Physics Education Laboratory
Lecture 16
Content Knowledge for Electromagnetism

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The conceptual representation using computer based simulations - **inquiry based approach (Inquiry-based learning with Interactive Simulation)**

What Levels of Guidance Promote Engaged Exploration with Interactive Simulations?

https://phet.colorado.edu/publications/PERC_Interview_Guidance.pdf

(Adams et al. 2008)

Materials for Physics education

Concept or "Clicker" Questions

Concept tests give students an opportunity to discuss and make sense of concepts related to the simulation.

Pose question
↓
Student-student discussion
↓
Vote 
↓
Follow-up discussion

Strategies for Writing Questions*

1. Predict an outcome of an "experiment" with the simulation (e.g., what will happen if? Which change in the sim setup would result in the desired behavior?)
2. Rank cases (e.g. which bulb with be brightest).
3. Compare contrasting cases (e.g., two different waves)
4. Interpret different representations (e.g. graphs, pictures, vectors).
5. Connect to real-world applications

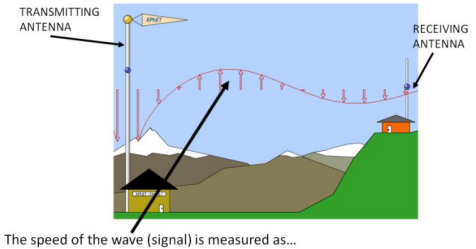
*adapted from Beatty et al., AJP, 2006

Interactive Lecture Demos (ILDs)*

ILD's increase student learning from demos by having students actively identify expectations, and resolve

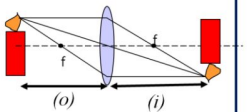
Instructor **probes common student difficulty** and then **helps students' visualize** speed of light with the *Radio Waves* sim.

How do you measure the propogation speed of the wave (signal)?

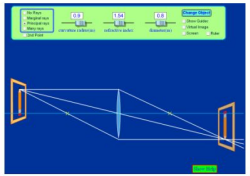


The speed of the wave (signal) is measured as...
a. how fast this peak moves towards antenna.
b. how fast this peak moves up and down.
c. both a or b

What will happen to image if we increase focal length of lens?
(Keeping the object distance fixed)
a. Image is same size, same place
b. Image is same size and further from lens
c. Image is bigger and further from lens
d. Image is smaller and closer to lens

