Exploring Technology-Enhanced Active Learning in Physics Teacher Education

Part 1/2

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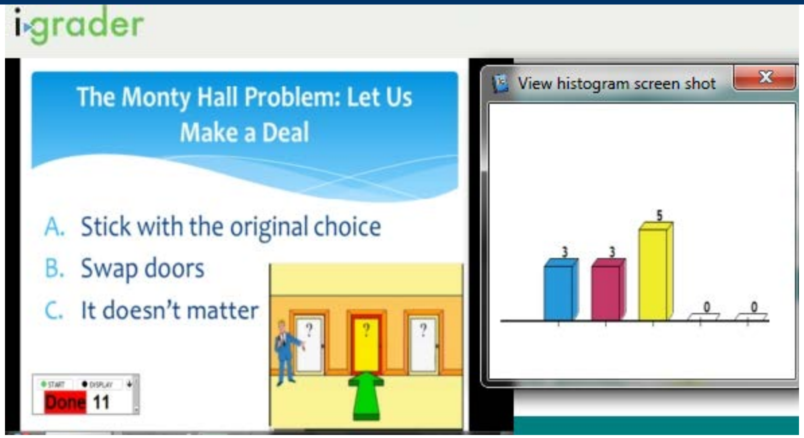
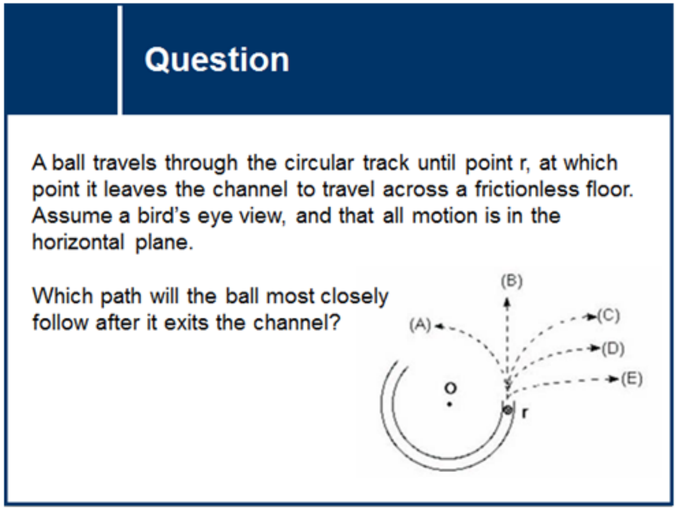
Modeling Active Engagement in Teacher Education

1. What are your **reasons for choosing active engagement pedagogies** in physics teacher education courses?
2. How do you know if these pedagogies are **having a positive impact** on teacher-candidates?
3. What is the **role of technology** in this process?

Technology-Enhanced Active Engagement





PW&PI

Research-Based Objectives

Investigate the effect of Active Engagement (AE) on teacher-candidates' (TCs') epistemologies

