Project outline for computational assessment

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April 1, 2017

Assessing Computational Understanding in Physics

Rationale

- Systematic measurement of student understanding is essential for evaluating movement towards more computational instruction
- Partners (i.e., PICUP and faculty collaborators) are grokking for some form of systematic assessment in specific classes
- Assessments can help drive further research investigations including comparative and longitudinal studies
- The development of these assessments can lead to high visibility of the centre

Assessing Computational Understanding in Physics

Product

- A suite of assessments of computational understanding in physics that are:
  - developed for specific courses, yet broadly applicable,
  - informed by observed student understanding,
  - grounded in faculty-articulated learning goals,
  - developed using strong theoretical grounding and methodology, and
  - deployed in a centralized way to facilitate community-level research.

Principles of Development

- Course-specific
- Broad applicability
- Informative about student understanding
- Informative to and valuable for faculty
- Strong theoretical basis for design and measurement

Principles of Development

Course-specific

- Goals for including computation and thus assessments are tied to specific learning outcomes for courses
- Course content is one such aspect, but others include the expectation of more advanced and deeper understandings of the same algorithms and tools
- As different courses vary in their depth and focus, overlapping course content should be evaluated (lowest-common denominator assessment)

Principles of Development

Broad applicability

- Assessments developed for specific courses should emphasize common content and topics (i.e., overlapping learning goals)
- Broader applicability of the assessments will lead to broader use of the assessments
- Can support developing a wealth of understanding about implementation and demographic effects

Principles of Development

Informative about student understandings

- Assessments should provide information beyond the percentage of students answering correctly
- Selected assessment stems should provide information about what understandings students are holding in the moment
- Stems should be drawn from expressed understandings of students
- Validation of the assessments must include discussion with students

Principles of Development

Informative to and valuable for faculty

- As such assessments are meant to inform faculty about changes made to their won courses, these assessment development must involve faculty
- Learning outcomes that will be evaluated must be drawn from faculty teaching specific courses
- Validation of the assessments must include discussion with faculty
- Centralized deployment and analysis can ensure minimal impact on faculty time

Principles of Development

Theoretical and Methodological Grounding

- Interviews with students and faculty will explore the variation in understanding and faculty learning goals (Phenomenographic approach)
- Continuous validation of items against student understanding and faculty learning goals as assessments are constructed
- Assessment design will make use of appropriate measurement theory (Rasch model)