

Gender gaps in a first-year physics lab

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preview

1. our students

preview

1. our students
2. concise data processing assessment (CDPA)
 - pre-test and post-test results

preview

1. our students
2. concise data processing assessment (CDPA)
 - pre-test and post-test results
3. standard measures of learning gain
 - and pitfalls

first-year introductory physics lab at UBC

- calculus-based course, for those with an interest in physical sciences
 - nature of measurement and uncertainty
 - handling data

first-year introductory physics lab at UBC

- calculus-based course, for those with an interest in physical sciences
 - nature of measurement and uncertainty
 - handling data
- data collected over 5 years, 130—145 students/year, 671 matched pairs
 - female representation 37—44%

CDPA

Phys. Rev. ST Phys. Educ. Res. **7**, 010114 (2011)
<https://www.physport.org/assessments>

CDPA

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example learning goal

Weigh the relative importance
of numbers that have
differing uncertainty.

CDPA

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example learning goal

Weigh the relative importance of numbers that have differing uncertainty.

example question

Student A measures the flow rate of water coming from a tap and reports it to be (90 ± 12) millilitres per second.

Student B follows a different measurement procedure and reports the flow rate to be (110 ± 1) millilitres per second.

How long would it take to fill a 1 litre container?

CDPA

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example learning goal

Weigh the relative importance of numbers that have differing uncertainty.

example question

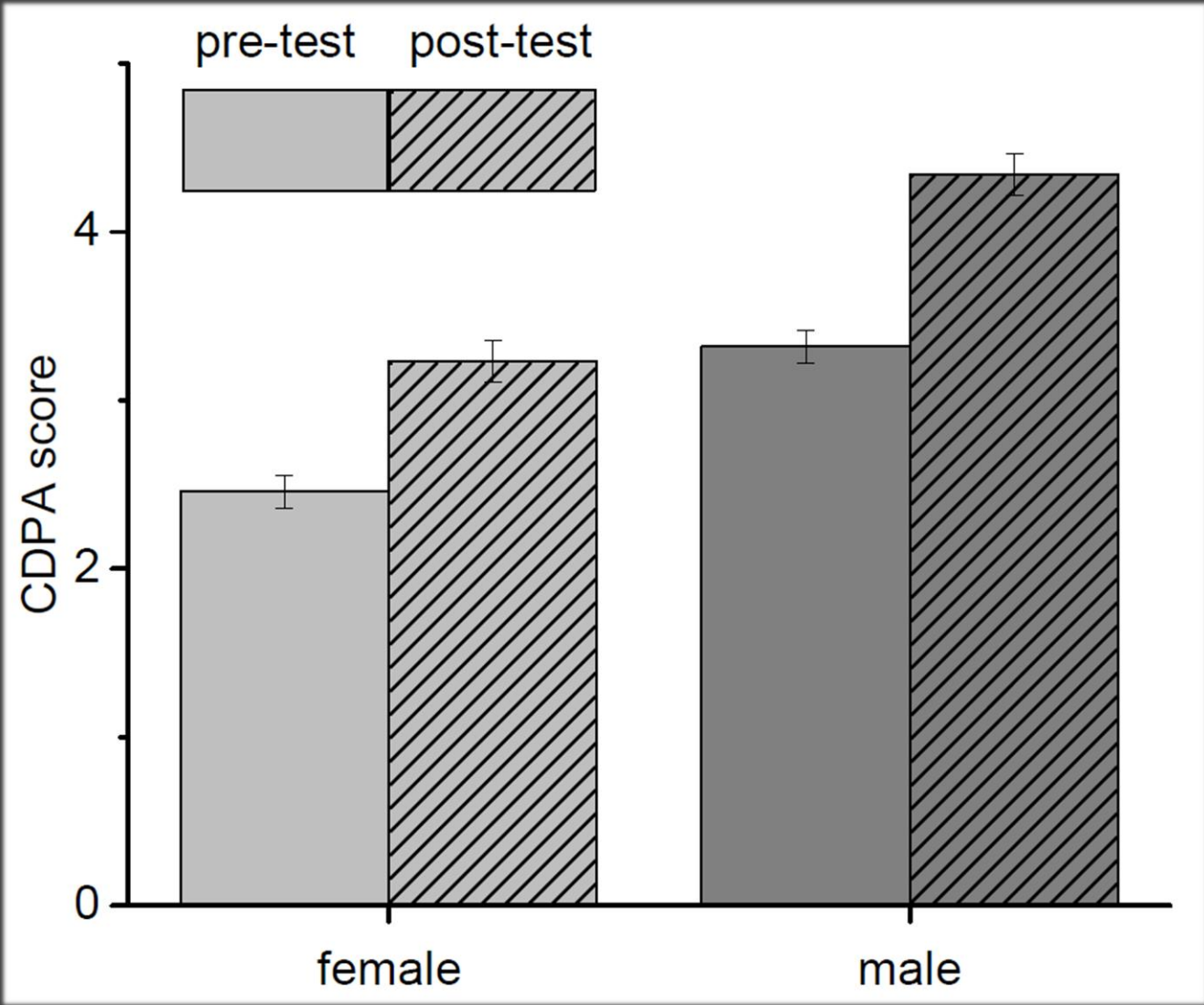
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How long would it take to fill a 1 litre container?

