Using Educational Technologies to Promote Inquiry & the Nature of Science in Teacher Education

Dr. Marina Milner-Bolotin

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Daegu University at Gyeongsan, Gyeongbuk, Korea

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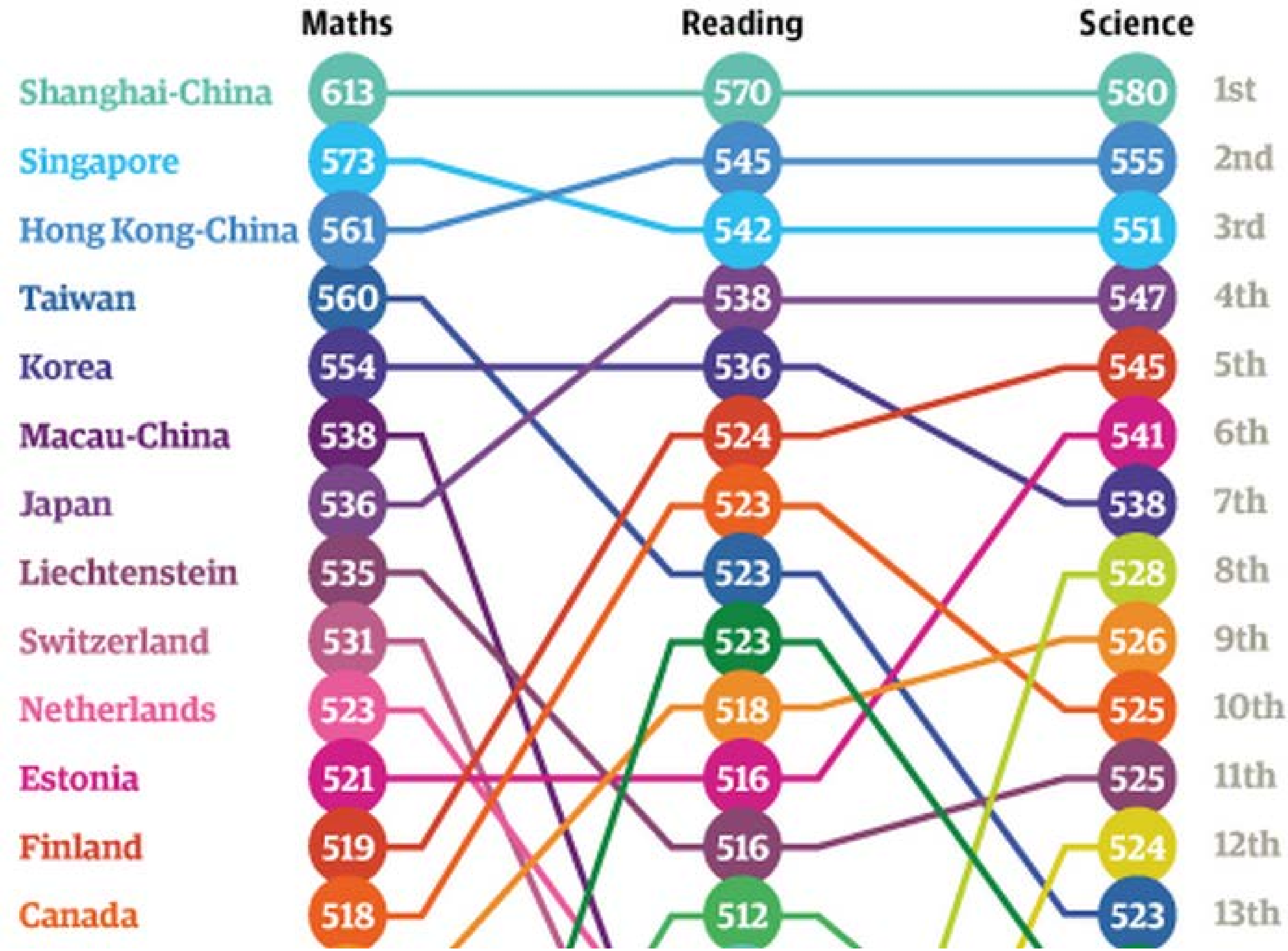
With the financial support of the UBC Teaching and Learning Enhancement Fund (TLEF 2012-2014)

Broadening the Horizon of Science Education: Synergetic Collaborations across Disciplinary Boundaries

PISA 2012 Results



Maths

5th

13th

[OECD, PISA 2012 Results]

Presentation Overview

Research on the effects of technology-enhanced Active Engagement (AE) on science teacher-candidates

Clickers

Clickers & Active Learning

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

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

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Piscataway, NJ 08854-8019; milnerm@physics.rutgers.edu

Teacl
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Clickers beyond the First Year Science Classroom

