CLASSROOM DEMONSTRATIONS
EDUCATION OR ENTERTAINMENT?

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Goals of demonstrations

- **Educate**
- **Motivate**

Can demonstrations be more educational?

- **Force students to think:**

Can demonstrations be more educational?

- **Force students to think: ask for predictions**

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- **Create one-on-one teaching environment: have students discuss predictions**

Can demonstrations be more educational?

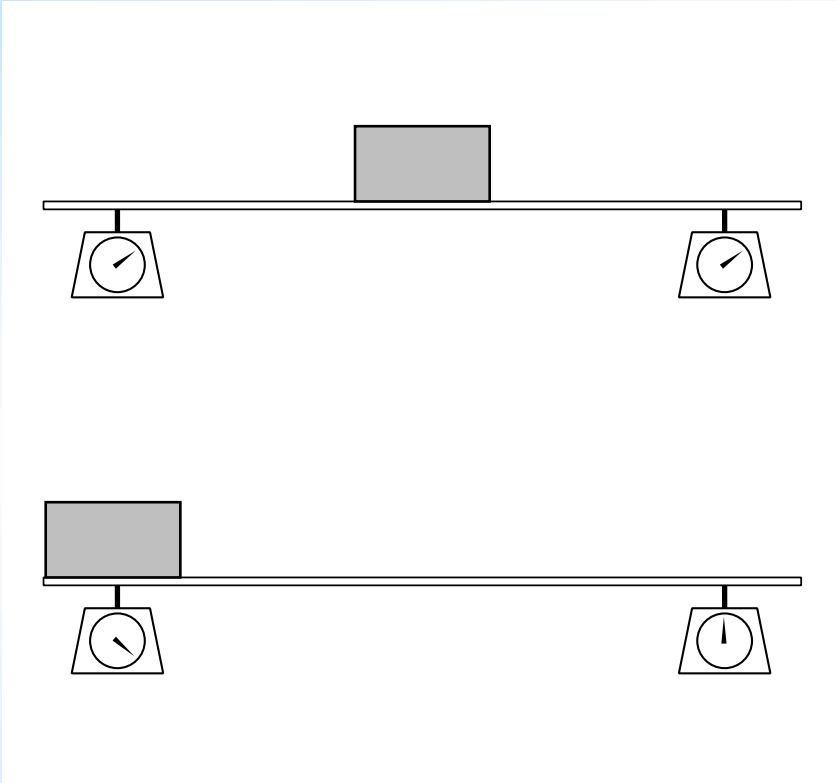
- **Force students to think: ask for predictions**
- **Create one-on-one teaching environment: have students discuss predictions**
- **Confront and resolve: make students rethink prediction after observation**

Research strategy

6 demonstrations presented to 9 sections of introductory physics class in one of four ‘modes’:

- **demonstration not shown**
- **traditional presentation**
- **students predict before demonstration**
- **students predict and discuss**

