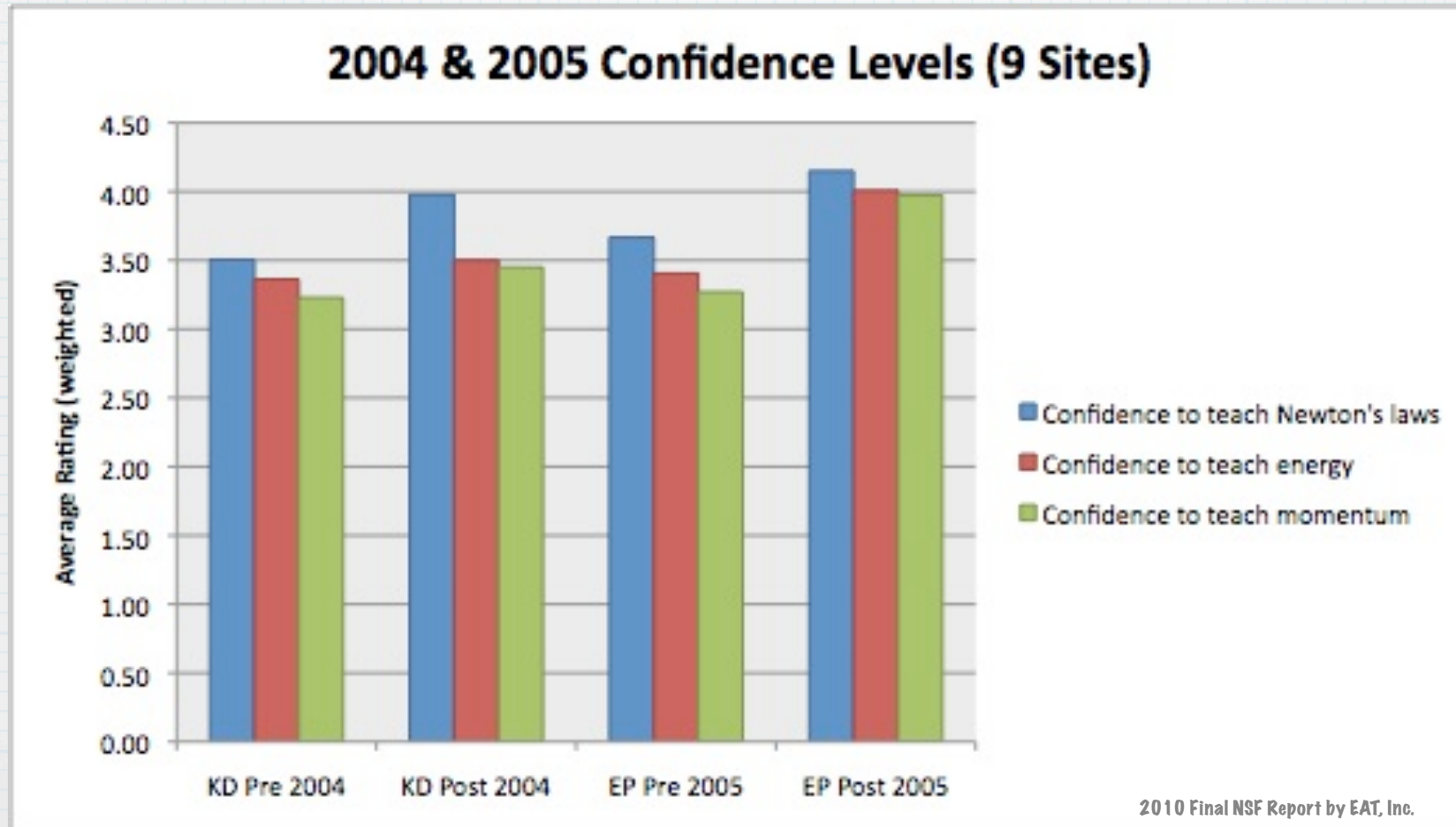


# **The Future.....**

**George Amann  
Jan Mader  
Karen Jo Matsler**

**“Soft” data only told part of the story.....  
There was an increased focus on research and models**



**Comparison of confidence for year prior to treatment (2004) and year of treatment (2005) in energy and momentum. Newton's Laws were taught in 2004.**

N pre = 194; N post = 176

# Research Component

If we knew what we are doing, we couldn't call it "research" would we?

Albert Einstein

---

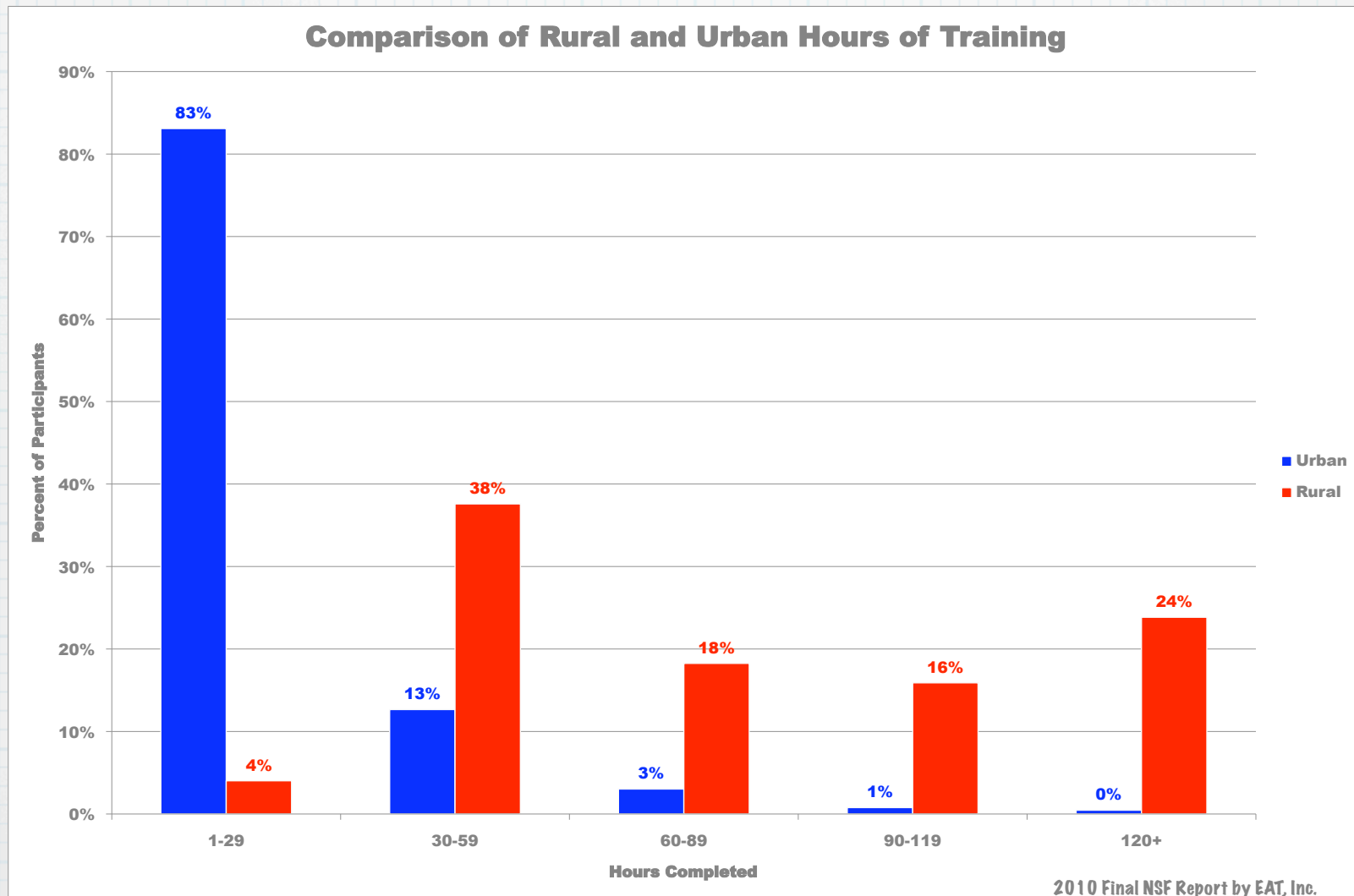
- \* Prior to 2002 Rural PTRAs collected qualitative data
- \* Continuation of funds was dependent on quantitative and qualitative data
- \* Implementation of research components evolved during duration of grant

