Physics and Everyday Thinking at Western Washington University

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Context:
Western Washington University

- Comprehensive PUI
- Enrolls ~15,000 students
- Prepares more teachers than any other institution in state

Context:
Science Education 201

- Ten week, 60 hour course
- One faculty instructor and one TA with ~25 students
- 8 sections offered throughout academic year
- Student population:
  - *Preservice elementary teachers*
  - *Liberal arts students*

Context:
Science Education 201

Typical coverage: Ch. 1-3 of PET

Chapter 1:
Interactions and Energy

Chapter 2:
Interactions and Forces

Chapter 3:
Interactions and Systems

Context:
Science Education Program at WWU

- Program housed in College of Science & Tech.
- Primary mission to prepare preservice teachers
- Nine faculty with joint appointments in *Physics, Chemistry, Geology, Biology,* and *College of Ed.*
- Full time director and two full time staff

Context:
Science Education Program at WWU

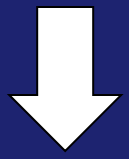
Active in applied research, curriculum development, and assessment,

with various ongoing projects
(TWSSP, SEISMIC, C-CORE, MORE)

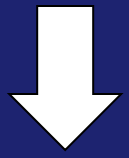
History: MSP Grant (2004-2009)

North Cascades and Olympics Science Partnership

PET adopted for summer inservice (2004)



PET adopted for AY preservice course (2005-present)



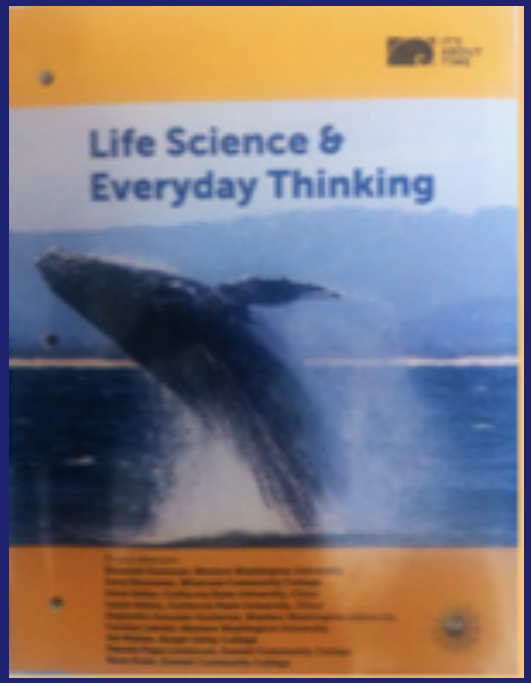
PET model used to develop and implement content courses in geology and biology (2006-present)

Science Education 20x sequence

- SCED 201: *Matter and Energy in Physical Systems*
- SCED 202: *Matter and Energy in Earth Systems*
- SCED 203: *Matter and Energy in Life Systems*
- SCED 204: *Matter and Energy in Chemical Systems*

