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
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Traditional Lecture vs. Peer Instruction
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Traditional Lecture vs. Peer Instruction

Pre-Post Test Gains Relative to Maximum Possible Gain
(N = 91)

Traditional lecture: 33%
Peer Instruction: 50%

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Traditional Lecture vs. Peer Instruction

Percentage of Students Who Switch Out of STEM Majors

Traditional lecture: 11%
Peer Instruction: 5%

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
Education in Finland

Ranking in 2009 PISA* Assessments (N=74)

<table>
<thead>
<tr>
<th></th>
<th>Science</th>
<th>Reading</th>
</tr>
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<tbody>
<tr>
<td>Finland</td>
<td>2</td>
<td>3</td>
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<tr>
<td>U.S.A.</td>
<td>23</td>
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* 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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