# Hours needed to impact classroom practice



Horizon, Inc

# Comparison of Hours Completed



N Urban = 2844  
N Rural = 1019

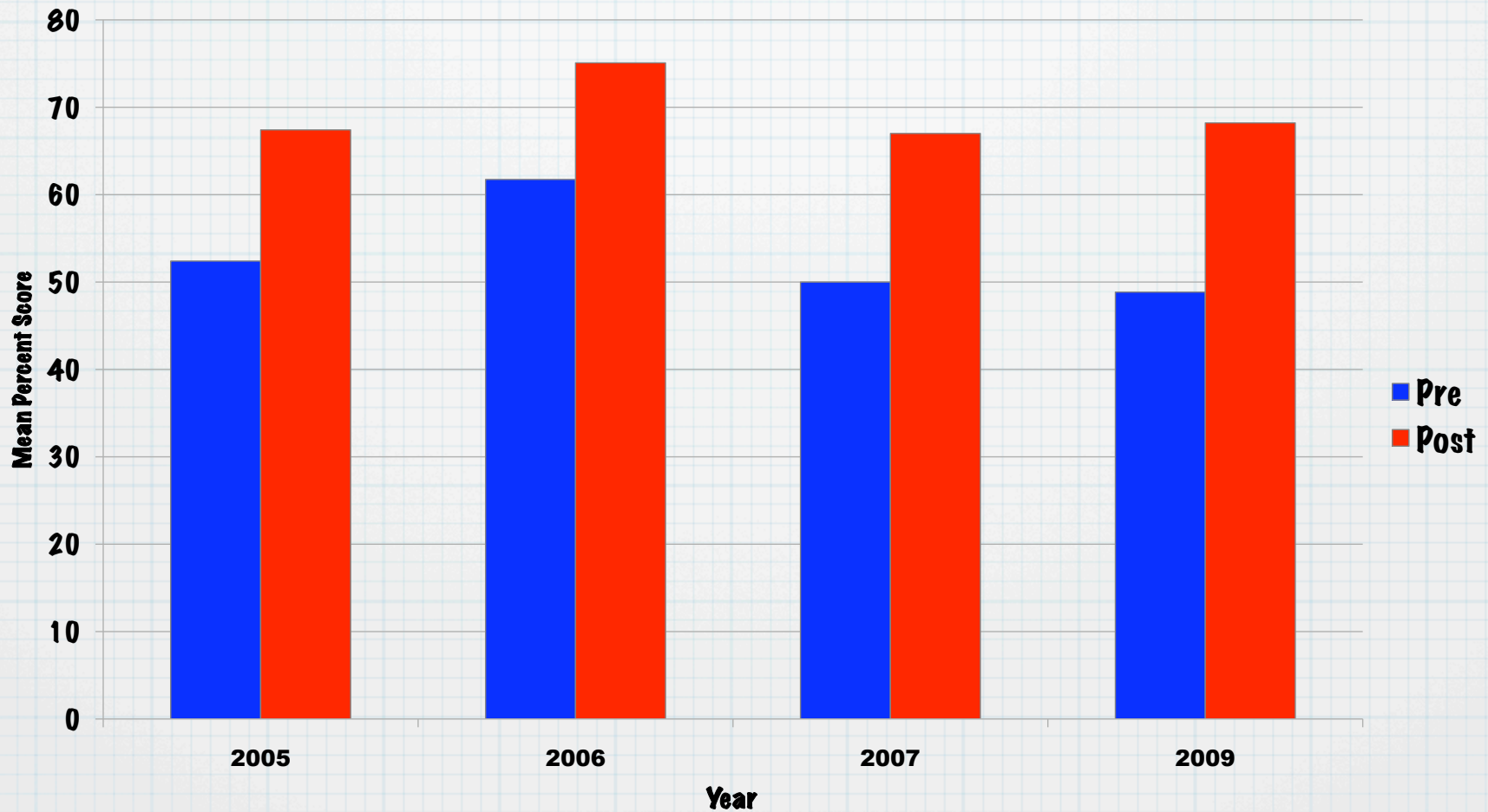
# Participant Data

# Impact on Content

## Did they learn anything?

N pre = 664  
N post = 645

**Participant Mean Percent Score (Electricity/Magnetism)**



# Hake Gains

## Electricity/Magnetism

\* 2005 = 0.32

\* 2006 = 0.36

\* 2007 = 0.39

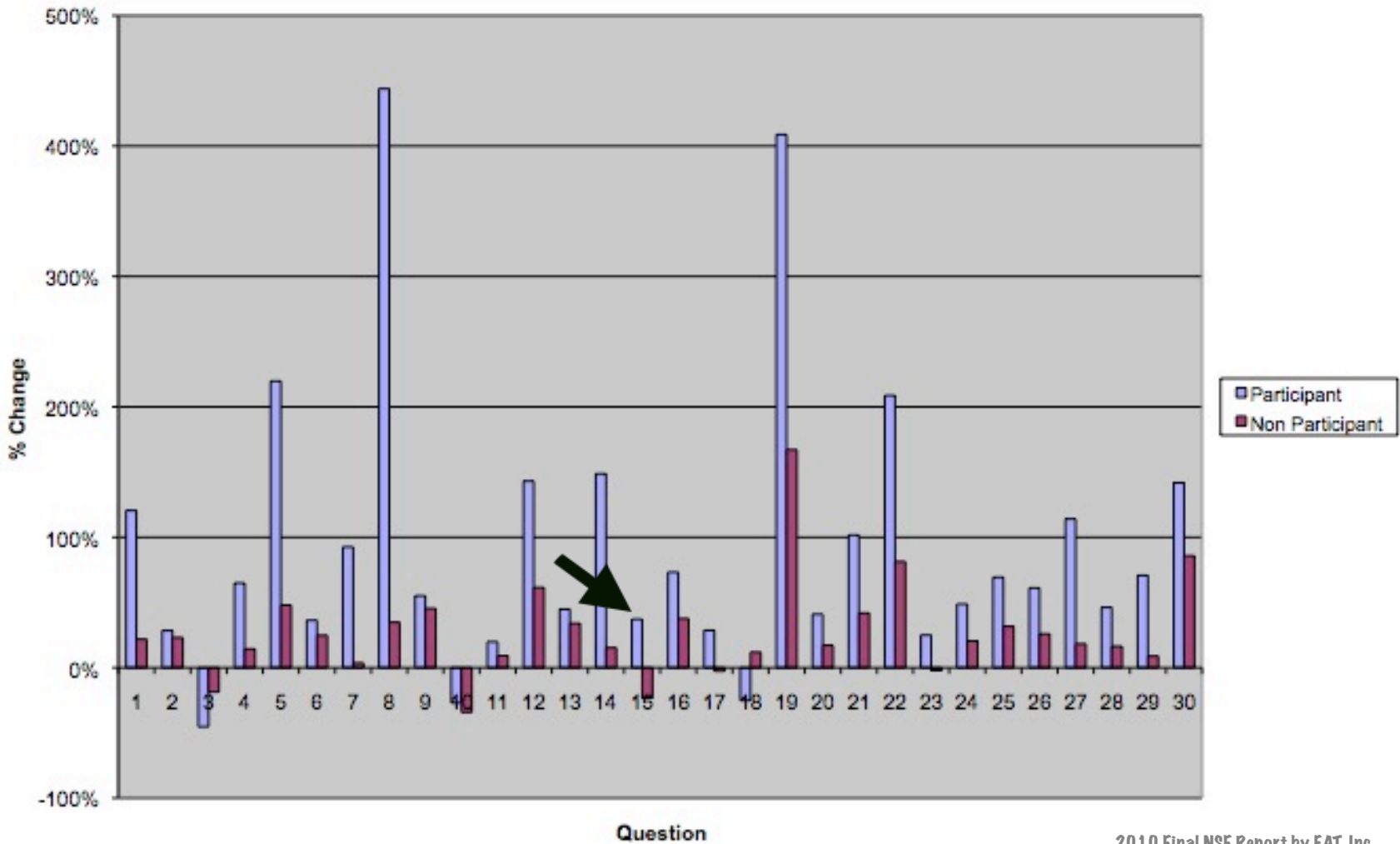
\* 2008 no sites

\* 2009 = 0.39