Marina Milner-Bolotin

Tetyana Antimirova

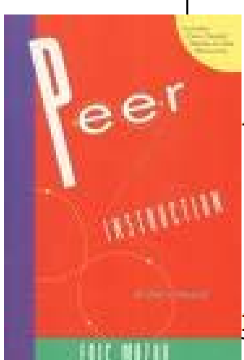
Anna Petrov

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

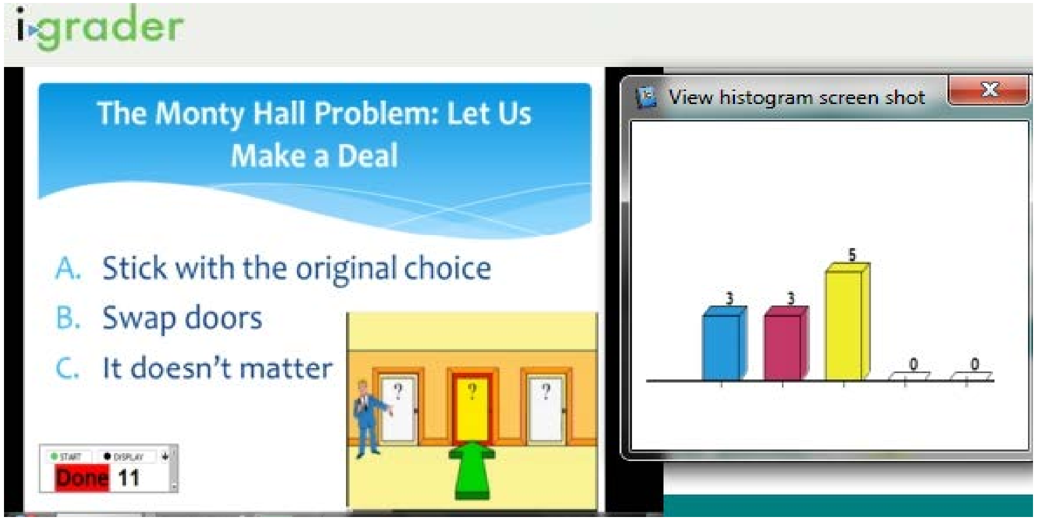
Abstract*:*

This case study's primary objective is to describe the implementation of the electron

response-system (clickers) in a small (N=25) secon

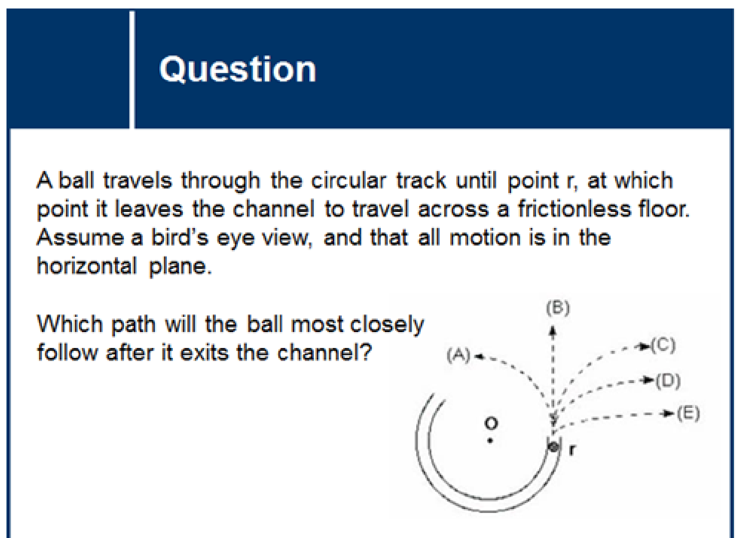


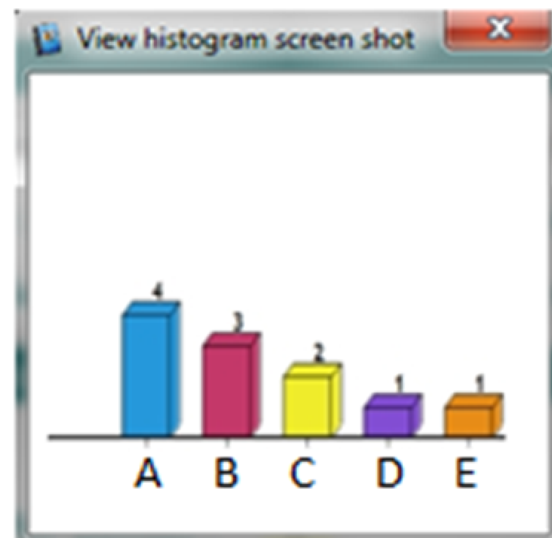
Peer Instruction Pedagogy



(b) Is the correct answer

in both cases





Peer Instruction Pedagogy

LUMAT 1(5), 2013

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

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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, Techn...
and Mathematics (STEM) education is Classroom Respo...
instructors generate in-class discussion by solicit...

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

PeerWise Online System

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

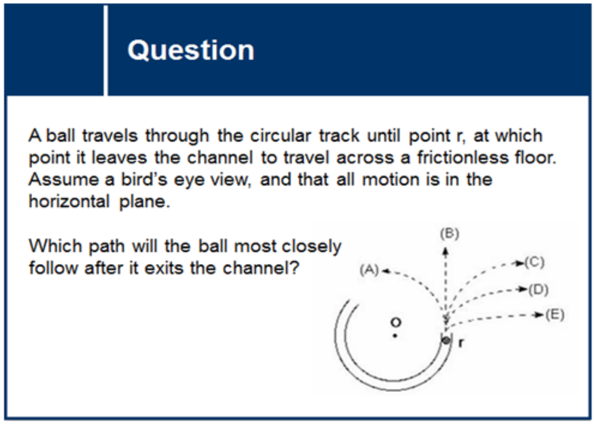
Return to main menu

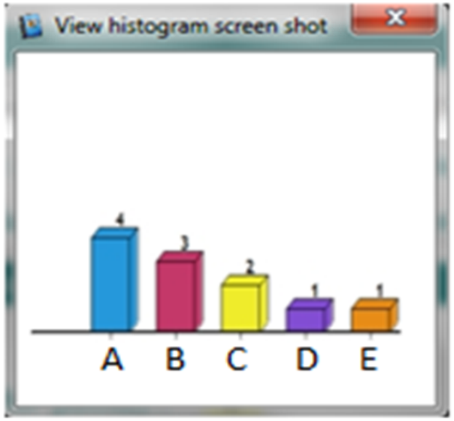
What is PeerWise?