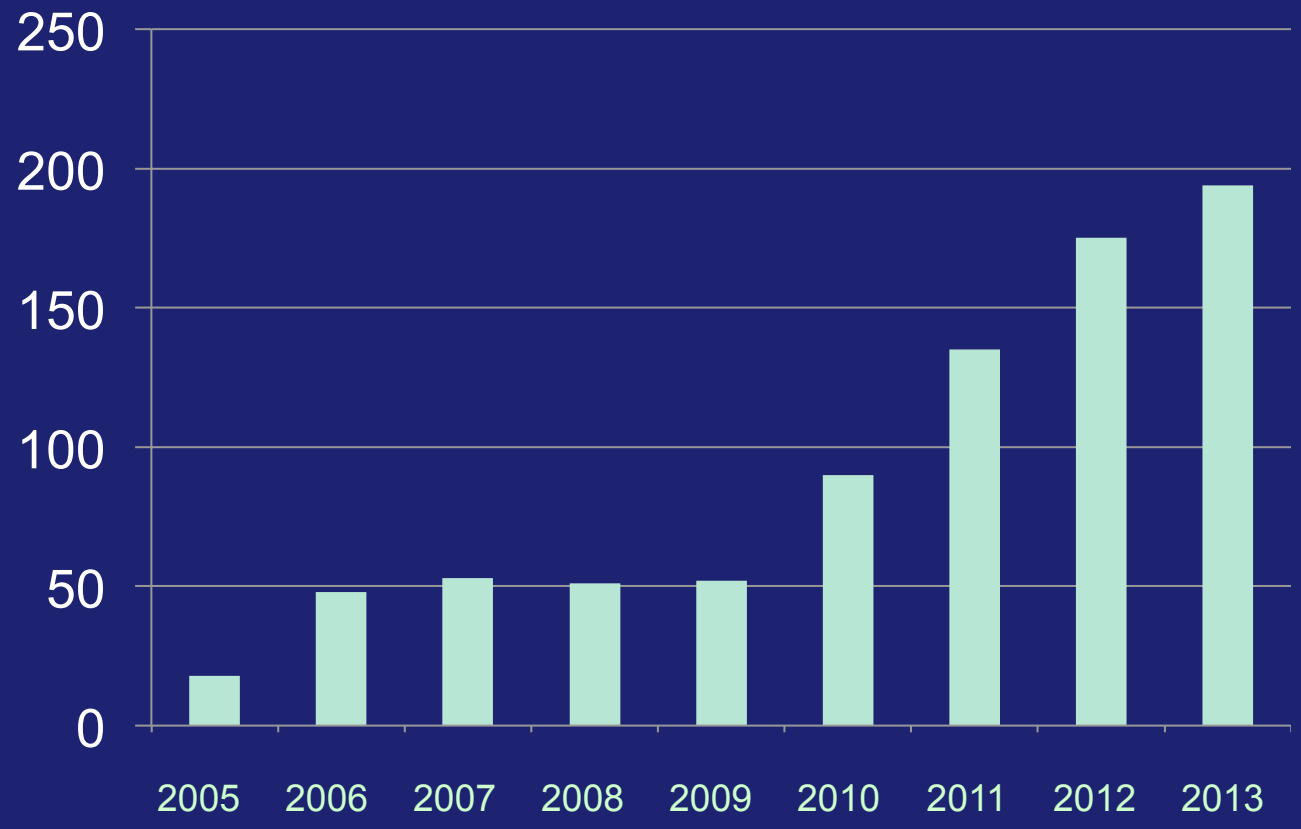
Life Science and Everyday Thinking
(Deborah Donovan *et al,* It's About Time, 2014)

Chapter 1: Intro to Living Things
Chapter 2: Consumers
Chapter 2: Producers
Chapter 4: Decomposers
Chapter 5: Cell Growth
Chapter 6: Cell Reproduction
Chapter 7: Evolution