# Student Data

2006 & 2007 HS Participant and NonPartic. Elec % Change

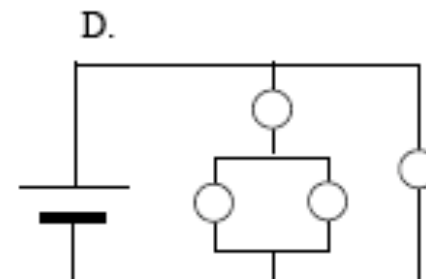
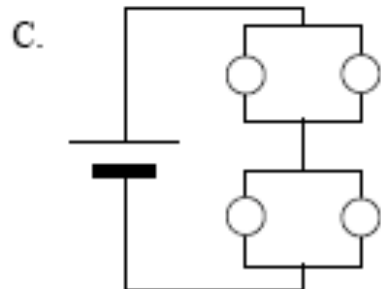
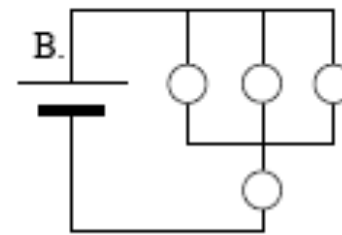
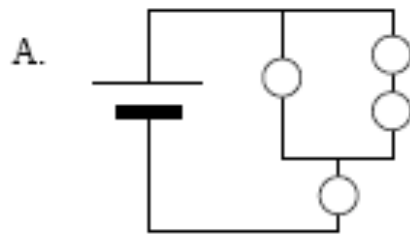
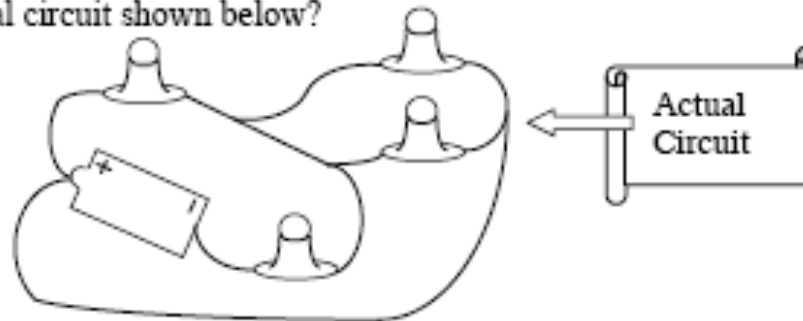


2010 Final NSF Report by EAT, Inc.

Comparison of student pre and post electricity/magnetism assessment scores

# Question #15

15. The four bulbs in the actual circuit shown are identical. Which schematic diagram is equivalent to the actual circuit shown below?

