Chaoyang School District Professional Development Course May 19-30 2015

Teaching Math & Science With Technology in the 21st Century

朝陽區　朝阳区

Dr. Marina Milner-Bolotin

Day 4 - May, 2015

Day 4 – May 2015

Computer simulations, games and online learning environments

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

简体中文 | 正體中文

I Course Tentative Schedule

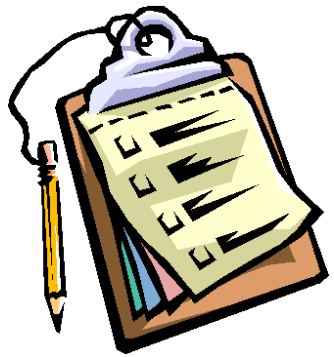
Day	Technology	
1	Student engagement: Clickers, multimedia	✔
2	Peer Instruction and PeerWise: inquiry via questioning; Exploring GeoGebra	✔
3	Data collection and analysis; mathematics modeling with Desmos	✔
4	Computer simulations, games, and online learning environments	✔
5	Summary and projects' presentations	

I This will revolutionize education or will it?

I This will revolutionize education or will it?

Agenda for the Day

I. Building students' intuition with technology: Earthquakes
II. Exploring virtual labs: PhET
III. Group activity: Designing lessons with PhET
IV. Flipped classroom and online teaching
V. Summary of the day



Agenda for the Day

I. **Building students' intuition with technology: Earthquakes**
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Dot-Decimal Notation:

点阵十进制表示法

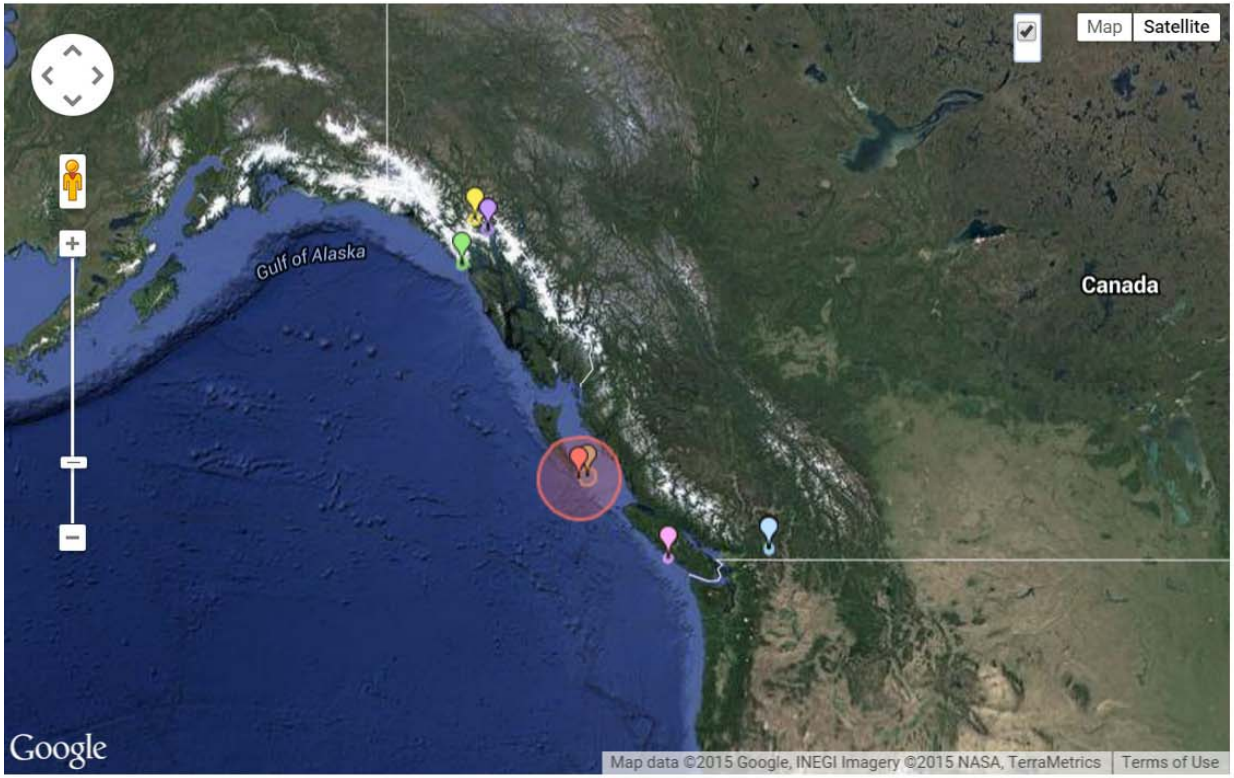
- In North America: $10.5 = 10\frac{1}{2}$
- In Europe and in China: $10{,}5 = 10\frac{1}{2}$

I am using North American notation: **1,234.56** means one thousand two hundred thirty four and 56/100

I Understanding Earthquakes' Magnitude

Nepal earthquake on 25th of April, 2015 – 7.8 in magnitude

I Understanding Earthquakes' Magnitude



6 days ago 2.2 magnitude, 0 km depth
British Columbia, Canada

7 days ago 1.9 magnitude, 13 km depth
Southeastern Alaska

8 days ago 2.1 magnitude, 7 km depth
Coast Of Southeastern Alaska

8 days ago 2.2 magnitude, 0 km depth
British Columbia, Canada

9 days ago 2.2 magnitude, 0 km depth
British Columbia, Canada

10 days ago 1.7 magnitude, 7 km depth
Southeastern Alaska

11 days ago 1.6 magnitude, 34 km depth
Vancouver Island, Canada

11 days ago 1.6 magnitude, 0 km depth
British Columbia, Canada

11 days ago 4.1 magnitude, 9 km depth
Haida Gwaii

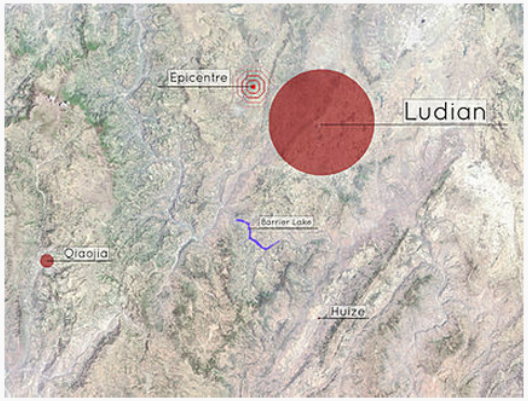
11 days ago 6.2 magnitude, 10 km depth
Kitimat, British Columbia, Canada

Earthquakes in British Columbia Canada: - Thursday, April 23, 2015 – 6.2 magnitude

