

Classroom demonstrations



Professional Development Day
Episcopal Academy
Newtown Square, PA, 24 March 2023



Classroom demonstrations



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Lecture demonstrations

how effective are lecture demonstrations?



Lecture demonstrations

Carry out seven demonstrations in four “modes”:

- no demo (control)
- observe
- predict
- discuss

Lecture demonstrations

Carry out seven demonstrations in four “modes”:

- no demo (control)
- observe
- predict (+2 mins.)
- discuss (+8 mins.)

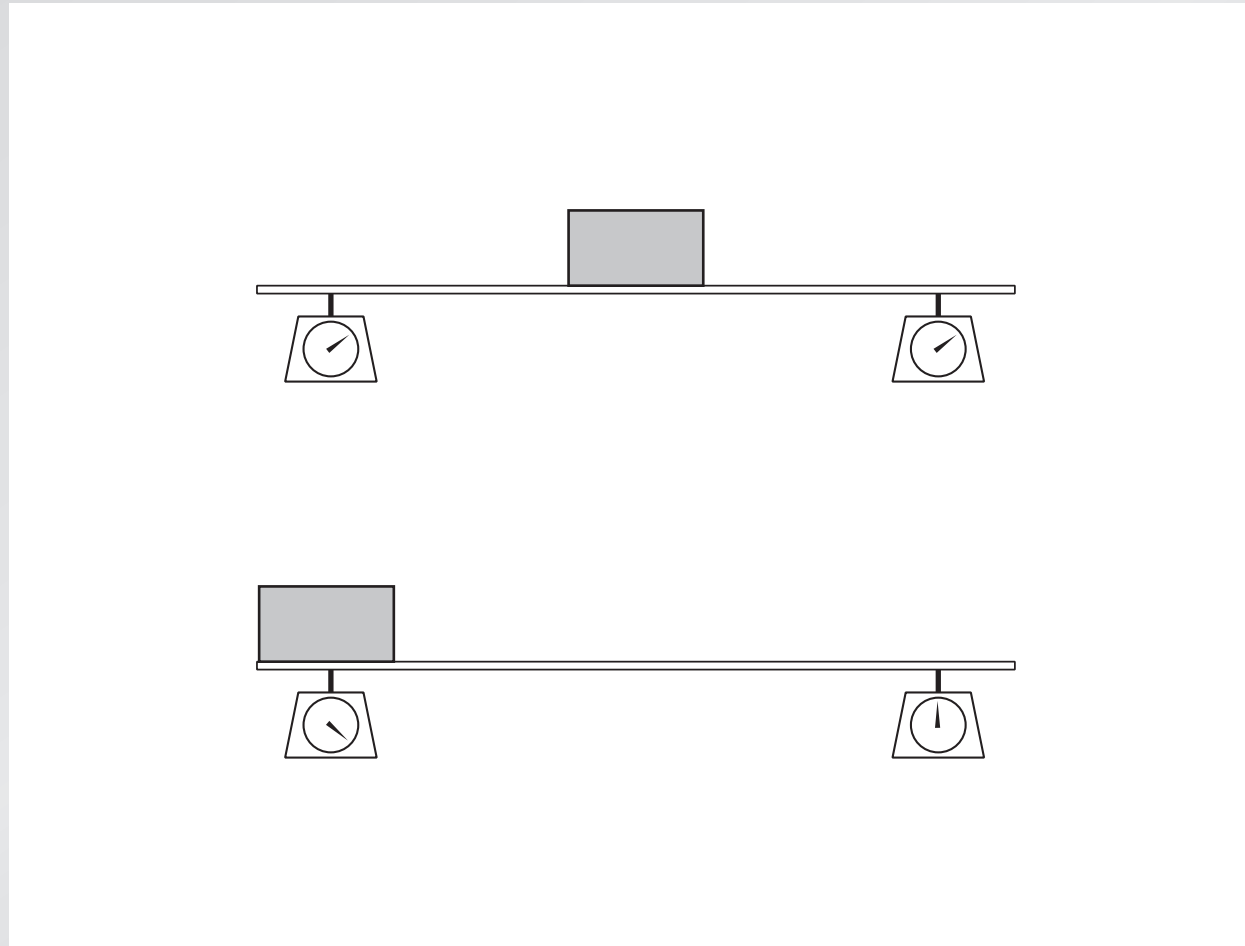
Lecture demonstrations

Follow up:

