Digital Government & CX Community

Virtual **EduTech**

Tapping into the power of technology to transform learning

Online | Tuesday, June 8, 2021 | Start: 12:00pm ET / 9:00am PT

PUBLIC SECTOR NETWORK

Certified B Corporation

Educational Silver Lining of the Pandemic: Looking forward, Glancing back

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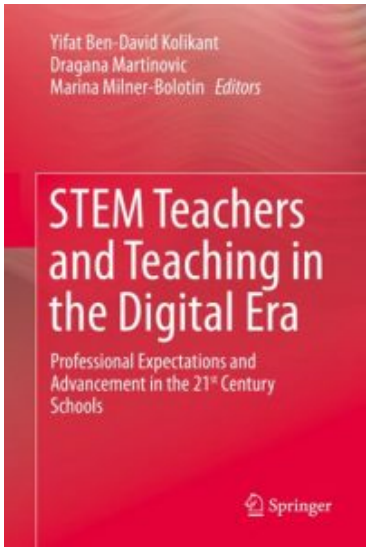

UBC Context

16,188 international students from 140+ countries!

UBC FACTS

- Public university (est. 1908)
- 2 campuses
- **~65,000 Students**
- Acceptance rate: 64%
- Ranking – 34th overall
- 10th – Education (2021)
- **The best Teacher Educ. program in the province**
- ~1,000 teacher candidates
- ~1,000 graduate students

STEM 2021 Conference

STEM

2021 | JULY 5-9

VIRTUAL CONFERENCE

HOSTED BY UBC, VANCOUVER CANADA

http://stem2021.ubc.ca/

Lessons from the Pandemic

Good old teaching practices still work

It's time to use educ. technology deliberately

Learning is a social process

Learning is a personal process

School is not only about "STEM" learning

Even an old dog can learn new tricks: Teachers should acquire 21st century skills

Learning is not limited to the classroom

Deliberate Use of Technology

CHAPTER 7

Promoting Deliberate Pedagogical Thinking with Technology in Physics Teacher Education: A Teacher Educator's Journey

Marina Milner-Bolotin, Ph. D.

This research has been approved by the University of British Columbia Ethics Research Board. The Ethics Board Certificate number: H15-01205

INTRODUCTION

David Goodstein, a notable physics educat
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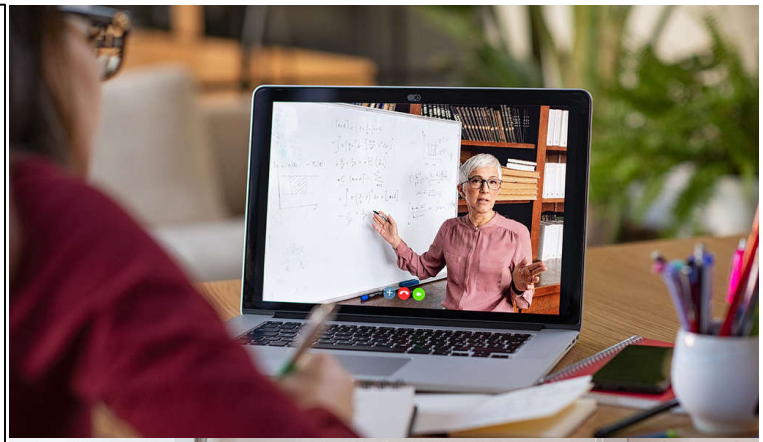
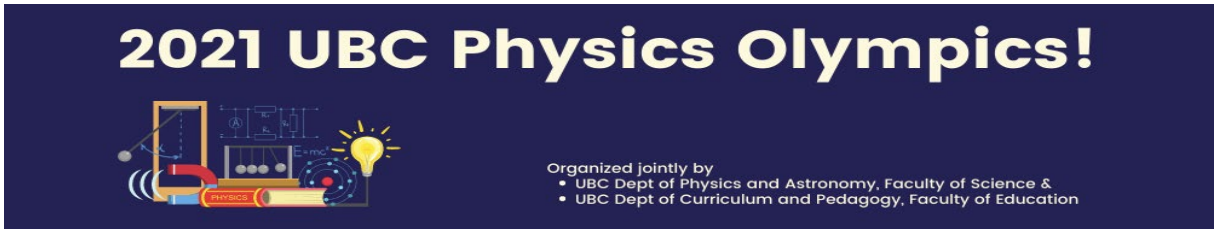


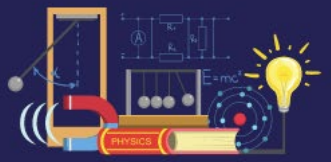
[Milner-Bolotin, M. (2016). Promoting Deliberate Pedagogical Thinking with Technology in physics teacher education: A teacher-educator's journey. In T. G. Ryan & K. A. McLeod (Eds.), *The Physics Educator: Tacit Praxes and Untold Stories* (pp. 112-141). Champaign, IL: Common Ground and The Learner.]