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/

Technology-Enhanced Active Engagement Integration





Peer Instruction modeled in every class

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

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

Teaching & Learning with Technology

Instructor modeling AE pedagogy

TCs experience developing questions

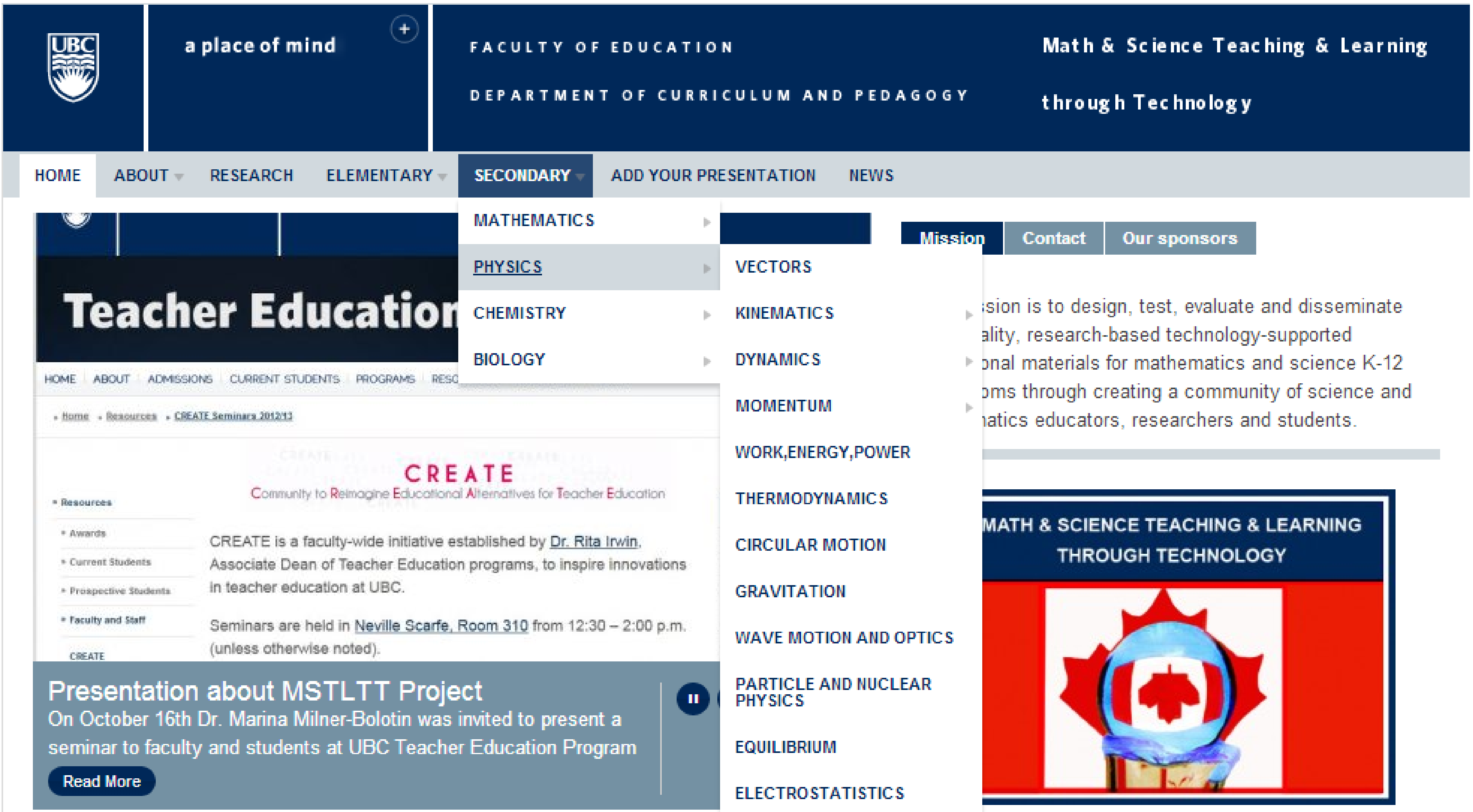
PeerWise

EDCP357 (Winter 1, 2013)

Home | Main menu > Comments written by you

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

Math & Science Teaching & Learning through Technology



Navigating the Resource

a place of mind

FACULTY OF EDUCATION

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Math & Science Teaching & Learning through Technology

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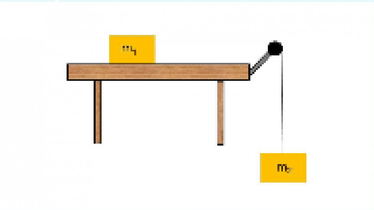
» Home » Secondary » Physics » Dynamics » Forces

FORCES

Blocks and a Pulley

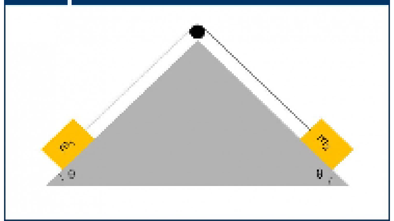


Exploration of free body diagrams, two body acceleration, and Newton's law through the system of two blocks attached through a pulley and one of them resting on a table.

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.