- **free-response test (online)**
- **exam questions**

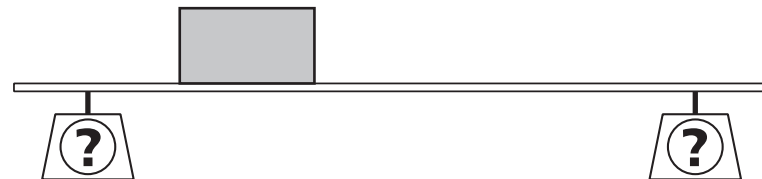
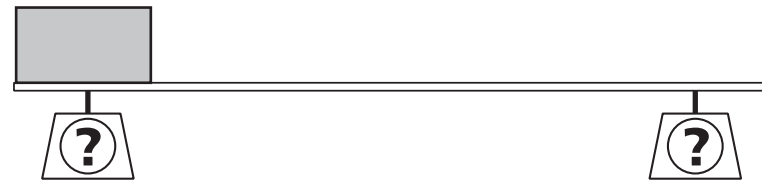
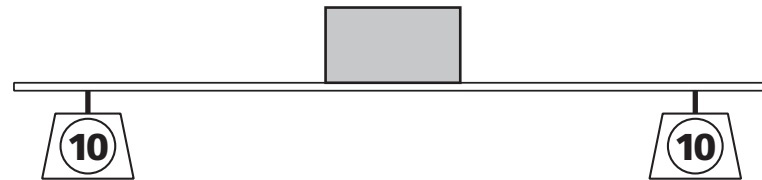
Lecture demonstrations

loaded beam demo



Lecture demonstrations

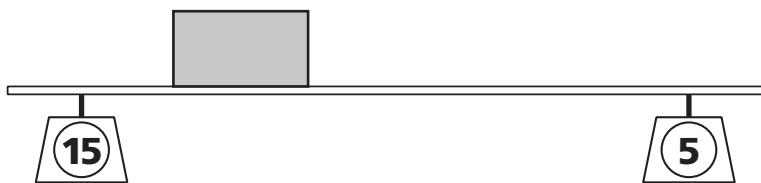
online test question



Lecture demonstrations

answers given

24% of students



correct (mentions torque)

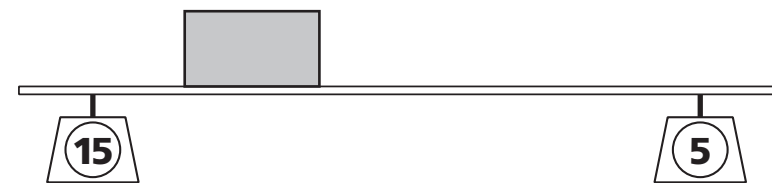
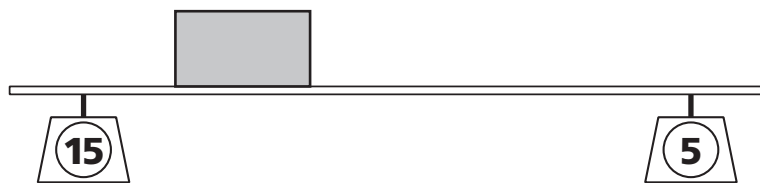
Lecture demonstrations

answers given

24% of students



38% of students



correct (mentions torque)

proportional reasoning

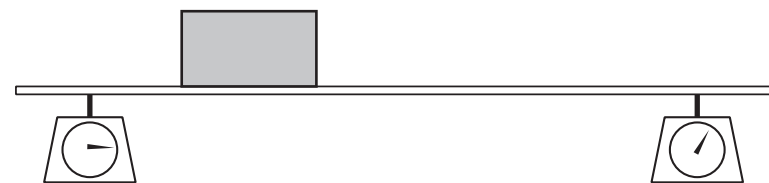
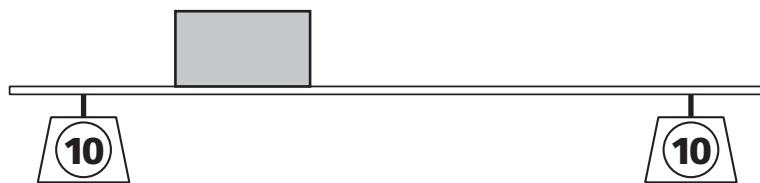
Lecture demonstrations

answers given

20% of students



10% of students



independent of position

qualitative reasoning

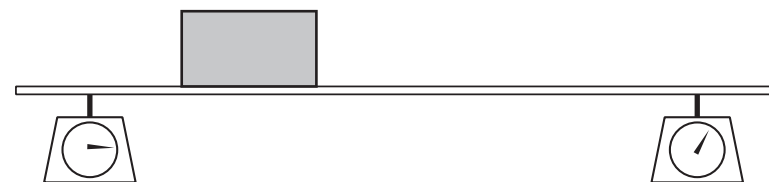
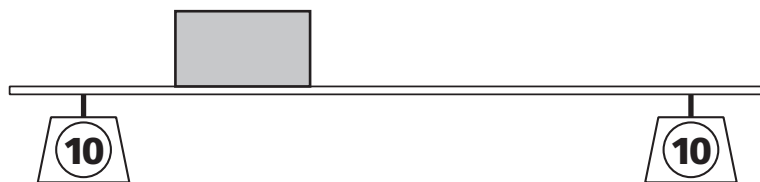
Lecture demonstrations

answers given

20% of students



10% of students



independent of position

qualitative reasoning

6%: forces not balanced; 2%: other incorrect

Lecture demonstrations

mode	correct	incorrect
no demo	30%	70%
observe	18%	82%
predict	29%	71%
discuss	30%	70%

