

# A Gender Context for the Force Concept Inventory

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# The Force Concept Inventory



- ⌘ The FCI is a 30-question multiple choice conceptual exam covering topics in first term introductory physics.
- ⌘ Many instructors use the FCI as a measure of student improvement in introductory physics courses.

# Women and the FCI

- ❧ At several schools, women do more poorly on the FCI than men do.
- ❧ The FCI is sometimes used as a placement test, or as part of a student's grade. If there is a systematic bias, women could suffer educationally.
- ❧ The FCI could also be serving as a barrier to women interested in physics.
- ❧ *Why do women do more poorly?*

Perhaps it's the test...

↳ It is possible that the test itself is inherently biased towards men. There is some research that suggests that context of questions can affect students' performance.\*

↳ How could we test if the FCI is gender-biased in its contexts?

↳ ***Create a different version of the FCI with different contexts!***

\*Rennie & Parker. Placing Physics Problems in Real-Life Context. *Aust. Sci. Teach. J.* 42(1) 55-60. 1996.

Rennie & Parker. Assessment of Learning in Science. *Aust. Sci. Teach. J.* 37(4) 56-59. 1991.

Enderstein & Spargo. Effect of Context, Culture & Learning... *Int. J. Sci. Educ.* 20(6) 711-736. 1998.

# A Gender FCI



↳ Instead of school- and male-oriented contexts, real-life- and female-oriented contexts were chosen.

↳ Examples:

Projectiles: Instead of a cannon shooting a cannonball, a baby knocks a bowl off of her high chair tray.

Gravity: Instead of a boy throwing a stone in the air, a girl throws a teddy bear.

↳ The physics is identical—only the context has changed.

# Testing the Test



↳ Students took both versions of the test at different times during the first week of the term. Their matched tests can be compared question by question, and overall.

↳ Interesting questions:

Which test produces more correct answers?

Does one gender do better on one version?

Does taking one test first make a difference?

# How Do the Tests Compare?

& Gender average: 35.3%  
Original average: 30.8% (N=61)

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& Of those who took the gender test first:  
Gender average: 39.1%  
Original average: 34.7% (N=20)

& Of those who took the original test first:  
Gender average: 33.5%  
Original average: 28.9% (N=41)

# Question by Question



Question by question, there was a large difference in which test produced more correct answers.

## Original:

A woman exerts a constant horizontal force on a large **box**. As a result, the box moves across a horizontal floor at a constant speed  $v_0$ . If the woman suddenly stops applying a horizontal force to the box, then the box will:

- (a) immediately come to a stop.
- (b) continue moving at a constant speed for a while and then slow to a stop.
- (c) immediately start slowing to a stop.
- (d) continue at a constant speed.
- (e) increase its speed for a while and then start slowing to a stop.

**About 65% of students responded correctly.**

## Gender:

A woman exerts a constant horizontal force on a large **couch**. As a result, the couch moves across a horizontal floor at a constant speed  $v_0$ . If the woman suddenly stops applying a horizontal force to the couch, then the couch will:

- (a) immediately come to a stop.
- (b) continue moving at a constant speed for a while and then slow to a stop.
- (c) immediately start slowing to a stop.
- (d) continue at a constant speed.
- (e) increase its speed for a while and then start slowing to a stop.

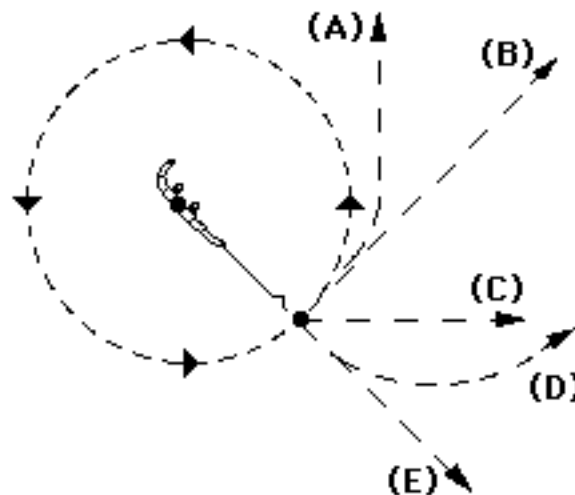
**About 58% of students responded correctly.**



**Original: About 59% of students responded correctly.**

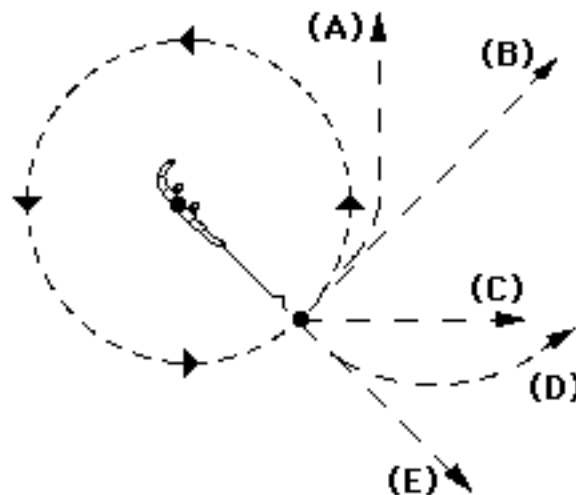
A steel ball is attached to a string and is swung in a circular path in a horizontal plane, as illustrated in the accompanying figure. At the point P indicated in the figure, the string suddenly breaks near the ball.

If these events were observed from directly above as in the figure, which path would the ball most closely follow after the string breaks?



**Gender: About 73% of students responded correctly.**

A heavy medallion attached to a long string of beads is swung in a circular path in a horizontal plane, as illustrated in the diagram below. At the point indicated in the diagram, the string suddenly breaks at the medallion. If these events were observed from directly above, indicate the path of the medallion after the string breaks.



# Women and Men



## ⌘ Average scores for women:

Gender average: 35.1%

Original average: 24.4% (N=9)

## ⌘ Average scores for men:

Gender average: 35.3%

Original average: 31.9% (N=52)

# Conclusions



- On average, students scored better overall on the gender version of the test.
- Question by question, there was a large difference in student responses between the tests.
- Women's gain on the gender version was much greater than men's gain on the gender version.
- *So, the context of the test can make a difference! It may be possible to create a test that decreases the gender gap.*

# Interested?



⌘ This is very preliminary data!

⌘ If you are interested in helping pilot-test this version of the FCI, please contact me at [mcculloughl@uwstout.edu](mailto:mcculloughl@uwstout.edu).

# Gender Threat a la Steele?

- It is possible that the male contexts of the FCI serve as a subtle gender “threat” which could lower women’s scores and raise men’s scores.
- In many institutions, the FCI is given on bubble sheets, which often have a male/female question in the introductory demographics. This also could be contributing to a possible gender threat.