I Understanding Earthquakes' Magnitude

2014 Ludian earthquake

Location of Yunnan Province in China

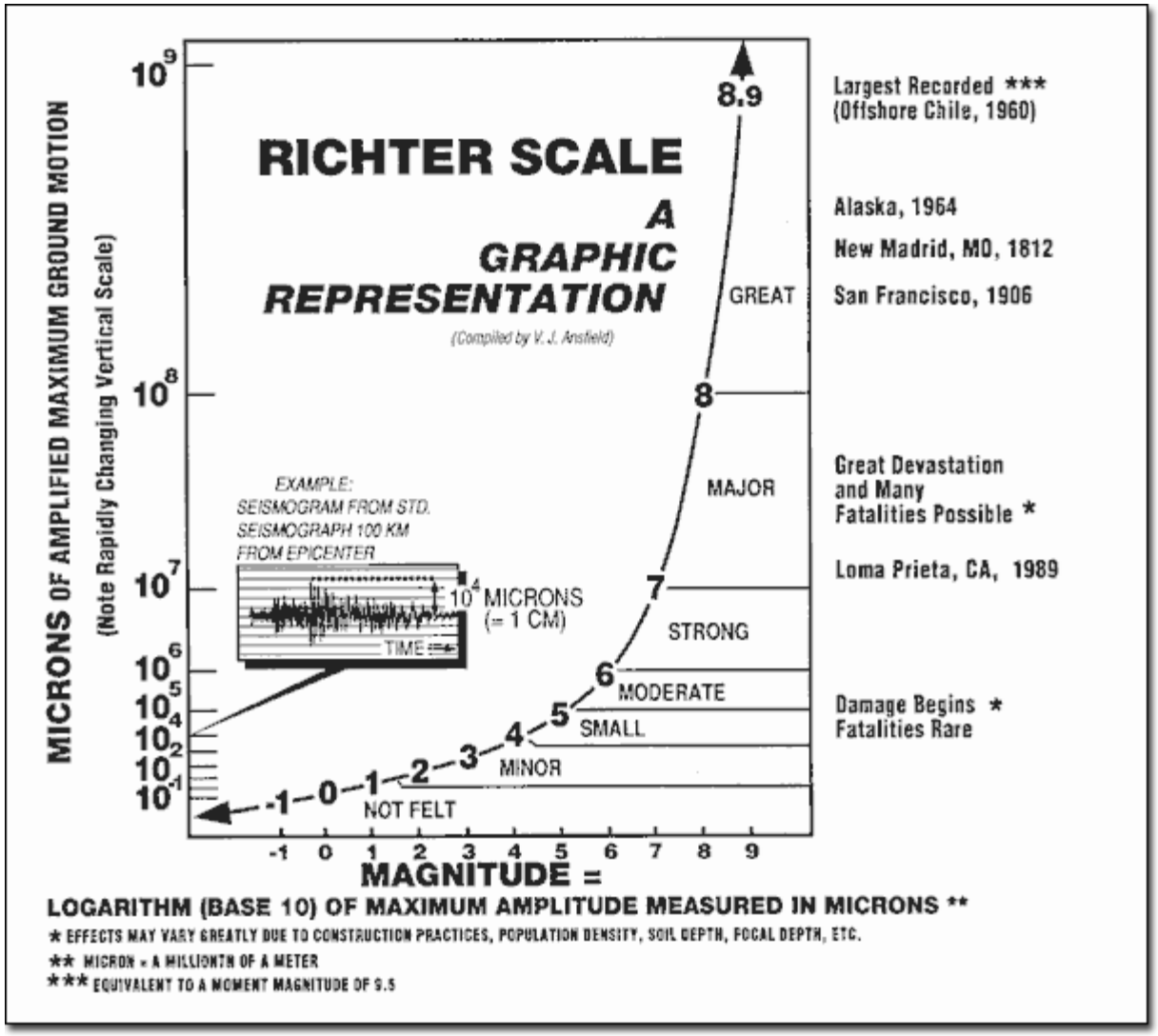


A map of the Ludian Earthquake. Size of red circles represent number of deceased per county.

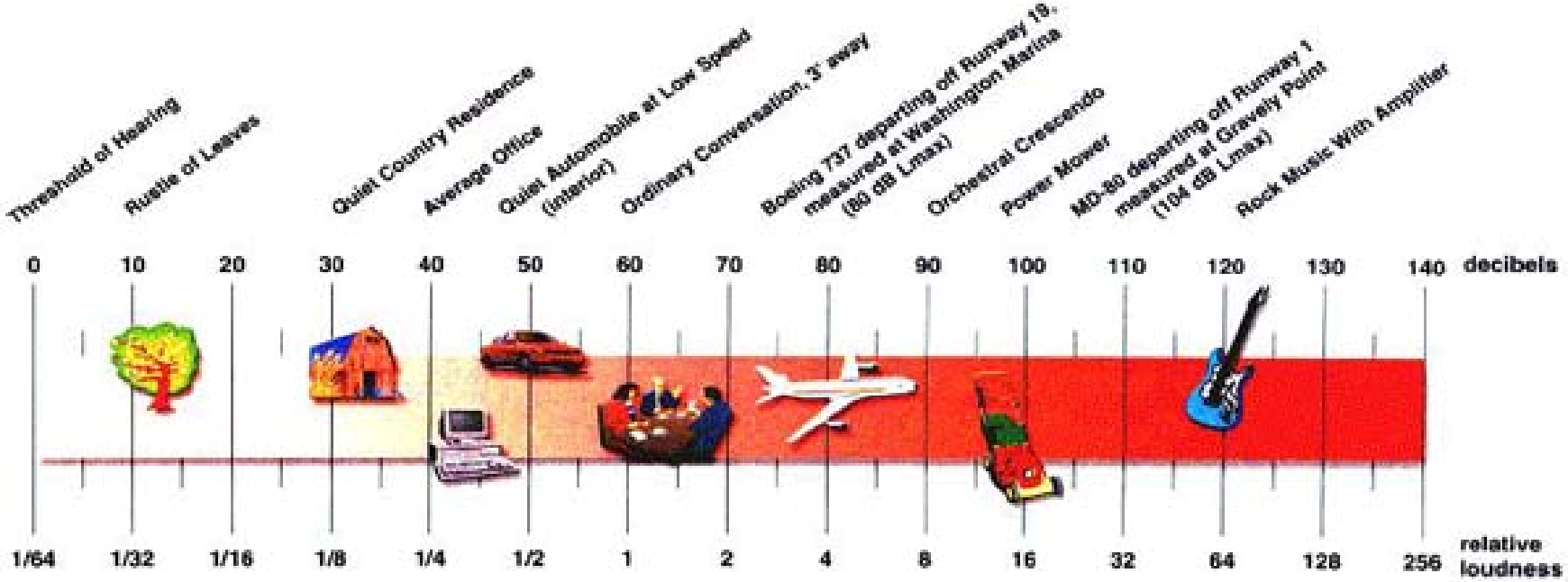
Date	3 August 2014
Origin time	08:03:13 UTC
Magnitude	6.5 M_L [1][2][3][4][5] 6.1 M_w [6]
Depth	10.0 km (6.2 mi)
Epicenter	27.245°N 103.427°E
Areas affected	Yunnan, China • Ludian County • Huize County • Qiaojia County
Total damage	$6 billion [7]
Max. intensity	VII (*Very Strong*) [8][9]
Casualties	617 dead (As of 8 August 7:00 UTC) [10] [11][12][13][14] 3,143 injured (As of 8 August 7:00 UTC) [7][10] 112 missing (As of 8 August 7:00 UTC) [10][15]

Earthquake in Ludian Province, China: - August 3, 2014 – 6.1 magnitude

Earthquakes' Magnitude: Richter Scale



Log Scale in Science: dB

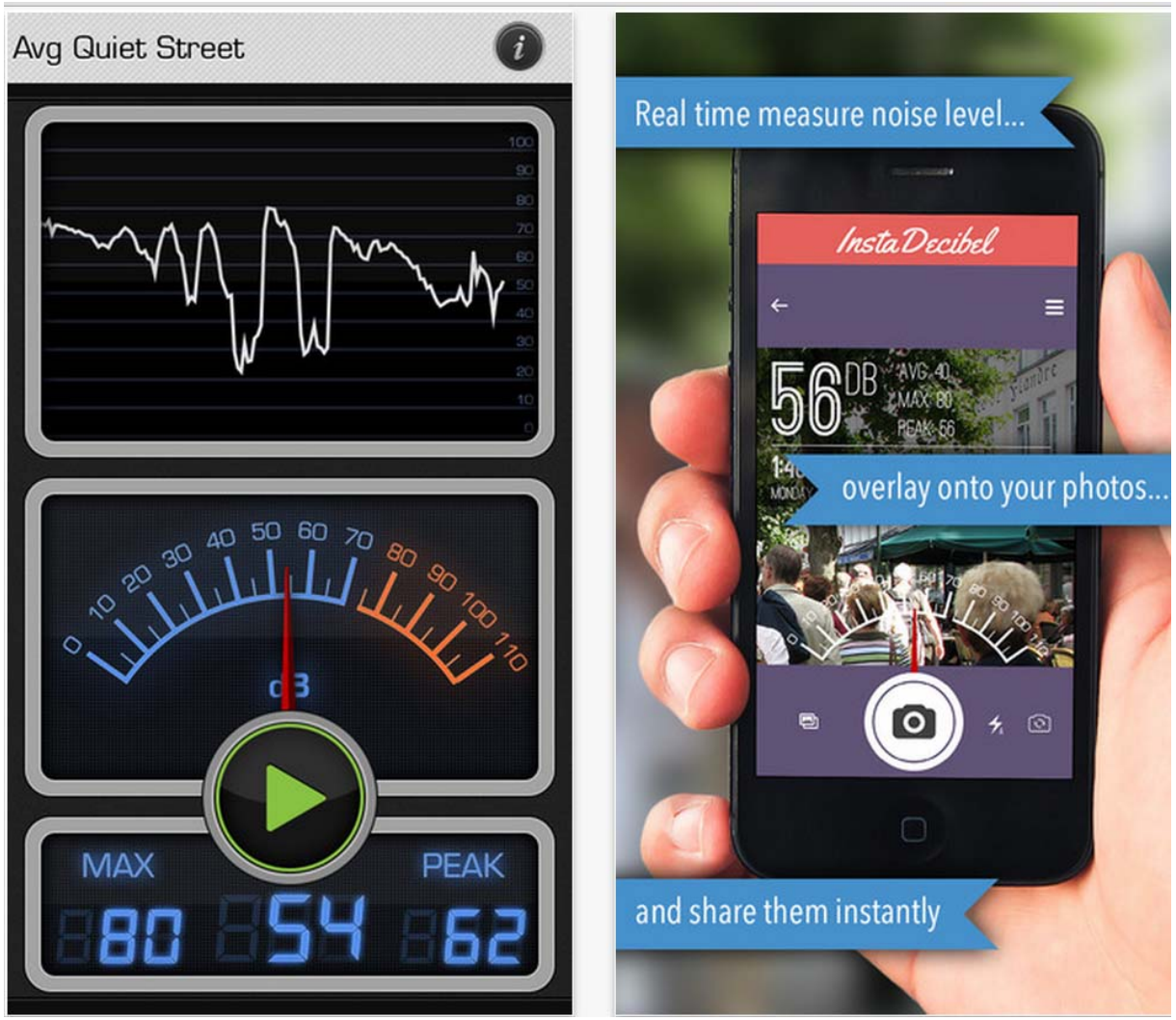


The **decibel (dB)** is a unit for describing sound pressure levels. A-weighted sound measurements (dBA) are filtered to reduce the effect of very low and very high frequencies, better representing human hearing. With A-weighting, sound monitoring equipment approximates the human ear's sensitivities to the different sounds of frequencies.