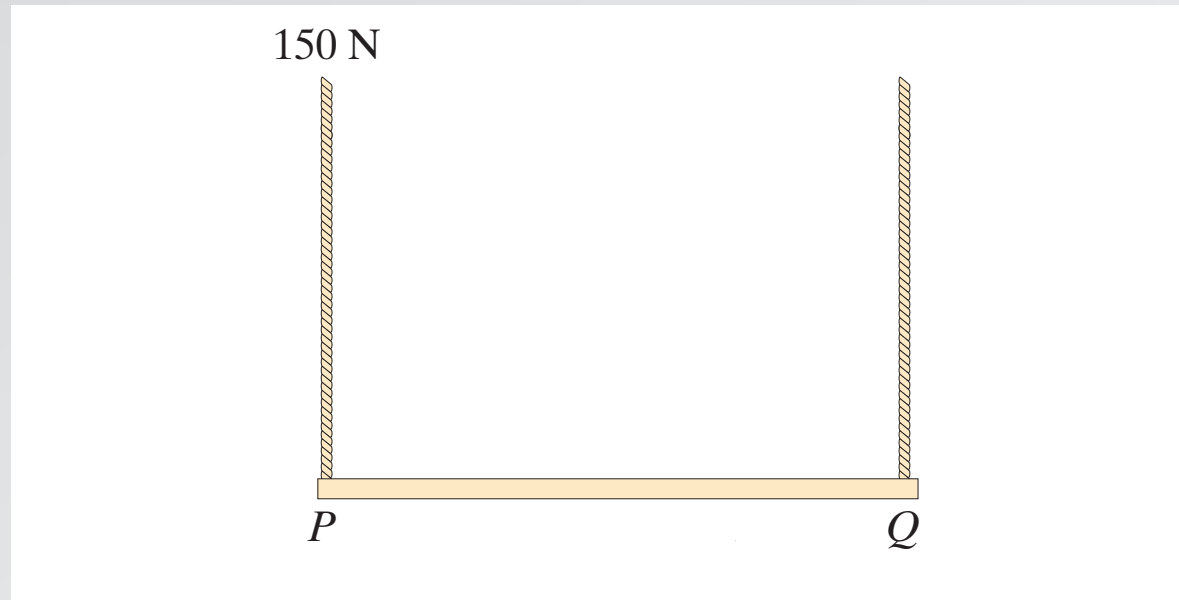
Lecture demonstrations

mode	correct	incorrect
no demo	30%	70%
observe	18%	82%
predict	29%	71%
discuss	30%	70%

just presenting harmful?

Lecture demonstrations

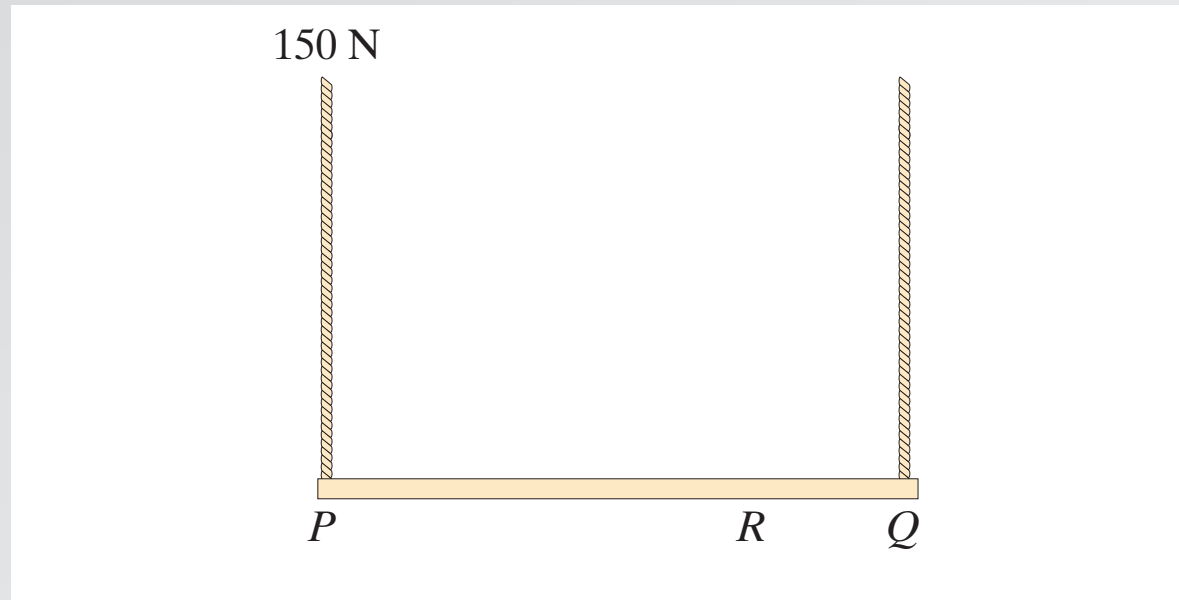
exam question



A uniform plank is supported by two ropes at points P and Q . The tension in the rope at P is 150 N .