A Learning Tool in Your Pocket

STEM **Languages**



2021 UBC Physics Olympics!



Organized jointly by
- UBC Dept of Physics and Astronomy, Faculty of Science &
- UBC Dept of Curriculum and Pedagogy, Faculty of Education

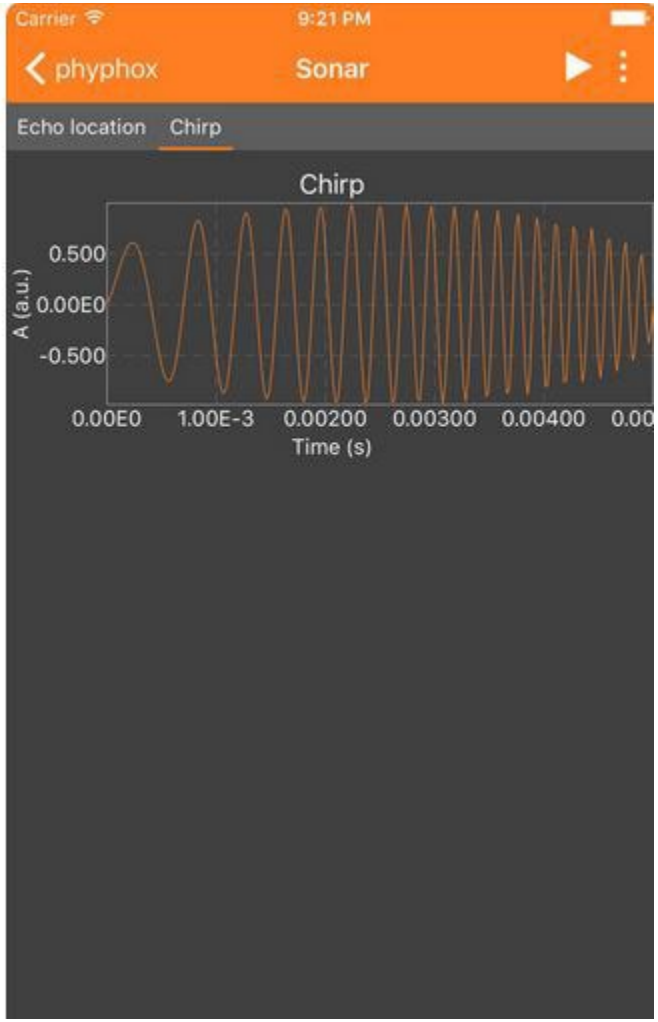
Physics Lab at Home Challenge: March 6th, 2021

Determining Acceleration of Free Fall using *phyphox* physics app

phyphox®
physical phone experiments

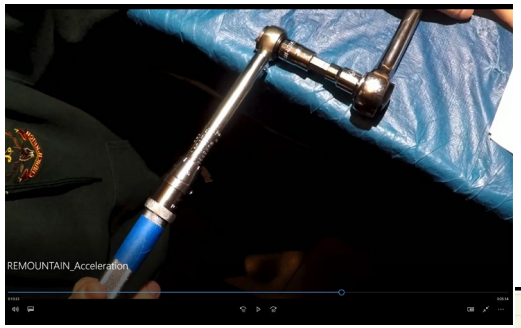
https://physoly.phas.ubc.ca/

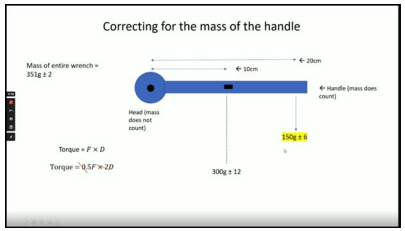
Phyphox: designed by S. Staacks & Science Educators @ University of Aachen, Germany



