

**AAPT**  
PHYSICS EDUCATION  
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# INQUIRY-BASED PD:

INFLUENCE ON SELF-EFFICACY  
IN TEACHING MATH THROUGH  
PHYSICS

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# REVIEW OF LITERATURE

Self-efficacy (SE) (Bandura, 1997) in teaching practice has been shown to correlate with teachers' content knowledge (CK) (Swackhamer, 2009), but how might this correlation differ in an area outside a teacher's specialization, such as physics CK with math teachers?

# REVIEW OF LITERATURE

Mobley's (2015) analysis of self-efficacy for teaching STEM had 3-factor model:

1. *social*: others-oriented, such as motivating students
2. *personal*: self-oriented, such as developing new knowledge
3. *material*: peripheral, such as use and access of technology

# RESEARCH QUESTIONS

*In the “short-term” (1-week workshop)*

- Does PD influence CK and SE?
- Do gains in CK and SE correlate?

*In the “long-term” (after semester follow-up)*

- Does PD influence CK and SE?
- Do gains in CK and SE correlate?

# PARTICIPANTS

20 math educators, from 5 LEAs.

Most held bachelor's degrees in math, 14 held graduate degrees in education, 2 held master's degrees in math, and 2 held master's degrees in physics.

6 were male, and 14 were female.

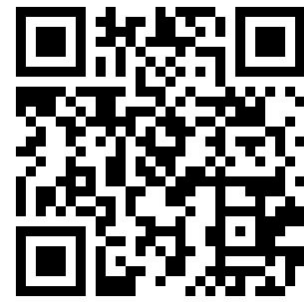
# PD WORKSHOP

*Let's Get Physical! Teaching Mathematics through the Lens of Physics* (Bertrand, 2017)

Equipment: physics packages, spring kits, current probes, circuit boards, refraction blocks, lasers, track systems, & ipads.

Inquiry-based. Focused on standards in Algebra I, II, & geometry.

# PD WORKSHOP



Modeled behavior of live insects to learn about displacement, velocity, geometry, and measurement.

Dropped coffee filters and modeled their fall to learn about drag & logarithms.

Other labs involved basketballs, toy cars, lasers, and circuits.

# TIMELINE

DATA COLLECTION

JUL AUG SEPT OCT NOV DEC

PROFESSIONAL  
DEVELOPMENT



# INSTRUMENTS

- SE: 8 capability statements, 0=*Certainly I am not capable*. 10=*Certainly I am capable*. Cronbach alpha=.96.
- CK: 5 multiple-choice items.  
Physics-based math. Cronbach alpha=.59.

DATA COLLECTED BEFORE  
AND AFTER WEEK-LONG  
SUMMER INQUIRY-BASED  
PD WORKSHOP.

## *SHORT-TERM:*

### DOES PD INFLUENCE CK AND SE?

- Post-workshop CK scores ( $M=3.20$ ,  $SD=1.28$ ) exceeded pre-test scores ( $M=1.70$ ,  $SD=1.30$ ),  $t(19)=-4.94$ ,  $p<.05$ .
- Post-workshop SE ratings ( $M=6.69$ ,  $SD=1.79$ ) significantly exceeded those pre-workshop ( $M=4.46$ ,  $SD=2.06$ ),  $t(19)=-6.10$ ,  $p<.05$ .

## *SHORT-TERM:*

# DOES PD INFLUENCE CK AND SE?

They also significantly improved in each of three SE subscales:

- Social,  $t(19)=-6.03$ ,  $p<.05$ ,
- Personal,  $t(19)=-5.37$ ,  $p<.05$ , and
- Material,  $t(19)=-5.40$ ,  $p<.05$ .