Lecture demonstrations

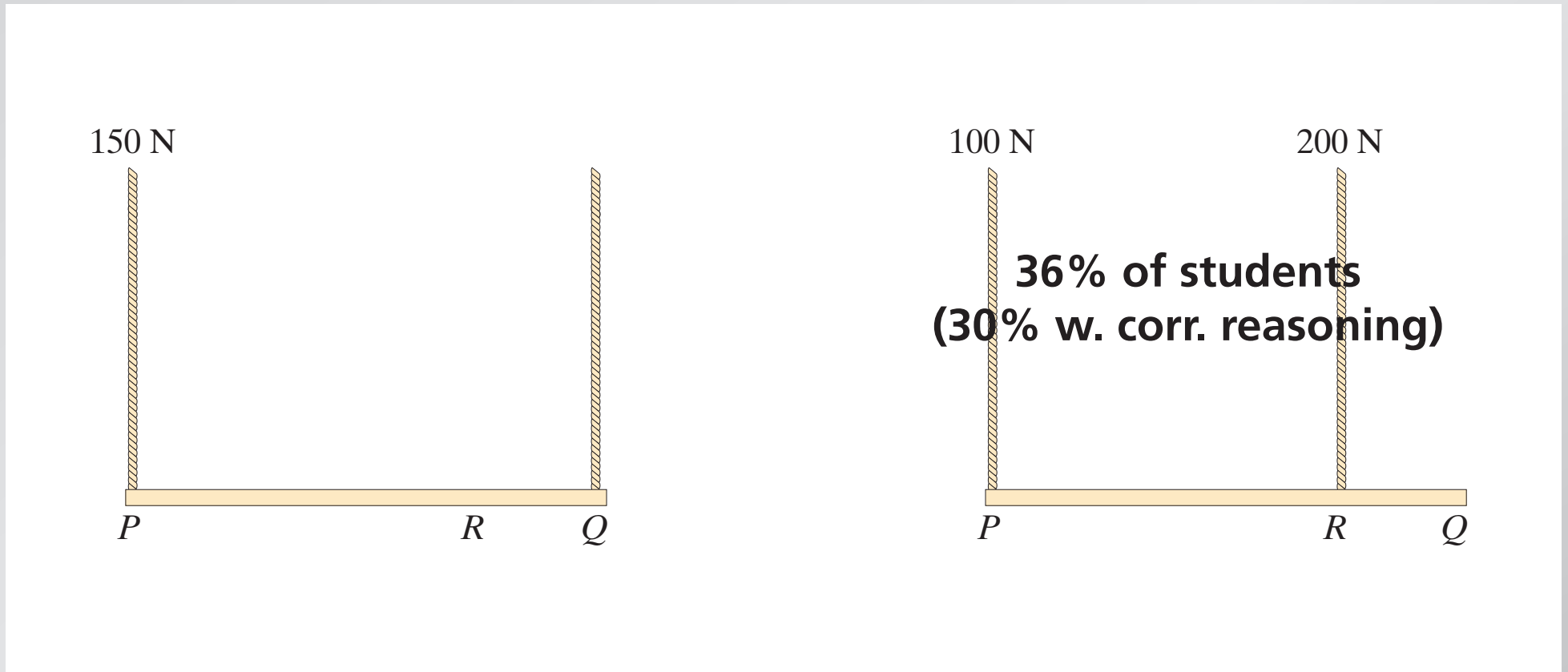
exam question



A uniform plank is supported by two ropes at points P and Q . The tension in the rope at P is 150 N . The point at which the other rope is attached to the plank is now moved to point R halfway between Q and the center of the plank. What are the tensions in the two ropes?