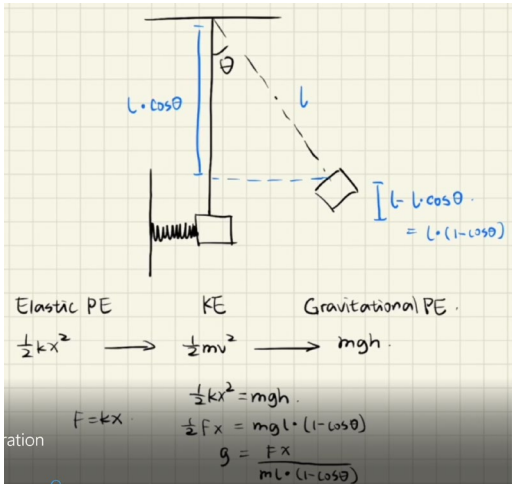
Physics Phone Experiments = PHY PHO X

How Creative Can you be with Measuring g?



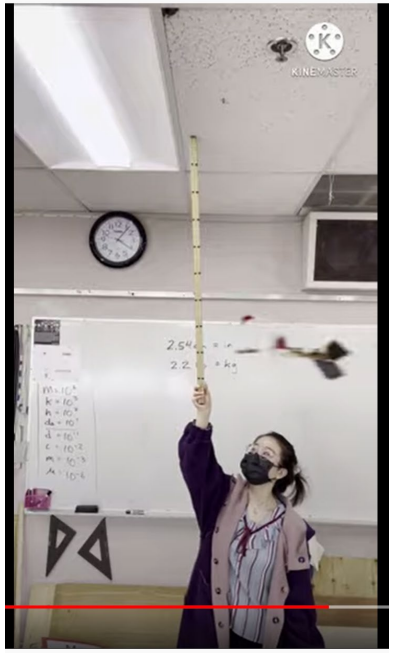


A torque wrench and a bucket of water!

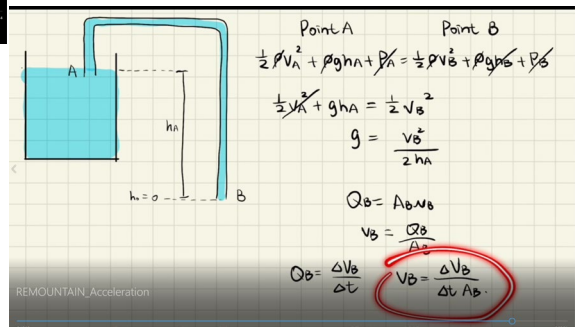


A spring collision

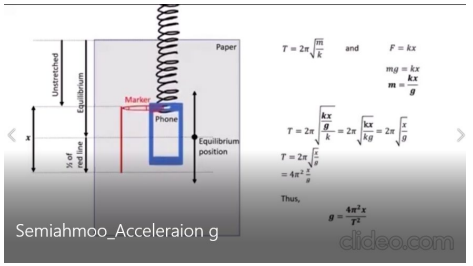
Acoustic stopwatch to measure free fall time



A plane with circular motion



Bernoulli's principle



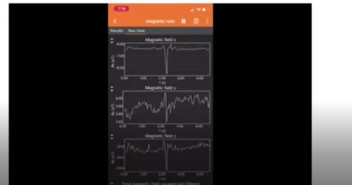
A phone oscillating on a vertical spring

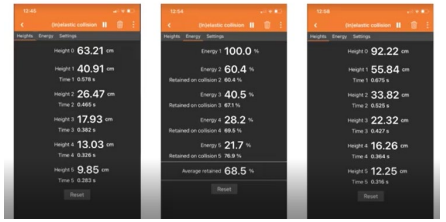
How Many Methods were proposed?
How Many Sensors were used??