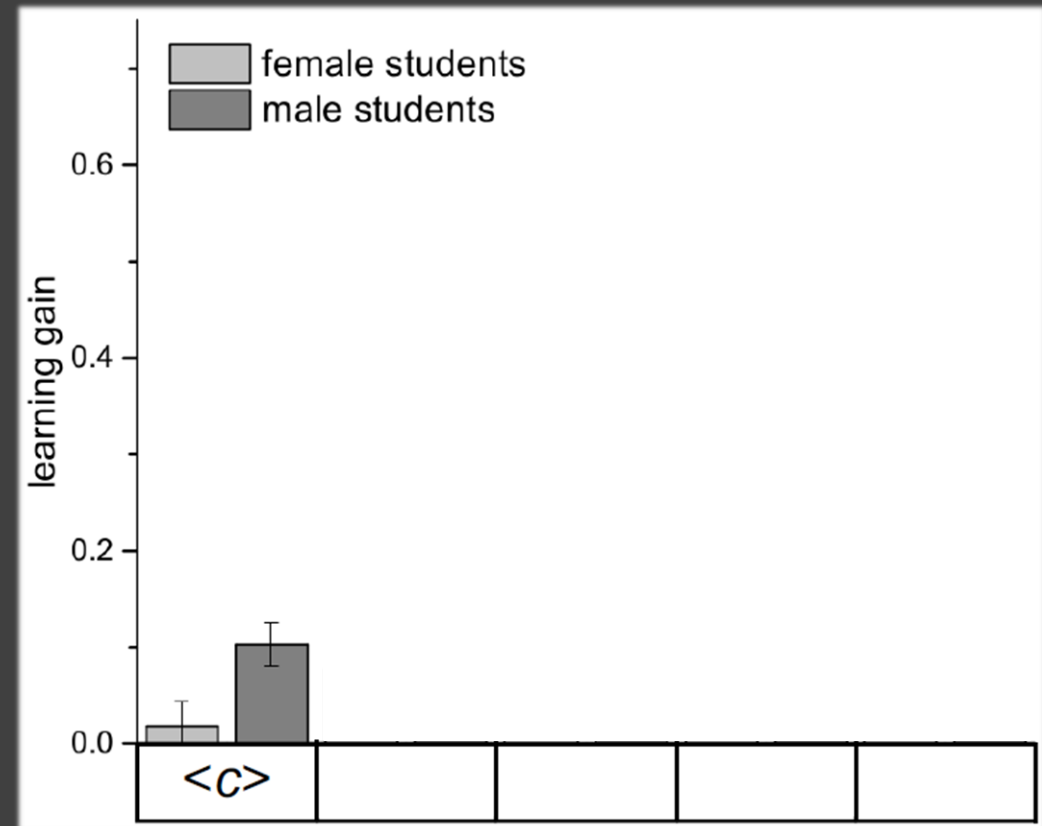
- (a) 10.0 s
- (b) 9.1 s
- (c) 11.1 s
- (d) 9.5 s
- (e) 10.6 s