Lecture demonstrations

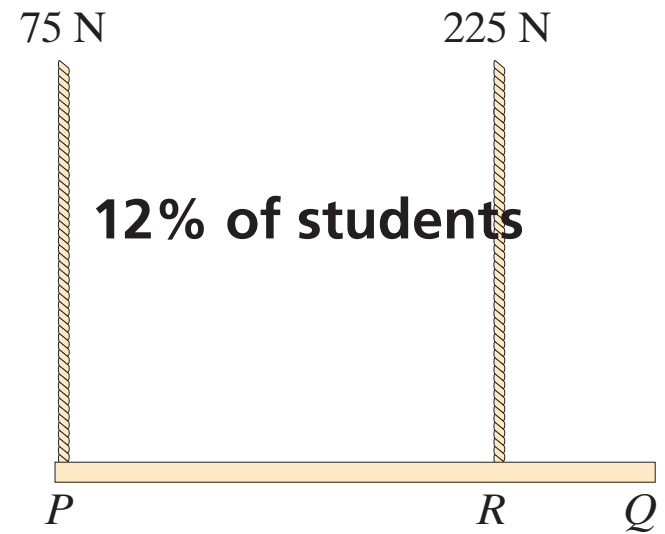
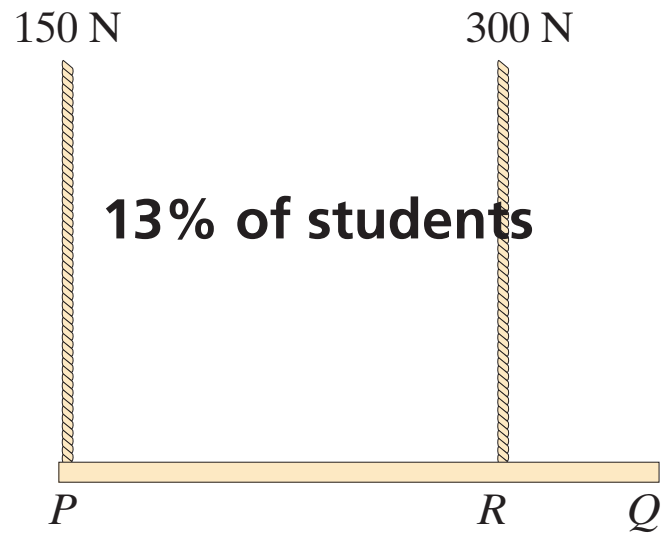
correct answer



considerable improvement from online test

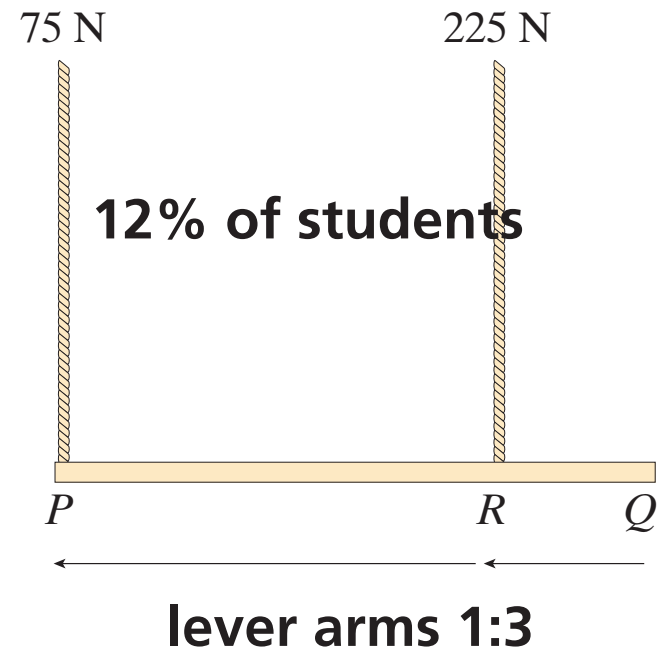
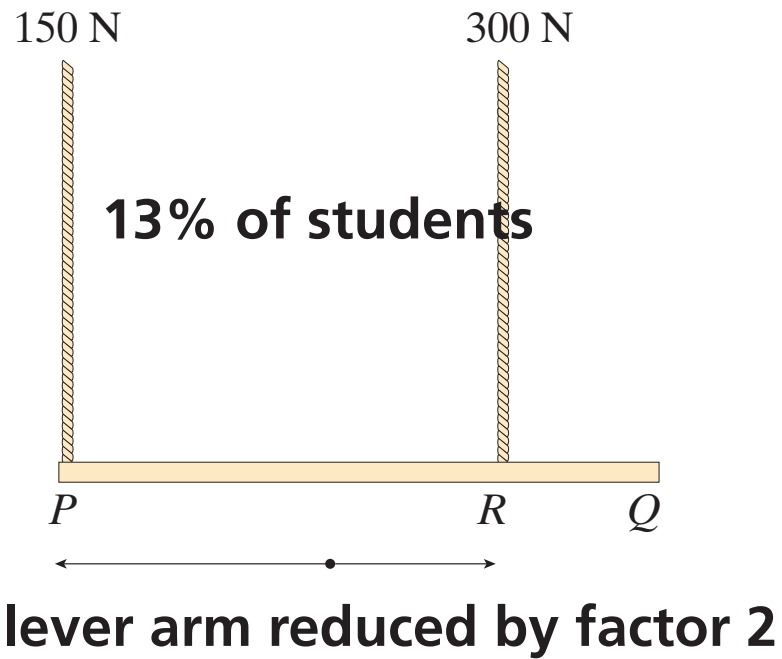
Lecture demonstrations