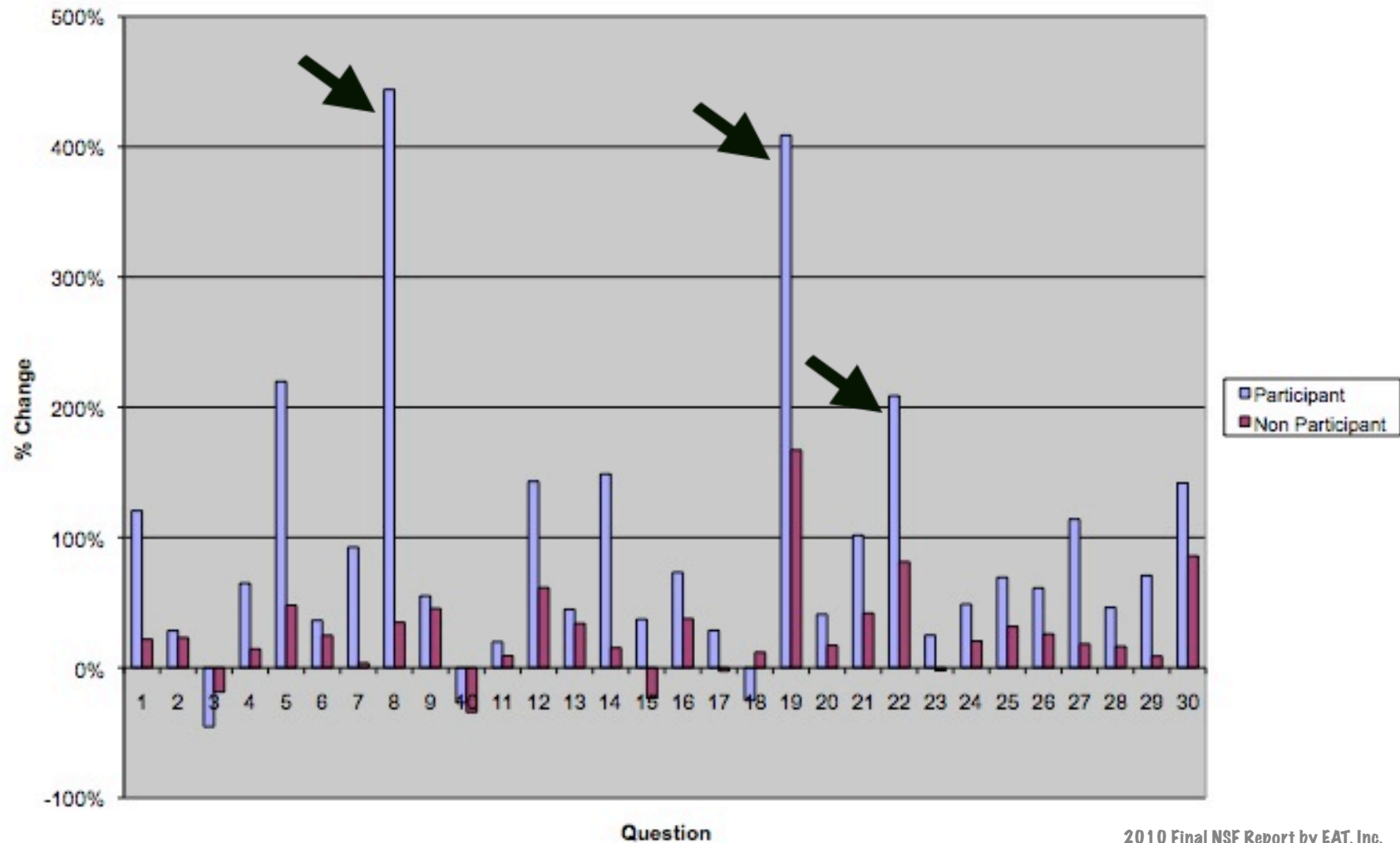


- E. None of these schematic diagrams is equivalent to the original circuit shown.

Copyright AAPT/PTRA

Particip = 37%  
Non Particip = 23%

2006 & 2007 HS Participant and NonPartic. Elec % Change



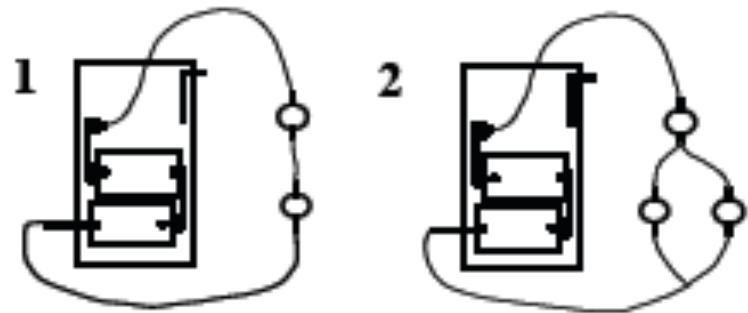
2010 Final NSF Report by EAT, Inc.

**Comparison of student pre and post electricity/  
magnetism assessment scores**

# Question #8

8. If all the bulbs in the circuit on the right are similar, what could you conclude about the brightness of the bulbs?

- A. The top bulb is brighter in circuit 1 than circuit 2.
- B. The top bulb is brighter in circuit 2 than circuit 1.
- C. The top bulb is the same brightness in both circuits.
- D. The brightness of the top bulbs cannot be determined.



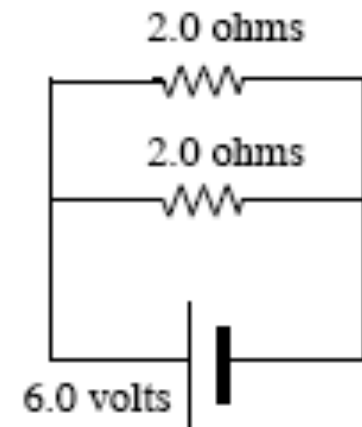
Copyright AAPT/PTRA

Participant = 444%  
Non Participant = 35%

# Question #19

19. In the circuit shown on the right, there is a 6.0 V battery connected to two 2.0-ohm resistors as shown. The total resistance of the circuit is

- A. 4.0 ohms.
- B. 2.0 ohms.
- C. 1.0 ohm.
- D. 0.50 ohm.



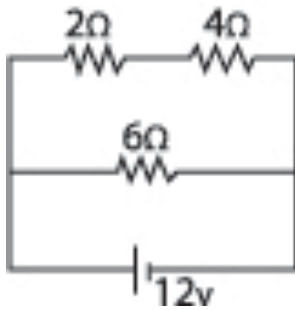
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Participant = 409%  
Non Participant = 167%

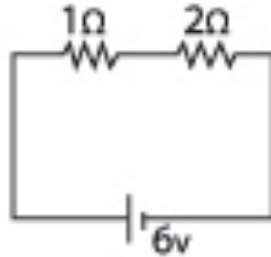
# Question #22

Consider the four circuits shown below to answer question 22.