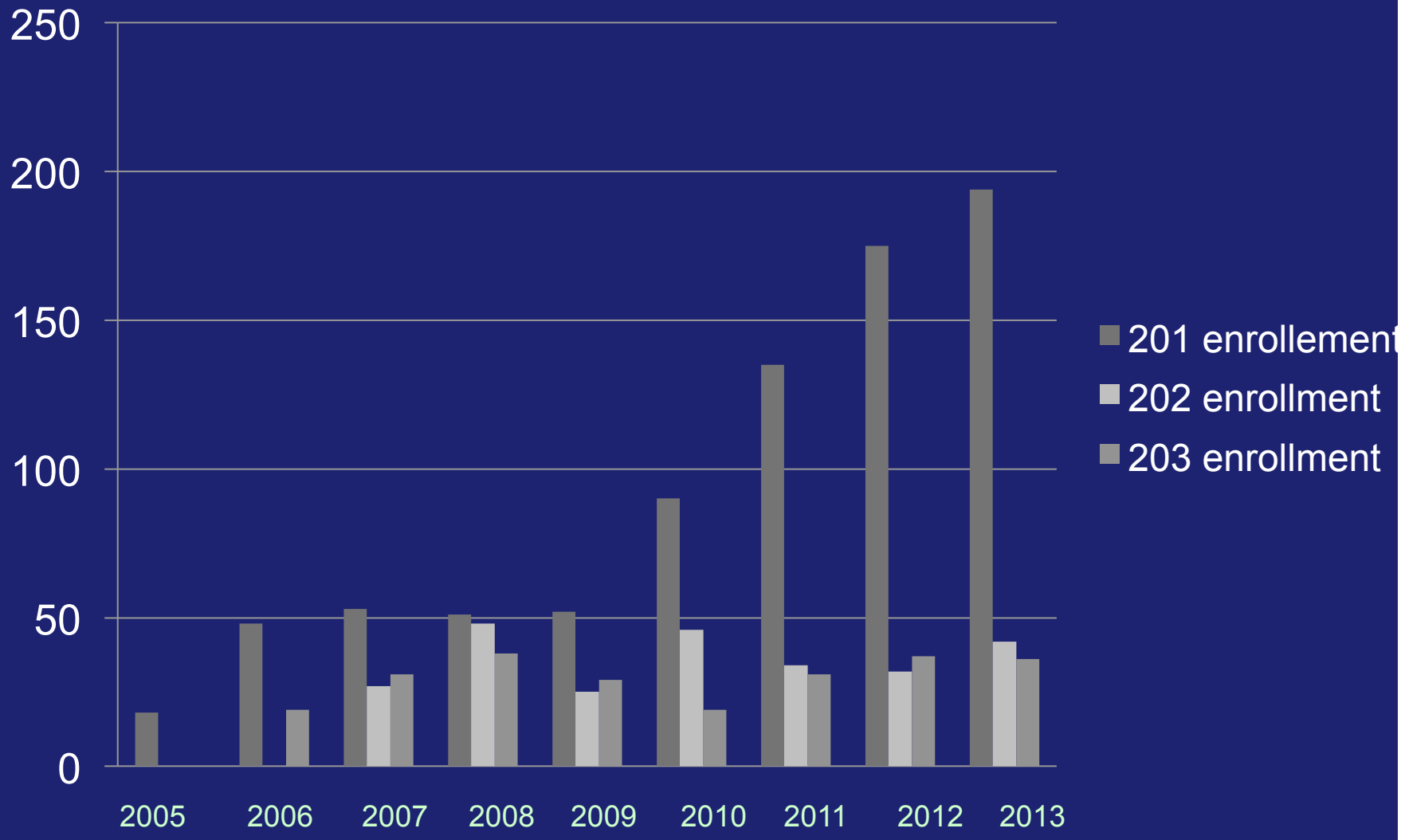


Donovan, D.A., L.J. Atkins, I.Y. Salter, D.J. Gallagher, R.F. Kratz, J.V. Rousseau, and G.D. Nelson. (2013) *Advantages and challenges of using physics curricula as a model for reforming an undergraduate biology course. CBE – Life Sci. Ed*. 12: 215-229.s

