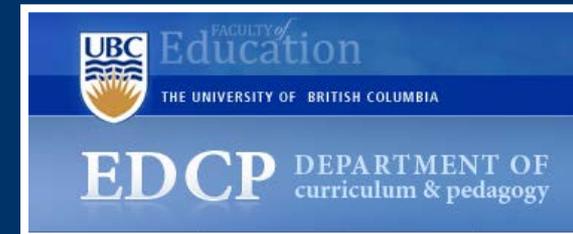




October 17 2016

Professional Development Day for a Chinese Physics Teacher Delegation



Dr. Marina Milner-Bolotin

UBC Department of Curriculum and Pedagogy

Agenda for the Day

- 1. 9:00 – 9:15: Introductions**
2. 9:15 – 10:30: Canadian education and teacher ed.
3. 10:30 – 10-45: break
4. 10:45 – 12:15: Technology in M&S teacher ed.
- 5. Lunch 12:30 – 2 pm**
6. 2 pm – 3:15 pm: A physics methods course
7. 3:30: Exploring UBC campus/Museum visit
8. 5 pm: Pick up at the Faculty of Education lobby.

1 Dr. Marina Milner-Bolotin

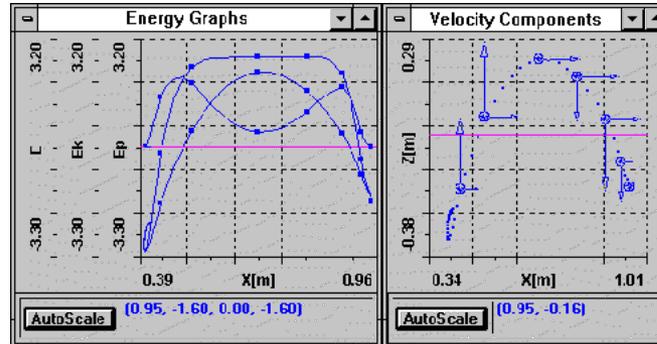
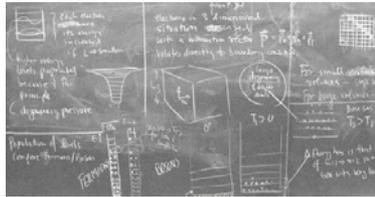


- Associate Professor in
Science Education, UBC, Canada
- Department of Curriculum & Pedagogy
- e-mail: marina.milner-bolotin@ubc.ca
- Web site: <http://blogs.ubc.ca/mmilner/>



1

My Math & Science Education Trajectory



V-scope



1

UBC (University of British Columbia)



**13,189 international students
from 139 countries!**

UBC Facts:

- Public university
- Established: 1908
- 2 campuses: Vancouver & Kelowna
- ~61,000 students
- Academic staff: 5334+
- Acceptance rate: 64%
- International ranking – 34th (U.S. News and World Report 2016)

1 UBC Outreach Experience



1

Getting to Know Each Other

What subjects do you teach?

1. Mainly physics
2. Physics and mathematics
3. Physics and chemistry
4. General science
5. Other



1 Getting to Know Each Other

What is your favourite subject to teach?

1. Mathematics
2. Biology
3. Chemistry
4. Physics and astronomy
5. Other science

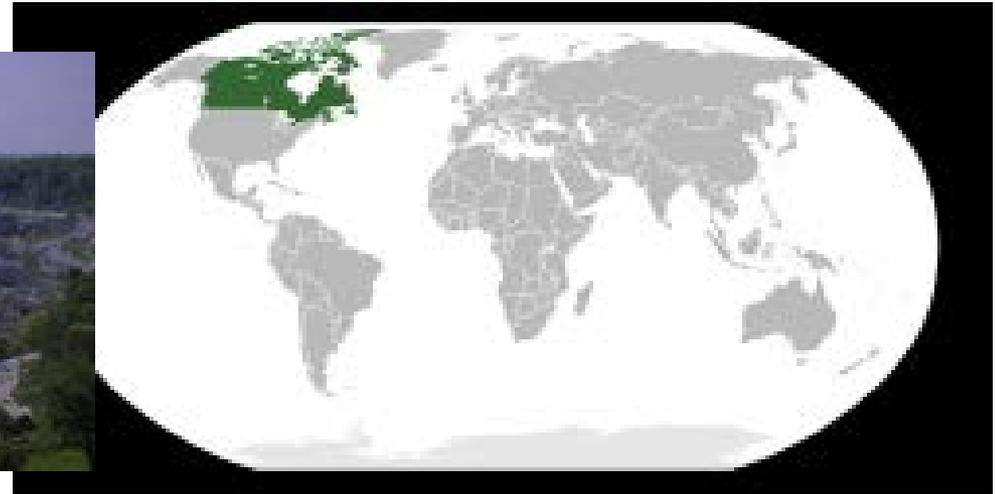


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2

Canadian Education and Teacher Education



20.6% of the total population of Canada are immigrants! Toronto transit offers information in > 70 languages. English is often 2nd language.

~75% of Canada's population live within 150 km of the US border.



Science Education in Canada

Science Exposure

K-12

University

Elem

Second

B. Science

Other fields



Teacher Education in Canada

Bachelor Subject + B.Ed.

Elem

Secondary

B.A.

B.Ed.