1. Free fall (g components)
2. Free fall (absolute g)
3. Incline Plane
4. Projectile motion
5. Pendulum
6. Vertical spring
7. Elevator
8. Ball bounce (collisions)
9. Circular Motion
10. Motor – Potential energy
11. Pendulum – potential energy
12. Torque Wrench
13. Bernoulli's effect
14. Pressure

1. Accelerometer
2. Magnetometer
3. Acoustic sensor
4. Light sensor
5. Microphone
6. ~~Video Analysis~~
7. ~~External timer~~
8. ~~Using other devices to collect data during the experiment~~

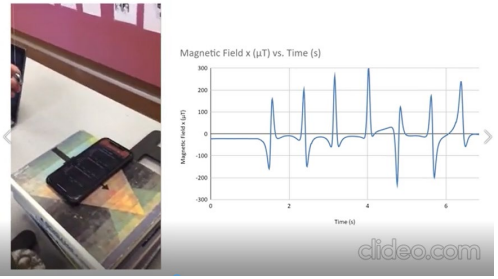
Phyphox magnetic ruler

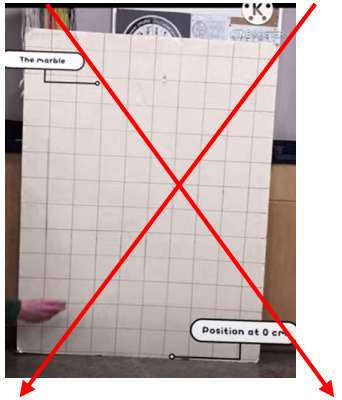




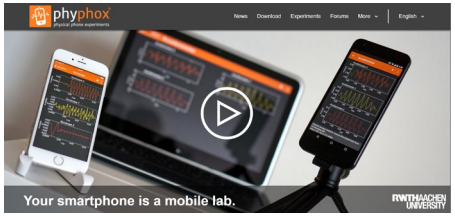
Inelastic collision sensor

Magnetic sensor





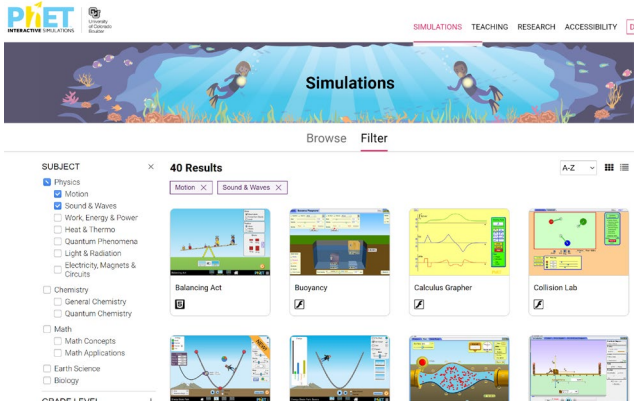
Video Analysis of projectile motion



Undergrad.: B. Ed. Program

YouTube Channel of Science Demos

Students collaborate online on designing hands on science experiments and demos and creating video explanations + using simulations and data collection with smartphones

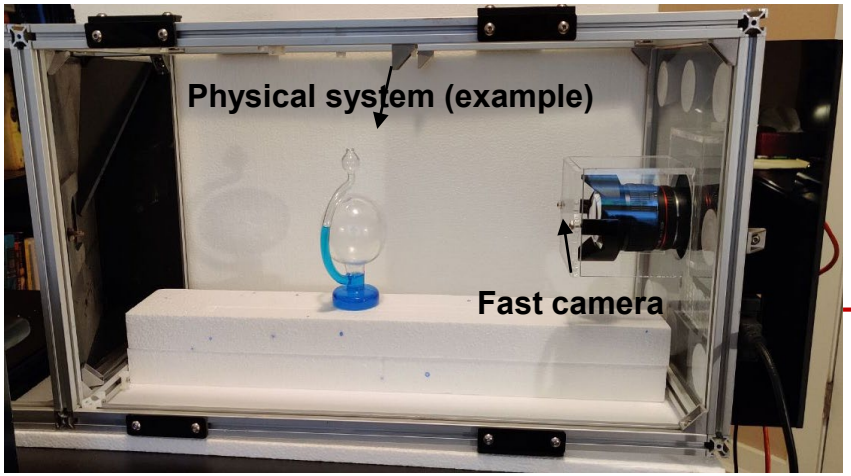


Pedagogical advantages:

1. **Better pedagogical and conceptual understanding.**
2. **Learning to use online resources.**
3. **Engaging with online resources: Sims, smartphones, data analysis.**

Secondary: Live Science Demos – ONLINE Synch classes

Portable demonstration station (at home/office)



Students' view during online class (via screen sharing)

