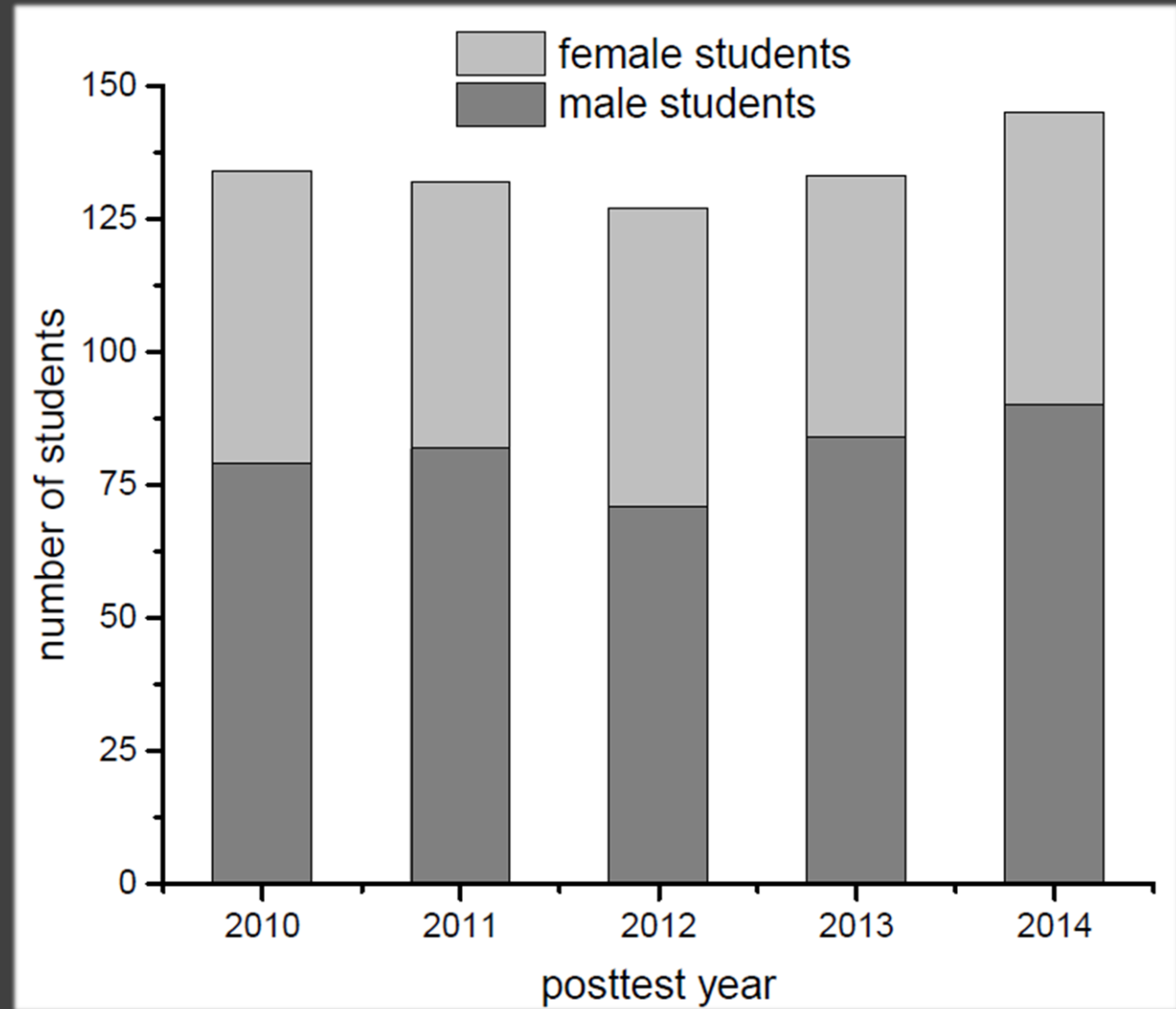


Gender gaps in a first-year physics lab

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first-year introductory physics lab at UBC



CDPA

Phys. Rev. ST Phys. Educ. Res. **7**, 010114

<https://www.physport.org/assessments/Assessment.cfm?I=55&A=CDPA>

example learning goal

Weigh the relative importance of numbers that have differing uncertainty.