B.Sc.

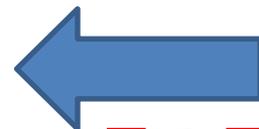
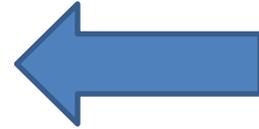
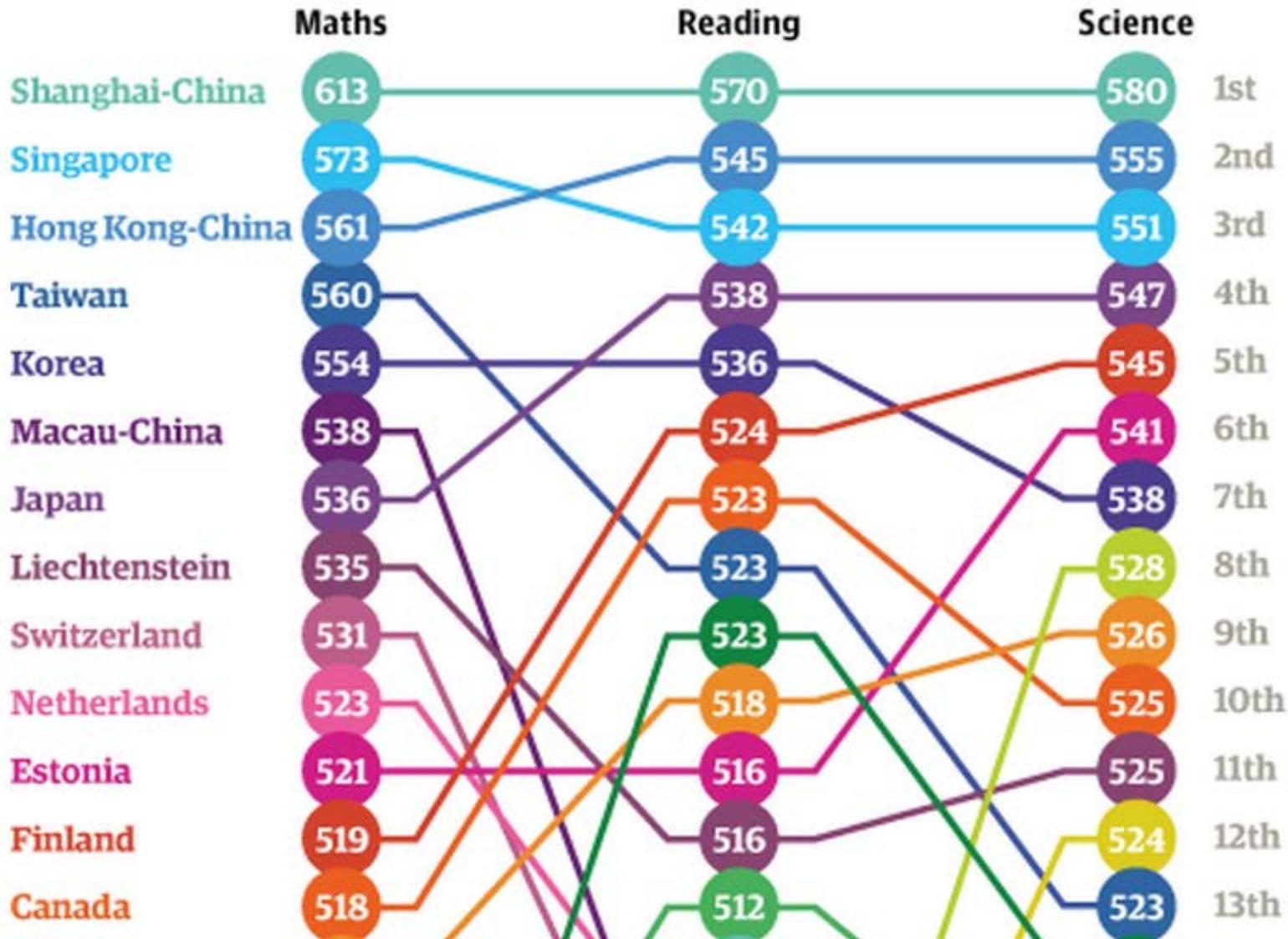
B.Ed.



GraphicMaps.com



PISA 2012 Results



[OECD, PISA 2012 Results]

2 Teacher Education in Canada

PROMOTING RESEARCH-BASED PHYSICS TEACHER EDUCATION IN CANADA: BUILDING BRIDGES BETWEEN THEORY AND PRACTICE

BY MARINA MILNER-BOLOTIN

More than 25 years ago, Lee S. Shulman, then president of the American Educational Research Association^[1], challenged us to re-think how we prepare teachers through focussing on *Pedagogical Content Knowledge* (PCK) - the knowledge of content and content-specific pedagogies. Shulman pointed out that in their attempt to incorporate generic educational research, many Teacher Education Programs suffered from the “missing paradigm” problem. They neglected the nature

content-specific professional development, teacher education programs should emphasize the development of teacher-candidates’ PCK.

Lastly, there is a significant gap between the findings of Physics Education Research (PER)^[4] and current physics teaching practices. In the words of the 2007 Nobel Laureate, Prof. Carl Wieman,



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4 Clickers & Active Learning

2004, *The Physics Teacher*, 42(8), 47-48.

