

DO STUDENTS LEARN MORE FROM SOME DEMONSTRATIONS THAN OTHERS?

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Classroom demonstrations

Classroom demonstrations can serve to:

➤ **Motivate**

➤ **Educate**

Are both of these goals met?

Classroom demonstrations

Does the pedagogy of the demonstration affect:

➤ **memory of the outcome?**

➤ **understanding of the material?**

Previous research

**7 demonstrations presented to 7 sections
($N \approx 15$ each) of introductory mechanics course
in one of 4 'modes':**

- demonstration not shown: '**no demo**'
- traditional presentation: '**observe**'
- students predict before demonstration: '**predict**'
- students record prediction & discuss: '**reinforce**'

Presented at 2002 AAPT National Meeting, Philadelphia, PA

Previous results: Outcome

correct outcome

no demo 49%

observe

predict

reinforce

Previous results: Outcome

correct outcome

no demo 49%

observe 54%

predict

reinforce

Previous results: Outcome

	correct outcome	<i>P</i>-value
no demo	49%	–
observe	54%	0.139
predict		
reinforce		

Previous results: Outcome

	correct outcome	<i>P</i>-value
no demo	49%	–
observe	54%	0.139
predict	69%	
reinforce	69%	

Previous results: Outcome

	correct outcome	<i>P</i>-value
no demo	49%	–
observe	54%	0.139
predict	69%	< 0.001
reinforce	69%	< 0.001

Previous results: Explanation

	fully correct	<i>P</i>-value
no demo	22%	–
observe	24%	0.319
predict	30%	0.022
reinforce	32%	0.008

Previous results

- **Demonstrations without active engagement produce little gain in understanding**
- **Predicting outcome gives significant learning gains without costing time**

Question

Does the demonstration itself influence the educational effectiveness?

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Does the demonstration itself influence the educational effectiveness?

Pick demos designed to address misconceptions

Research strategy

9 demonstrations presented to 5 sections (N \approx 20 each) of an introductory E&M course in the same 4 'modes'

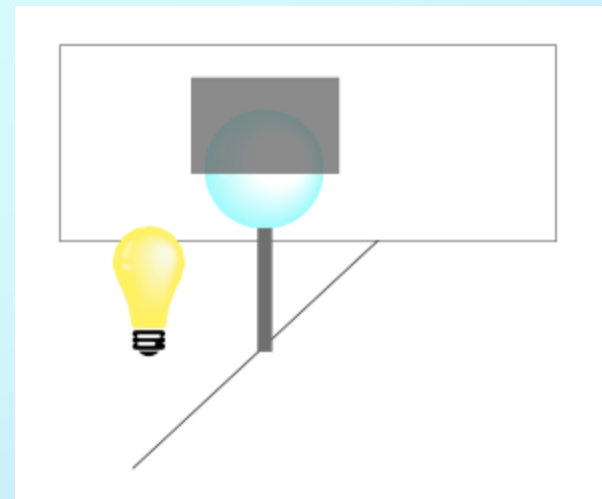
- 3 of demonstrations taken from Interactive Lecture Demonstrations (ILDs) of Sokoloff & Thornton
- 6 others were standard lecture demonstrations for electricity & magnetism/optics/circuits at Harvard

D.R. Sokoloff & R.K. Thornton, *Phys. Teach.* 35, 340 (1997)

Half-lens demonstration

A giant light bulb is placed to the left of a converging lens at a distance greater than the focal length of the lens. The image of the bulb is formed on a screen to the right of the lens. What will happen to the image if you block the top half of the lens with a card?

1. The top half of the image disappears.
2. The bottom half of the image disappears.
3. The entire image disappears.
4. The image becomes blurred.
5. The image becomes fainter.



Results: 3 ILD demos

	correct outcome	<i>P</i>-value	<i>N</i>
no demo	46%	–	162
observe			
predict			
reinforce			

Results: 3 ILD demos

	correct outcome	<i>P</i>-value	<i>N</i>
no demo	46%	–	162
observe	61%	0.040	41
predict			
reinforce			

Results: 3 ILD demos

	correct outcome	<i>P</i>-value	<i>N</i>
no demo	46%	–	162
observe	61%	0.040	41
predict	74%	0.002	31
reinforce			

Results: 3 ILD demos

	correct outcome	<i>P</i>-value	<i>N</i>
no demo	46%	–	162
observe	61%	0.040	41
predict	74%	0.002	31
reinforce	87%	< 0.001	30

Results: 3 ILD demos

	correct explanation	<i>P</i>-value	<i>N</i>
no demo	36%	–	164
observe			
predict			
reinforce			

Results: 3 ILD demos

	correct explanation	<i>P</i>-value	<i>N</i>
no demo	36%	–	164
observe	42%	0.258	41
predict			
reinforce			