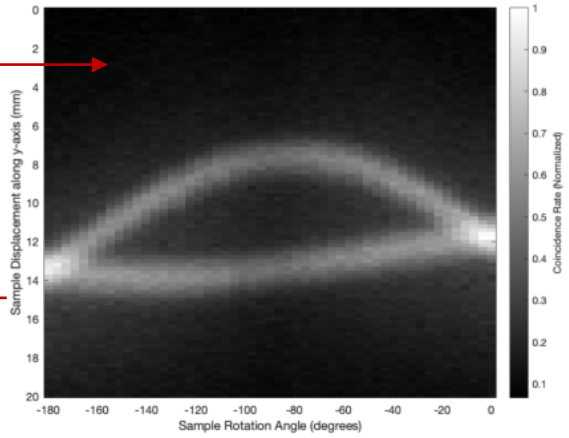
Pedagogical advantages:

1. Live experiment, even though online.
2. Use of state-of-the-art technology.
3. Follow-up video analysis.

Post-Secondary: Undergrad Physics Labs

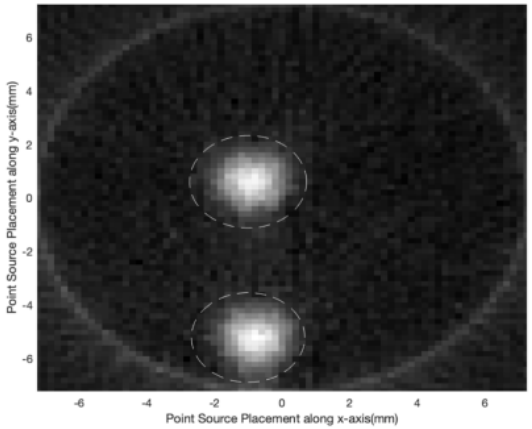
Exp PET Scan

Students receive real data, pre-recorded by instructors as if taken by a student.



Students create numerical model of the system & carry out numerical experiments in an attempt to reproduce real data… and then perform extensive data processing.

Reconstructed image



Electronic Lab Book

Task 1v.1

We first try modelling by tracing all lines from scintillator to scintillator that pass through the point source. We choose points across the left side of the detector and find the corresponding point on the right detector whose line from the left point passes through the point source. We use the following equation to model detection at either end.

$$O(y) = \begin{cases} Q & \text{W/2<y<H/2} \\ 1 & \text{-W/2 < y< W/2} \\ Q & \text{-H/2<y<-W/2} \\ 0 & \text{else} \end{cases}$$

Where Q is a bernoulli random variable that is models how opaque the copper is.

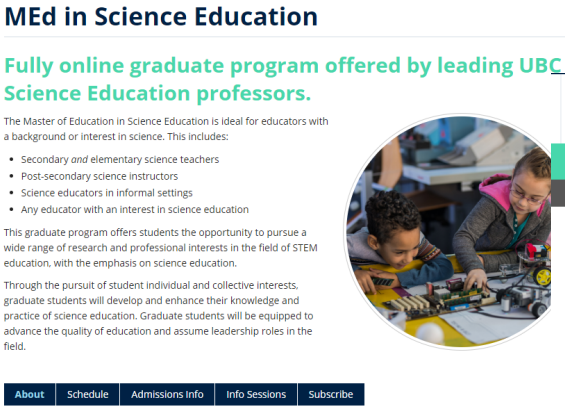
```
close all;
clearvars;
Q = 1;
W = 0.9;
H = 1;
D = 10;
x0 = D/2;

res = 500;
dx = H/res;
C = zeros(1, res);
y0s = linspace(-H/2, H/2, res);
yls = linspace(-H/2, H/2, res);
for i = 1:length(y0s)
    y0 = y0s(i);
    Ctemp = 0;
    for k = 1:length(yls)
        yl = yls(k);
        yr = D*(y0-yl)/x0;
        Ctemp = Ctemp + getIncidence(yl, W, H, Q)*getIncidence(yr, W, H, Q);
    end
    C(i) = Ctemp*dx;

end
figure;
plot(y0s, C)
```

Pedagogical advantages:

1. Better conceptual understanding of the experiment.
2. Training in numerical modeling.
3. More time for in-depth data analysis.

Graduate: Online Programs

1. Master of Museum Education MMEd.
2. M.Ed. In Science Education
3. M.Ed. In Math. Education



Silver Lining of the Pandemic

The Pandemic proved that educators can learn new ways of learning with technology. Let us use what we learned and emerge as better teachers and learners