Tips for Using a Peer Response System in a Large Introductory Physics Class

Marina Milner-Bolotin, Physics and Astronomy Department, Rutgers, The State University of New Jersey
Piscataway, NJ 08854-8019; milnerm@physics.rutgers.edu

Clickers beyond the First Year Science Classroom

Marina Milner-Bolotin

Tetyana Antimirova

Anna Petrov

2010, *Journal of College Science Teaching*,
40(2), 18-22.

Teaching physics is a challenge for

Abstract:

This case study's primary objective is to describe the implementation of the electronic peer response-system (clickers) in a small (N=25) second-year physics class.



4 Peer Instruction Pedagogy

LUMAT 1(5), 2013

Modeling Active Engagement Pedagogy through Classroom Response Systems in a Physics Teacher Education Course

Marina Milner-Bolotin

Department of Curriculum and Pedagogy, Faculty of Education, The University of British Columbia •
marina.milner-bolotin@ubc.ca

Heather Fisher

Department of Curriculum and Pedagogy, Faculty of Education, The University of British Columbia

Alexandra MacDonald

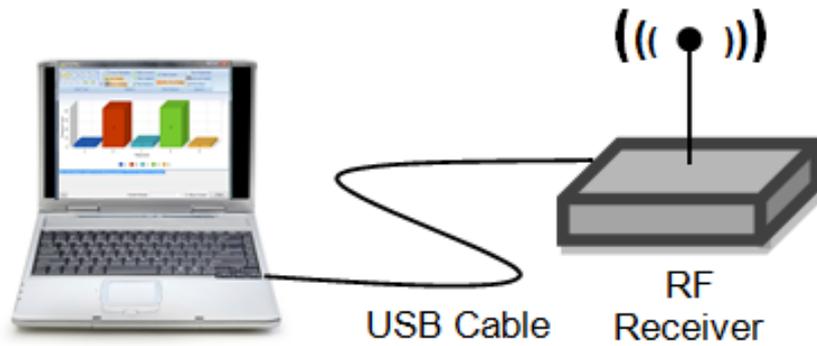
Department of Curriculum and Pedagogy, Faculty of Education, The University of British Columbia

Abstract One of the most commonly explored technologies in Science, Technology, and Mathematics (STEM) education is Classroom Response Systems (CRS). In this study, we explore how instructors generate in-class discussion by soliciting student responses using CRS.

[LUMAT: Research and Practice in Math, Science & Technology Education, 2013. 1(5): p. 525-544.]

4

Technology for Peer Instruction



USB Cable

RF Receiver



Clickers used by the students

Software installed on the teacher's computer connected to a classroom projector

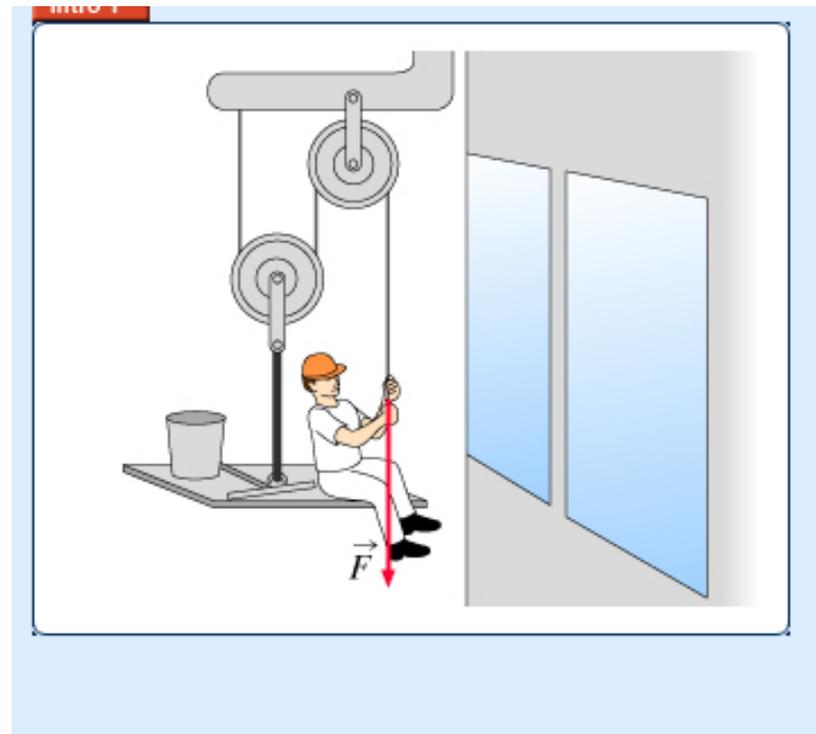


In near future smart phones, i-pads and other devices will replace clickers, **but the basic pedagogy will remain the same...**