Explore a possible mechanism for AE pedagogy

Model AE in the context of the course content

Course-Based Objectives

Experience learning science through AE

Value conceptual knowledge

Evaluate/develop resources that match TCs' values

Create a long-term connection with UBC community

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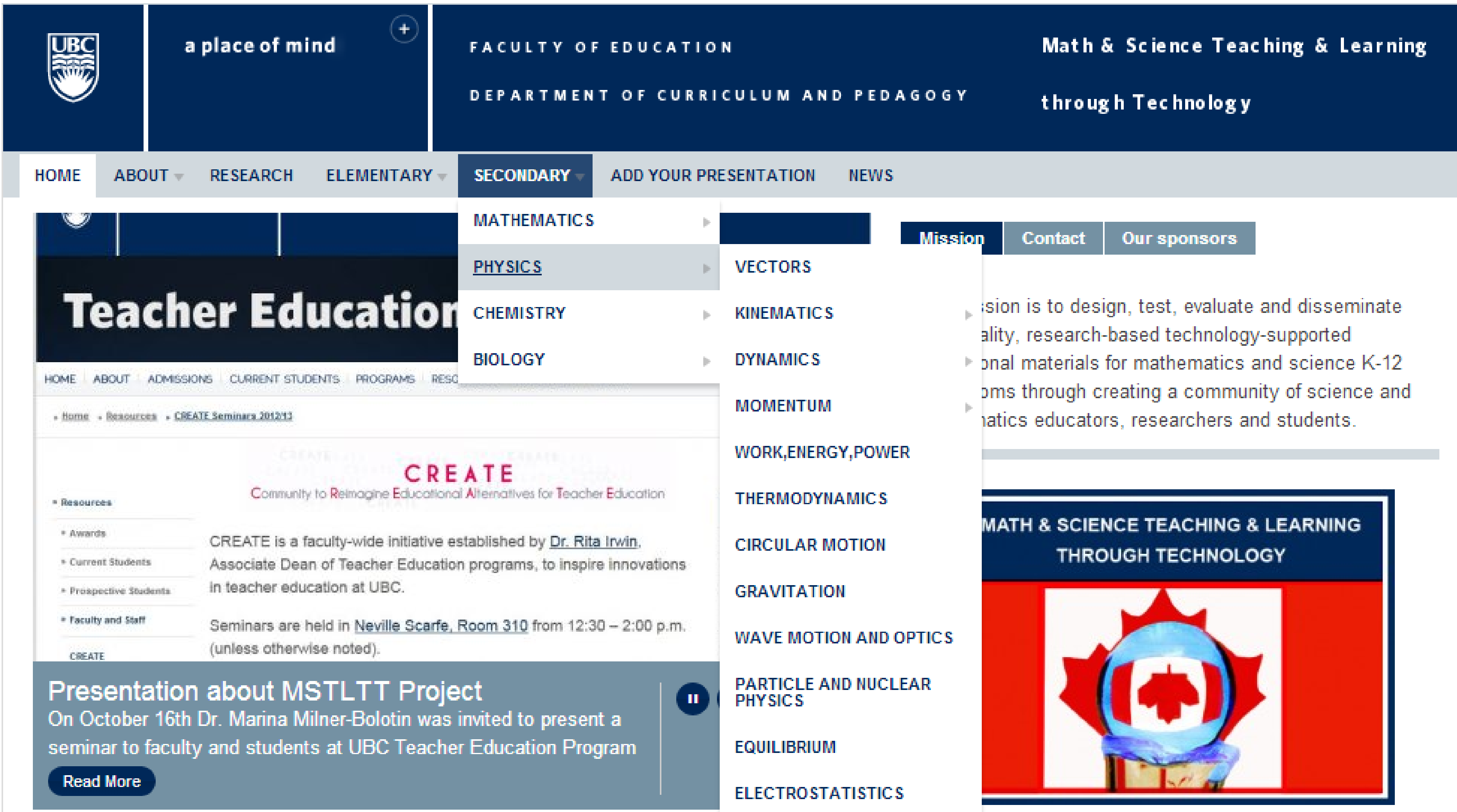

Navigating the Resource

a place of mind

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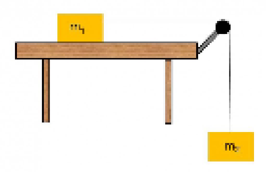
FORCES

Blocks and a Pulley

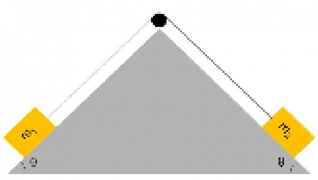


Exploration of free body diagrams, two body acceleration, and Newton's law through the system of two blocks attached through a pulley and one of them resting on a table.

acceleration, forces, friction, Newton`s laws, pulleys, string tension

rating (No Ratings Yet)

Blocks on a Pyramid



Exploration of free body diagrams, two body acceleration, and newton's laws through the system of two blocks resting on a pyramid and attached by a pulley.