Sample demonstration



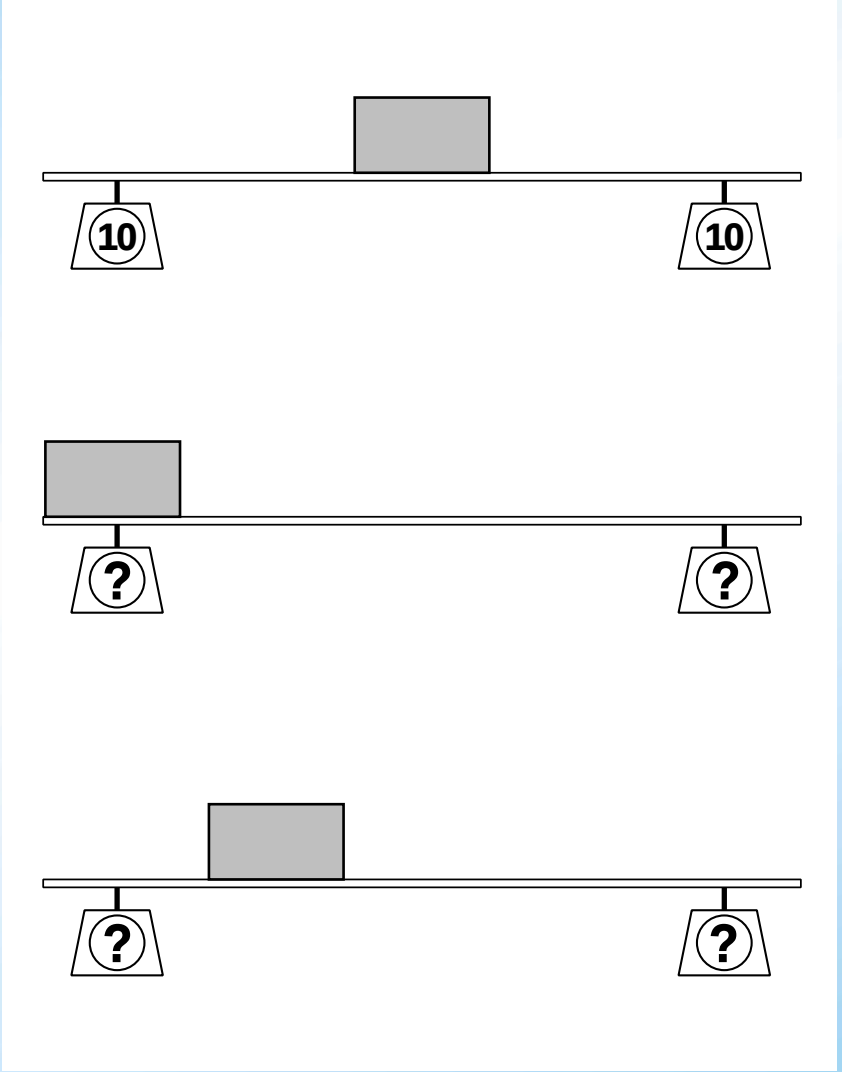
Testing

- **Web-based test**
  - **free response questions**
  - **graded on effort alone**

Testing

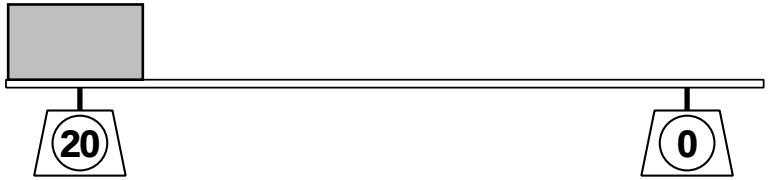
- **Web-based test**
  - **free response questions**
  - **graded on effort alone**
- **Use answers to determine:**
  - **memory of experimental outcome**
  - **physical understanding**

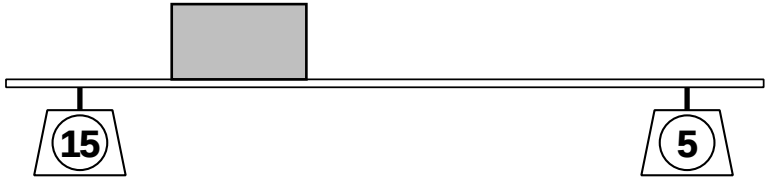
Sample test question



Answers

24% of students

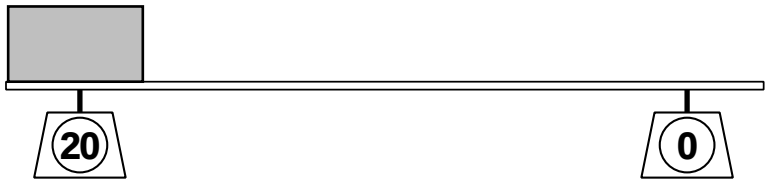


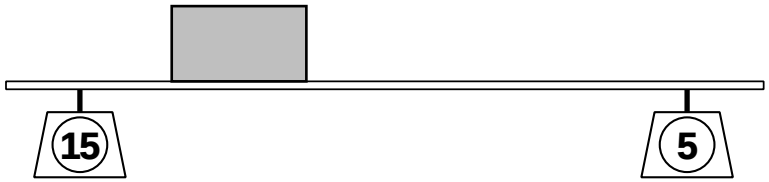


correct (mentions torque)