$$L_2 - L_1 = \left(10 \log \frac{P_2}{P_1}\right) dB \Rightarrow \text{If } P_2 = 2P_1 \Rightarrow L_2 - L_1 = 3dB$$

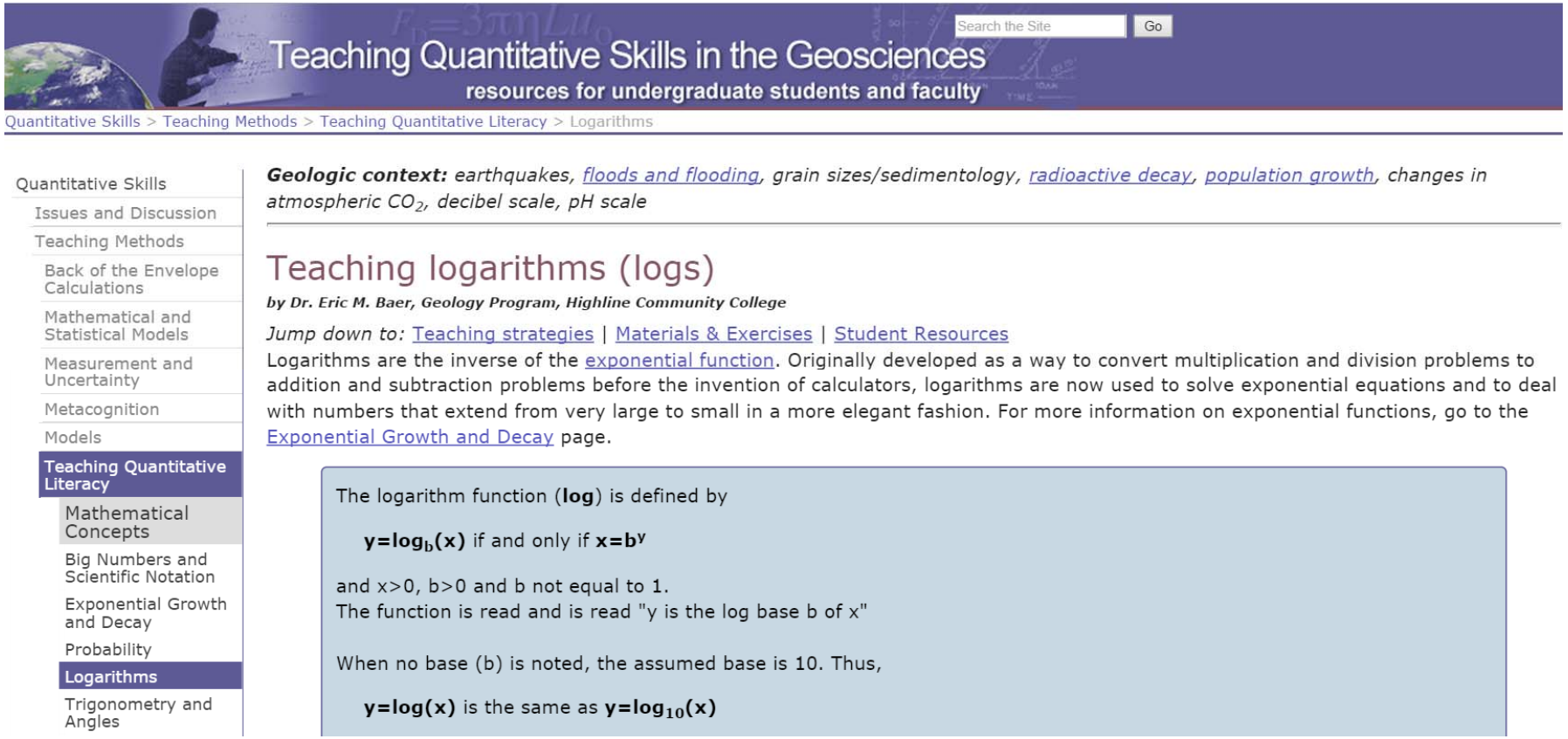
$L-$ sound pressure level measured in dB; P - power of sound

I Log Scale in Science: dB



Most Smart phones today will have apps that can help you measure sound levels.

I Students' Problems with Logarithmic Scales



http://serc.carleton.edu/quantskills/methods/quantlit/logarithms.html

I Comparing Earthquakes' Magnitudes

By how much the **magnitude of the earthquake** in Nepal (7.8) is larger than the magnitude of British Columbia or of Chinese recent earthquakes (6.1)?

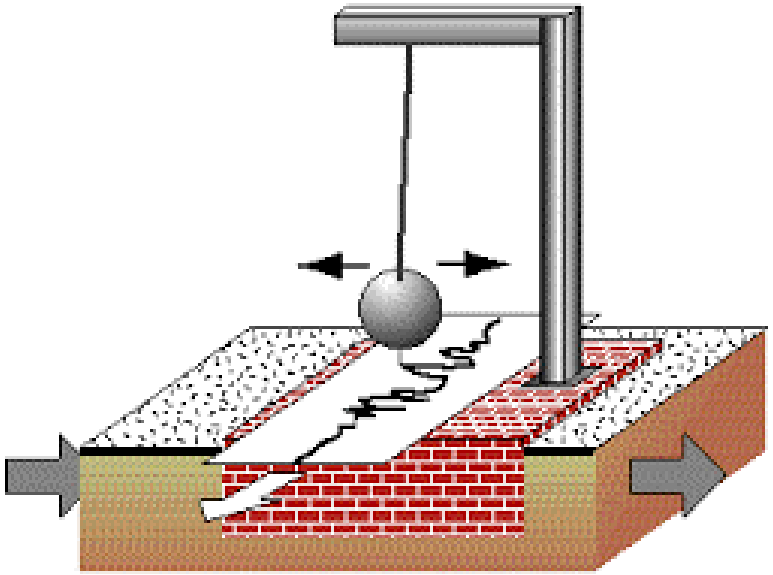
A. 1.7 times

B. 10 times

C. 50 times

D. 100 times

E. 350 times

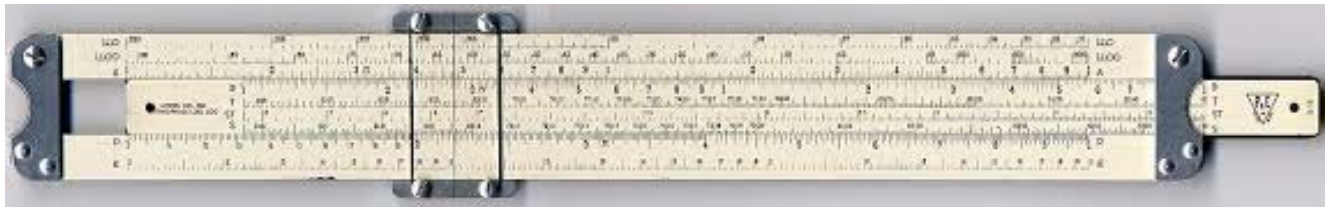


I Comparing Earthquakes' Magnitudes

A magnitude (M_s) 7.8 earthquake is 50 times BIGGER on a seismogram than a magnitude 6.1 earthquake. The magnitude scale is logarithmic, so

$$\frac{\text{Magnitude\_Nepal}}{\text{Magnitude\_China}} = \frac{M_{S\_Nepal}}{M_{S\_China}} = \frac{10^{7.8}}{10^{6.1}} = 10^{7.8-6.1}$$

$$\frac{M_{S\_Nepal}}{M_{S\_China}} = 10^{1.7} = 50.118 \approx 50 \text{ times}$$