pre-test and post-test
CDPA results



measuring learning gain

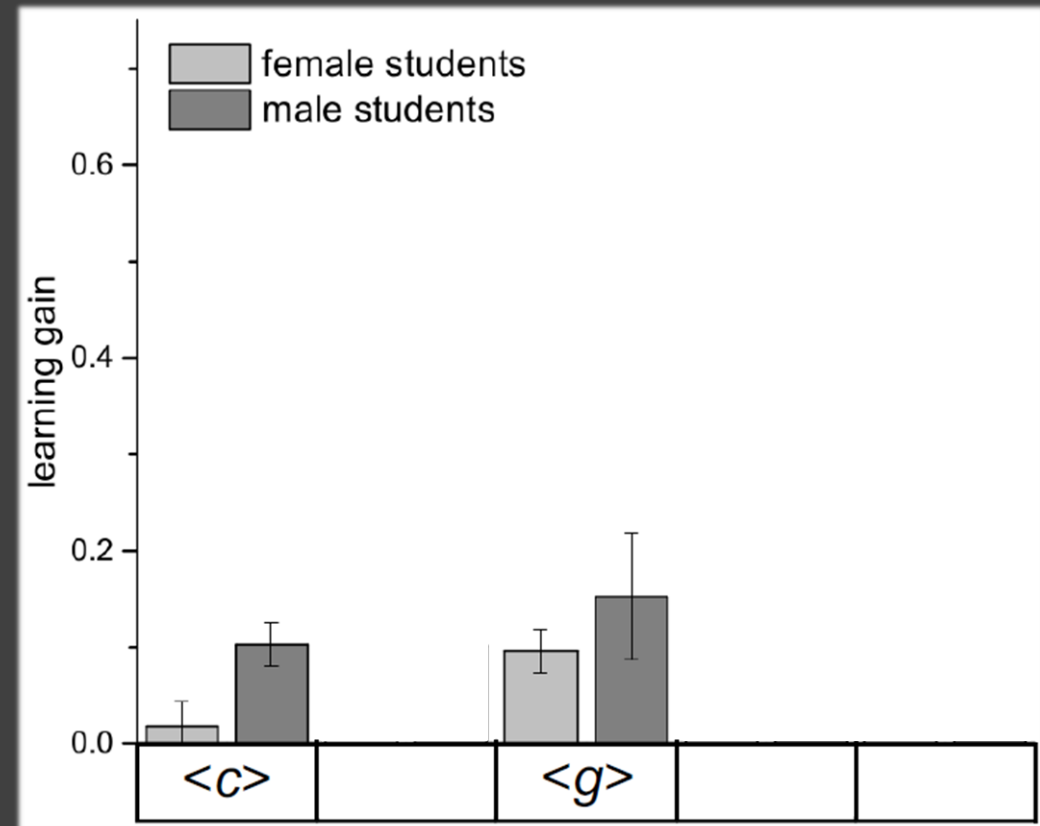
$$c = \begin{cases} (post - pre)/(max - pre), & \text{if } post > pre \\ \text{drop,} & \text{if } post = pre = max \text{ or } 0 \\ 0, & \text{if } post = pre \\ (post - pre)/(pre), & \text{if } post < pre \end{cases}$$



measuring learning gain

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$$\langle g \rangle = (\langle post \rangle - \langle pre \rangle) / (max - \langle pre \rangle)$$