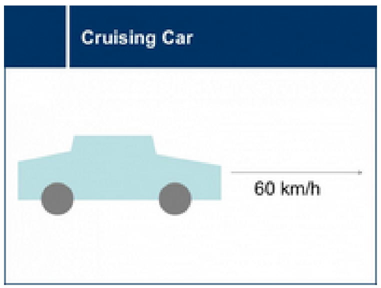
acceleration, forces, friction, gravitational acceleration, net force, normal force, weight

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

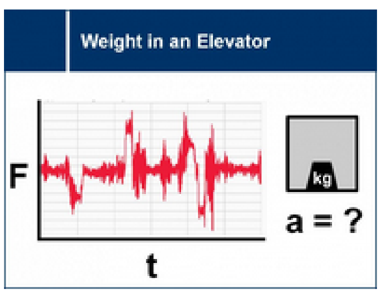
Navigating the Resource

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

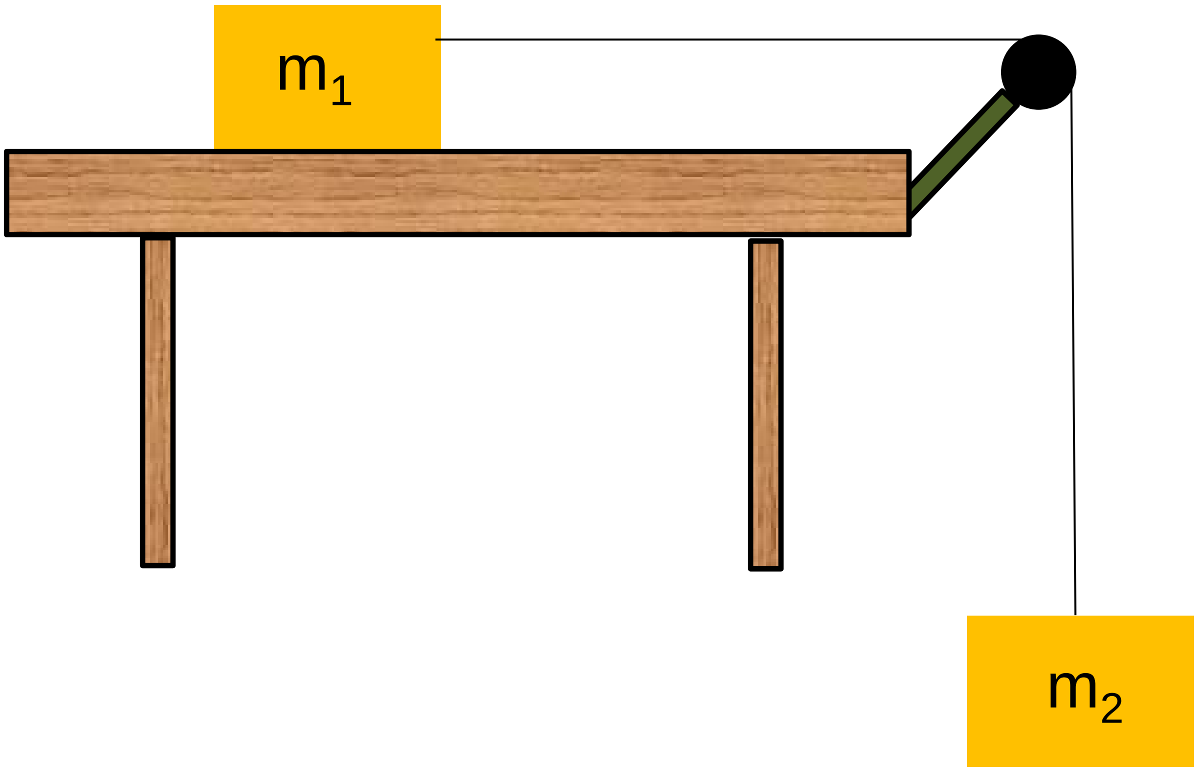
rating (No Ratings Yet)

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

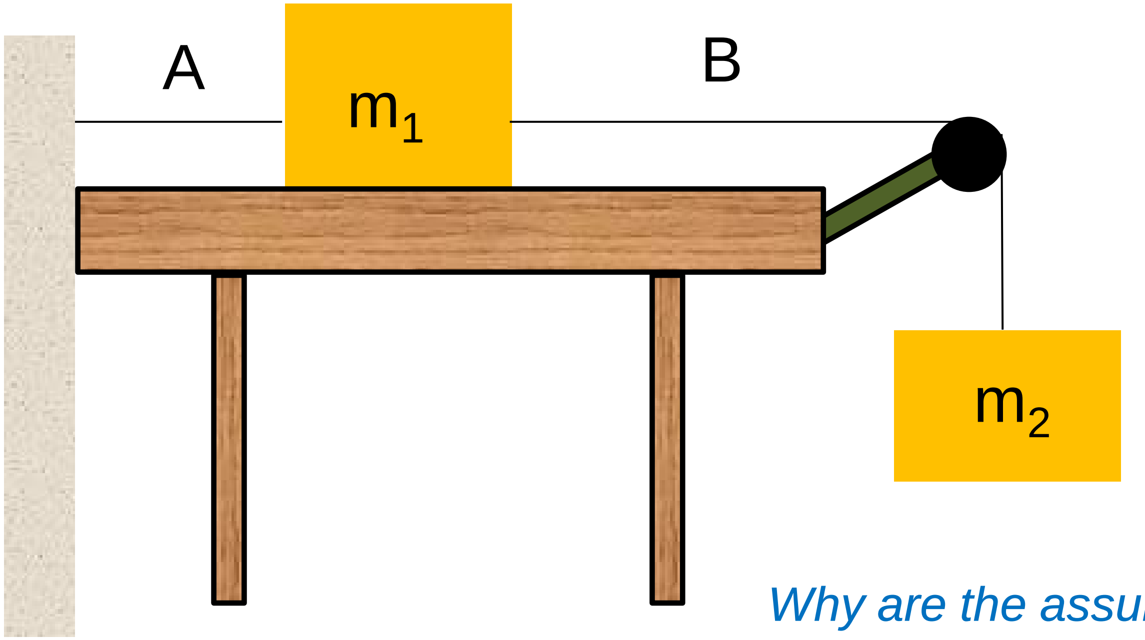
http://scienceres-edcp-educ.sites.olt.ubc.ca/