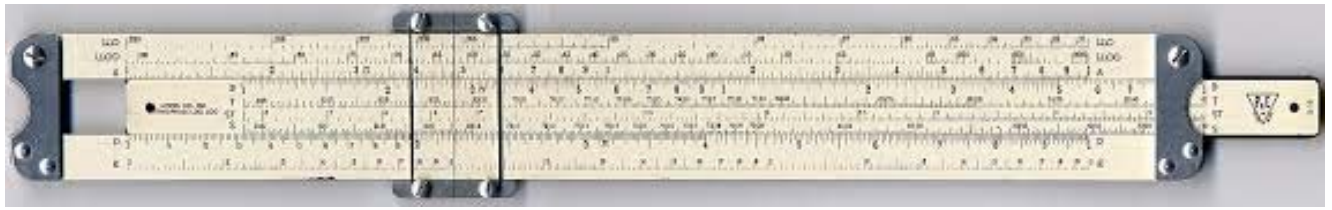


I Comparing Earthquakes' Magnitudes

1 unit of magnitude is about 10 times the amplitude on a seismogram; 0.1 unit of magnitude - 1.3 times the energy

$$\frac{\text{Magnitude\_Nepal}}{\text{Magnitude\_China}} = \frac{10^{7.8}}{10^{6.1}} = 10^{7.8-6.1}$$

$$\frac{\text{Magnitude\_Nepal}}{\text{Magnitude\_China}} = 10^{1.7} = 50.118 \approx 50 \text{ times}$$



I Comparing Earthquakes' Energy Release

By how much the **energy release of the earthquake** in Nepal (7.8) is larger than the magnitude of British Columbia or of Chinese recent earthquakes (6.1)?

A. 50 times

B. 150 times

C. 250 times

D. 350 times

E. 450 times

I Comparing Earthquakes' Energy Release

By how much the **energy release of the earthquake** in Nepal (7.8) is larger than the magnitude of British Columbia or of Chinese recent earthquakes (6.1)?

A. 10 times

B. 150 times

C. 250 times

D. 350 times

E. 450 times

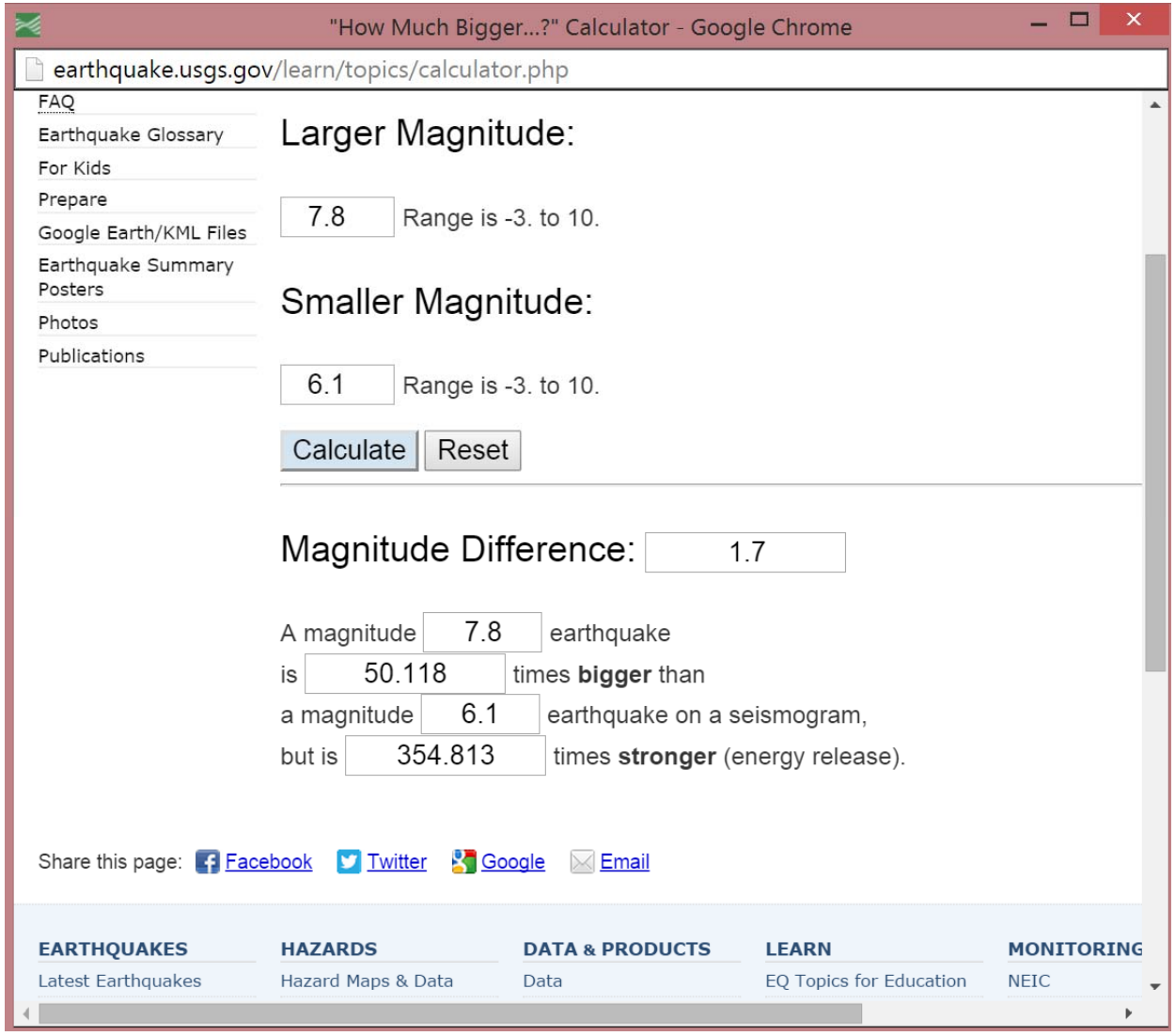
$$\log_{10} Energy = 11.8 + 1.5\,\mathrm{M}_S$$

$$Energy = 10^{(11.8+1.5\mathrm{M}_S)} = 10^{11.8} \times 10^{1.5\mathrm{M}_S}$$

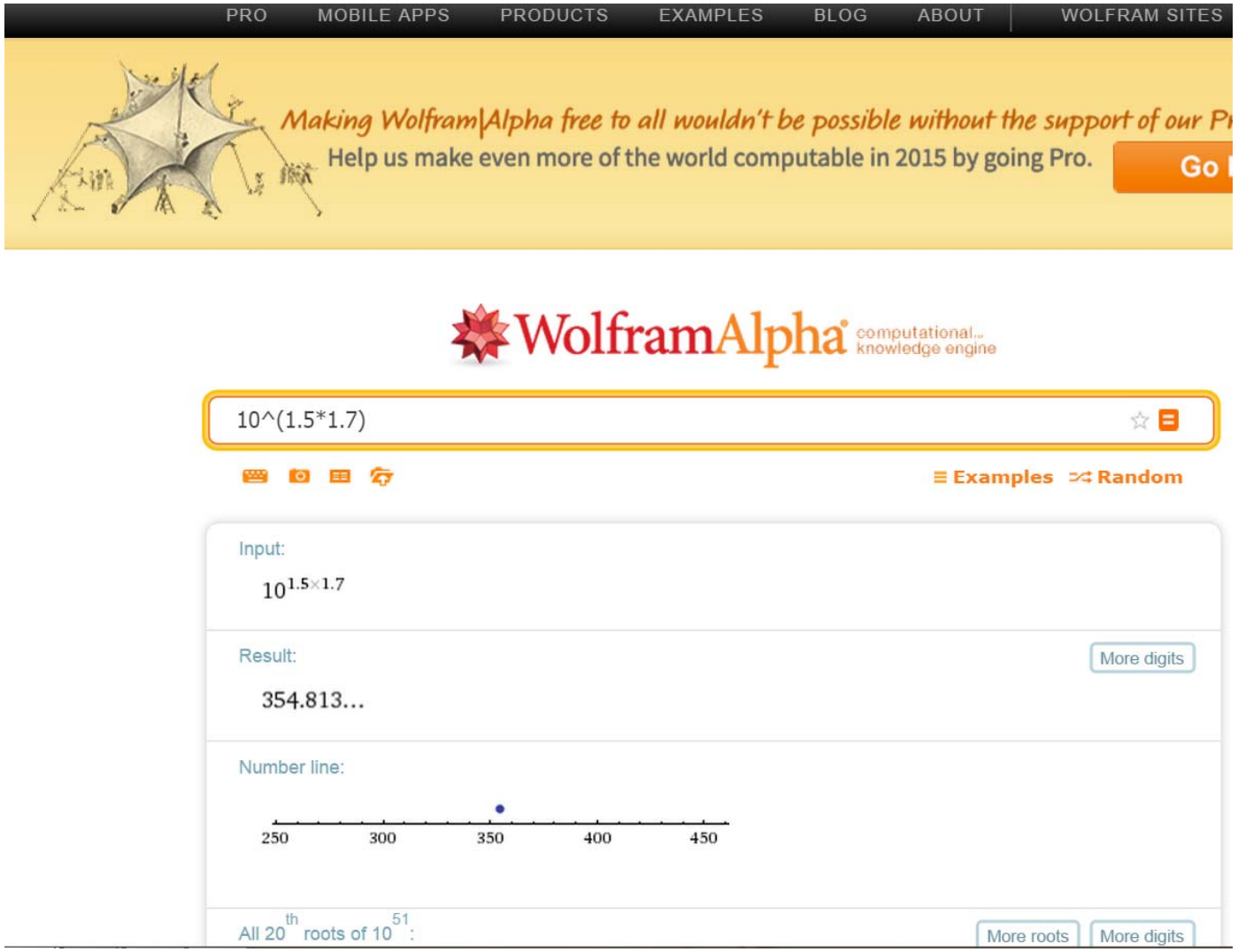
$$\frac{\mathrm{Energy\_Nepal}}{\mathrm{Energy\_China}} = \frac{10^{11.8} \times 10^{1.5\mathrm{M}_{S\_Nepal}}}{10^{11.8} \times 10^{1.5\mathrm{M}_{S}\_China}}$$

$$\frac{\mathrm{Energy\_Nepal}}{\mathrm{Energy\_China}} = 10^{1.5(7.8-6.1)} = 354$$