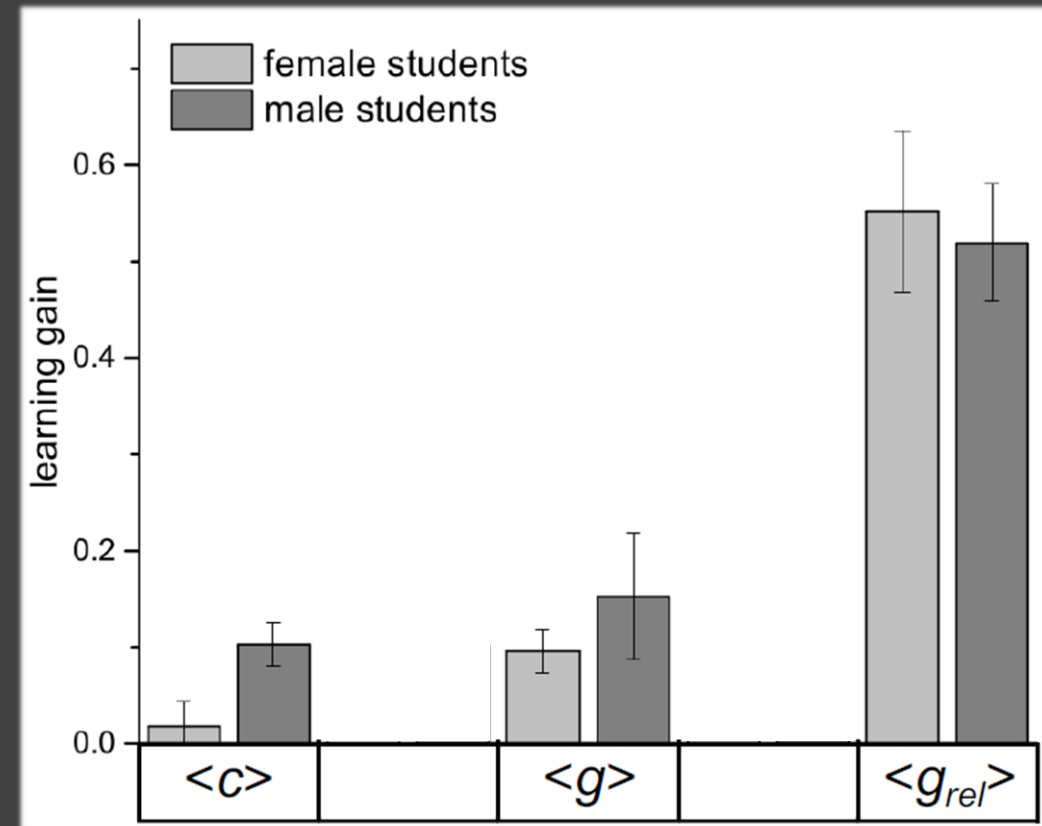


measuring learning gain

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$$\langle g \rangle = (\langle post \rangle - \langle pre \rangle) / (max - \langle pre \rangle)$$

$$g_{rel} = (post - pre) / (pre)$$



measuring learning gain

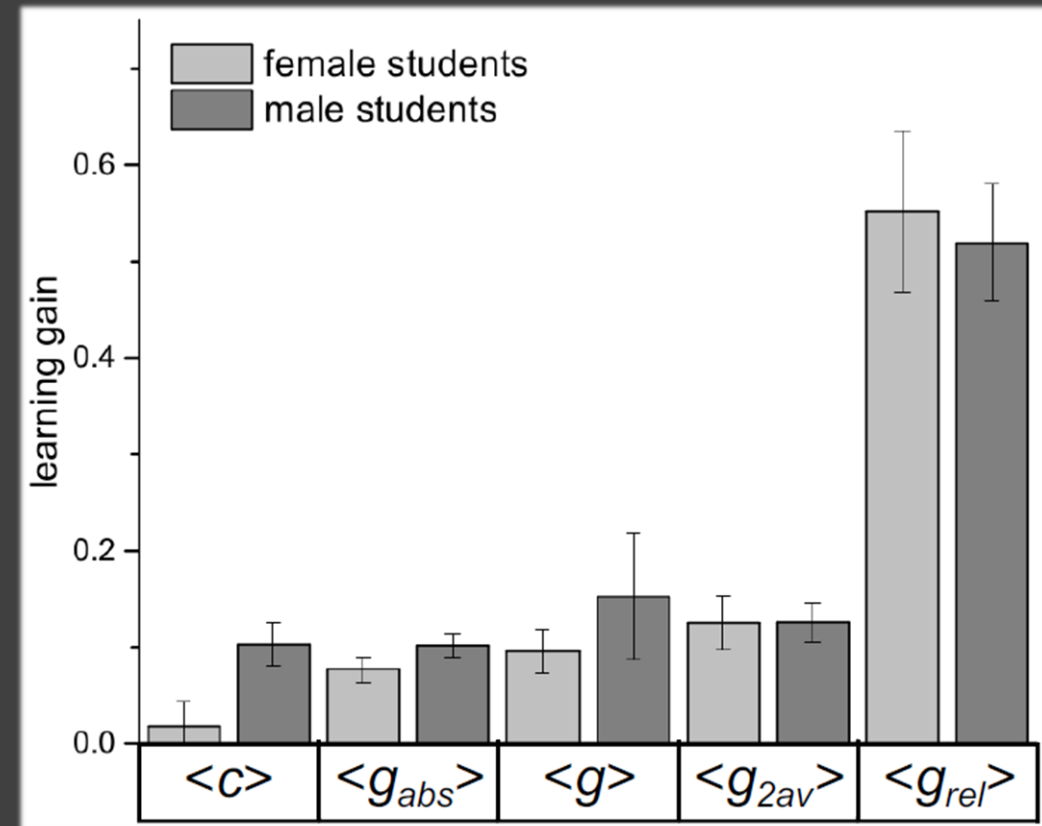
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$$g_{abs} = (post - pre)/(max)$$

$$\langle g \rangle = (\langle post \rangle - \langle pre \rangle)/(max - \langle pre \rangle)$$

$$g_{2av} = (post - pre)/(post + pre)$$

$$g_{rel} = (post - pre)/(pre)$$



measuring learning gain: use caution

Astro. Ed. Rev. **6**, 25 (2007)
Am. J. Phys. **77**, 651 (2009)



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We have
NO
evidence that
female
students are
less capable of
learning than
male peers.