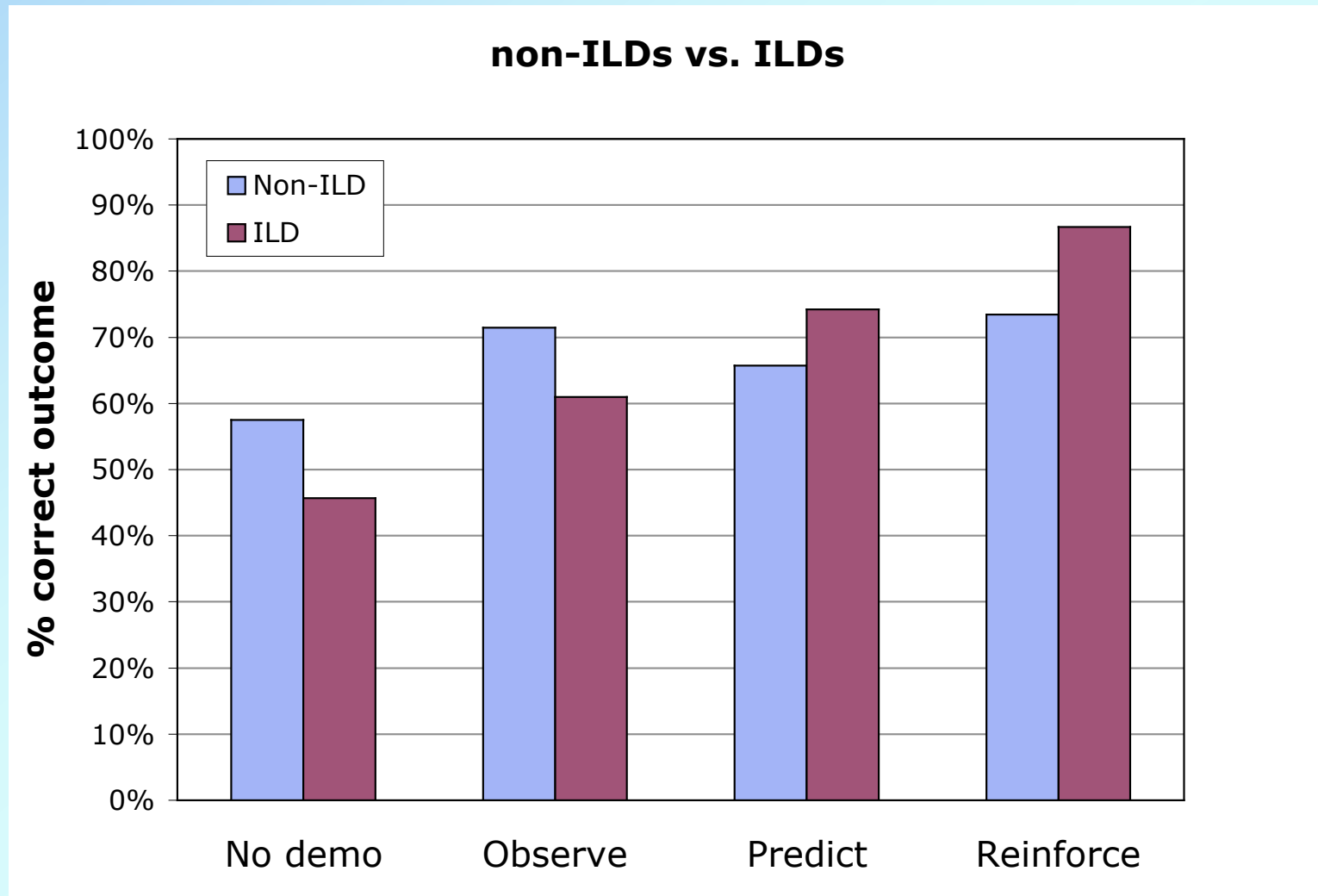
Results: 3 ILD demos

	correct explanation	<i>P</i>-value	<i>N</i>
no demo	36%	–	164
observe	42%	0.258	41
predict	58%	0.011	31
reinforce			

Results: 3 ILD demos

	correct explanation	<i>P</i>-value	<i>N</i>
no demo	36%	–	164
observe	42%	0.258	41
predict	58%	0.011	31
reinforce	67%	< 0.001	30

Does the demo type matter?



Conclusions

- **passive presentation of demonstrations may not lead to learning**

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- **passive presentation of demonstrations may not lead to learning**
- **discussion leads to increased understanding over simple prediction for E&M demos**
- **demos explicitly designed to address misconceptions may be more effective at increasing understanding, even when taken in isolation**

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**For a copy of this talk and
additional information:**

<http://mazur-www.harvard.edu/>