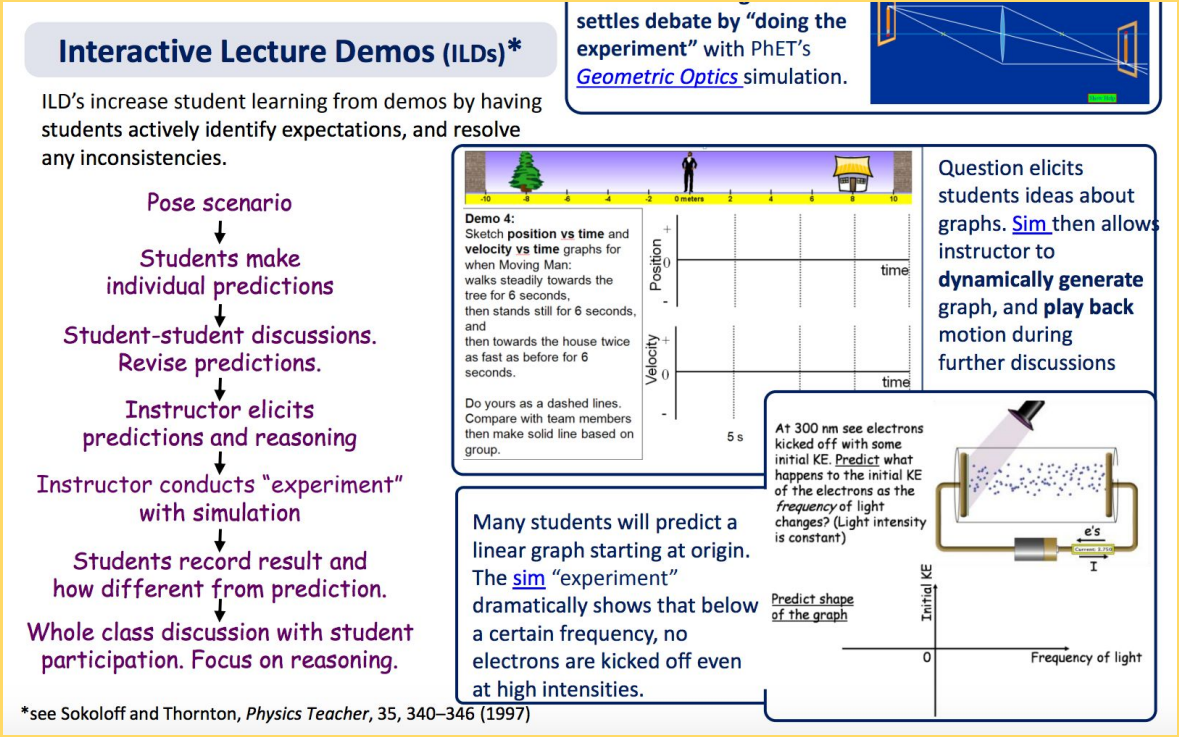


After peer discussion and voting, instructor **elicits student reasoning** and then **settles debate by "doing the experiment"** with PhET's *Geometric Optics* simulation.



https://phet.colorado.edu/

Materials for Physics education

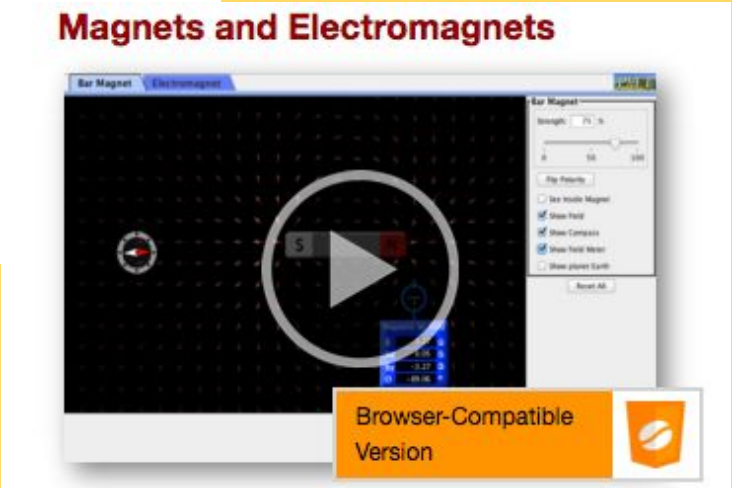


https://phet.colorado.edu/

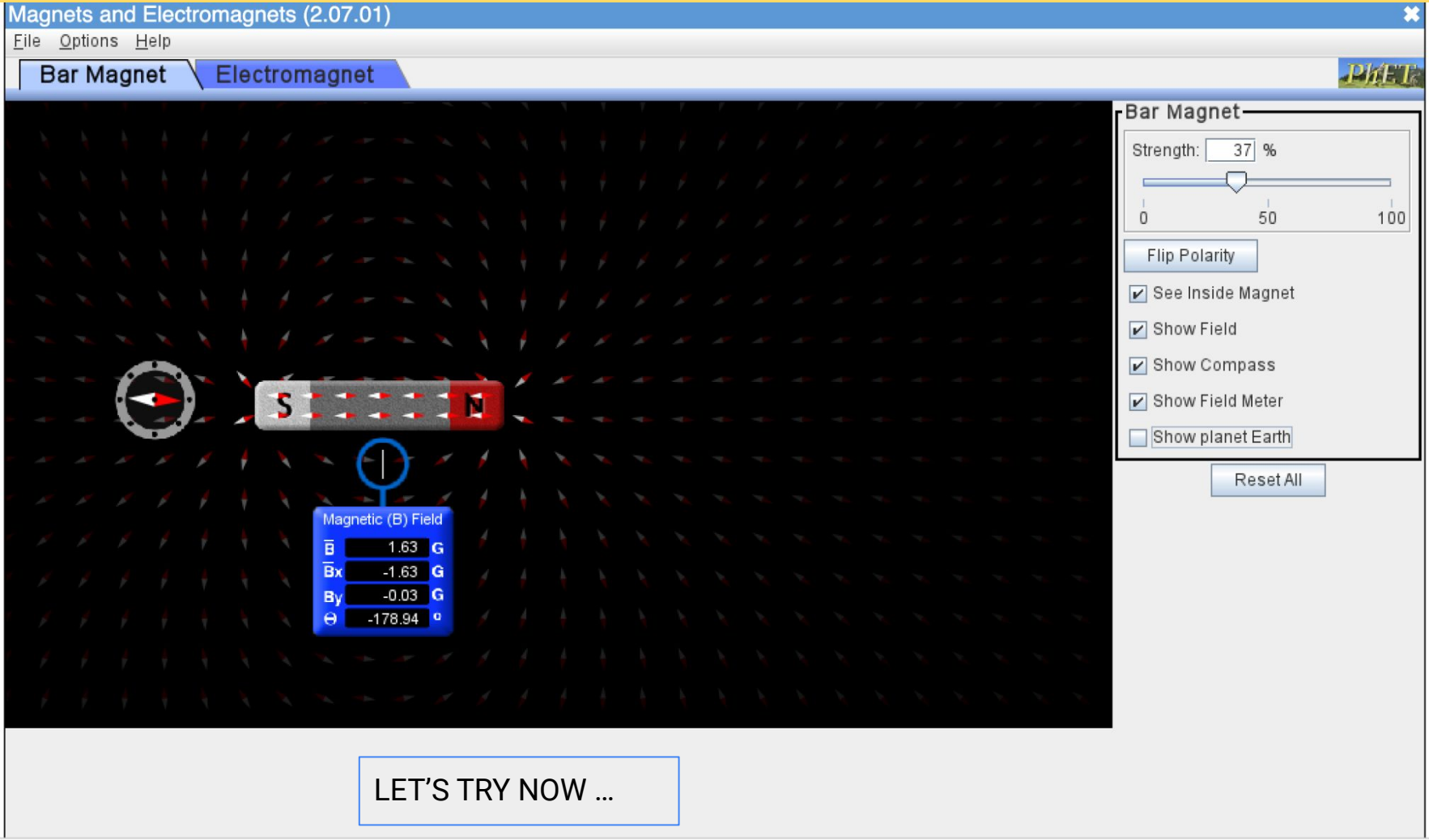
Magnets-Introduction (Inquiry Based)