## *SHORT-TERM:*

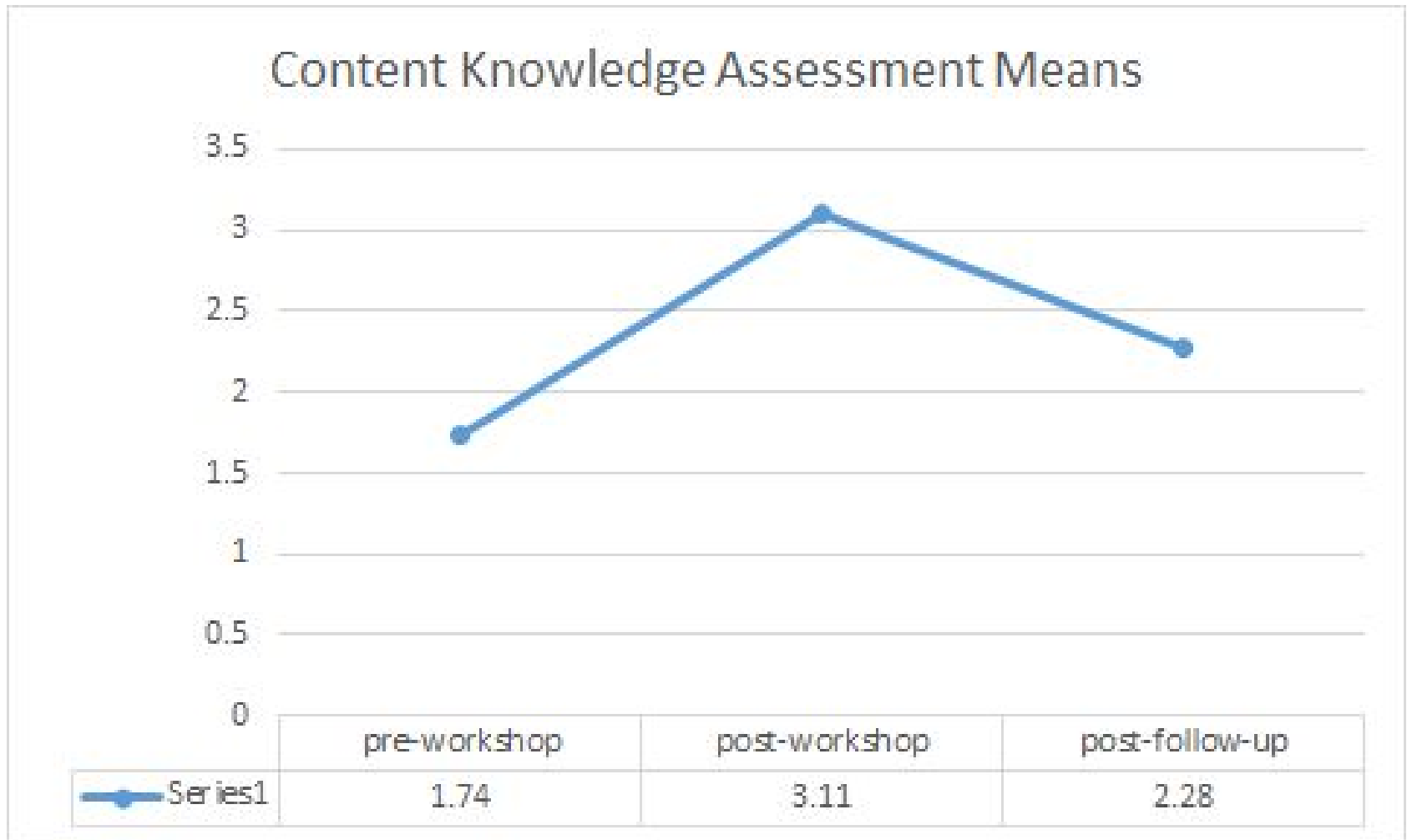
### DO GAINS IN CK AND SE CORRELATE?

- Gains in CK and SE were not significantly correlated,  $r(18)=.022$ ,  $p>.05$ .
- None of the SE subscale gains significantly correlated with CK:
  - Social,  $r(18)=.034$ ,  $p>.05$ .
  - Personal,  $r(18)=-.084$ ,  $p>.05$ .
  - Material,  $r(18)=-.035$ ,  $p>.05$ .