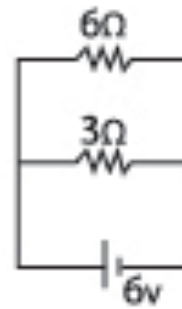
A.



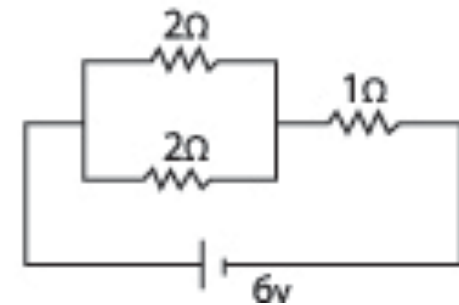
B.



C.



D.



22. Which circuits have the greatest equivalent resistance?

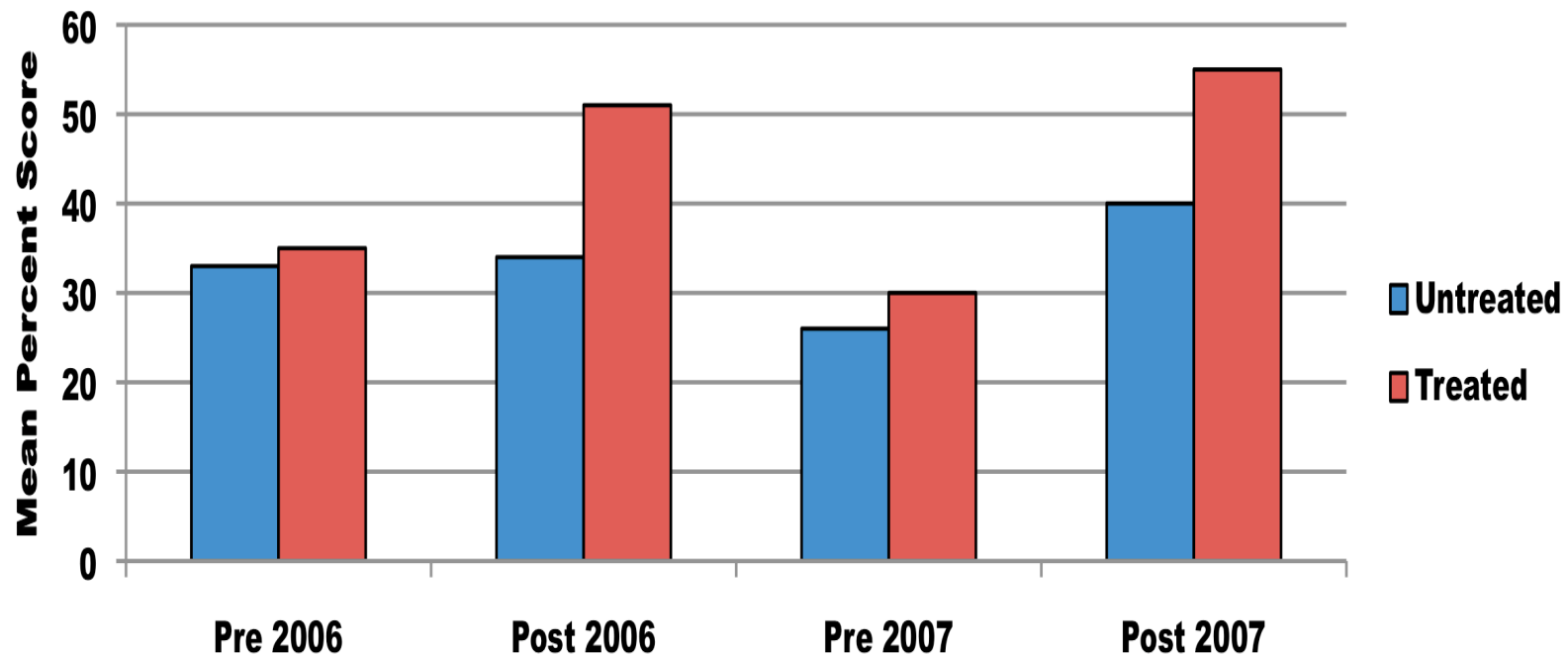
- A. A and B
- B. B and C
- C. C and D
- D. D and A

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Participant = 209%  
Non Participant = 81%

# Student Impact Mean Percent Score

## Student Impact (Electricity 2006 & 2007)



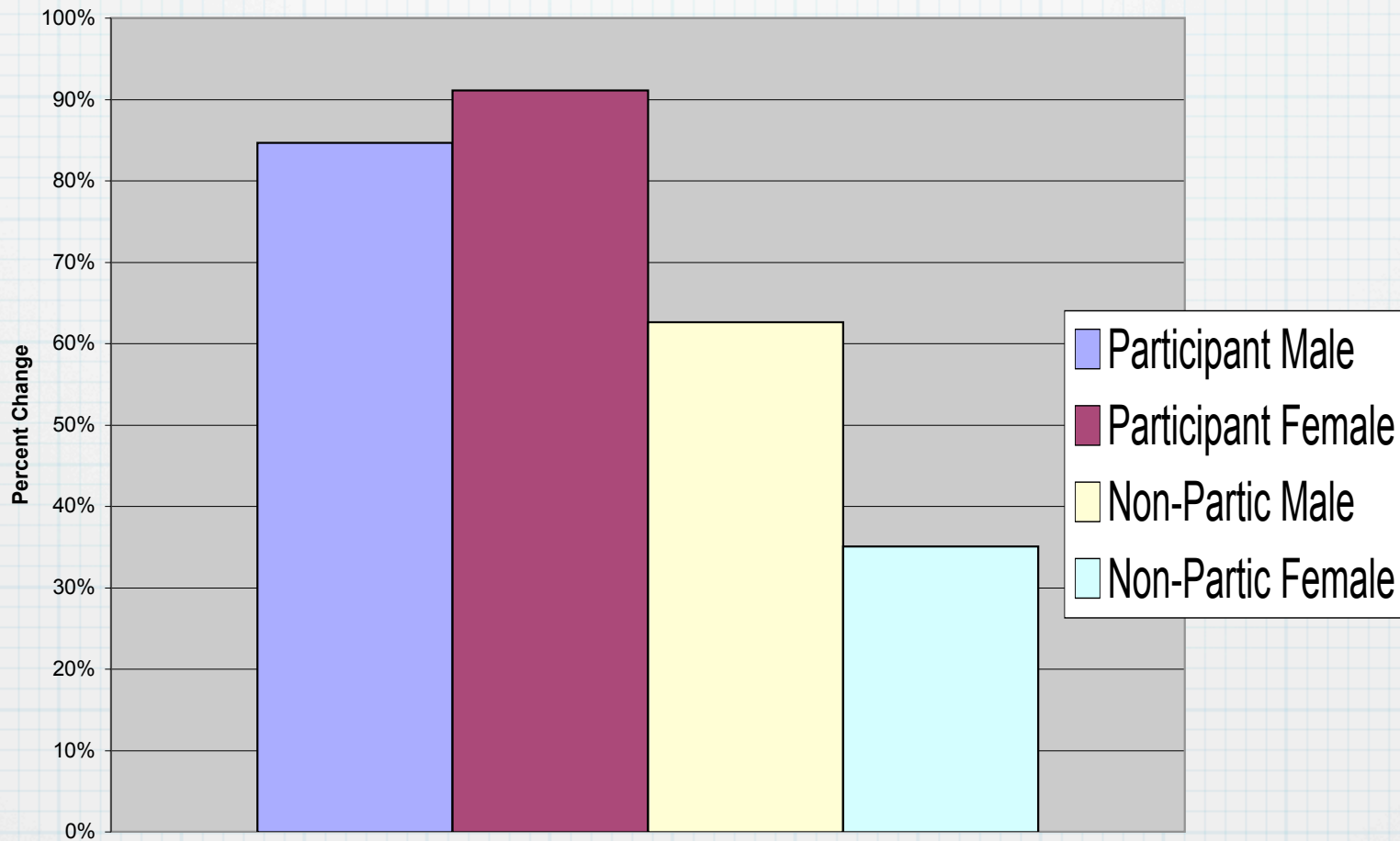
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N pre untreated = 299; N post untreated = 281  
N pre treated = 177; N post treated = 172