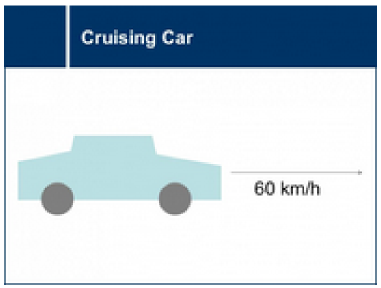
acceleration, forces, friction, gravitational acceleration, net force, normal force, weight

rating (No Ratings Yet)

- Mathematics
- Physics
  - » Vectors
  - Kinematics
  - Dynamics
    - » Forces
    - » Springs
    - » Newton's Laws
  - Momentum
  - » Work,Energy,Power
  - » Thermodynamics
  - » Circular Motion
  - » Gravitation
  - » Wave motion and Optics
  - » Particle and Nuclear Physics

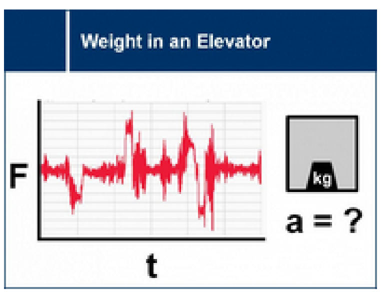
Navigating the Resource

rating (No Ratings Yet)



An introduction to acceleration and newton's laws using a demonstration of a commuting car.
acceleration, displacement, distance, forces, net force, velocity

rating (No Ratings Yet)



How does a reading on a scale change when on a moving elevator? Scenarios with an elevator moving at different velocities and acceleration will be considered. The concepts learned will then be used to analyze data from a real-life experiment.
acceleration, gravitational acceleration, mass, net force, normal force, real-life data, velocity, weight

rating (No Ratings Yet)

The following set of questions apply Newton's Second Law to scenarios with multiple blocks held together by the tension force from strings.

acceleration area centripetal force common ratio conservation of energy conservation of momentum Conversion Factors counting current displacement distance elastic collisions forces frames of reference free-body diagrams friction graphs gravitational acceleration gravitational potential energy inelastic collisions kinetic energy molar mass mole net force normal force numbers patterns percentages permutations power probability projectile motion ratios rectangles resistance sequences series tension triangles trigonometry unit circle vectors velocity voltage weight

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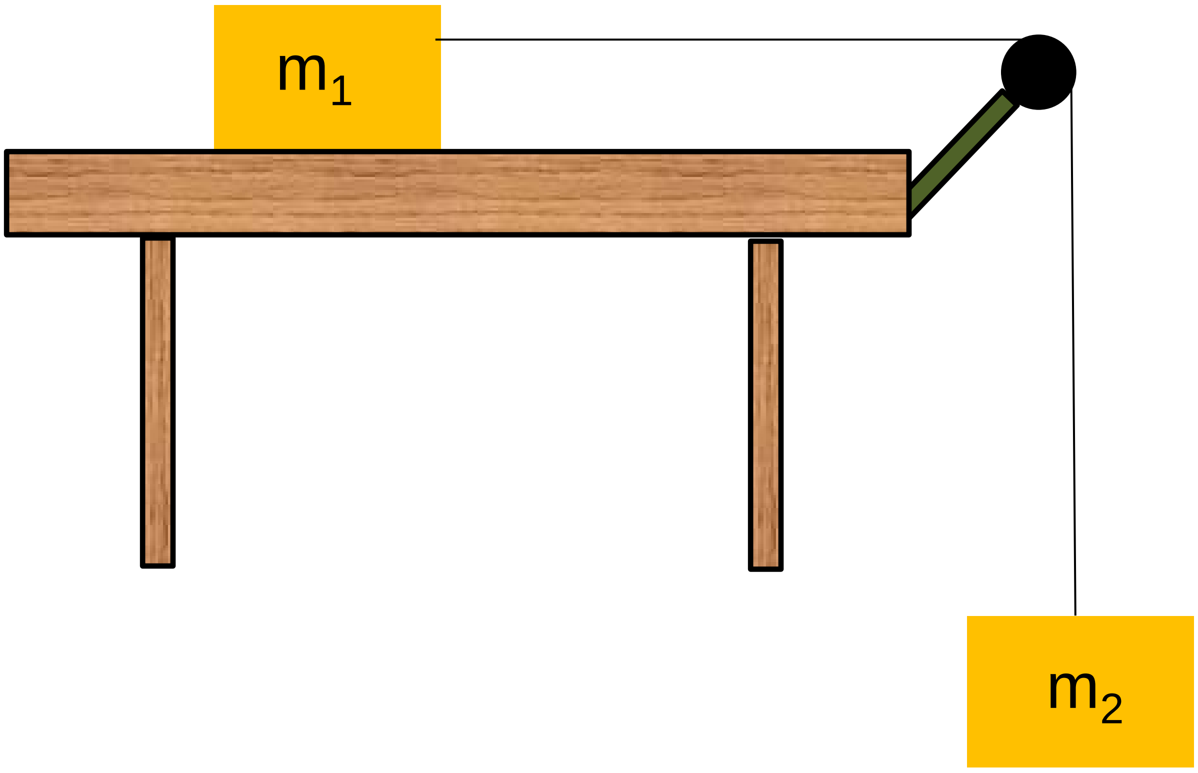
Integrating into the Classroom