MONTHLY FOLLOW-UP  
MEETINGS DURING FALL  
DATA COLLECTED AFTER

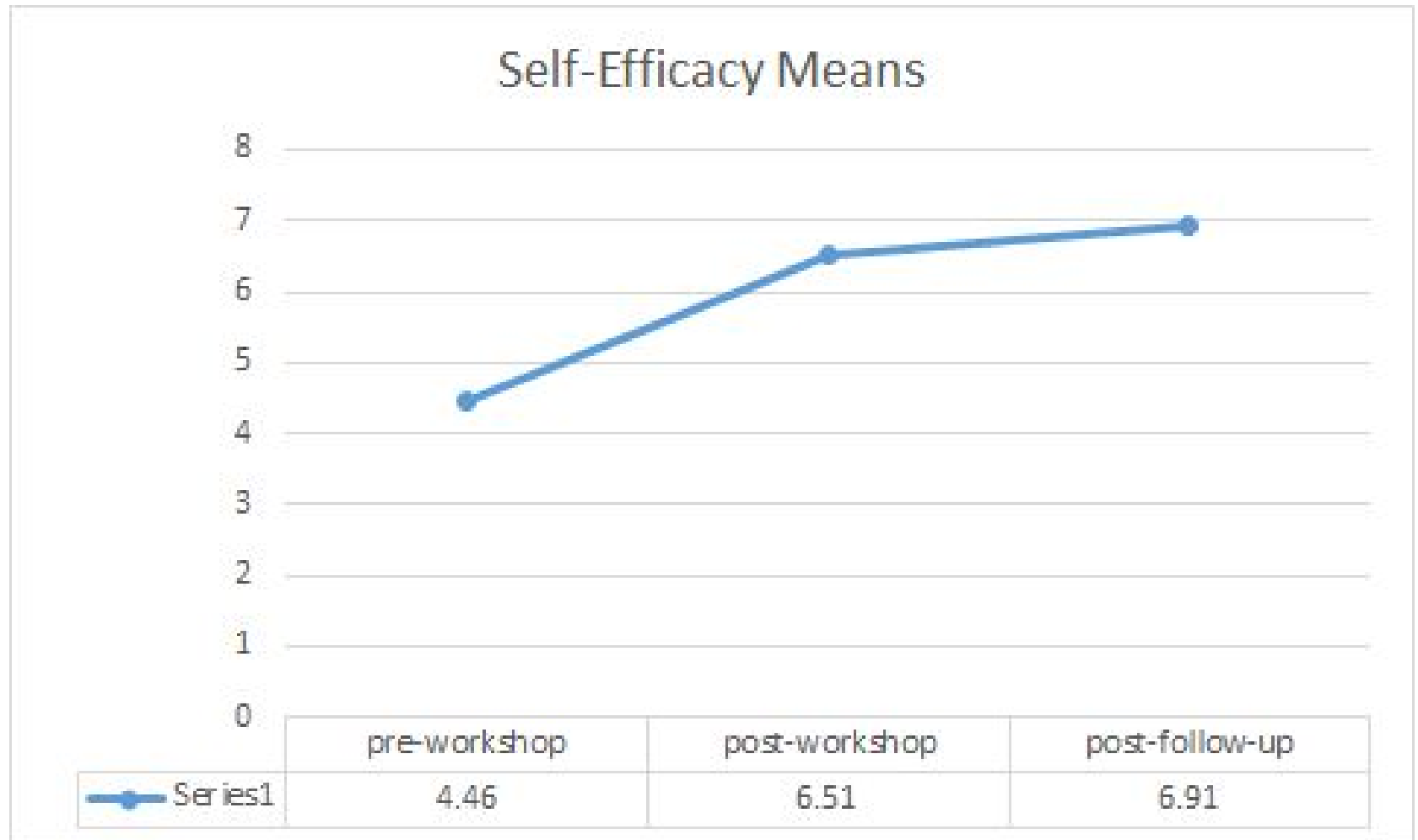
# *LONG-TERM:*

## DOES PD INFLUENCE CK AND SE?



# *LONG-TERM:*

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## *LONG-TERM:*

### DOES PD INFLUENCE CK AND SE?

- Post-follow-up CK scores ( $M=2.37$ ,  $SD=1.64$ ) did not exceed pre-workshop scores significantly,  $t(18)=1.79$ ,  $p>.05$ .
- Post-follow-up SE ratings ( $M=6.91$ ,  $SD=2.00$ ) significantly exceeded those pre-workshop,  $t(18)=5.57$ ,  $p<.05$ . Differences were also significant for each SE subscale.

## *LONG-TERM:*

# DO GAINS IN CK AND SE CORRELATE?

	SE gains	CK gains	SE Social	SE Personal	SE Material
SE gains	1				
CK gains	0.515*	1			
SE Social	0.953**	0.514*	1		
SE Personal	0.943**	0.511*	0.821**	1	
SE Material	0.909**	0.374	0.84**	0.793*	1

\*Correlation is significant at the .05 level.

\*\*Correlation is significant at the .01 level.