# Comparison of Treated and Untreated Students

High School Student 06 & 07 Electricity Percent Change



# Classroom Impact

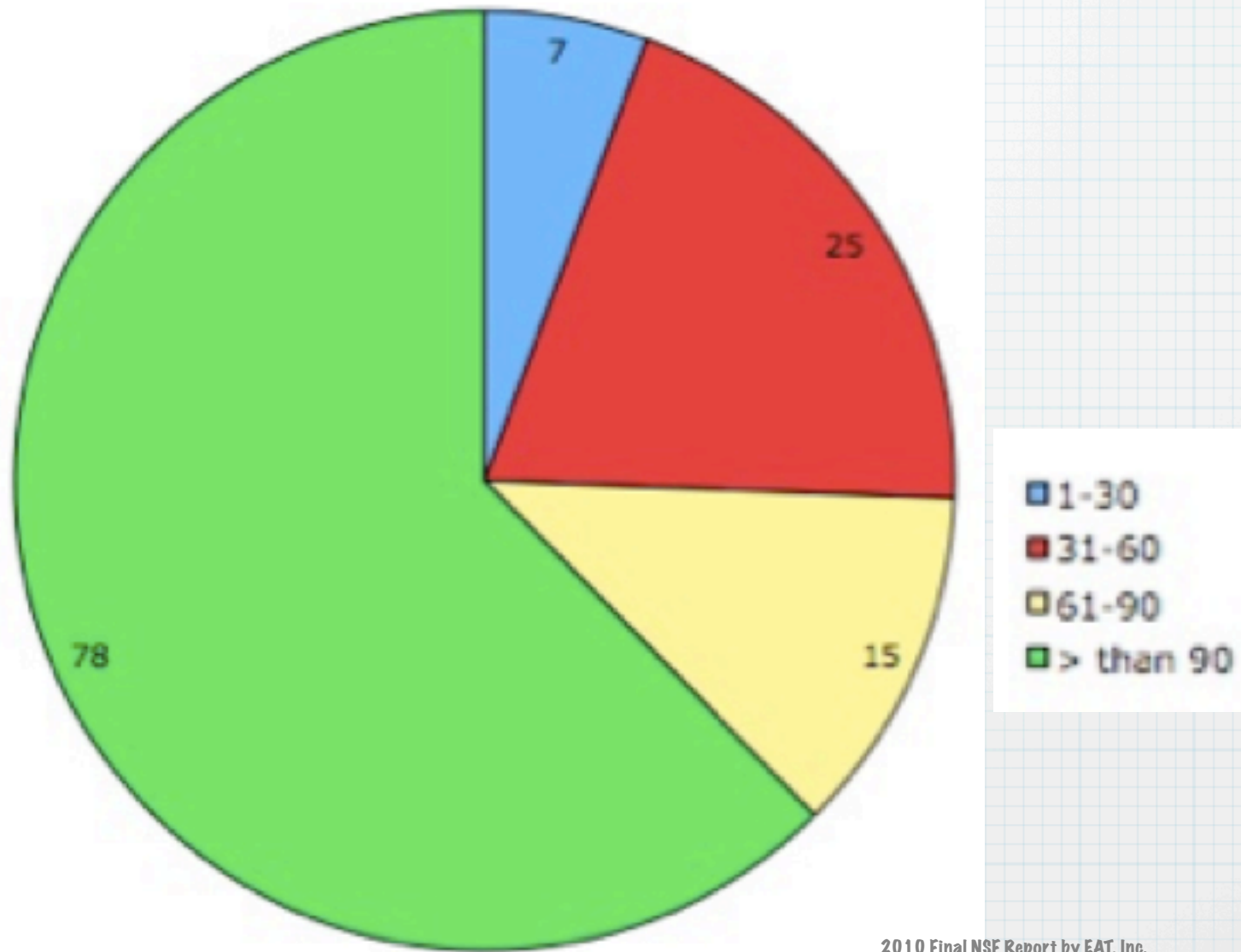
- \* **Discovery and scaffolding type learning**
- \* **Use of technology to collect, display and analyze data**
- \* **I understand misconceptions and how to deal with them**
- \* **I now understand how to differentiate**
- \* **My labs are inquiry based, not facts and equations**
- \* **Developing equations after they collect data, not using labs to verify equations**
- \* **Less lecture and more active learning**
- \* **Look at big idea or conceptual idea they need to know, not equation**