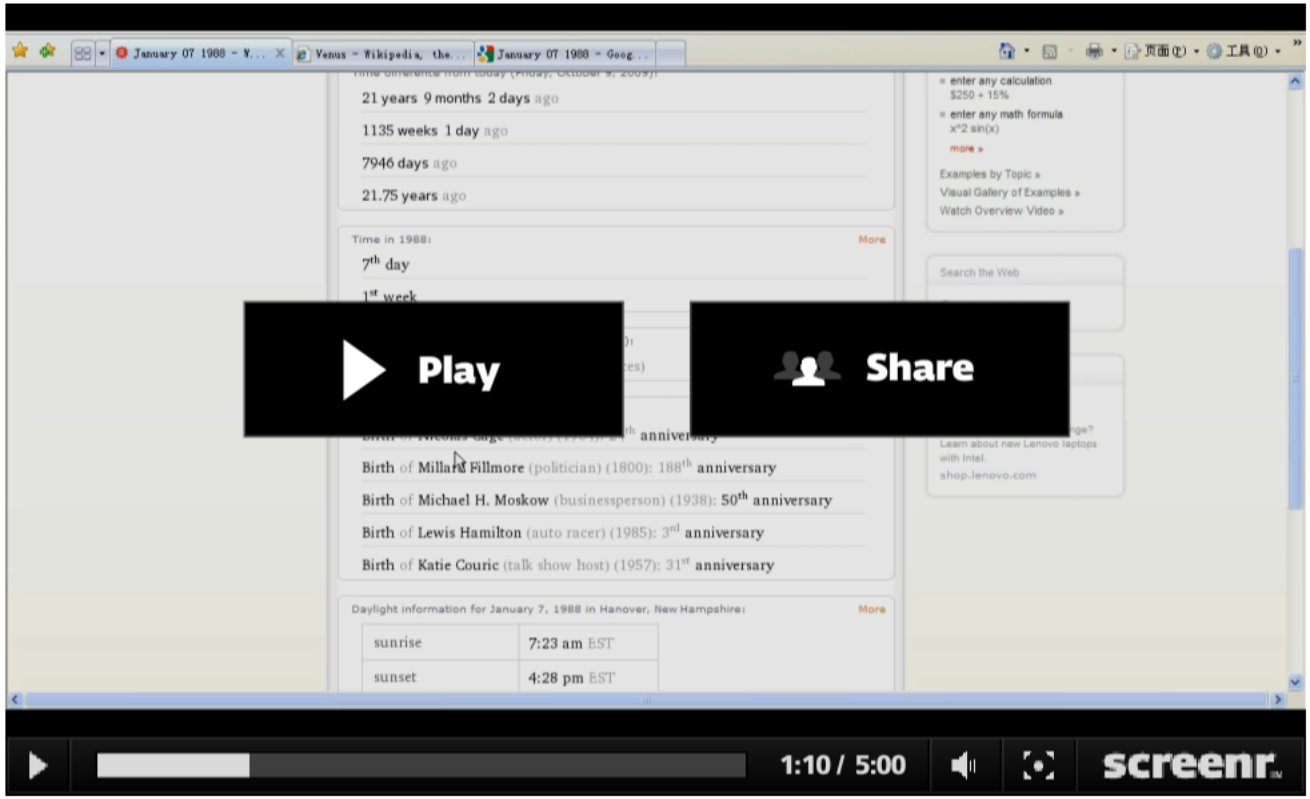
I Understanding Earthquakes



I Wolfram Alpha



I Wolfram Alpha



Agenda for the Day

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What is PhET?

FREE resources

PhET Computer simulations from the University of Colorado, Boulder

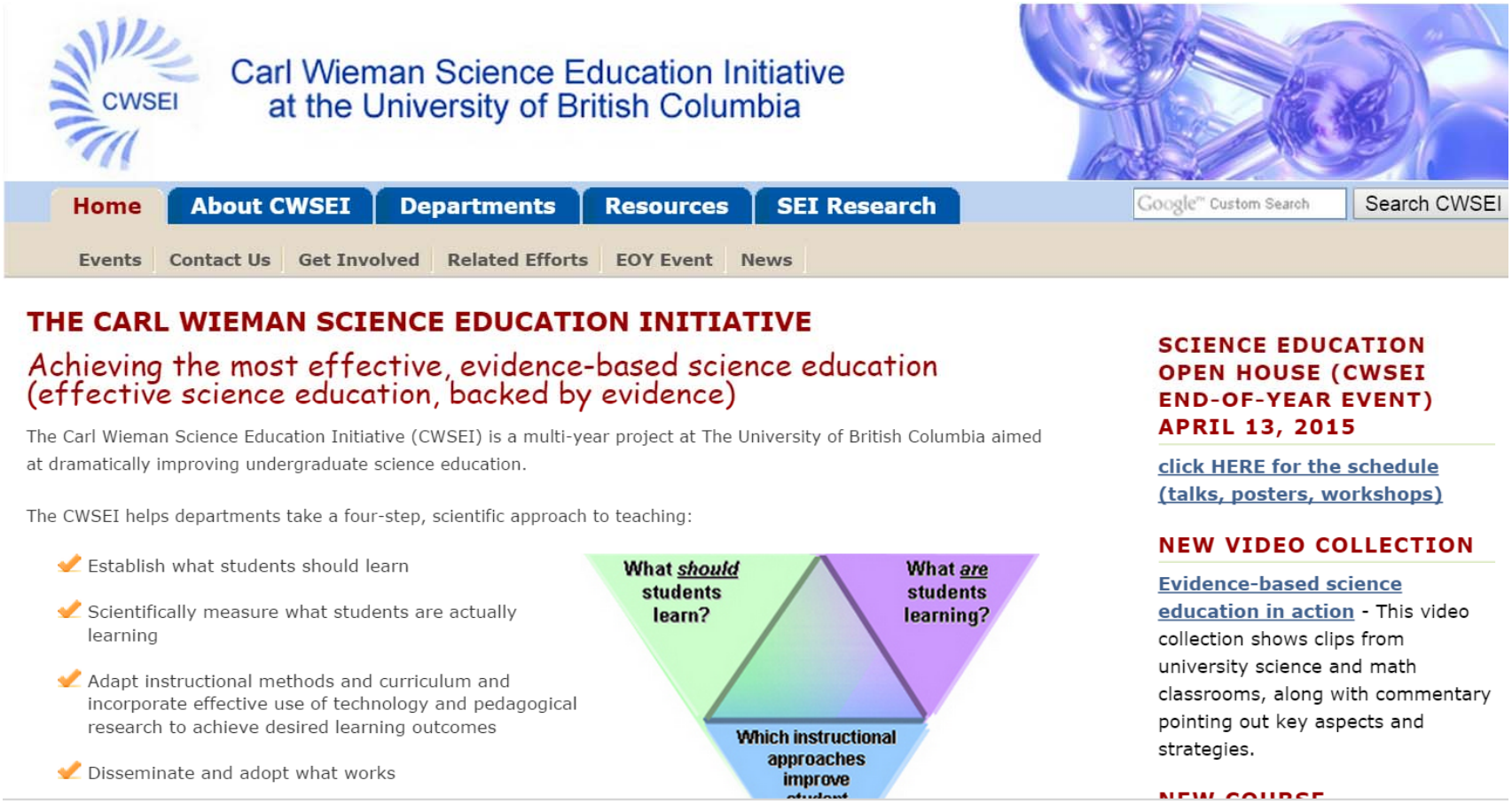
You can download the simulations. You can also use Chinese!