4 Peer Instruction Example 1

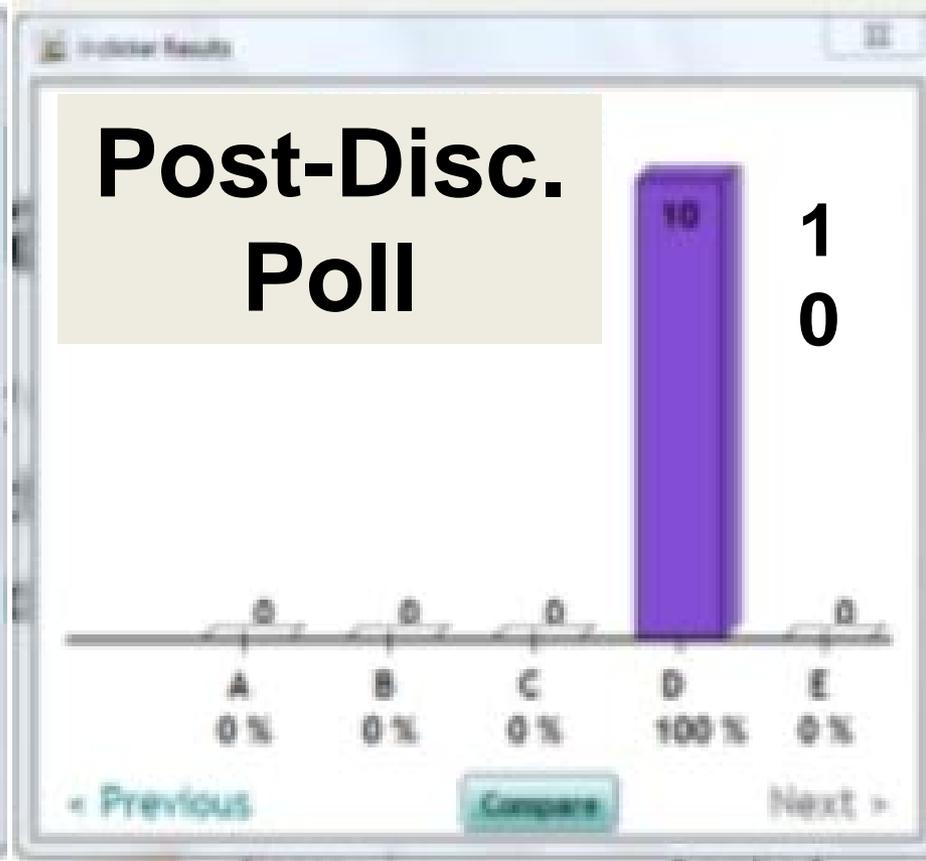
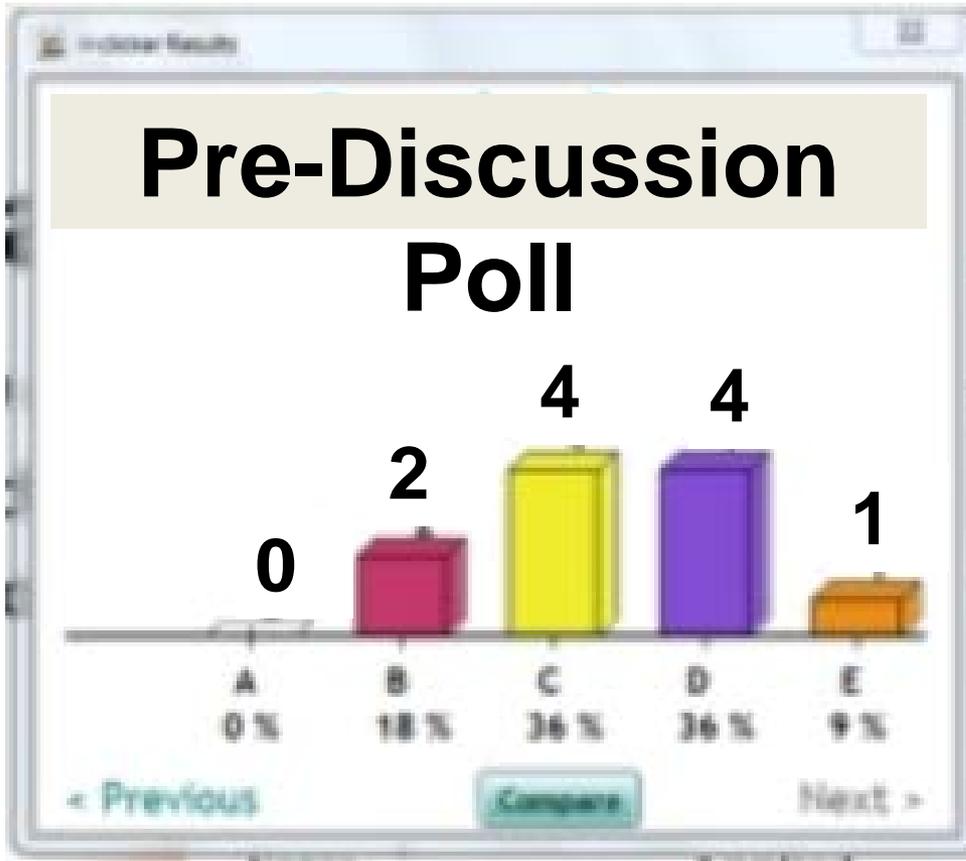
Find the magnitude of the force a 60 kg person has to pull the rope with in order to pull himself upwards with a **constant speed**.