# The “Model”

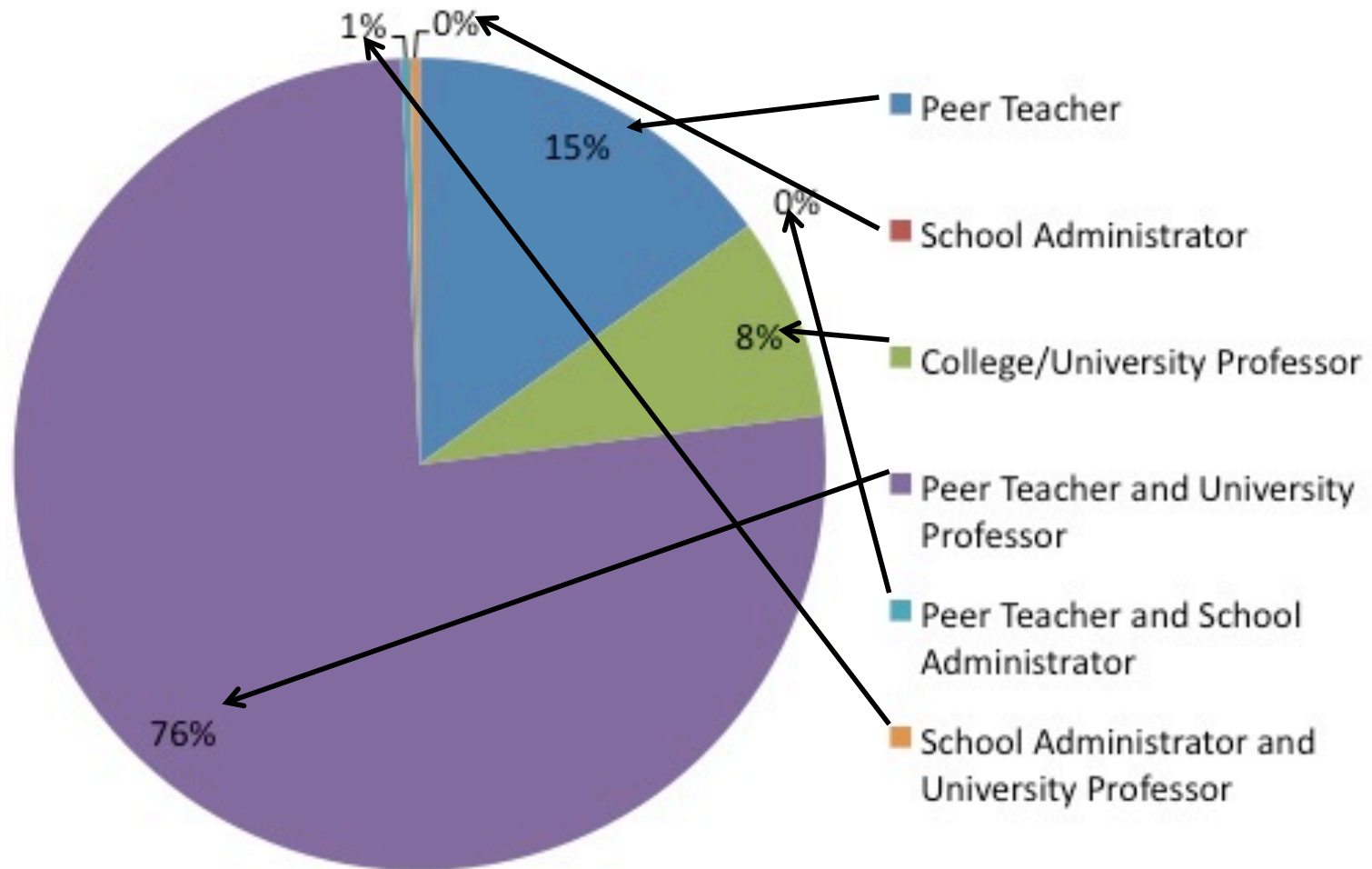
# What Worked

- \* Partnerships between AAPT, university/college professors and PTRAs (workshops led by PTRAs)
- \* Offering multiple opportunities to attend training (rotate years, sites and topics)
- \* Predetermined and consistent curriculum (quality control)
- \* PTRAs trained in curriculum, pedagogy, and adult learning methods
- \* Assessments correlated to workshop objectives
- \* ABC: Activity Before Concept; Active learning
- \* Peer led professional development by AAPT certified master teachers

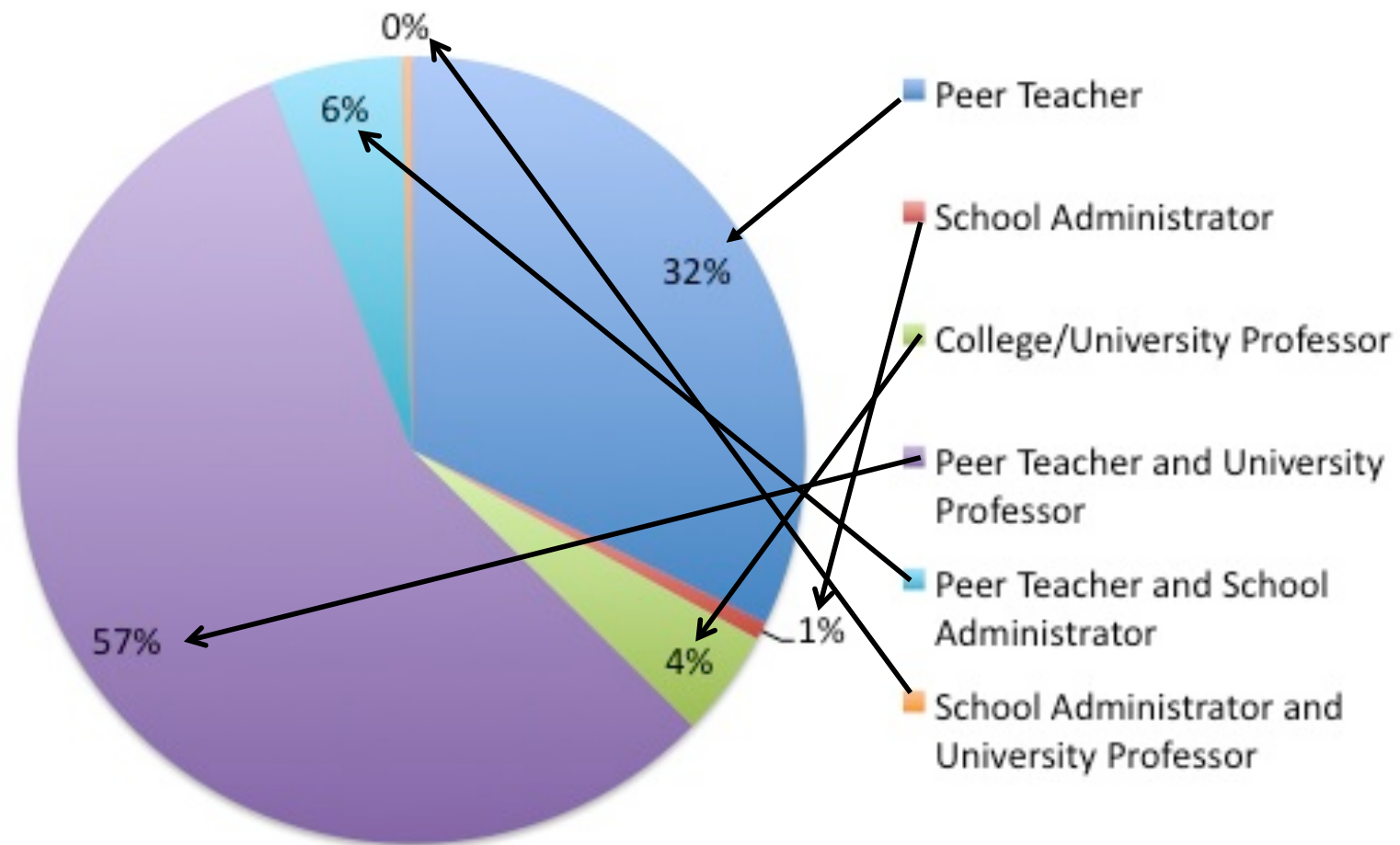
**Site rotation and multiple opportunities to attend same topic workshops increased overall completion of hours and increased retention**