简体中文 | 正體中文

Carl Wieman – 2001 Nobel Prize in Physics

Wieman joined UBC on January1, 2007 and headed a CWSEI; he retained a 20% appointment at the University of Colorado Boulder to head the PhET science education project he founded in Colorado.[3] … In 2013 he moved to Stanford. He currently serves as Chair of the Board on Science Education of the National Academy of Sciences. He has used and promotes Eric Mazur's "peer instruction"… In 2007, Wieman was awarded the AAPT Oersted Medal, which recognizes notable contributions to the teaching of physics.

The Carl Wieman Science Education Initiative at UBC



http://www.cwsei.ubc.ca/

II Virtual Labs

PHYSICAL REVIEW SPECIAL TOPICS - PHYSICS EDUCATION RESEARCH **1**, 010103 (2005)

When learning about the real world is better done virtually: A study of substituting computer simulations for laboratory equipment

N. D. Finkelstein, W. K. Adams, C. J. Keller, P. B. Kohl, K. K. Perkins, N. S. Podolefsky, and S. Reid
Department of Physics, University of Colorado, Boulder, Colorado 80309, USA

R. LeMaster
Kavli Operating Institute, Santa Barbara, California 93101, USA
(Received 17 May 2005; published 6 October 2005)

This paper examines the effects of substituting a computer simulation for real laboratory equipment in the second semester of a large-scale introductory physics course. The direct current circuit laboratory was modified to compare the effects of using computer simulations with the effects of using real light bulbs, meters, and wires. Two groups of students, those who used real equipment and those who used a computer simulation that explicitly modeled electron flow, were compared in terms of their mastery of physics concepts and [illegible] real equipment. Students who used the simulated equipment outperformed th[illegible] ceptual survey of the domain and in the coordinated tasks of a[illegible] worked.

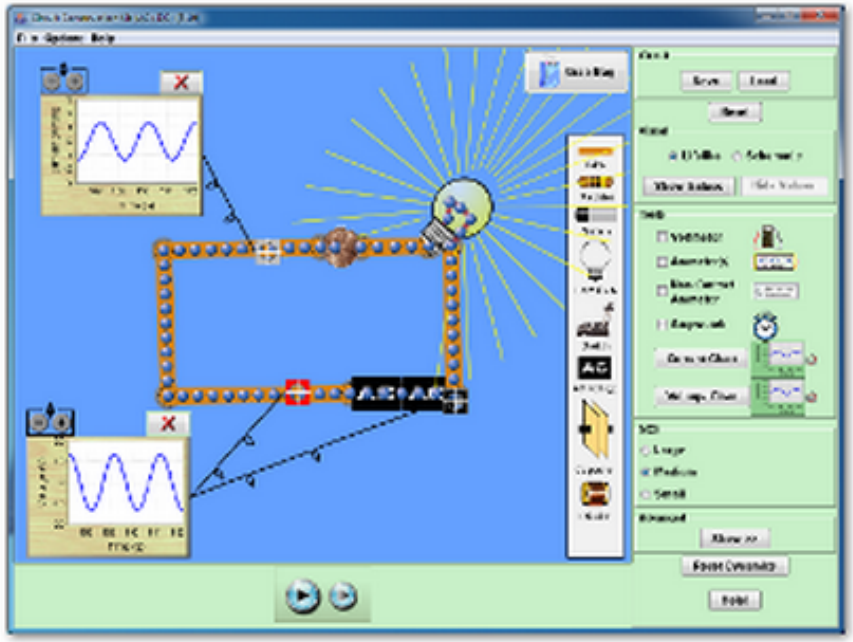
[Finkelstein, N. D., Adams, W. K., Keller, C. J., Kohl, P. B., Perkins, K. K., Podolefsky, N. S., . . . LeMaster, R. (2005). When learning about the real world is better done virtually: A study of substituting computer simulations for laboratory equipment. Physical Review Special Topics - Physics Education Research, 1(1), 010103.]

What is PhET?

II Experimenting with DC or AC Circuits

- Home
- Simulations
  - New Sims
  - Physics
    - Motion
    - Sound & Waves
    - Work, Energy & Power
    - Heat & Thermo
    - Quantum Phenomena
    - Light & Radiation
    - Electricity, Magnets & Circuits
  - Biology
  - Chemistry
  - Earth Science
  - Math

Circuit Construction Kit (AC+DC)



Download

Run Now!

Embed

Version 3.20

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III Guiding Questions for PhET

1. Why do I want my student to use PhET?
2. When do I use PhET (home, in class, before instruction, during, or after?)
3. How do I assess student work?
4. Do they work in group or alone?
5. How do I guide them?
6. How do I incorporate it into final assessment?

III Designing Lessons with PhET

Group activity (45 min)

1. Choose a partner and explore PhET together
2. Design your own PhET activity
3. Share your activity with another group
4. We will share all the ideas with the entire group

III Break: Mental Exercise

III Break: Mental Exercise

Suppose 6 monkeys take 6 minutes to eat 6 bananas. How many minutes would it take 4 monkeys to eat 4 bananas?

a) 1 minute
b) 4 minutes
c) 6 minutes
d) 12 minutes
e) 24 minutes

III Break: Mental Exercise

Suppose 6 monkeys take 6 minutes to eat 6 bananas. How many monkeys would it take to eat 42 bananas in 42 minutes?