- A. 600 N
- B. 450 N
- C. 300 N
- D. 200 N
- E. 150 N



4

Peer Instruction in Action

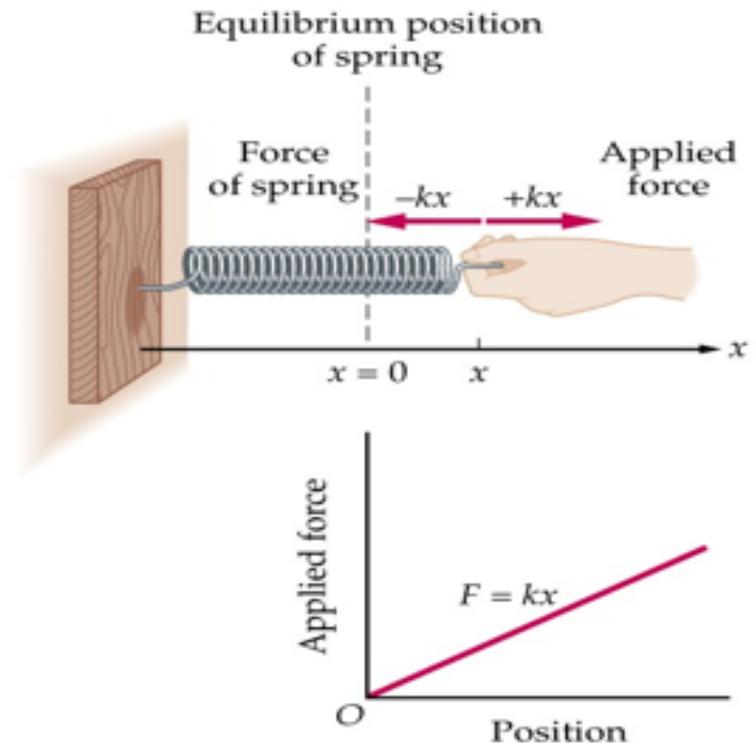


Respondents: Physics Teacher-Candidates

4 Peer Instruction Example 2

The work needed to stretch a spring **10 cm** from equilibrium (from $x_1 = 0$ m to $x_2 = 0.1$ m) is **10 J**. How much work needs to be done to stretch the spring additional **10 cm** (from $x_2 = 0.1$ m to $x_3 = 0.2$ m) ?

- A. 5 J
- B. 10 J
- C. 20 J
- D. 30 J
- E. 40 J

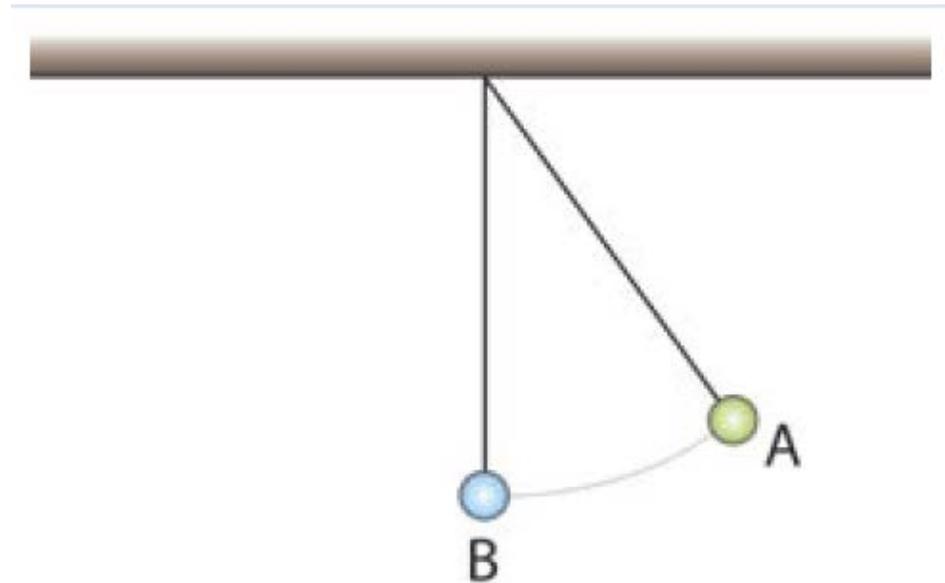


4 Peer Instruction Example 3

A 0.2-kg pendulum bob is attached to a string 1.2 m long. The bob is released at the point A as shown in the picture. The tension in the string as the bob passes its lowest position is about (use $g = 10 \text{ m/s}^2$):

- (A) 0.00 N (B) 0.70 N (C) 1.30 N (D) 2.00 N (E) 2.70 N

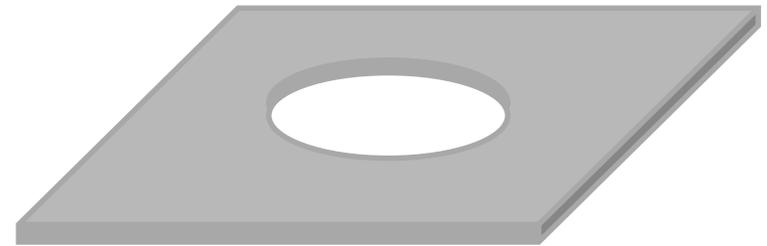
- A. (A)
B. (B)
C. (C)
D. (D)
E. (E)



4 Peer Instruction Example 4

You have a uniform metal plate with a circular hole inside it. You heat it up by 200°C . **As a result of heating, the hole will:**

1. Increase
2. Decrease
3. Remain the same



Math & Science Teaching & Learning through Technology

UBC a place of mind + FACULTY OF EDUCATION Math & Science Teaching & Learning
DEPARTMENT OF CURRICULUM AND PEDAGOGY through Technology

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ality, research-based technology-supported
onal materials for mathematics and science K-12
oms through creating a community of science and
matics educators, researchers and students.