- Introductio_to_Magnets_Faraday_Electromagne_Lab_CQ.pptx - 186 kB
- Lesson plan intro to magnets.docx - 19 kB
- Clicker_questions_faraday_Introductio_to_Magnets.PDF - 357 kB
- Lesson plan intro to magnets.pdf - 123 kB
- Student directions for intro to magnets.pdf - 119 kB
- Student directions for intro to magnets.DOC - 27 kB

Download all files as a compressed .zip



https://phet.colorado.edu/en/simulation/legacy/magnets-and-electromagnets


Magnets and Electromagnets (2.07.01)
File Options Help
Bar Magnet
Electromagnet
PhET
Bar Magnet
Strength: 37 %
0
50
100
Flip Polarity
See Inside Magnet
Show Field
Show Compass
Show Field Meter
Show planet Earth
Reset All
S
N
Magnetic (B) Field
B 1.63 G
Bx -1.63 G
By -0.03 G
Θ -178.94 °
LET'S TRY NOW …

Behind the curtains ...

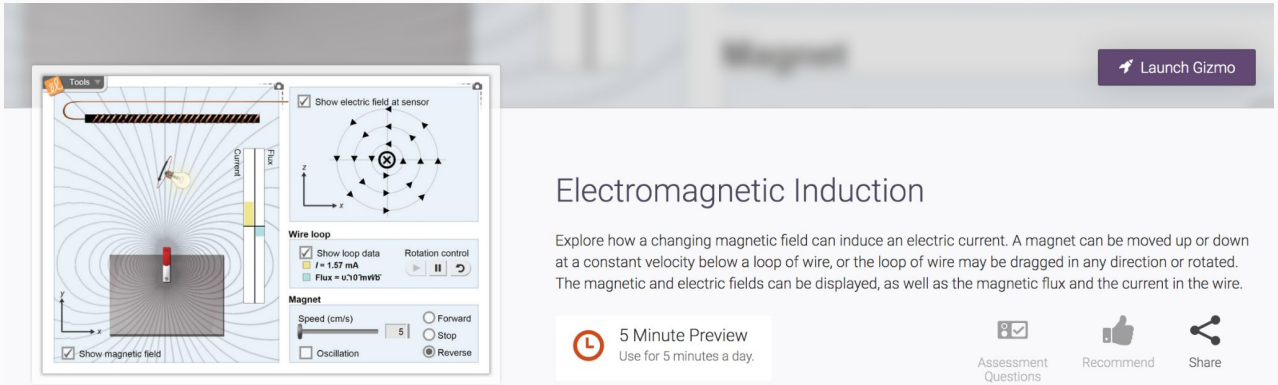
- EXPLORING the SIMULATION
- https://phet.colorado.edu/en/simulations/faraday
- EXPLORING STUDENTS' SHEETS
- https://phet.colorado.edu/en/contributions/view/2827
- FOLLOWING the INSTRUCTIONS
- https://phet.colorado.edu/en/teaching-resources/activity-guide

LET'S TRY NOW ...

Comparing Simulations and Activities

ELECTROMAGNETISM in GIZMO

https://gizmos.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=1044



Electricity and Magnetism Conceptual Assessment (EMCA)

https://drive.google.com/file/d/1pG16k-IvDqwohShthWi8MpTn9tK2D8NZ/view?usp=sharing (positivecharge)