Applying a Simple Rubric to Assess Student Problem Solving

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INTRODUCTION

Problem solving skills (qualitative and quantitative) are a primary tool used in most physics instruction. Despite this importance, a reliable, valid, and easy to use quantitative measure of physics problem solving does not exist.

The goal of the project is to develop a robust, easy to use instrument to assess students’ written solutions to physics problems and obtain evidence for reliability and validity. The instrument should be general (not specific to instructor pedagogy) and applicable to a range of problem types and topics.

This poster describes a test of the utility of the rubric:
- Does the rubric give more useful information about student difficulties than standard grading?
- Does the rubric give information about improving the problem statement?

(Figure showing the rubric)

A useful description is a summary of the essential problem information visually, symbolically, and/or in writing.

A physics approach is selecting appropriate physics concepts and principles to use.

A specific application of physics is applying the concepts and principles appropriately.

Mathematical procedures are following appropriate mathematical rules and procedures during problem solving.

A logical progression is that the solution progresses logically; it is coherent, focused toward a goal, and consistent.

EXAMPLE TEST QUESTION

Problem 1: Show all work! The system of three blocks shown is released from rest. The connecting strings are massless, the pulleys ideal and massless, and there is no friction between the 3 kg block and the table.

(A) At the instant M3 is moving at speed v, how far (d) has it moved from the point where it was released from rest? (answer in terms of M1, M2, g and v)

GRADE DISTRIBUTION

- 69%: 4
- 30%: 3
- 1%: 2

FINDINGS

The rubric indicates areas of student difficulty for a given problem. For example, the most common student difficulty involves specific application of physics whereas other categories are adequate.

For more detailed information on coaching and problem writing, examine the solutions for specific application of physics (see the table of common student responses).

The rubric responds to different problem features. For example, in this problem visualization skills were not measured.

REFERENCES