Answers

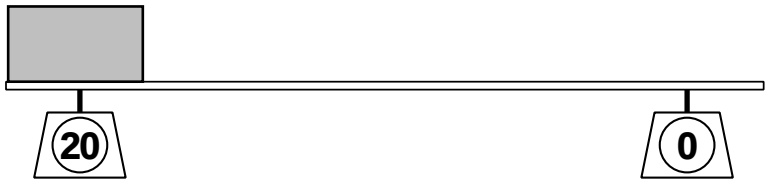
24% of students

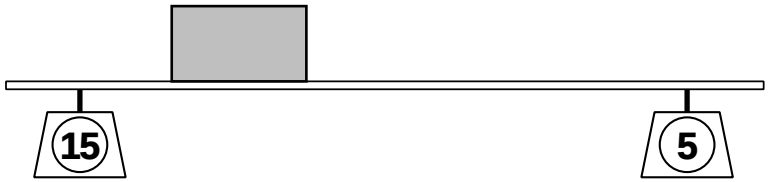




correct (mentions torque)

38% of students

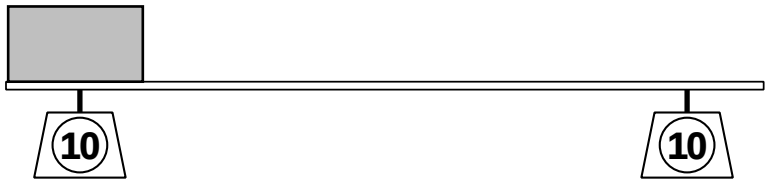


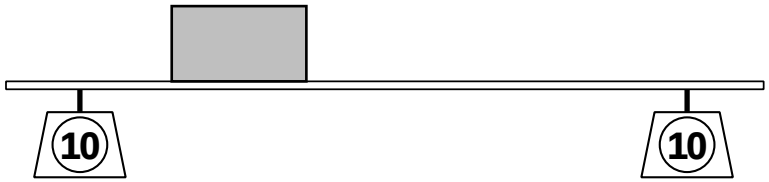


proportional reasoning

Answers

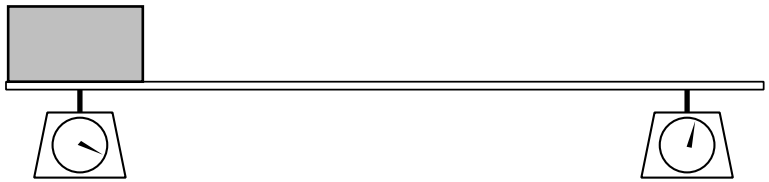
20% of students

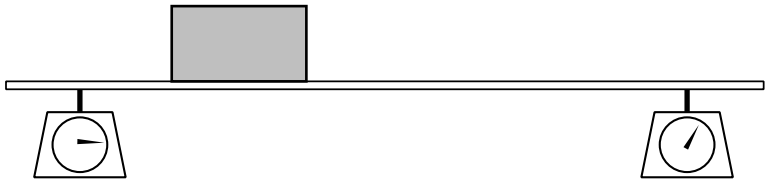




independent of position

10% of students





qualitative reasoning

6% do not balance forces
2% give other incorrect answers

Observations: Memory of demonstrations

correct
no demo
demo
predict
discuss

Observations: Memory of demonstrations

	correct
no demo	49%
demo	
predict	
discuss	

Observations: Memory of demonstrations

	correct
no demo	49%
demo	52%
predict	
discuss	

Observations: Memory of demonstrations

	correct	*p*-value
no demo	49%	–
demo	52%	0.68
predict		
discuss		

Observations: Memory of demonstrations

	correct	*p*-value
no demo	49%	–
demo	52%	0.68
predict	57%	0.91
discuss		

Observations: Memory of demonstrations

	correct	*p*-value
no demo	49%	–
demo	52%	0.68
predict	57%	0.91
discuss	57%	0.92

'Understanding' affects memory!

"As demonstrated in lecture, both scales will read 10N, regardless of where the center of mass is located. The platform and the metal block form one unit that is being measured, so the scales show two evenly distributed readings, no matter where the metal block is placed along the platform."

Observations: Understanding

	fully correct	*p*-value
no demo	16%	–
demo	18%	0.69
predict	20%	0.84
discuss	22%	0.93

Observations: Understanding

	concepts correct	*p*-value
no demo	27%	–
demo	27%	0.49
predict	33%	0.90
discuss	32%	0.83

Conclusions

- **Demonstrations alone do not improve knowledge or understanding**
- **Asking students to predict outcome may improve learning**
- **Worth further study!**

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Research: Students and staff of Physics 1
Demonstrations: Dr. Wolfgang Rueckner
Discussion: Prof. Gay Stewart

For a copy of this talk and additional information:

http://mazur-www.harvard.edu