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Home Resources CREATE Seminars 2012/13

CREATE
Community to Reimagine Educational Alternatives for Teacher Education

Resources

- Awards
- Current Students
- Prospective Students
- Faculty and Staff

CREATE is a faculty-wide initiative established by [Dr. Rita Irwin](#), Associate Dean of Teacher Education programs, to inspire innovations in teacher education at UBC.

Seminars are held in [Neville Scarfe, Room 310](#) from 12:30 – 2:00 p.m. (unless otherwise noted).

Presentation about MSTLTT Project
On October 16th Dr. Marina Milner-Bolotin was invited to present a seminar to faculty and students at UBC Teacher Education Program

[Read More](#)

VECTORS
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MOMENTUM
WORK,ENERGY,POWER
THERMODYNAMICS
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GRAVITATION
WAVE MOTION AND OPTICS
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EQUILIBRIUM
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MATH & SCIENCE TEACHING & LEARNING THROUGH TECHNOLOGY

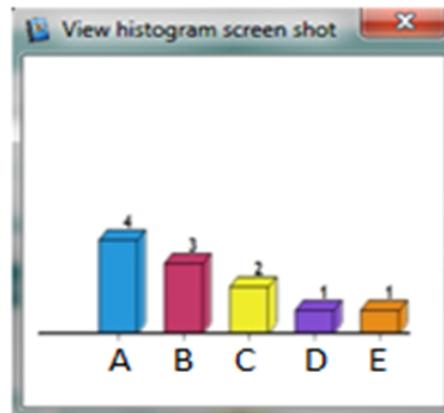
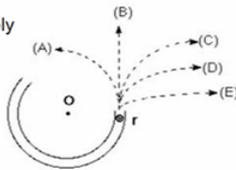
<http://scienceres-edcp-educ.sites.olt.ubc.ca/>

Technology-Enhanced Science Education

Question

A ball travels through the circular track until point r , at which point it leaves the channel to travel across a frictionless floor. Assume a bird's eye view, and that all motion is in the horizontal plane.

Which path will the ball most closely follow after it exits the channel?



PeerWise

EDCP357 (Winter 1, 2013)

[Home](#) | [Main menu](#) > Comments written by you

Comments written by you

Comments written by you, about questions you have answered, are shown below.

Select an order:

[New replies](#) [Most recent first](#) [Show agreements only](#) [Show disagreements only](#)

Showing new replies only

No comments to view

[Return to main menu](#)

Peer Instruction and PeerWise integration

4

PeerWise Online System



EDCP357 (Winter 1, 2013)

[Home](#) | [Main menu](#) > Comments written by you

Comments written by you

Comments written by you, about questions you have answered, are shown below.

Select an order:

[New replies](#) [Most recent first](#) [Show agreements only](#) [Show disagreements only](#)

Showing new replies only

No comments to view

[Return to main menu](#)



What is PeerWise?

Students use PeerWise to create and to explain their understanding of course related assessment questions, and to answer and discuss questions created by their peers.

<http://peerwise.cs.auckland.ac.nz/>

4

Let us Play a Game

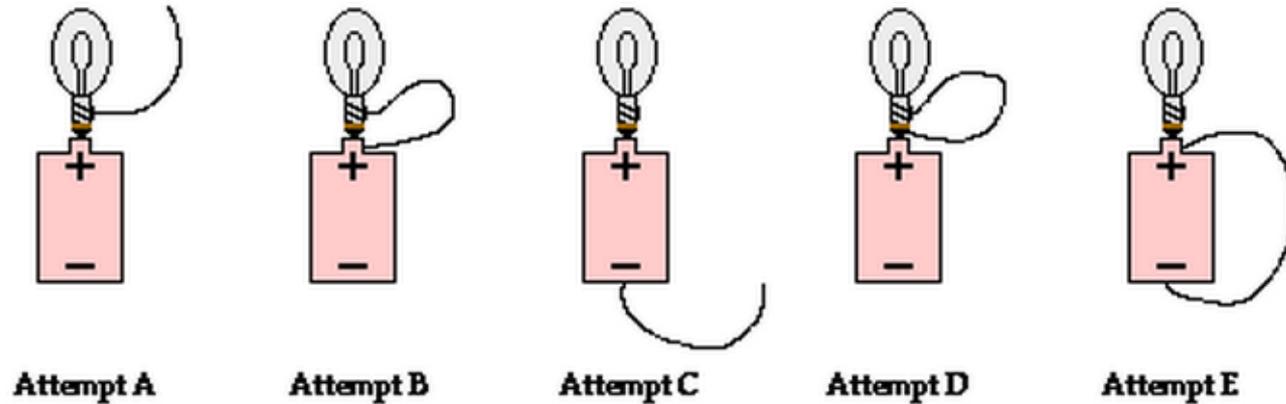


You have a light bulb, a battery and a wire. Draw all possible way how you can connect them to light up the light bulb