example question

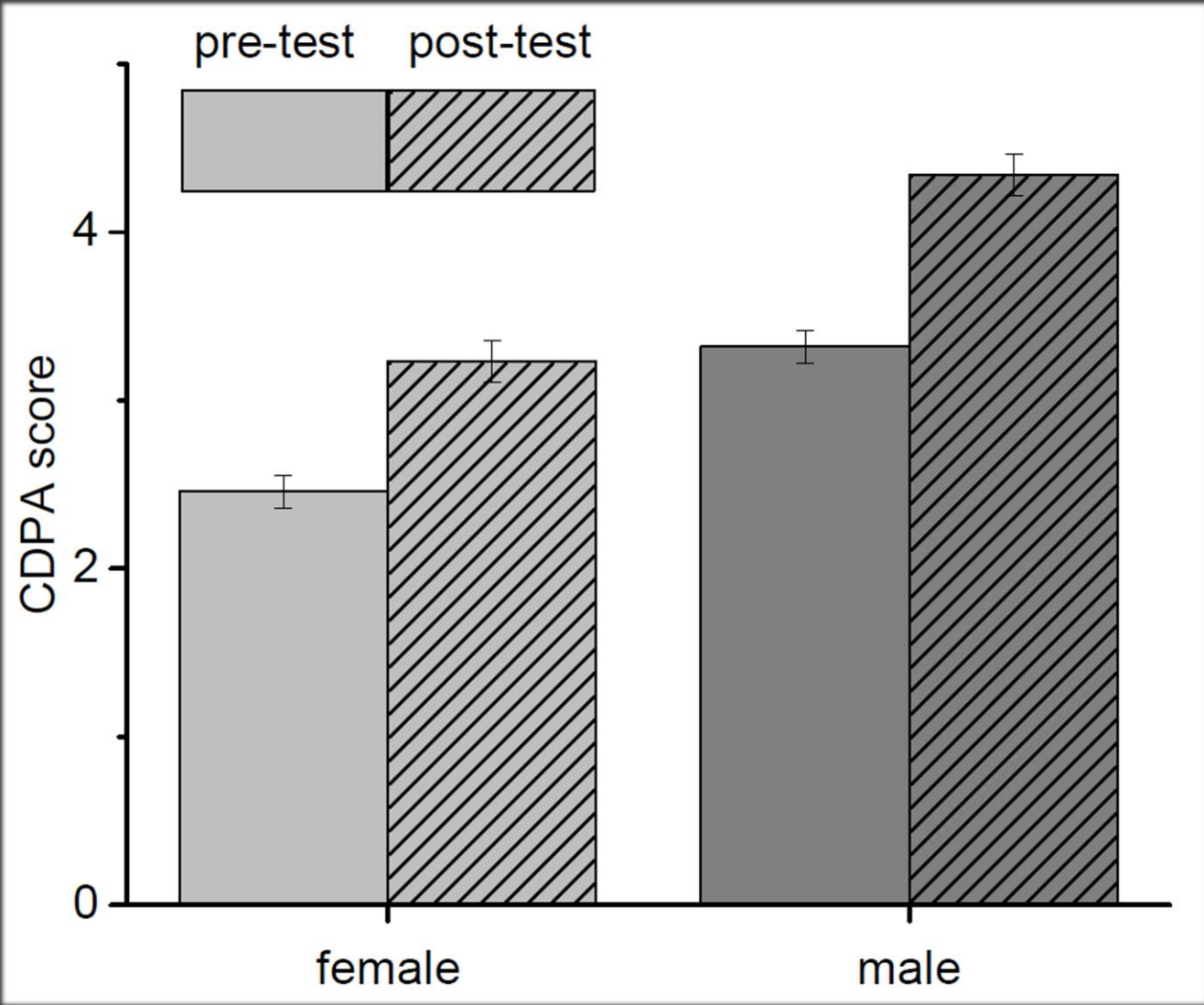
Student A measures the flow rate of water coming from a tap and reports it to be (90 ± 12) millilitres per second.

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?