Instructor modeling AE pedagogy

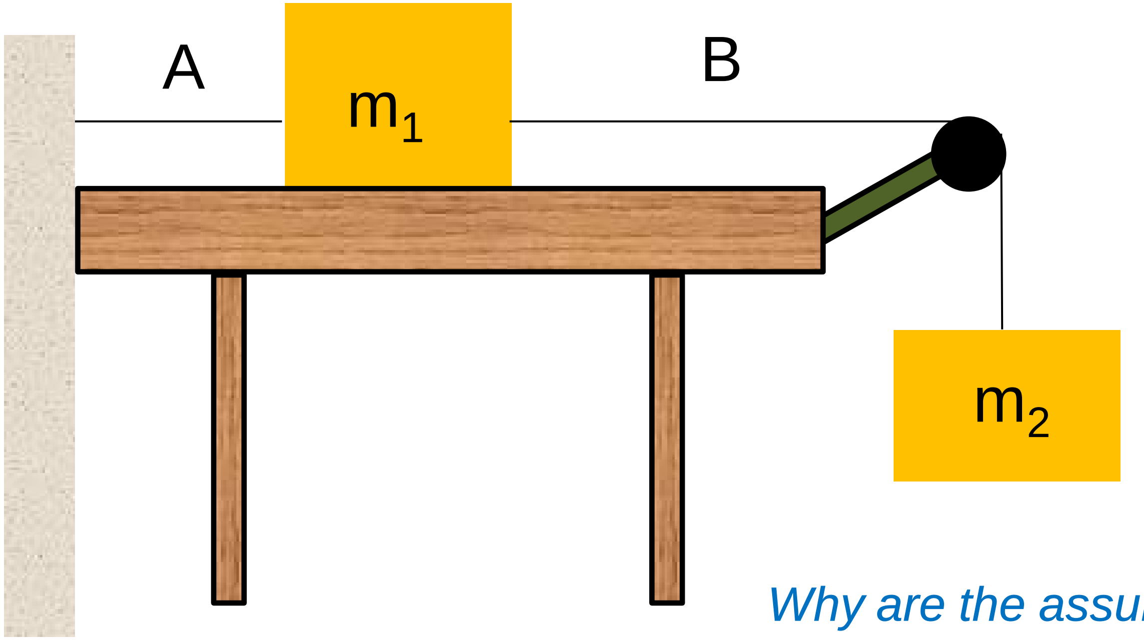
TCs experience developing questions

Blocks and a Pulley



Blocks and a Pulley II

Two blocks are connected via a pulley. The blocks are initially at rest as block m_1 is attached to a wall. If string A breaks, what will the accelerations of the blocks be? (**Assume** friction is very small and strings don't stretch)



A. $a_1 = 0;\ a_2 = 0$

B. $a_1 = g;\ a_2 = g$

C. $a_1 = 0;\ a_2 = g$

D. $a_1 = g;\ a_2 = 0$

E. None of the above

Why are the assumptions above important?

