESTION

Can a research-based sequence of math, physics and non-traditional problems improve students’ ability to solve physics problems in graphical and equational representations?

3. METHODOLOGY

Focus Group Learning Interviews (FOGLI)’s [2]

- Pre-test/post-test Control Group Design
- 20 engineering students enrolled in a calculus-based physics course were randomly assigned into either a control group (8 students) or treatment group (12 students)
- Students attempted a pre-test, a problem set prepared by the researchers and a post-test similar to the pre-test.
- Problem set for the treatment group included:
  - two pairs of matched math and physics problems
  - one debate problem
  - two problem posing tasks [3]
- Problem set for the control group included isomorphic textbook problems covering the same topics and principles.
- Students worked individually on the pre-test and post-test and worked in pairs on the problem set.
- Students in the control group were provided with a printed solution of each problem while students in the treatment group were required to check in with a moderator before proceeding to the next problem.

4. INTERVIEW PROBLEMS

4.1. Problem set for the control group in FOGLI session 3

4.2. Problem set for the treatment group in FOGLI session 3

5. RESULTS

- Problems in the pre-test and post-test graded separately on the physics part and the representation part.
- The non-parametric Mann-Whitney test used to test significance of the difference in scores between control and treatment groups.

5.1. Mann-Whitney for physics scores

6. CONCLUSIONS

Initial results suggest that our research-based sequence of problems has a positive effect in improving students’ performance on the representation aspect of problems, while it is not as effective in improving students’ performance on the physics aspect of problems.

7. REFERENCES