4

How Students Learn

Unsuccessful Attempts at Lighting the Light Bulb



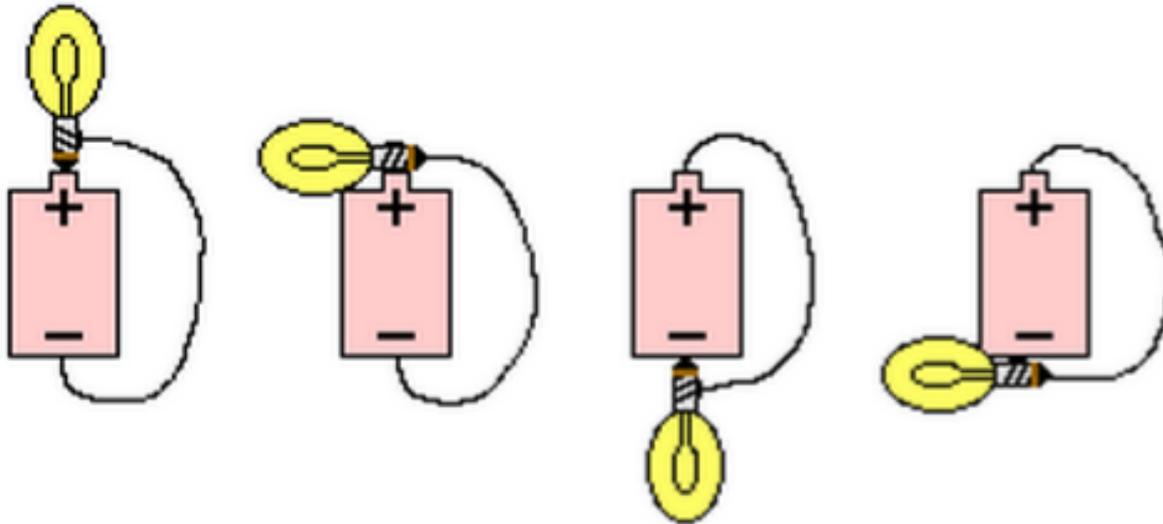
Unsuccessful attempts



4

How Students Learn

Successful Attempts at Lighting the Light Bulb



Unsuccessful attempts



4

What is PhET?

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RESOURCES

Over 200 million simulations delivered

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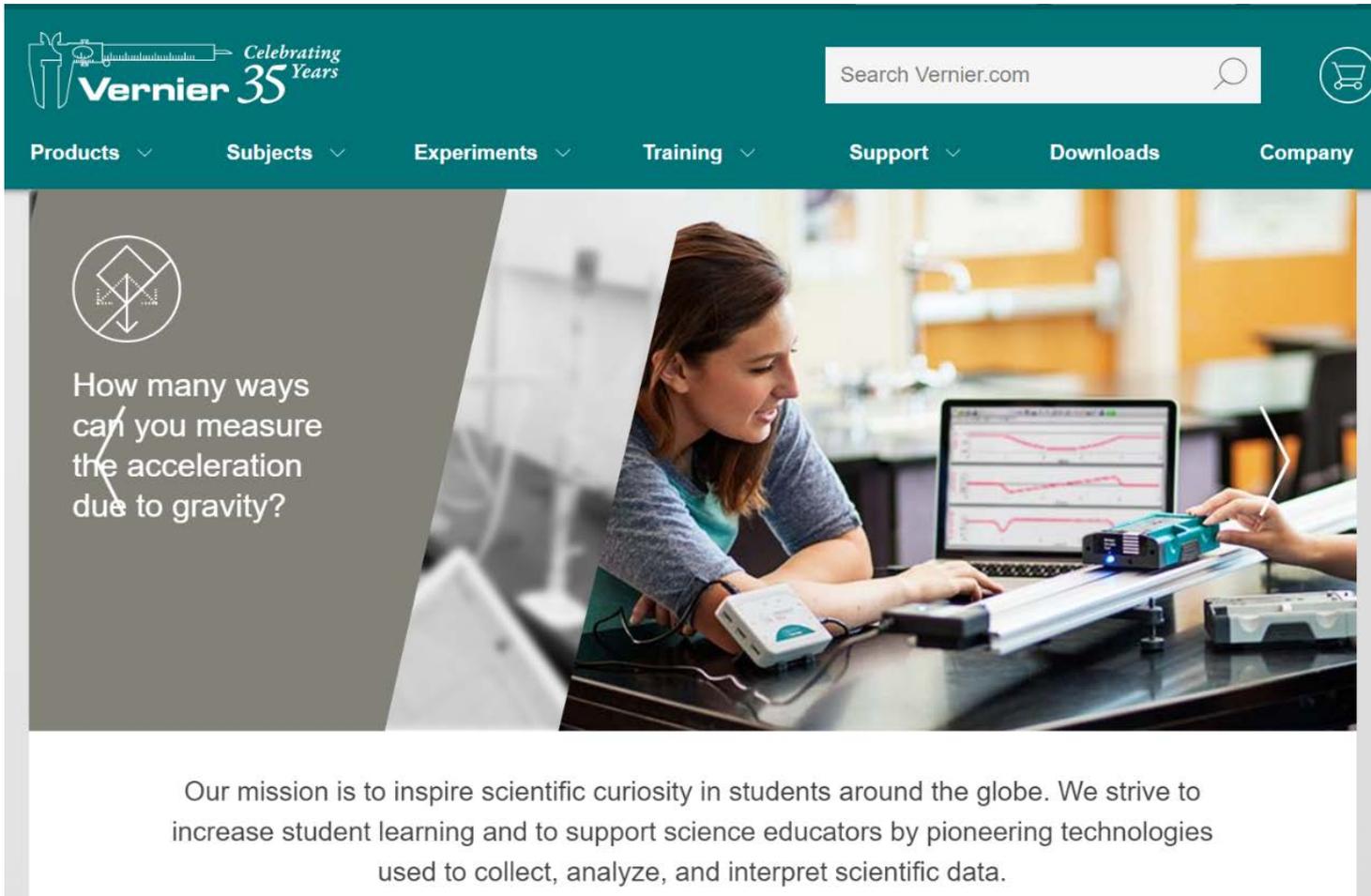
Panco Pan America Construction Corp.