a) 6 monkeys
b) 7 monkeys
c) 13 monkeys
d) 42 monkeys
e) Other

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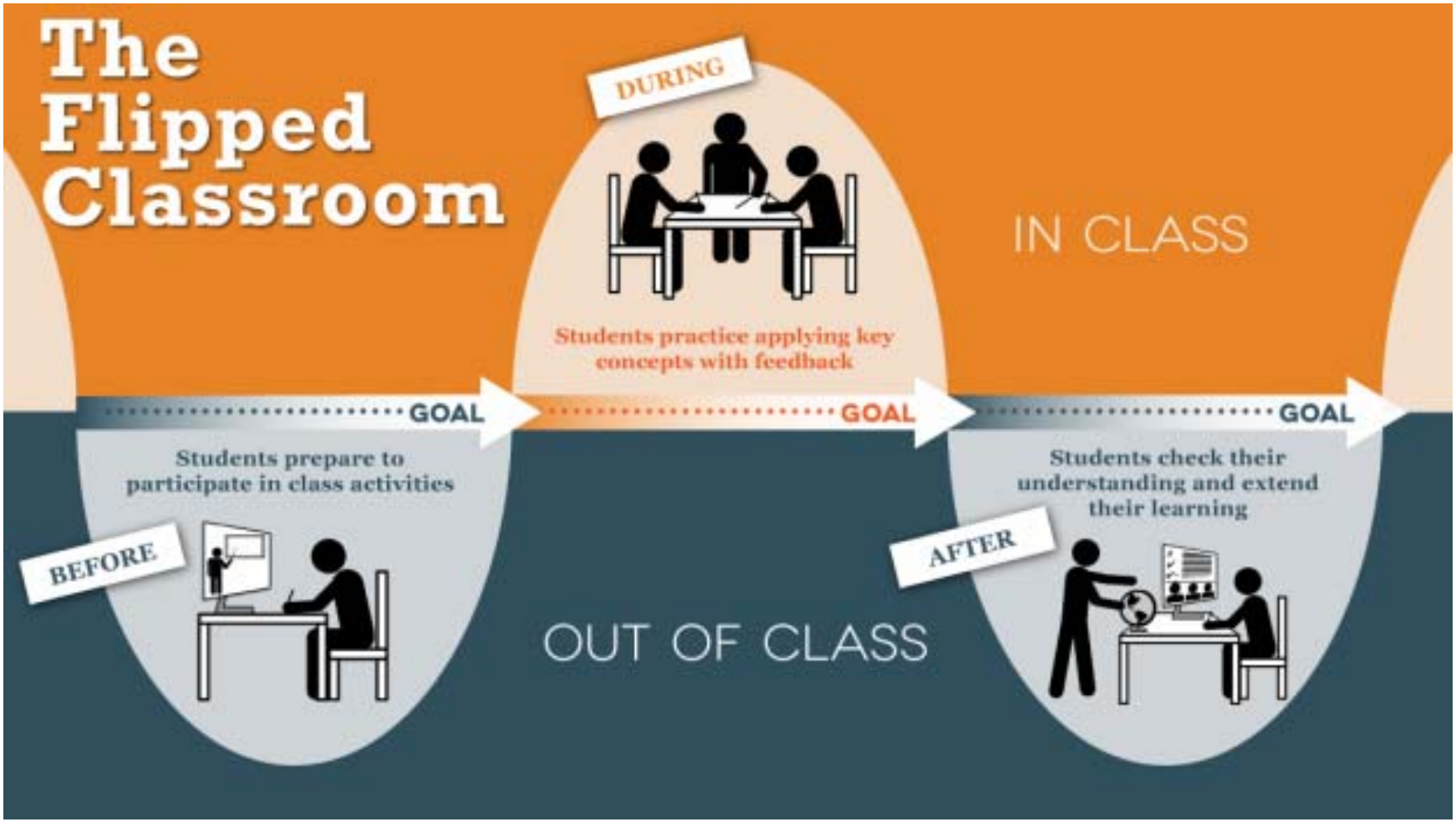
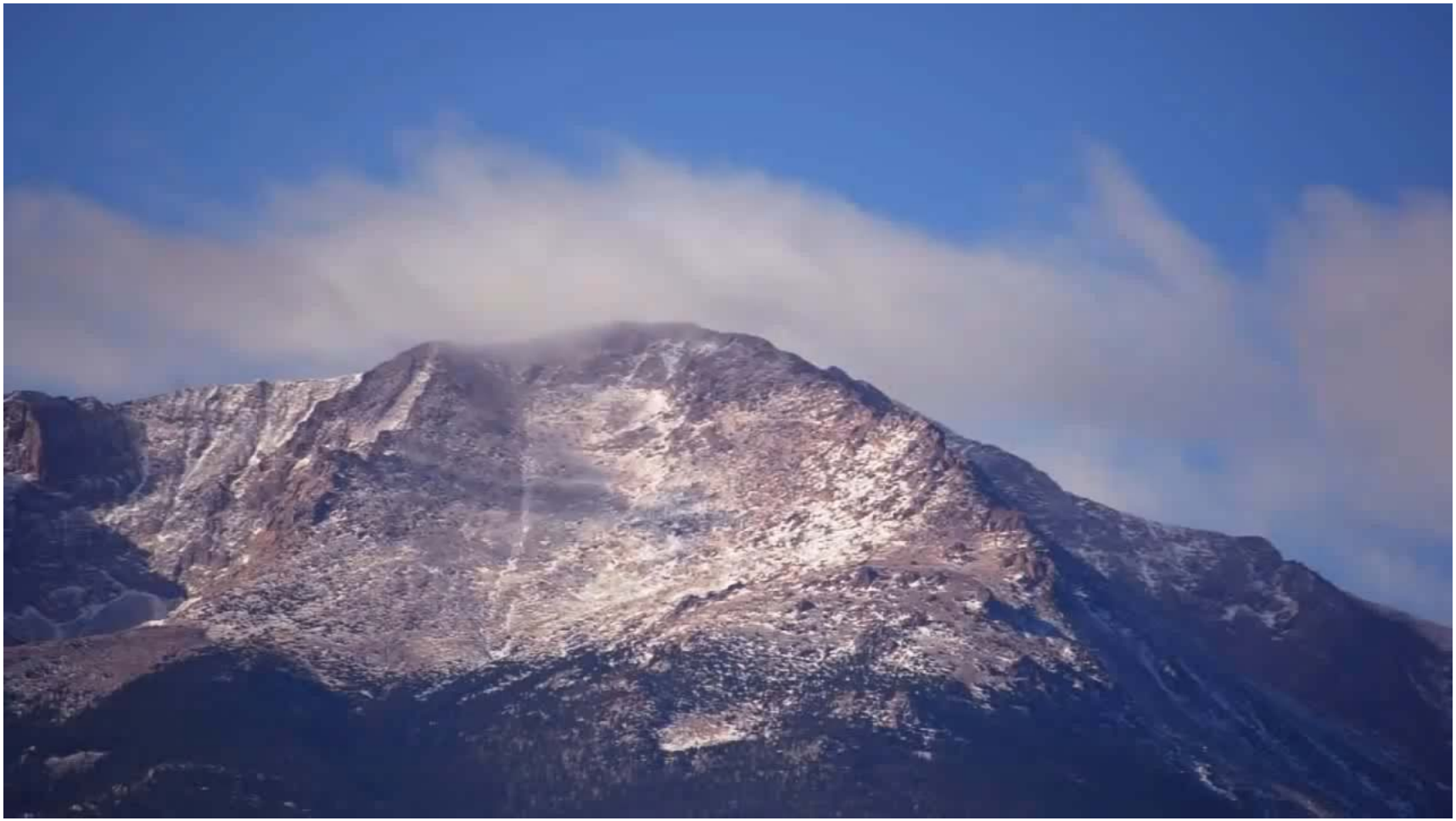
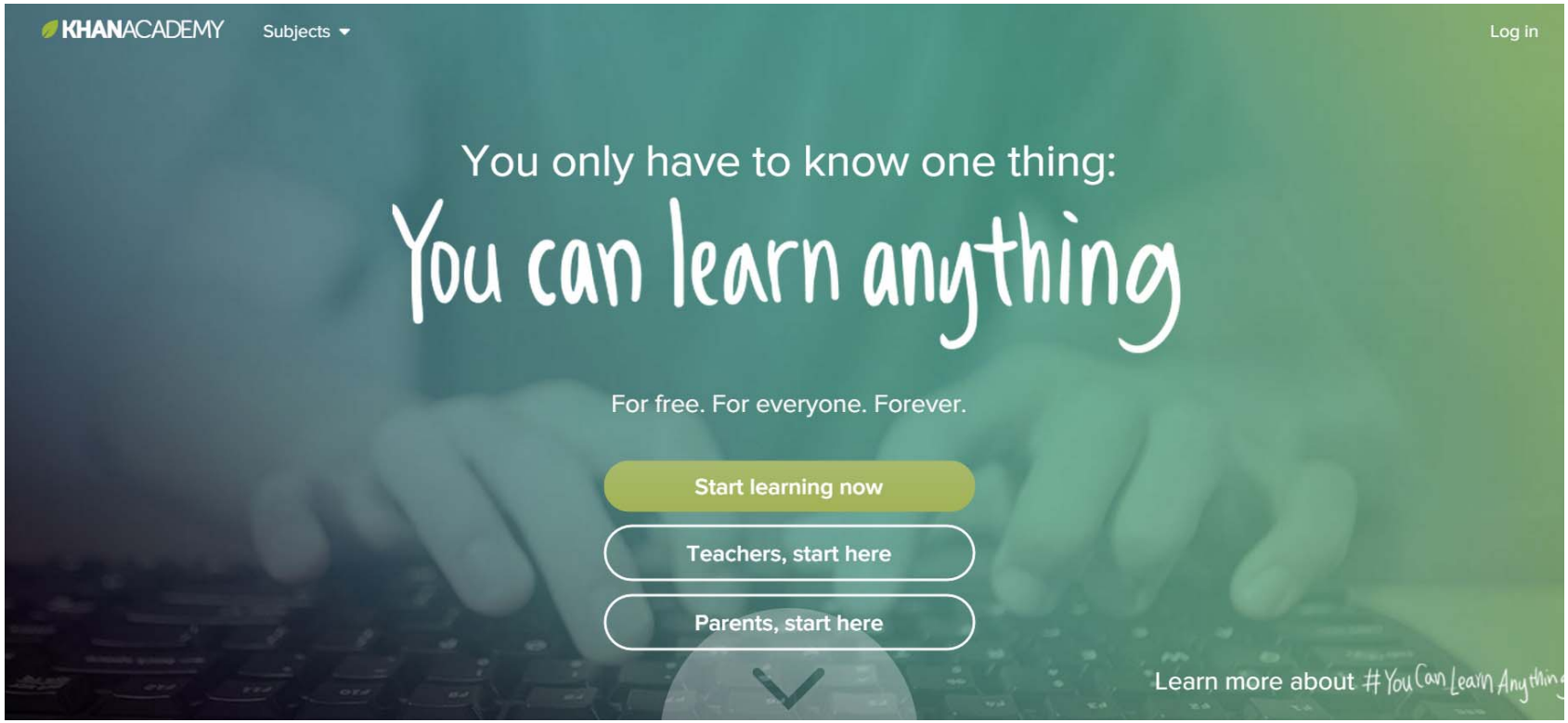
IV Flipped Classroom and Online Teaching



IV Flipped Classroom and Online Teaching



IV Tools for Flipped Classroom



Khan Academy and other content providers created a lot of resources you can use in your classrooms : MOOCs, courses delivered by big universities, online resources

IV Teaching Online Courses

a place of mind

THE UNIVERSITY OF BRITISH COLUMBIA

Vancouver Campus

Faculty of Education
Master of Educational Technology

Home | Program Overview | Courses | How to Apply | MET Faculty | For Students | FAQs