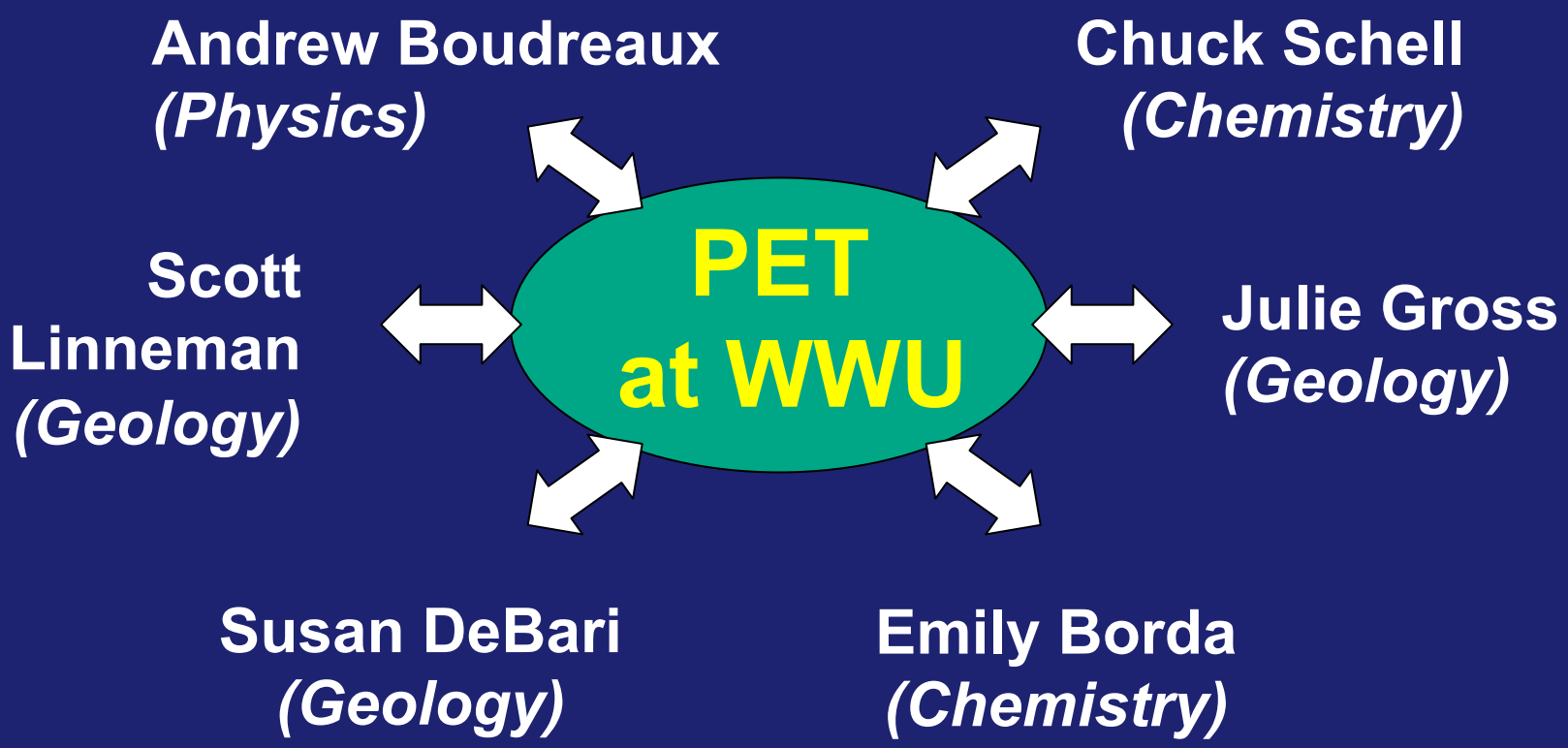
Enrollment in SCED 201 (PET) by Academic Year



Enrollment in SCED 201-2-3



SCED 201: Instructional staff
Co-teaching mentorship model



Model of Researched-Based Education for Teachers

MORE FOR TEACHERS

Five-year study to explore PCK development. Follows K-6 teachers as they complete science content and methods courses and begin classroom teaching.

Co-PIs: Daniel Hanley, Chris O'Hanna

WESTERN WASHINGTON UNIVERSITY

NSF

Instructional element *added* to PET: *How People Learn*

Read *How People Learn: Key Findings.* Be prepared to discuss 1) the ways you see the key findings reflected in how this course is taught, and 2) your ideas about the role of the key findings in your future work as a teacher.

Instructional element *added* to PET: *Interview-a-child assignment*

- Interview a young student about the forces involved in a soccer ball kick.
- Ask questions to draw out student thinking.
- Summarize the interview in 1 or 2 pages. Make connections to *Common Student Ideas* reading from PET.