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

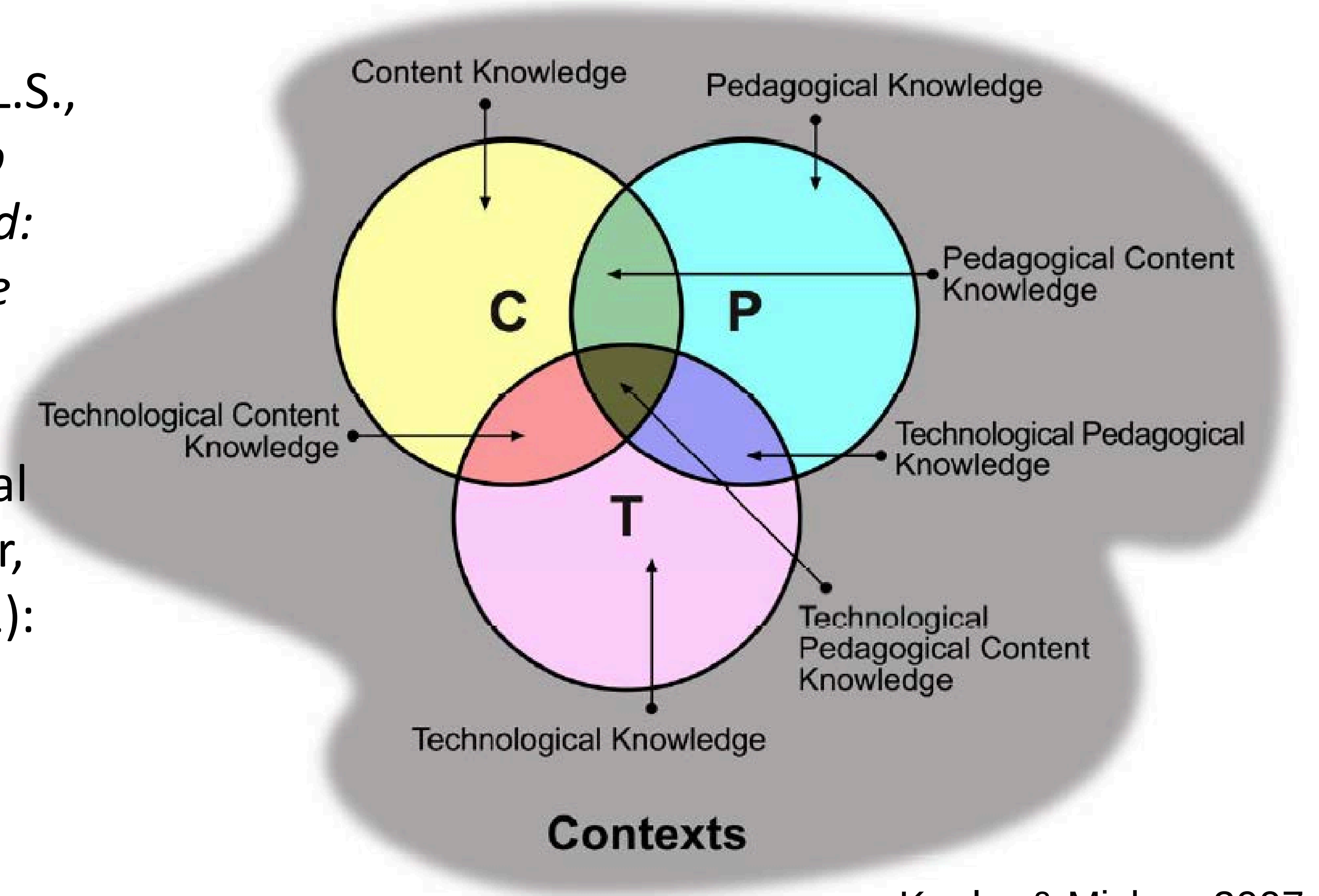
Justification: None of the above answers is correct. Consider two blocks as one system: one can see that the system has a mass of (m_1+m_2), while the net force pulling the system down is m_1g. Therefore, applying Newton's second law, one can see that the acceleration of the system must be less than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

