

Phenomenon-Based Learning Using Gadgets and Gizmos



Matt Bobrowsky

Comparison of Teaching Methods

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Traditional Lecture vs. Interactive Engagement

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Traditional Lecture vs. Interactive Engagement

Pre-Post Test Gains Relative to Maximum Possible Gain

(N = 6542)

Traditional lecture: $23\% \pm 4\%$ (st. dev.)

Interactive engagement: $48\% \pm 14\%$ (st. dev.)

(Source: Hake, R. 1998, Am. J. Phys. 66, 64)

Comparison of Teaching Methods

Comparison of Teaching Methods

Traditional Lecture vs. Peer Instruction



Comparison of Teaching Methods

Traditional Lecture vs. Peer Instruction

Pre-Post Test Gains Relative to Maximum Possible Gain

(N = 91)

Traditional lecture: 33%

Peer Instruction: 50%

(Source: Lasry, N., Mazur, E., & Watkins, J. 2008, Am. J. Phys., 76, 1066)

Comparison of Teaching Methods

Comparison of Teaching Methods

Traditional Lecture vs. Peer Instruction



Comparison of Teaching Methods

Traditional Lecture vs. Peer Instruction

Percentage of Students Who Switch Out of STEM Majors

Traditional lecture: 11%

Peer Instruction: 5%

(Source: Watkins, J. & Mazur, E. 2013, J. Coll. Sci. Teaching, 42, 36)

Responsive Teaching

Responsive Teaching

Increase in % of students at “proficient”
level from 52% to 71%

(Reported at NSTA Conference, Boston, April 2014)

Education in Finland

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Ranking in 2009 PISA* Assessments (N=74)

	Science	Reading
Finland	2	3
U.S.A.	23	17

* *Programme of International Student Assessment*
(PISA is coordinated by the Organization for Economic Cooperation and Development — OECD — an intergovernmental organization of industrialized countries.)

In Finland...

- There is very little homework or testing until students are into their teens.
- The children are not measured at all for the first six years of their education.
- There is only one mandatory standardized test, taken when students are 16.
- All children, clever or not, are taught in the same classrooms.
- The difference between weakest and strongest students is the smallest in the world.
- There are not “better schools” and “worse schools.”

Phenomenon-Based Learning

- Increased learning
- Students enjoy learning more
- Excellent for heterogeneous classes
- New students can jump right in
- Great for pre-service teachers



Phenomenon-Based Learning (PBL)

- Teach broader concepts and useful thinking and performance skills (as with *NGSS*) rather than asking students to simply memorize facts and formulae.
- Students investigate an interesting gadget and, motivated by their own curiosity, explore and discover how it works and what physical phenomena are involved.
- The PBL approach to learning is based on curiosity and creativity — a fun way to learn!

Hands-On Activity

- Form groups of 3 ± 1
- One person from each group come up and get the materials: one tile and one suction cup
- Explore for one minute
 - What can you do with the materials?
 - What physical principles do they demonstrate?
- Questions
- Please return materials when convenient

The End



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