- (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 results



measuring learning gain

(choose your own adventure)

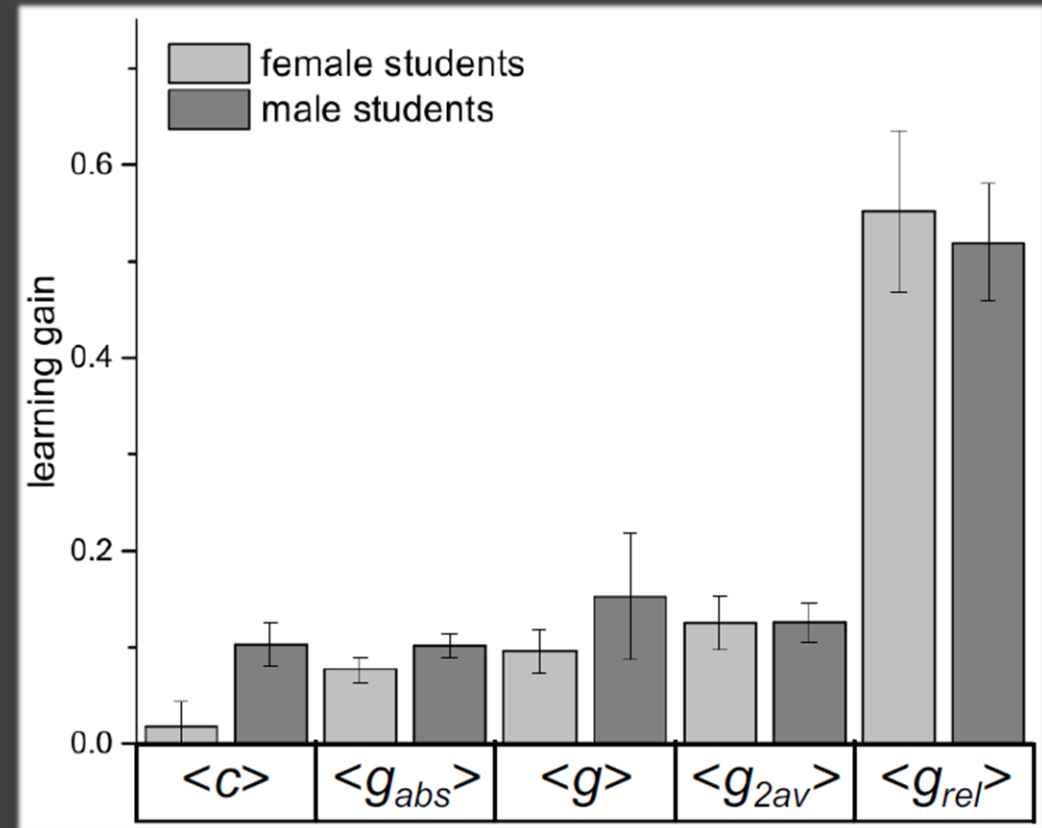
$$c = \begin{cases} (post - pre)/(max - pre), & \text{if } post > pre \\ \text{drop,} & \text{if } post = pre = max \text{ or } 0 \\ 0, & \text{if } post = pre \\ (post - pre)/(pre), & \text{if } post < pre \end{cases}$$

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

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

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

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



re-framing the question



Is there a gendered difference on post-test scores, after having controlled for some of the differences with which students begin the course?

~~Has one gender learned more than another?~~

analysis of covariance

		<i>unadjusted</i>		<i>adjusted</i>	
	N	mean	s.e.	mean	s.e.
male students	280	4.34	0.12	4.18	0.11
female students	191	3.23	0.13	3.46	0.13

The effect of gender is statistically significant $F(1, 468) = 16.86, p < 0.001$, partial $\eta^2 = 0.035$ but smallish in size, accounting for just 3.5% of the variance in the post-test scores.

The covariate of CDPA pre-test score has a significant impact on the difference observed between female and male students, accounting for 13.1% of the variance in the post-test scores.

How the students finish is largely predicted by how they started.

adding context

But small effects can be important:

- if they accumulate into larger effects
 - there is a gender gap on the pre-test
- if they trigger larger consequences
 - possible disengagement with physics

practical significance

main message

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

We urge caution when using gain measures to draw conclusions about differences in science classroom performance across gender.