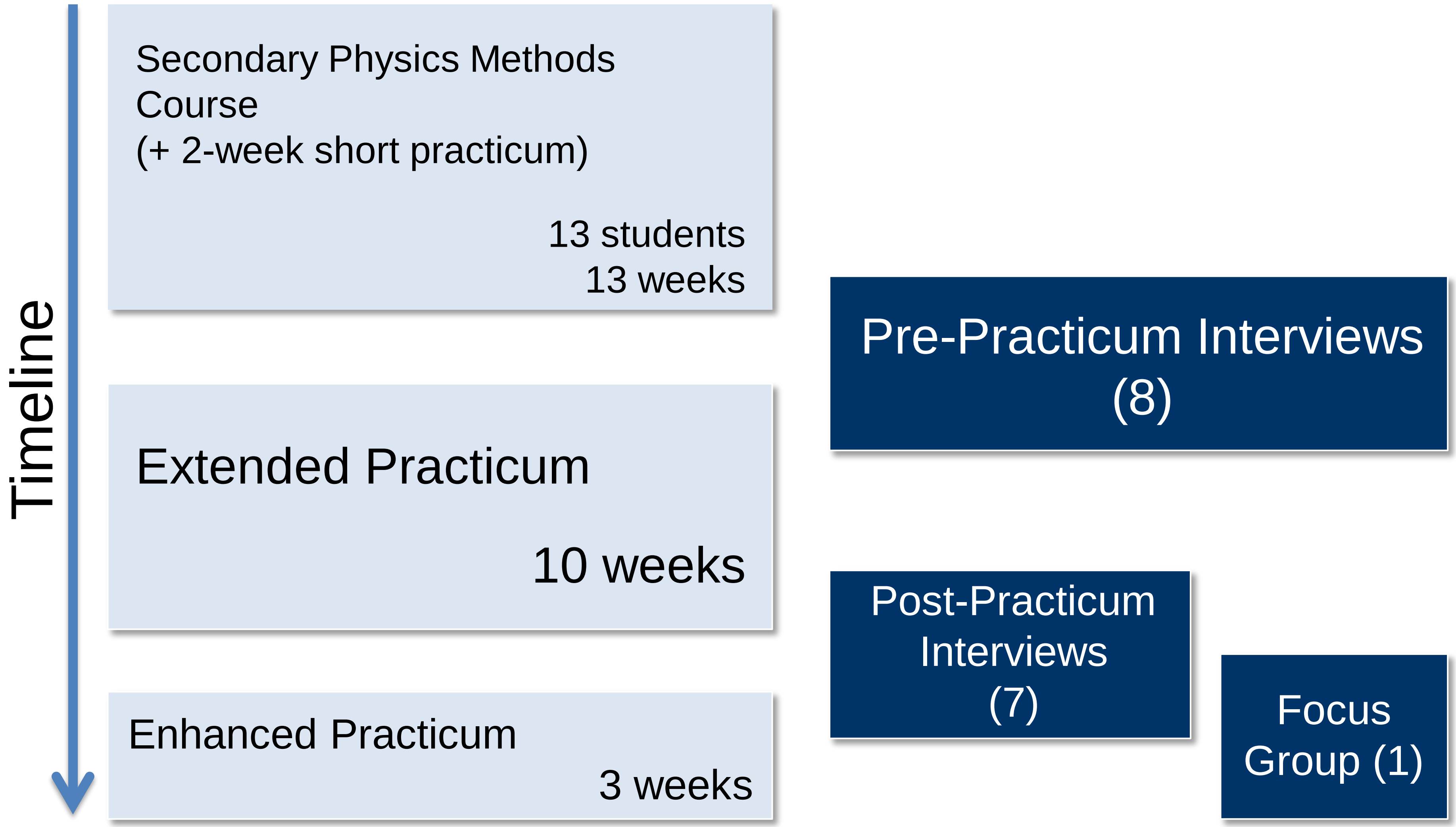
Theoretical Framework

Shulman, L.S., *Those who understand: Knowledge growth in teaching.* Educational Researcher, 1986. **15**(2): p. 4-14.