# RESEARCH QUESTIONS

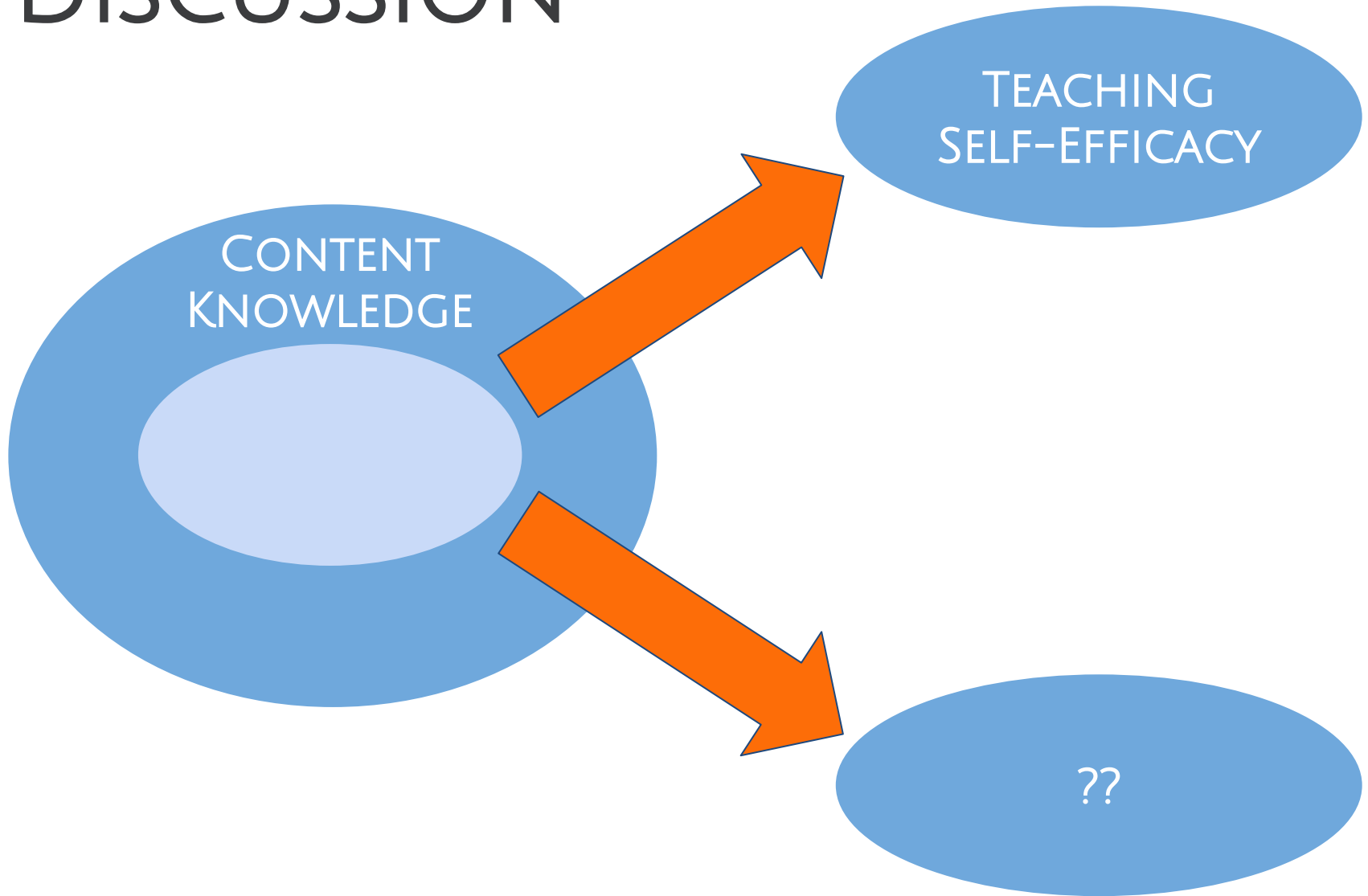
## *In the “short-term” (1-week workshop)*

- Does PD influence CK & SE? **YES & YES**
- Do gains in CK and SE correlate? **NO**

## *In the “long-term” (after semester follow-up)*

- Does PD influence CK & SE? **NO & YES**
- Do gains in CK and SE correlate? **YES**

# DISCUSSION



# QUESTIONS, COMMENTS?

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- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W H Freeman/Times Books/ Henry Holt & Co.
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- Mobley, M. C. (2015). *Development of the SETIS Instrument to Measure Teachers' Self-Efficacy to Teach Science in an Integrated STEM Framework*. PhD diss., University of TN.
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