



☆ <sup>Digital Government & cx Community</sup> Virtual **EduTech** Tapping into the power of technology to transform learning Online | Tuesday, June 8, 2021 | Start: 12:00pm ET / 9:00am PT



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

### Dr. M. Milner-Bolotin

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#### STEM Teachers and Teaching in the Digital Era

Professional Expectations and Advancement in the 21<sup>st</sup> Century Schools

🔁 Springer



## **UBC** Context





# 16,188 international students from 140+ countries!

### **UBC FACTS**

- Public university (est. 1908)
- 2 campuses
- ~65,000 Students
- Acceptance rate: 64%
- Ranking 34<sup>th</sup> overall
- 10<sup>th</sup> 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

Learning is a social process



It's time to use educ. technology deliberately

Learning is a personal process

School is not only about "STEM" learning

Even an old dog can learn new tricks: Teachers should acquire 21<sup>st</sup> 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 education



[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

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# Physics Lab at Home Challenge: March 6<sup>th</sup>, 2021

### Determining Acceleration of Free Fall using phyphox physics app



### 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!

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

- . Accelerometer
- 2. Magnetometer
- 3. Acoustic sensor
- 4. Light sensor
- 5. Microphone
- 6. <u>Video Analysis</u>
- 7. <u>External timer</u>
- 8. <u>Using other</u> devices to collec data during the experiment



#### Magnetic sensor

Phyphox magnetic ruler





12:45		12.54	2		58
		÷ .		0.1	
wights Energy Settings		Heights	Energy Settings	Height	ta Energy Settinga
	63.21 cm		Energy 1 100.0	*	Height 0 92.22 cm
Height 1 a Time 1 G	40.91 cm	Retaine	Energy 2 60.4 % ed on collision 2 60.4 %		Height 1 55.84 cm Time 1 0.675 s
Height 2 Time 2	26.47 cm	Retaine	Energy 3 40.5 % ed en collision 3 67.1 %		Height 2 33,82 cm Time 2 0.525 s
Height 3	17.93 cm 1382 s	Retaine	Energy 4 28.2 % ed on collision 4 69.5 %		Height 3 22.32 cm Time 3 0.427 s
Height 4	13.03 cm	Retaine	Energy 5 21.7 % ed on collision 5 76.9 %		Height 4 16.26 cm Time 4 0.364 s
Height 5	9.85 cm 1283 s		verage retained 68.5 % Reset		Height 5 12.25 cm Time 5 0.316 s

# Inelastic collision sensor



Video Analysis of projectile motion



# Undergrad.: B. Ed. Program

#### YouTube Channel of Science Demos



#### Pedagogical advantages:

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

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







# Secondary: Live Science Demos – ONLINE Synch classes

#### **Portable demonstration station (at home/office)**



Pedagogical advantages:

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

Students' view during online class (via screen sharing)



# Post-Secondary: Undergrad Physics Labs

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



Sample Rotation Angle (degrees)

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

#### Pedagogical advantages:

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

#### 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.

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

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

close all: clearvars; 0 = 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(v0s)  $v\theta = v\theta s(i);$ Ctemp = 0; for k = 1:length(vls) vl = vls(k);yr = D\*(y0-y1)/x0; Ctemp = Ctemp + getIncidence(y1, W, H, Q)\*getIncidence(yr, W, H, Q); end C(i) = Ctemp\*dx;

end figure; plot(y0s, C)



# **Graduate: Online Programs**

Master of Museum 1.

**Education MMEd.** 

2. M.Ed. In Science

### Education

M.Ed. In Math. 3.

### Education



#### **MEd in Science Education**

#### Fully online graduate program offered by leading UBC **Science Education professors.**

The Master of Education in Science Education is ideal for educators with a background or interest in science. This includes:

- Secondary and elementary science teachers
- · Post-secondary science instructors
- Science educators in informal settings Any educator with an interest in science education

This graduate program offers students the opportunity to pursue a wide range of research and professional interests in the field of STEM education, with the emphasis on science education.

Through the pursuit of student individual and collective interests. graduate students will develop and enhance their knowledge and practice of science education. Graduate students will be equipped to advance the quality of education and assume leadership roles in the field.

#### Schedule Admissions Info Info Sessions

Upon completing the MEd in Science Education degree, students will be able to:



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The study of education that occurs in museums and informal learning contexts.

MMEd | Master of Museum Education

THE UNIVERSITY OF BRITISH COLUMBIA

#### Online (90%) | In Person (10%)

Vancouver Campus

The Master of Museum Education is a unique graduate degree focusing on the study of education and learning that occurs in museums and other informal learning contexts (such as, ort gollerie science centres, parks, historic sites, etc.). This program draws togethe Museum professionals, educators and those with an interest in using the community to support teaching and learning to further their Enclose and the exciting research conducted by student

program, see the recent publication of some of their work in Research Informing the Practice of Museum Educators: Diverse Audiences, Challenging Topics and Reflective Praxis, s museums contemplate new roles within society it will be incumber

on museum professionals, and particularly museum educators, to become ways of thinking about the clucational roles and potentials of museums and other informal learning sites, teaching and learning in museum settings as relationships between museums and the broade

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#### Info Sessions:

to be announced View the recorded session from Ianuary 16, 2020

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THE UNIVERSITY OF BRITISH COLUMBIA

Vancouver Campus

#### **MEd in Mathematics Education**

The study of innovative strategies for teaching and learning Mathematics with/in

This MEd in Mathematics Education is a unique fully online graduate program that explores approaches for constructing and living mathematics curriculum that is responsive to place/land and connecte to community.

- The program offers opportunities to study teaching and learning mathematics in diverse community contexts including:
- Teaching and learning gardens
- Cultural spaces
- Urban, rural and Indigenous communitie
- Artistic performances
- Inside and outside school classrooms
- Family settings
- Public spaces such as libraries, malls, community centres
- · Issues important to communities such as climate change, poverty, and social justice

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# **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