incorrect answers



Lecture demonstrations

incorrect answers

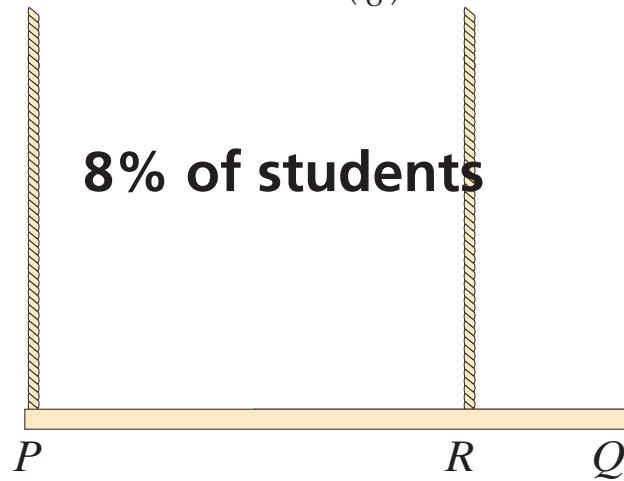


Lecture demonstrations

incorrect answers

$$\left(\frac{3}{8}\right) 300 \text{ N} = 112.5 \text{ N} \quad \left(\frac{5}{8}\right) 300 \text{ N} = 187.5 \text{ N}$$

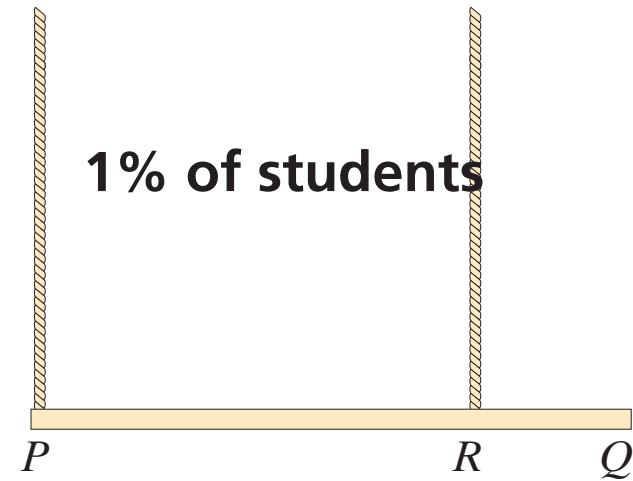
8% of students



$$112.5 \text{ N}$$

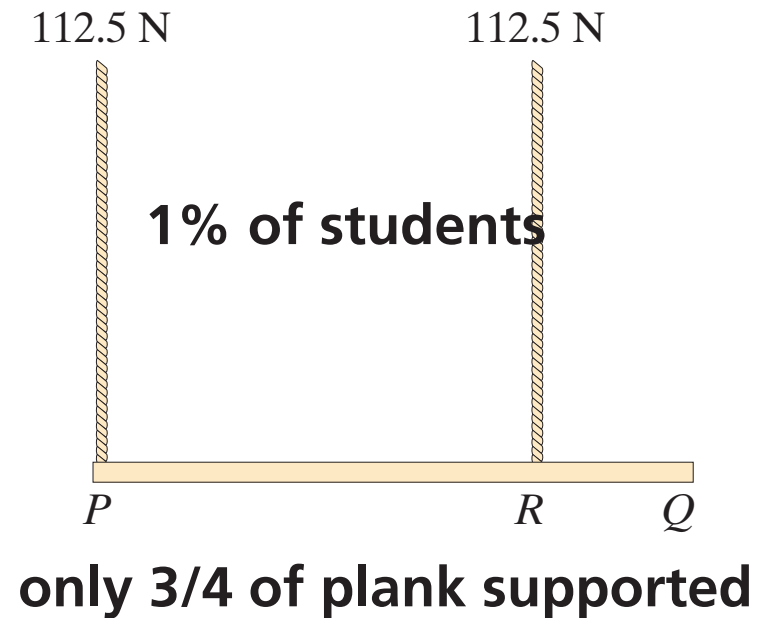
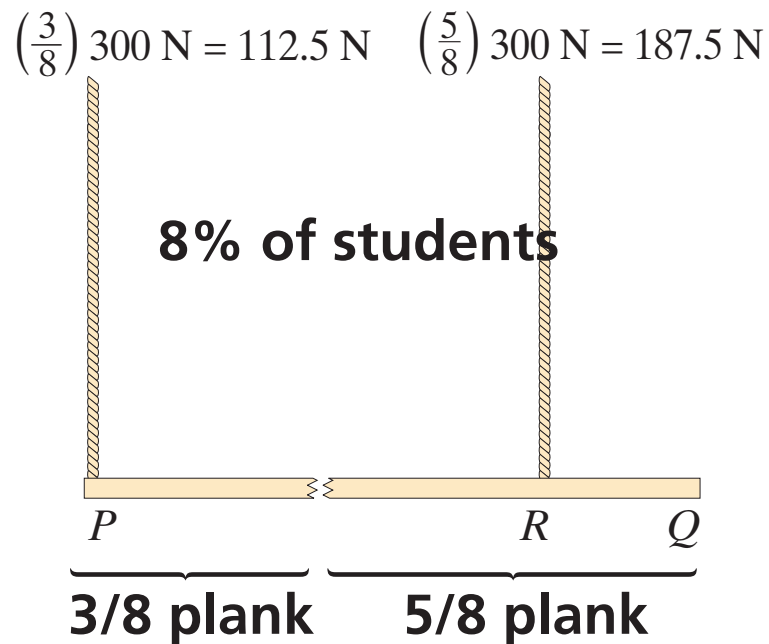
$$112.5 \text{ N}$$

