Beyond the FCI

Towards a fairer Force Concept Inventory

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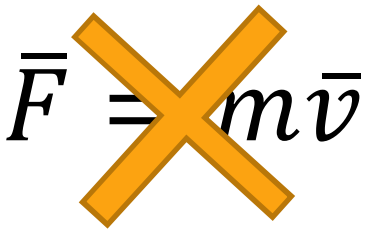
Force Concept Inventory



- FCI (Hestenes et al, 1992) is used in a large part of the US and elsewhere as a diagnostic assessment
  - Pre and post instruction - what (concepts) did the students learn
  - Based on “common misconceptions”, such as constant force = constant speed, impetus etc
  - Translated to many languages
    - But is it really appropriate for physics majors elsewhere?

We need a new test

- Traxler *et al.* (2018): Reduced FCI with smaller gender gap and better working items
- Reduced FCI from makes gender gap smaller in UH but not in NBI data
  - saturates
- Can we have a test which is
  - Hard enough?
  - Fair(ish)?
  - Works for a high-achieving student population?
  - Somewhat comparable to FCI?

The process

FCI data from UH ($N = 177$) and NBI ($N = 779$)

What can we use?

Difficulty: Classical test theory item discrimination

Identify hard items that differentiate between better and worse students

Fairness: Mantel-Haenzel statistics

Identify items that have smaller gender gaps $|\Delta_{MH}| > 2$

Reduced set of FCI items

New concepts: conservation of energy & momentum, CoM

Harder questions on Newtonian forces

Beyond FCI