Solution

Answer: E

Justification: None of the above answers is correct. Consider two blocks as one system: one can see that the system has a mass of (m_1+m_2), while the net force pulling the system down is m_1g. Therefore, applying Newton's second law, one can see that the acceleration of the system must be less than g:

$$a = \frac{m_2 g}{(m_1 + m_2)} = \frac{m_2}{(m_1 + m_2)} g < g$$

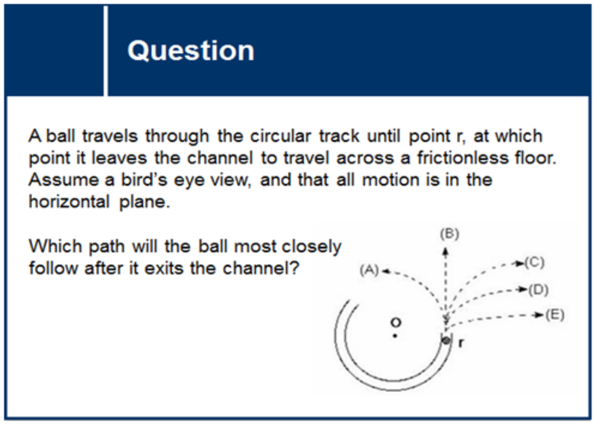
Some people think that the acceleration will be g. They forget that the system consists of two blocks (not just m_1) and the only pulling force is m_1g. Thus the system is NOT in a free fall. Compare this questions to the previous one to see the difference.

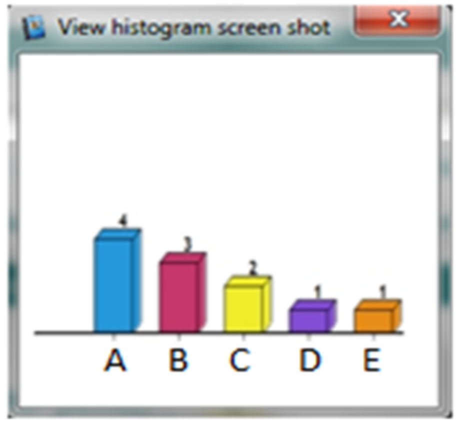
Integrating into the Classroom

Instructor modeling AE pedagogy

TCs experience developing questions

Technology-Enhanced Active Engagement Integration





PI modeled in every class

PW used to design, critique, respond to Conceptual Questions as a community of future teachers

Resources

- Beatty, I., Gerace, W., Leonard, W., & Defresne, R. (2006). Designing Effective Questions for Classroom Response System Teaching. *American Journal of Physics*, *74*(1), 31–39.
- CWSEI Clicker Resource Guide: An Instructors Guide to the Effective Use of Personal Response Systems (Clickers) in Teaching. (2009, June 1).
- Lasry, Nathaniel. (2008). Clickers or Flashcards: Is There Really a Difference? *The Physics Teacher, 46*(May), 242-244.
- Milner-Bolotin, Marina. (2004). Tips for Using a Peer Response System in the Large Introductory Physics Classroom. *The Physics Teacher, 42*(8), 47-48.
- Mishra, P., & Koehler, M. J. (2007). Technological pedagogical content knowledge (TPCK): Confronting the wicked problems of teaching with technology. In *Society for Information Technology & Teacher Education International Conference* (Vol. 2007, pp. 2214–2226). Retrieved from http://www.editlib.org/p/24919/