1% of students



Lecture demonstrations

incorrect answers



who would have thought??

Lecture demonstrations

mode	correct	balances torques	no clear reasoning
no demo	31%	53%	42%
observe	42%	55%	42%
predict	41%	65%	32%
discuss	46%	85%	15%

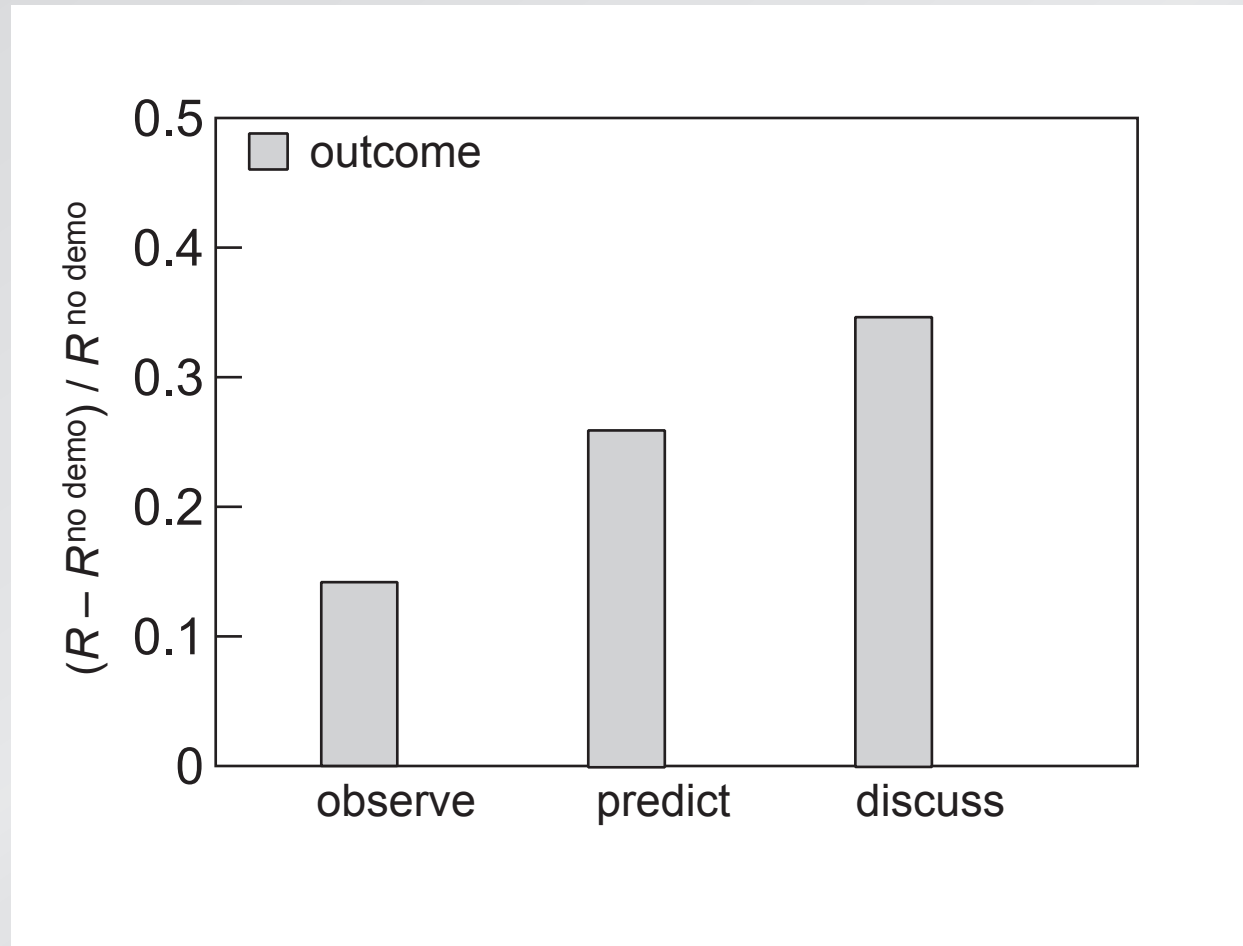
Lecture demonstrations

aggregate results for seven demonstrations

mode	N	R_{outcome}	$R_{\text{explanation}}$
no demo	297	61%	22%