## Most Effective Leadership for PD in Content



## Most Effective Leadership for PD in Instructional Strategies



# What Doesn't Work

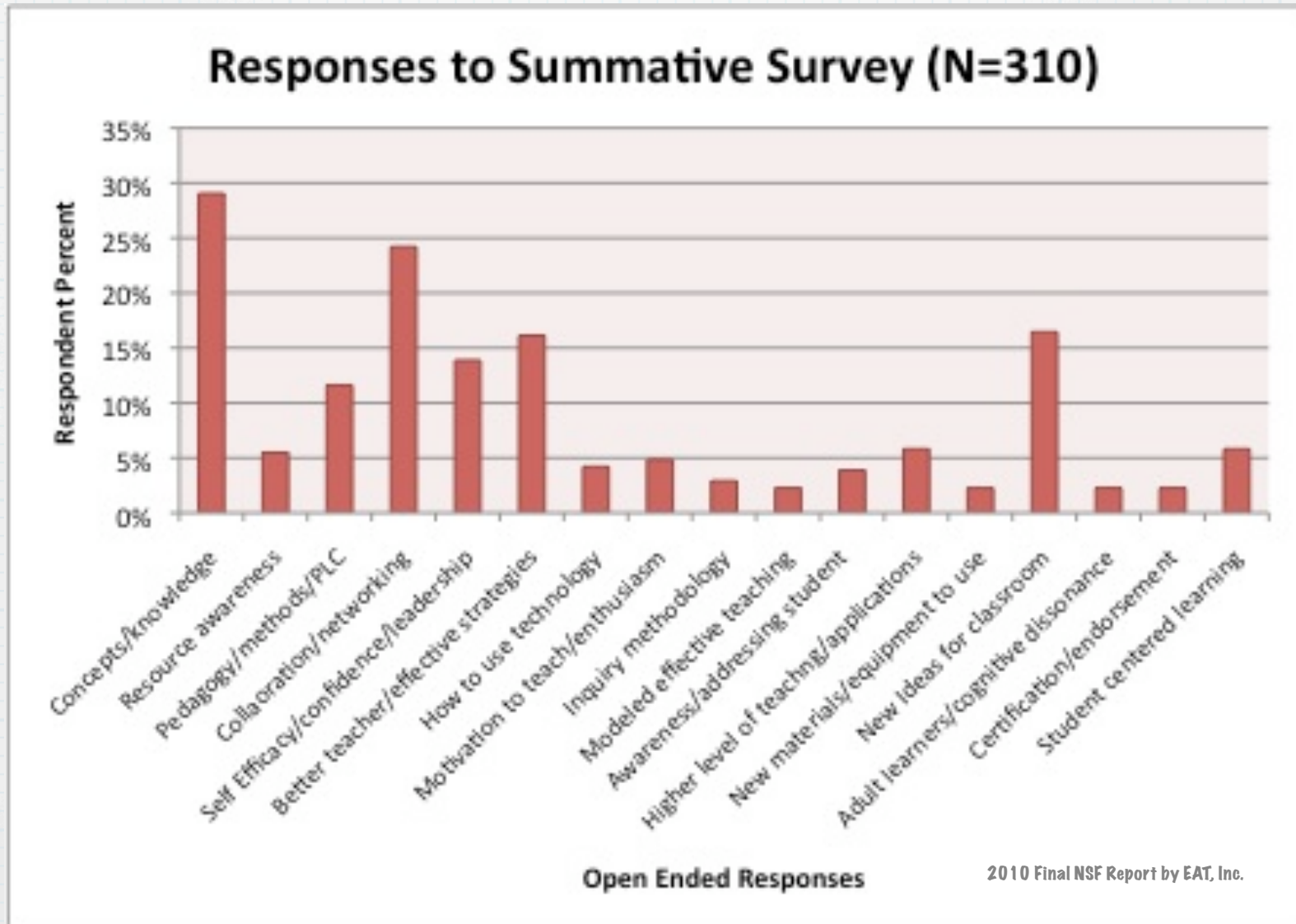
- \* **Spray and Pray (Smorgasboard Curriculum)**
  - \* **Inconsistency in hours of training**
  - \* **Inconsistency in curriculum/topics taught**
- \* **Lack of storyline; discontinuity of Professional Development**
- \* **Isolated lecture**
- \* **Demonstrations/activities without applicable content**
- \* **Free equipment without content context or training**
- \* **Training teachers in equipment they don't have**



# Broader Impact

- \* **Math Science Partnership Grants**
- \* **Certification/graduate credit**
- \* **Over 1 000 teachers with average of 1 13 students =  
1 13,000 students/year x 5 years = 565,000 students**
- \* **Development of replicable model**
- \* **Systemic reform/focus at universities and colleges**
- \* **Implementation of instructional technology**
- \* **Change in classroom practices**
- \* **Professional involvement**

# Feedback Impact



# Paradigm Shift....

Changes in Classroom Practices



# Classroom impact

- \* “Provided a model of inquiry based instruction that I now use extensively in my class”
- \* “Because of the PTR program I taught for 46 years and the students were blessed with a REAL physics teacher the last few years”
- \* “I now understand what my students experience.....”

**“If your actions inspire  
others to dream more,  
learn more, do more, and  
become more, you are a  
leader.”**

**John Quincy Adams**