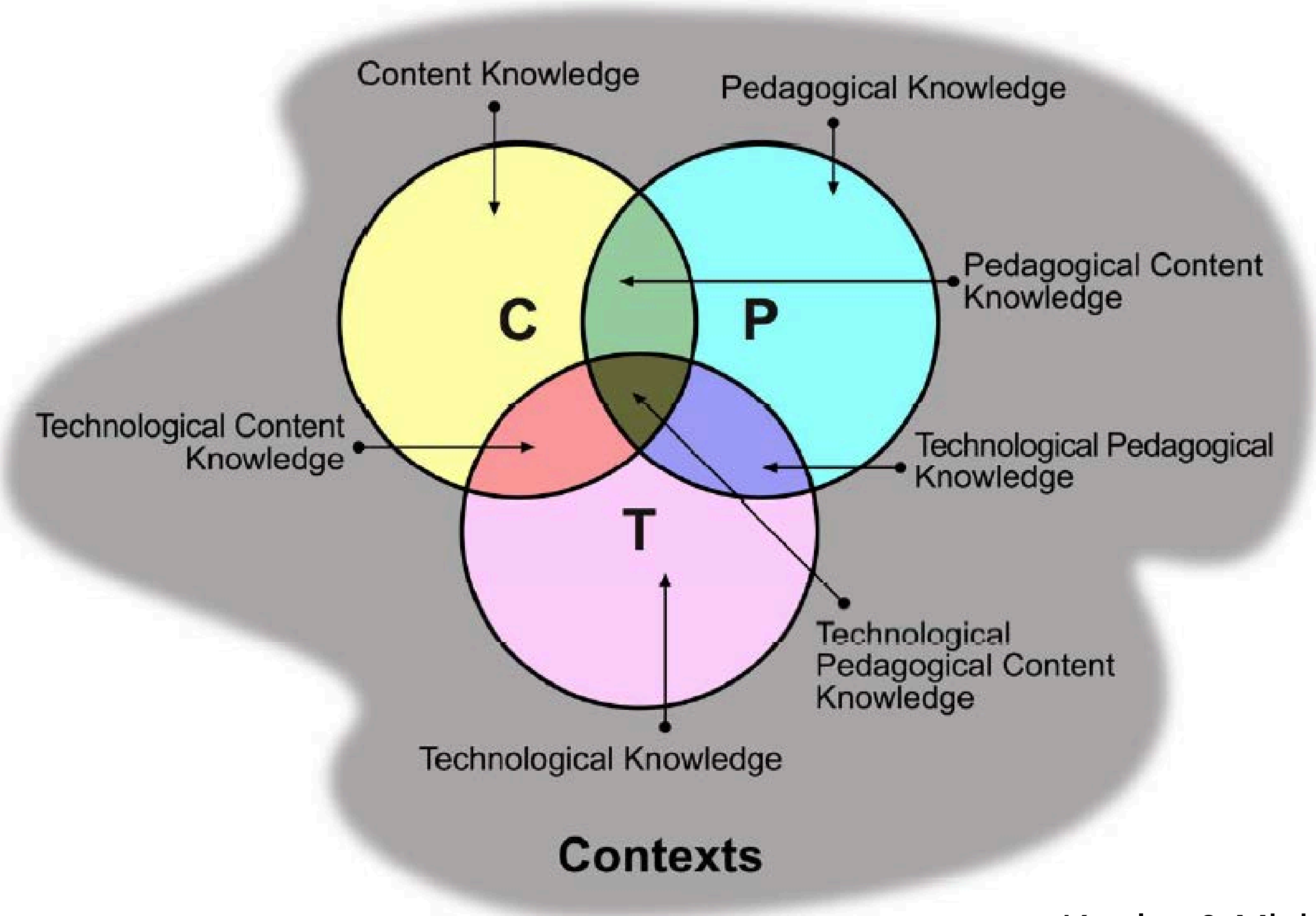


Koeler & Mishra, 2007

Research Methods



Results

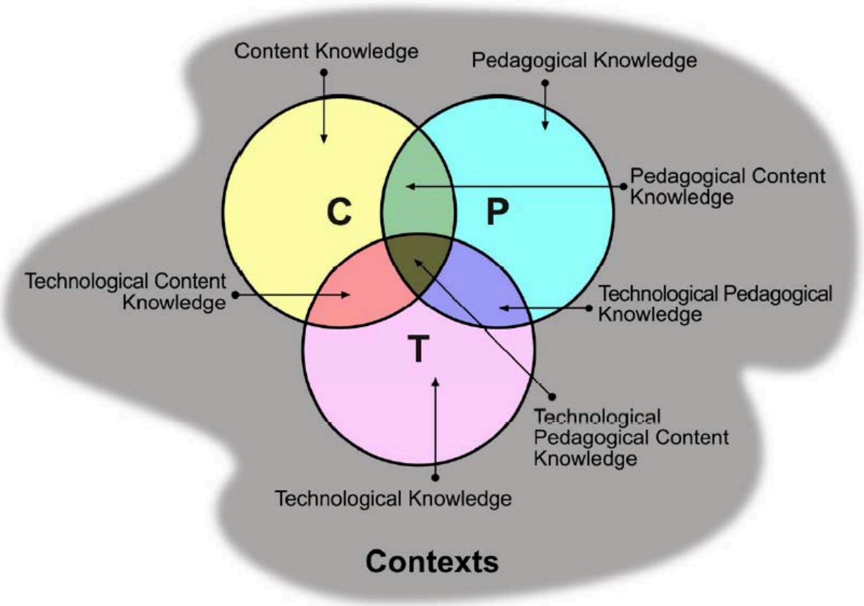


Koeler & Mishra, 2007

Results: Quantitative

	Questions	Answers	Comments
1	50	110	52
2	50	85	40
3	51	115	74
4	50	90	34
5	60	110	79
6	50	112	82
7	57	109	107
8	50	192	14
9	50	91	81
10	50	100	50

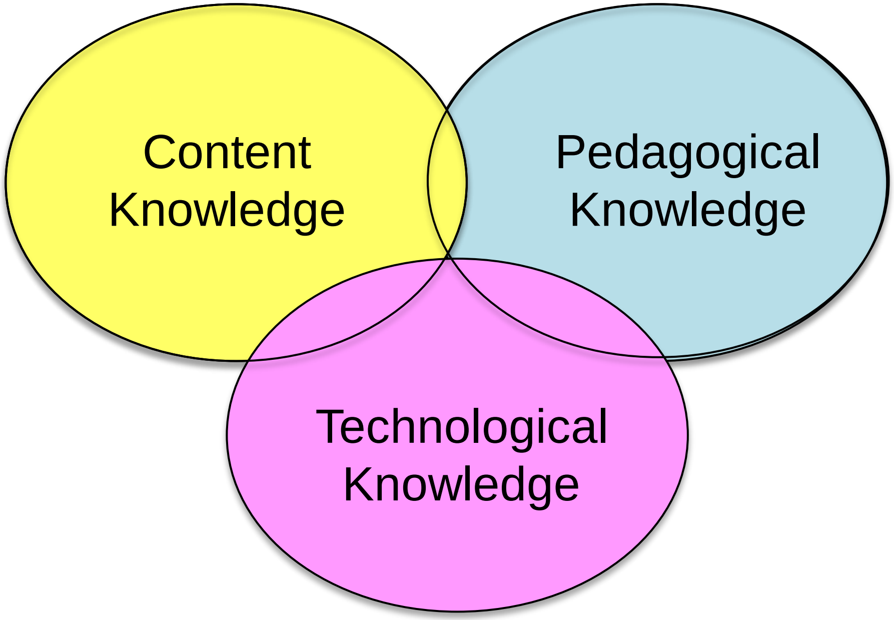
Results: Qualitative: Direct Impact



"It really opens the door for umm discussions between people. Um regarding a) you know, what is the right answer, and b) how would you explain that to uh either teacher-candidates or to your potential students."