observe	220	70%	24%
predict	179	77%	30%
discuss	158	82%	32%

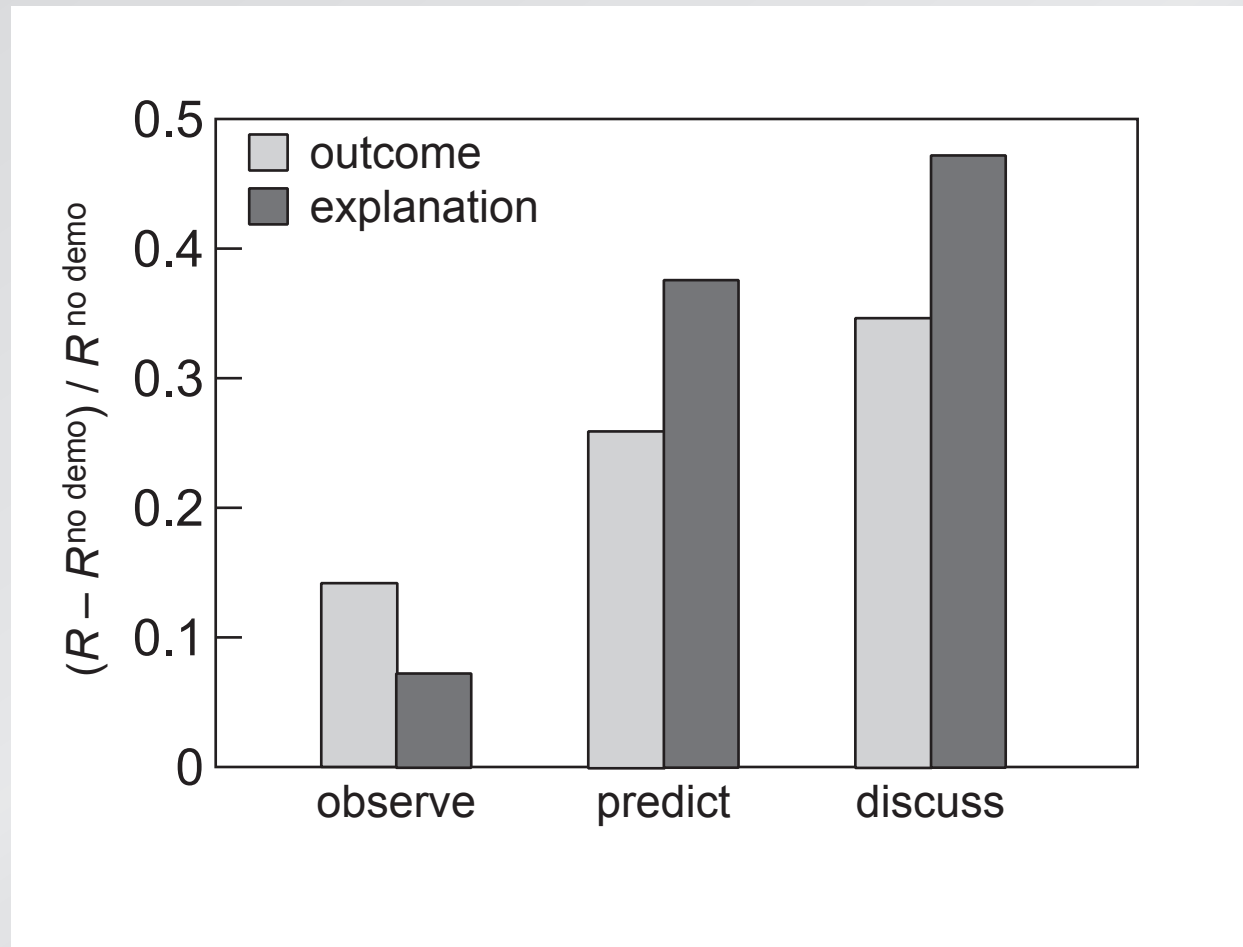
Lecture demonstrations

improvement correlates with engagement



Lecture demonstrations

improvement correlates with engagement



Lecture demonstrations

Points to keep in mind:

- **demonstrations without engagement not very helpful**
- **results can be improved by having students predict outcome**