and our [other sponsors](#), including educators like you.

PhET Computer simulations from the University of Colorado, Boulder

You can download the simulations. You can also use Chinese!

4 Sensors in Physics Teaching



The image shows a screenshot of the Vernier website. The header is dark green with the Vernier logo on the left, which includes a stylized 'V' and the text 'Celebrating 35 Years'. To the right of the logo is a search bar with the text 'Search Vernier.com' and a magnifying glass icon. Further right is a shopping cart icon. Below the header is a navigation menu with the following items: 'Products', 'Subjects', 'Experiments', 'Training', 'Support', 'Downloads', and 'Company', each with a downward arrow. The main content area features a large photograph of a woman in a classroom setting, smiling as she works on a laptop. The laptop screen displays several graphs. In the foreground, there is a Vernier motion detector on a track, connected to a computer interface. To the left of the photograph, there is a circular icon containing a diamond shape with a vertical line and arrows pointing up and down, and the text 'How many ways can you measure the acceleration due to gravity?'. Below the photograph, there is a paragraph of text: 'Our mission is to inspire scientific curiosity in students around the globe. We strive to increase student learning and to support science educators by pioneering technologies used to collect, analyze, and interpret scientific data.'

Vernier Celebrating 35 Years

Search Vernier.com

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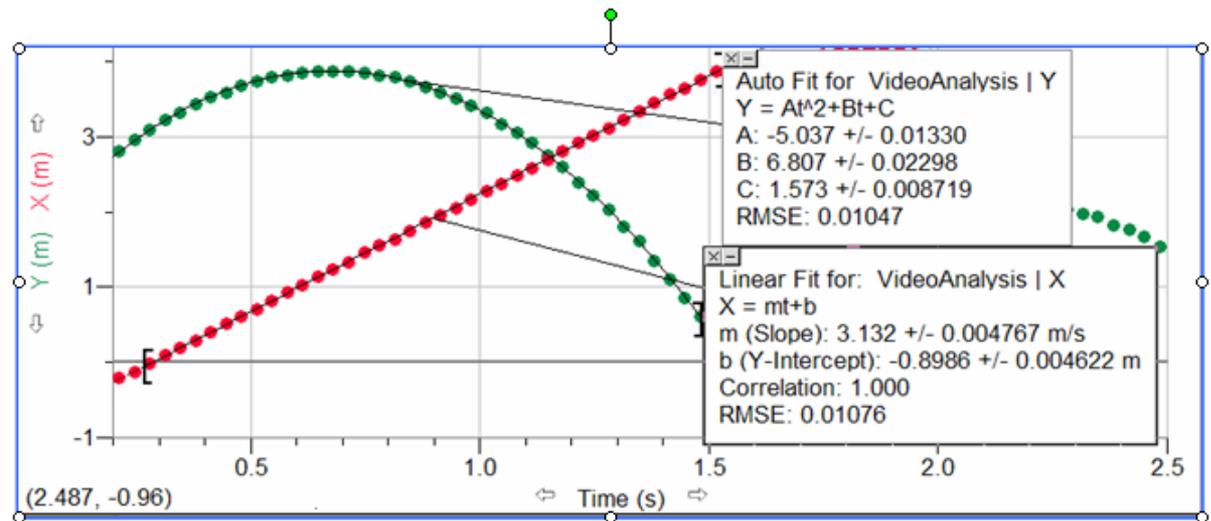
How many ways can you measure the acceleration due to gravity?

Our mission is to inspire scientific curiosity in students around the globe. We strive to increase student learning and to support science educators by pioneering technologies used to collect, analyze, and interpret scientific data.

4 Reconsidering Assessment

Your friend analyzed a video clip of a basketball shot using a Logger *Pro* Video Analysis feature. However she was not certain how to find the acceleration of free fall from his analysis and turned to you for advice. What is the **reasonable experimental value** of the **magnitude** of the acceleration of free fall your friend should report during the next class?

- a) 5.037 m/s²
- b) 6.807 m/s²
- c) 9.823 m/s²
- d) 10.074 m/s²
- e) 10.10 m/s²





Workshop: Feedback 1

How satisfied are you with the day?

1

3

5





Workshop: Feedback 2

Do you feel you have learned new ideas for math and science teaching?

1

3

5