Instructional element *added* to PET: *Learning Commentary assignment*

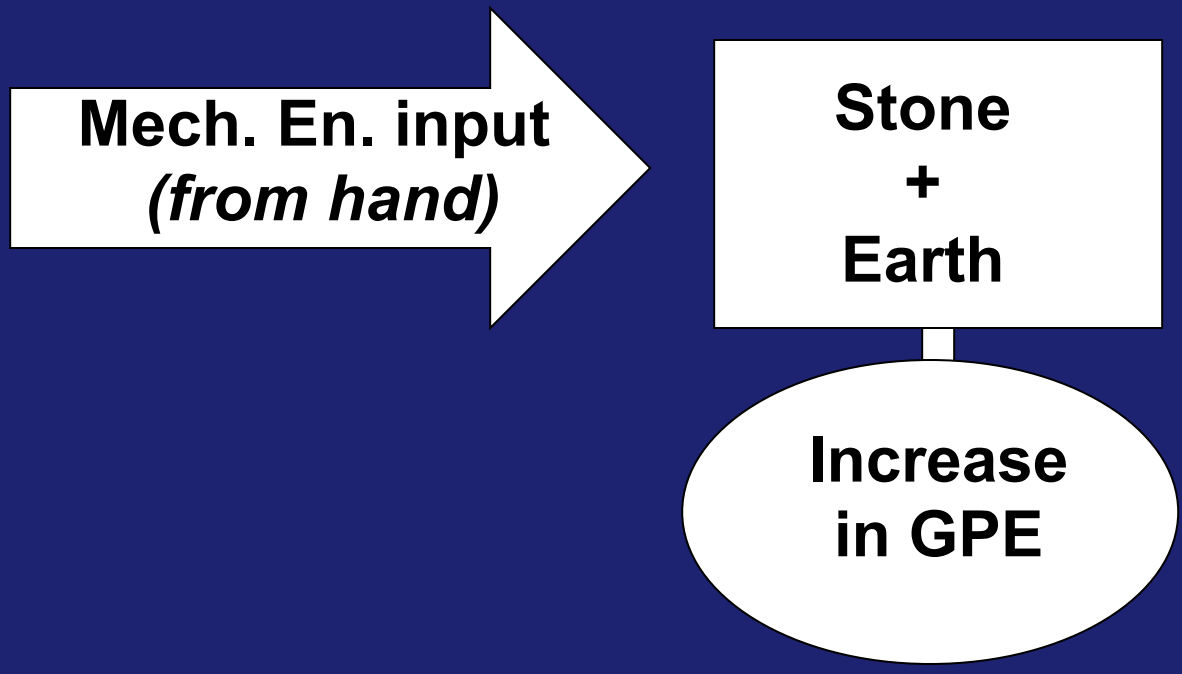
- Choose one of the Scientists' Ideas.
- Describe your initial thinking. What was it that you initially understood about this idea? Cite evidence from your work.
- Describe your current understanding. Highlight how your current understanding differs from your initial.
- Discuss what led to the changes you described *(e.g. specific experiment, simulation, video, discussion).*

SCED 201 at WWU:
Ongoing research on student learning

- Investigating student reasoning and conceptual understanding
- Measuring instructor effects
- Measuring longevity of learning gains and attitudinal shifts

Assessment task

A 5th grader holds a stone on the palm of her hand. She then lifts the stone vertically upward at a constant speed. Use energy ideas to explain *why the stone moved with constant speed.*



Student response

"Because we know that balanced forces allow for an object to move at constant speed, the 5th grader must have exerted an equal force to the force of gravity, which is pulling it back to the Earth. I know that the further the stone rises from the ground, the greater its GPE becomes. And the less the kinetic energy it has because it is transformed into GPE . . . that is why the stone moves with constant speed."