MET

MET – International Online Graduate Program

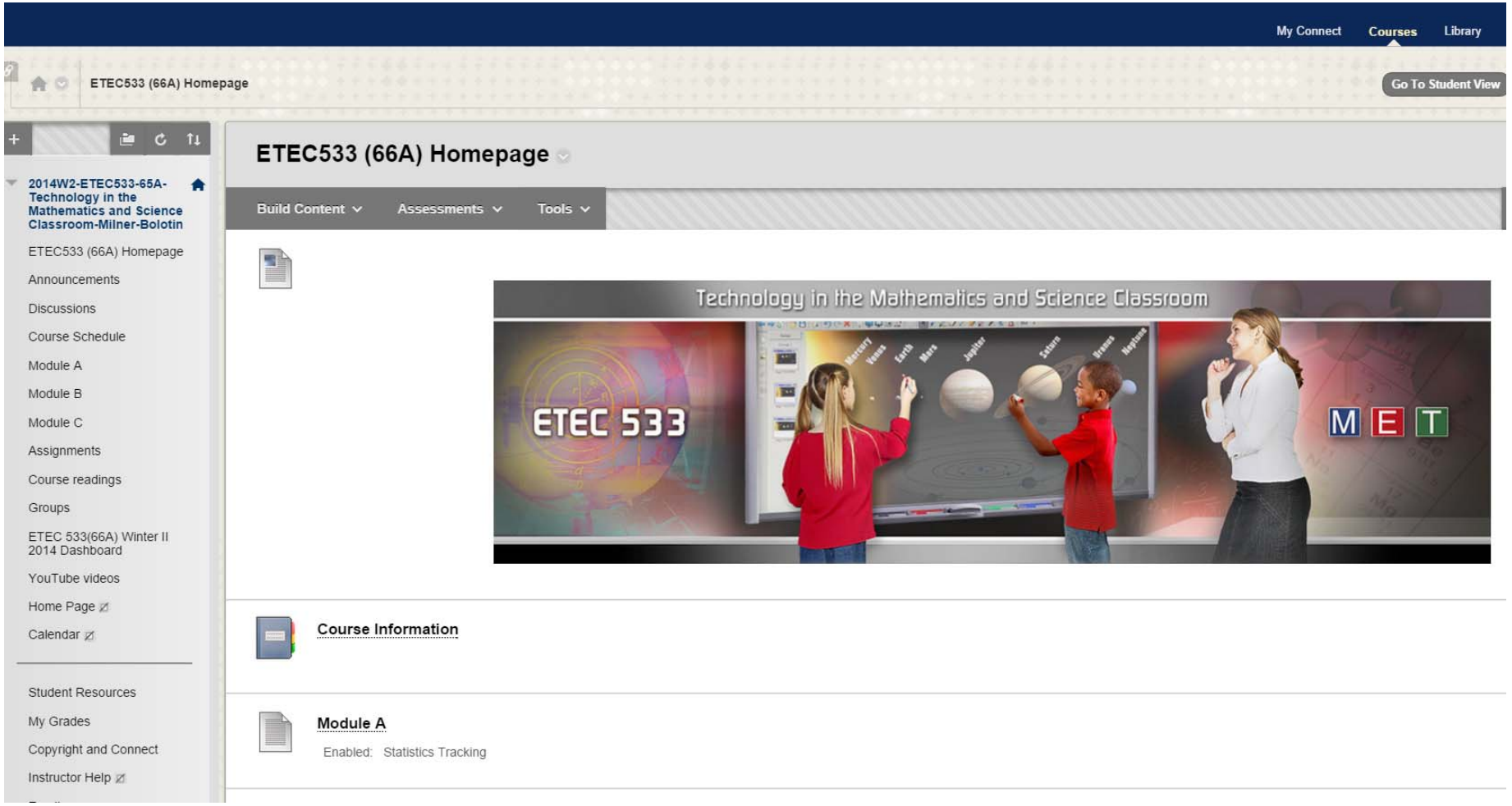
Skilled Educators create rich learning environments where students are introduced to new ideas, develop new skills, and expand their perspectives. The informed use of technology can **engage students** in new experiences and **create a community of learners** across geographical boundaries. The UBC Master of Educational Technology (MET) is a fully online graduate-level program offered by a world-renowned university, that has attracted students from over 35 countries. In addition to the master's degree, there are two specialized graduate certificates both of which ladder into the degree program.

Find Your Program.

Why Online? Where and when do we learn as educators?

Student representation in Jan-April 2015 online ETEC 533 course

ETEC 533: Math & Science Teaching & Learning through Technology



Lessons Learned

Ryan, T. G., & Young, D. C. (Eds.). (2014). Teaching Online: Stories from Within. Champaign, IL, USA: Common Ground.

Chapter 2: Making Online Graduate Teacher Education Courses Matter—From Theory to Successful Technology-enhanced Practice..... 10

Dr. Marina Milner-Bolotin

Thinking about Online Courses

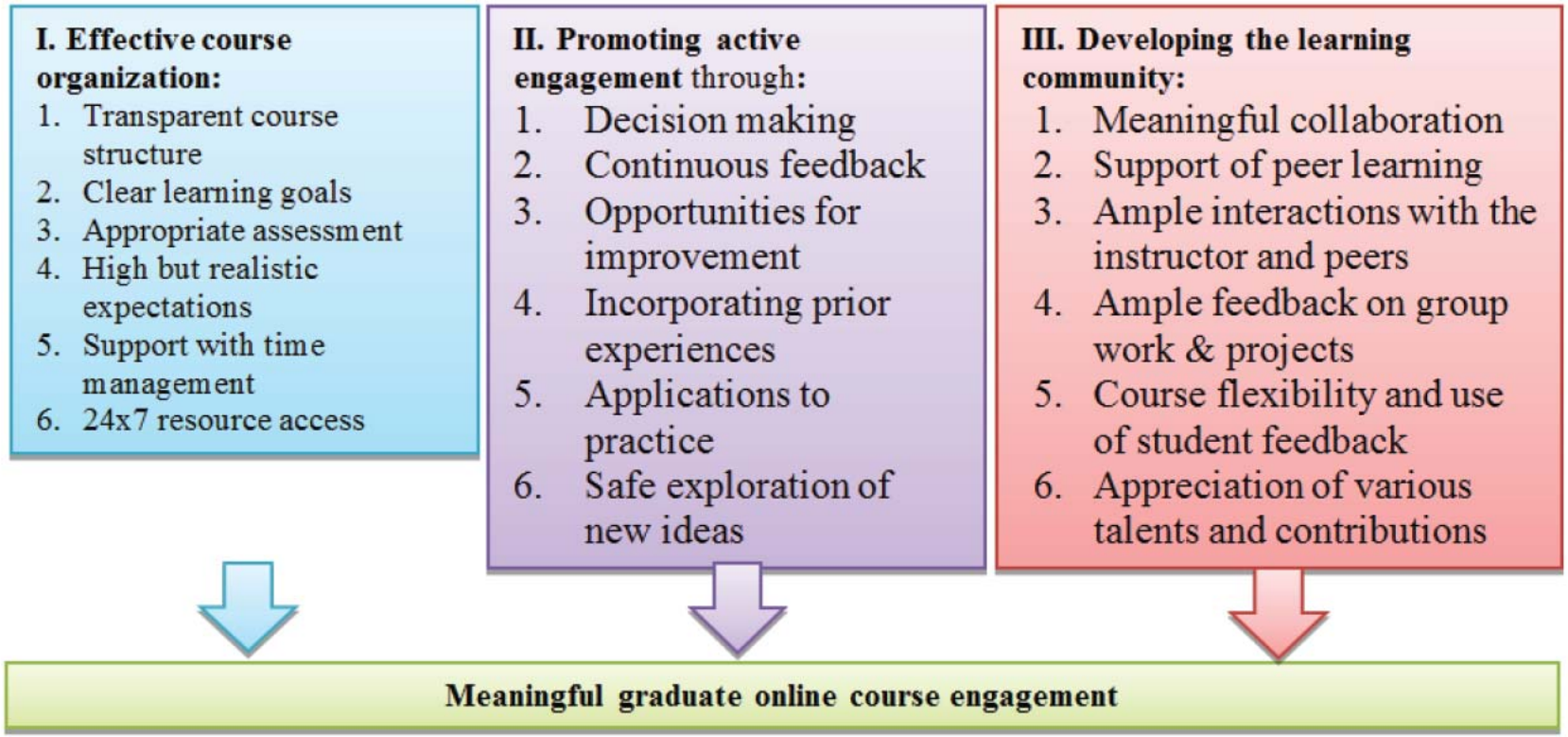


Figure 1: Big ideas for a successful design of graduate courses for educators

IV Group Activity: Experiencing online education

Group activity

1. If you have participated in an online course, share your experience with your group
2. If you haven't participated in an online course, what would you like to learn if you were to participate in such a course?

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Day 4: Feedback 1

How satisfied are you with the day?

1 3 5

Day 4: Feedback 2

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

1 3 5

Day 4: Feedback 3

Are you looking forward to Day 2?

1 3 5



Day 4: Feedback 4

What was the pace of the day?

1 3 5

Day 4: Feedback 5

What was the amount of information for you today?

1 3 5