Pre-Interview 2, Participant 9

Direct Impact on our Teacher-Candidates



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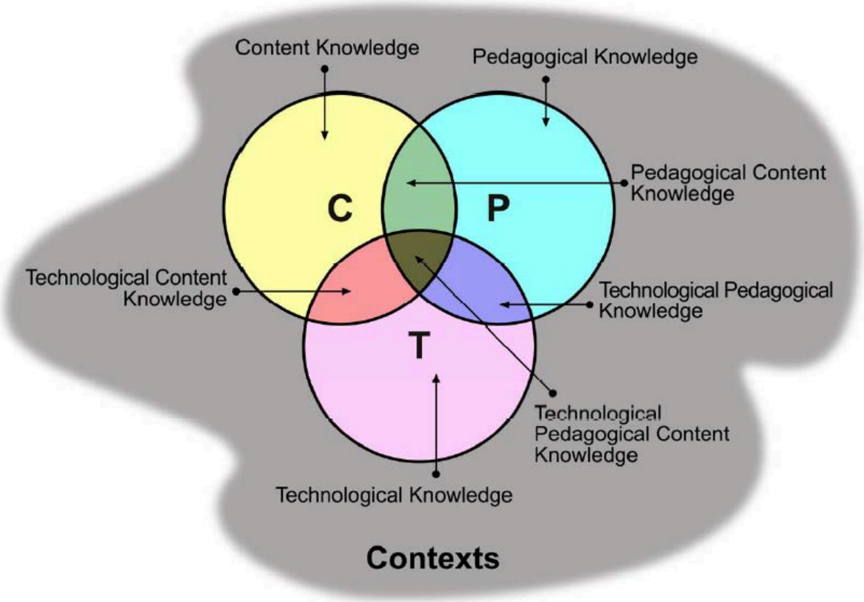
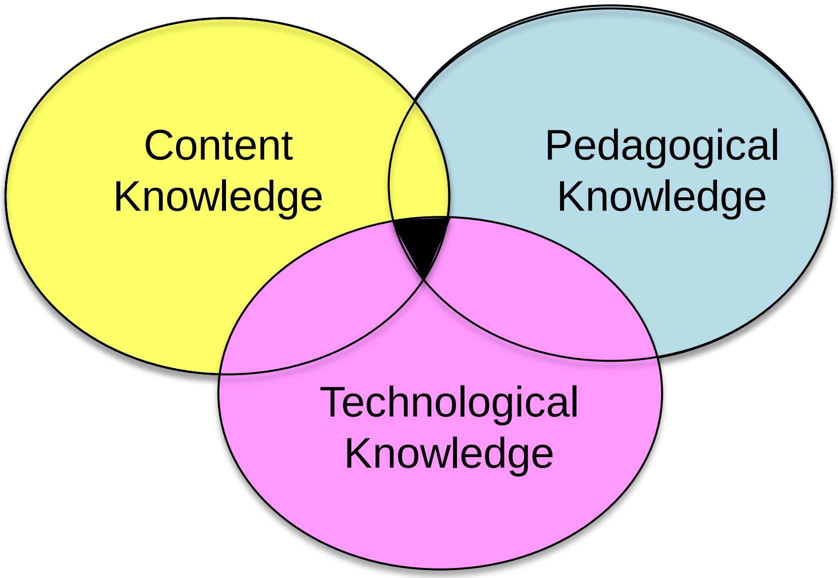
Direct Impact on our Teacher-Candidates



"So, if you set it up in a dynamic where… different types of people have [different needs], so if you need to talk to someone, you still get that, if you need silence, you get to think on it on your own, and then people aren't so stressed… And they actually get to argue and talk back and forth and they'll remember it more. So for them, I think they'll master it more."

Post-Interview 2, Participant 20

Direct Impact on our Teacher-Candidates



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Post-Interview 2, Participant 20

Broad Impact for Teacher Education

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

Model AE with the course content

Modeling impacts TCs' epistemologies, regardless of successes/challenges in practicum

"I'm there as a teacher, (pause) but I'm also there as a student. Conversely, they're there as a student, but they're also there as a teacher. That doesn't mean they're teaching necessarily, teaching me. They're teaching each other... You're always a student-teacher, regardless of whether or not, what your position says. The-the moment you step out, and you meet someone, you now are both a teacher and a learner."

Post-Interview 1, Participant 15

Broad Impact for Teacher Education

Explore a possible mechanism for AE pedagogy

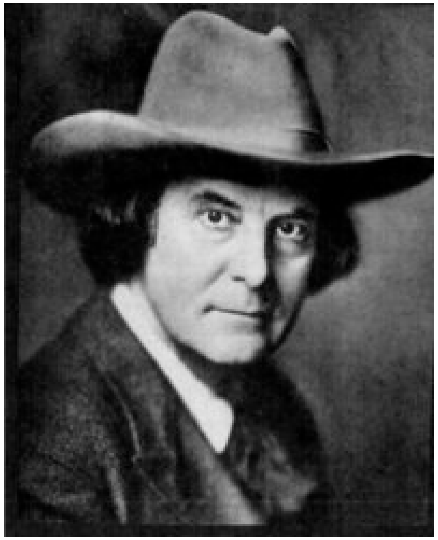
Clicker-enhanced pedagogy works as a mechanism for AE pedagogy in a small class

“Coming into the program, we were all sort of thought that we were expected to be masters, and if the instructor puts up a clicker question, you think ‘Jeez, I don’t actually know the answer’ – immediately you think well, we’re all supposed to be masters, I’m probably the only one who doesn’t know. But uh when the responses come in, you see other people think like you, it’s definitely reassuring.”

Pre-Interview 2, Participant 9

Broadening the Horizon of Science Education: Synergetic Collaborations across Disciplinary Boundaries

Elbert Hubbard (1854-1915)



One computer can do the work of fifty ordinary teachers. No computer can do the work of one extraordinary Teacher."

~ Adapted from an American writer, publisher, artist and philosopher, E. Hubbard (1854-1915)


EDUCATION
Math + Science Ed UBC

Resources

1. 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.

2. CWSEI Clicker Resource Guide: An Instructors Guide to the Effective Use of Personal Response Systems (Clickers) in Teaching. (2009, June 1).

3. Lasry, Nathaniel. (2008). Clickers or Flashcards: Is There Really a Difference? *The Physics Teacher, 46*(May), 242-244.

4. Milner-Bolotin, Marina. (2004). Tips for Using a Peer Response System in the Large Introductory Physics Classroom. *The Physics Teacher, 42*(8), 47-48.

5. 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/

6. Milner-Bolotin, Marina, Fisher, Heather, & MacDonald, Alexandra. (2013). Modeling active engagement pedagogy through classroom response systems in a physics teacher education course. *LUMAT: Research and Practice in Math, Science and Technology Education, 1*(5), 525-544