26-Item Force and Motion Assessment *(Horizon Research, Inc.)*

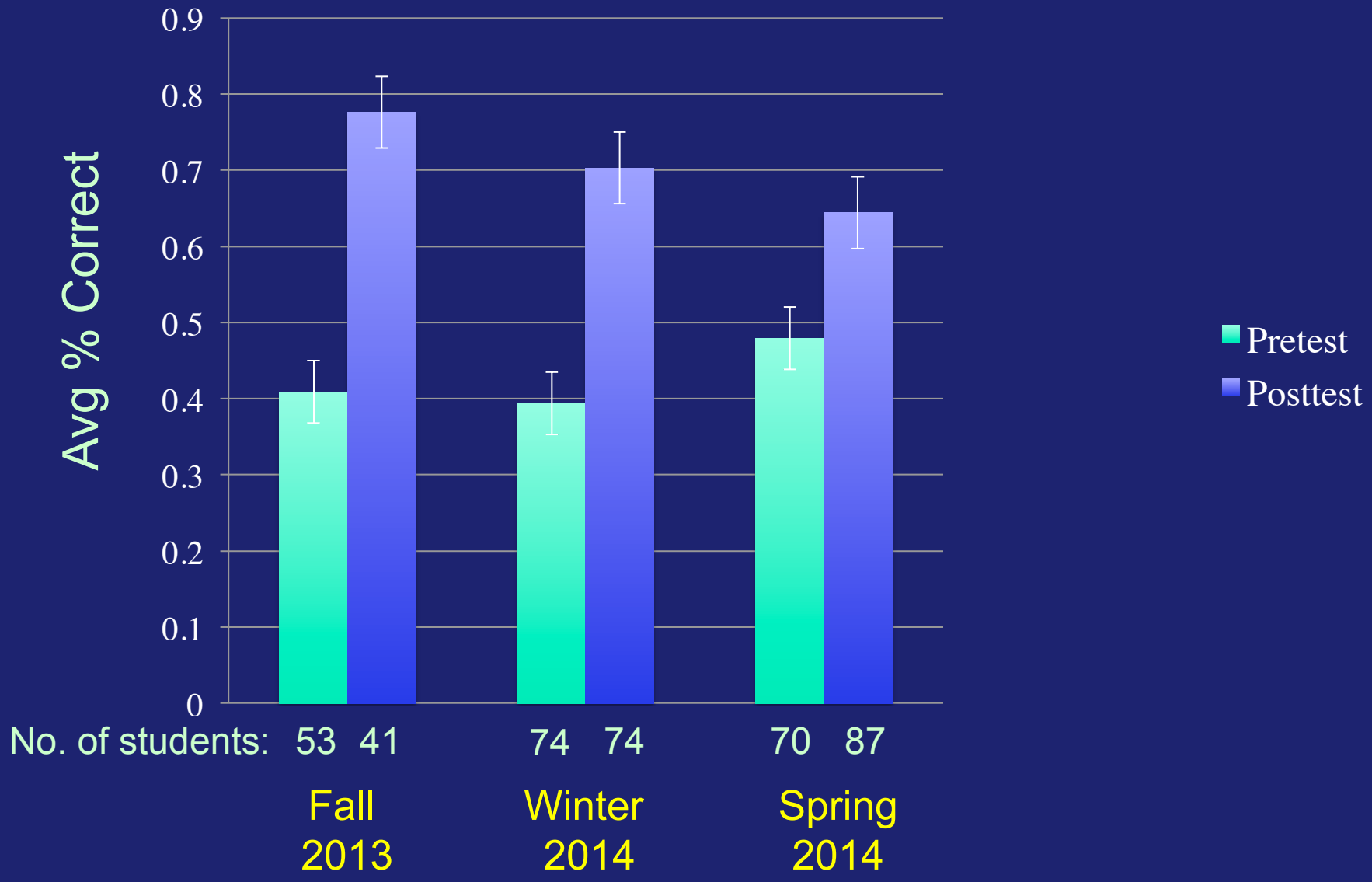
A teacher gives her students the following question.

> Student Assessment Item
>
> Jorge is pushing a shopping cart along level ground at a constant speed and then lets go. The cart starts moving slower and slower. Why does the cart move slower and slower?

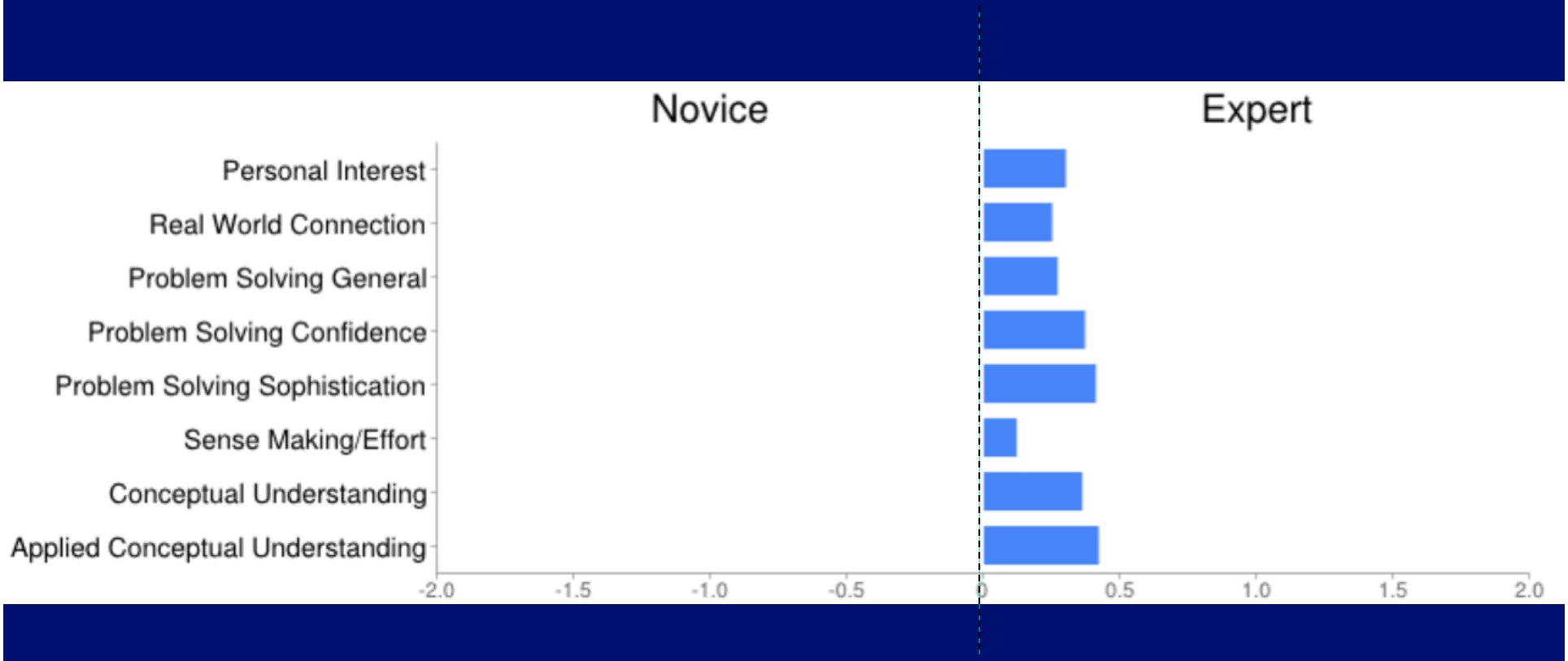
Which one of the following answers is correct?

○	A	Jorge's force was used up by friction.
○	B	There are no longer any forces acting on the cart.
◉	C	There is a net force in the direction opposite to the cart's motion.
○	D	The cart's force was used up by friction.

26-Item Force and Motion Assessment



Results from CLASS (N = 65)



Summary

A thriving instructional program using the *Physics and Everyday Thinking* curriculum provides opportunities

- for students to connect meaningful learning experiences to their future work as teachers, and
- for researchers to examine multiple aspects of students learning and test approaches to instruction.