Teaching Physics in Alabama

Alliance for Physics Excellence (APEX)

Physics Teaching Research Program (PTR)

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University of Alabama

Alliance for Physics Excellence

The goal of the *Alliance for Physics Excellence* (APEX) program is to integrate research-based teaching practices into Alabama physics classrooms via in-service teacher education, and evaluate the impact on physics teachers and their students in the state's school systems.

APEX
Physics Teacher Research (PTR)

APEX PTR 2013-2014
Cohorts 1 & 2 Data Collection & Analysis Team

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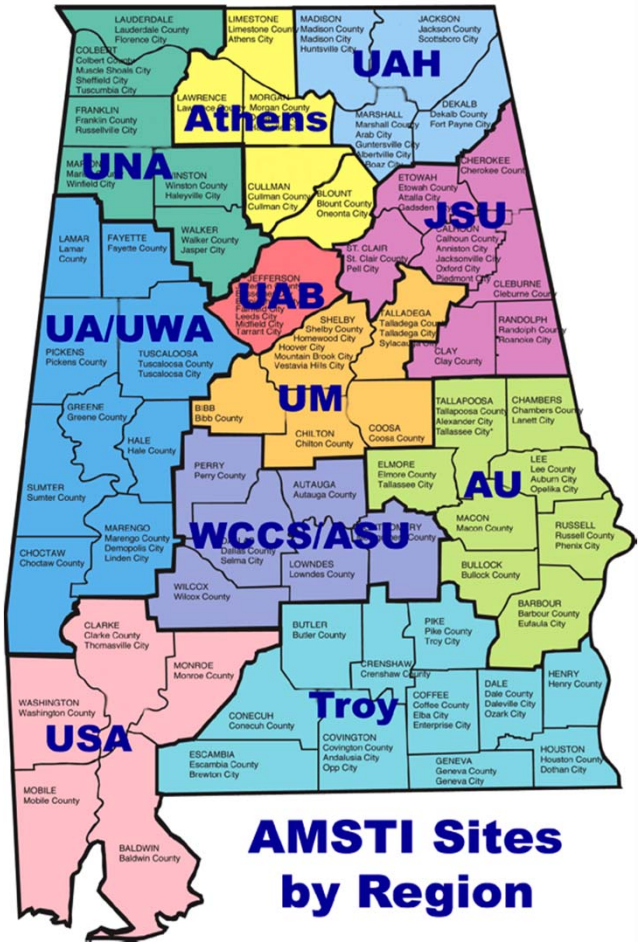
Who are Alabama Teachers of Physics?

Selected Sample

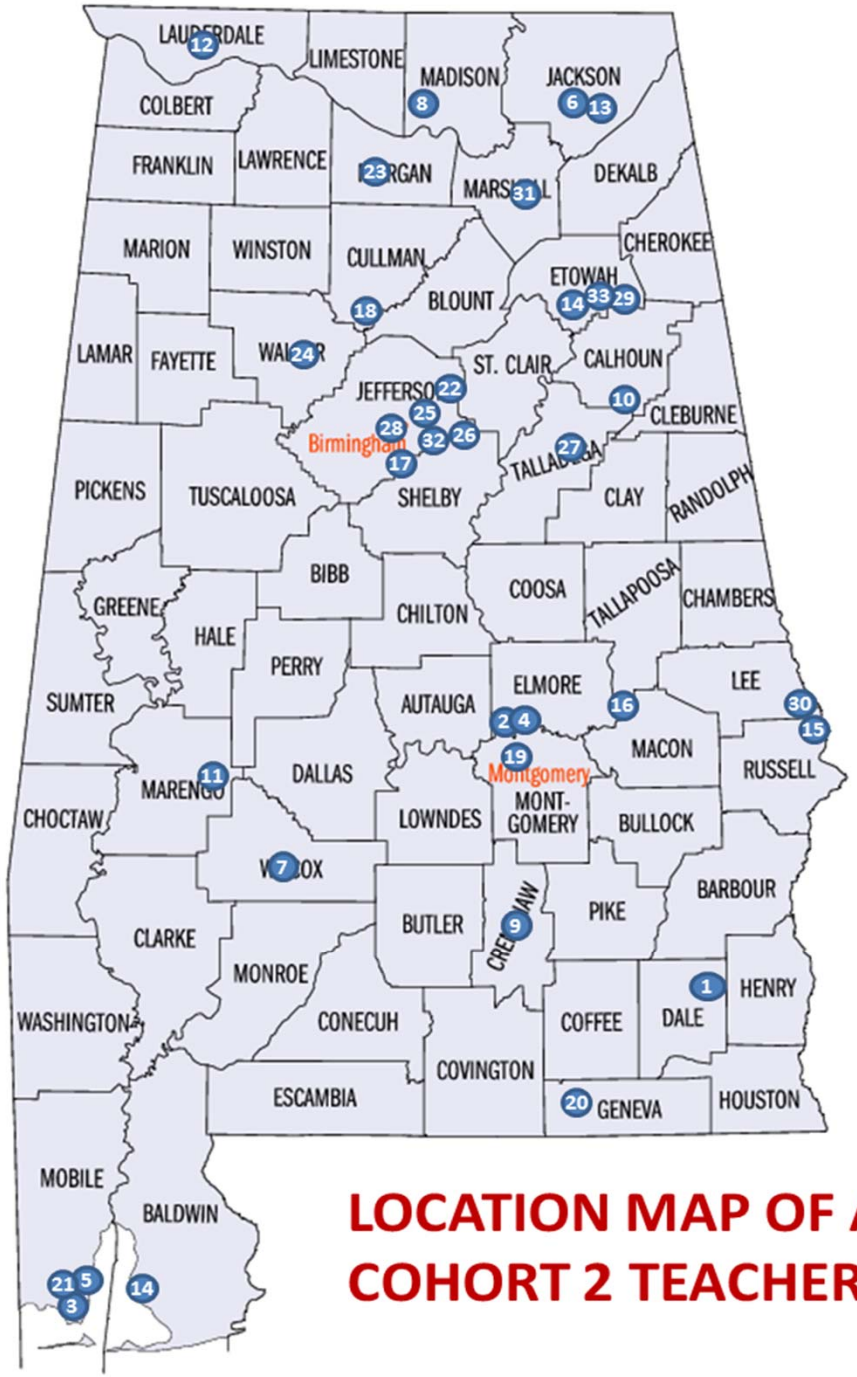
APEX Cohort 2

Selected APEX Sample – Cohort 2

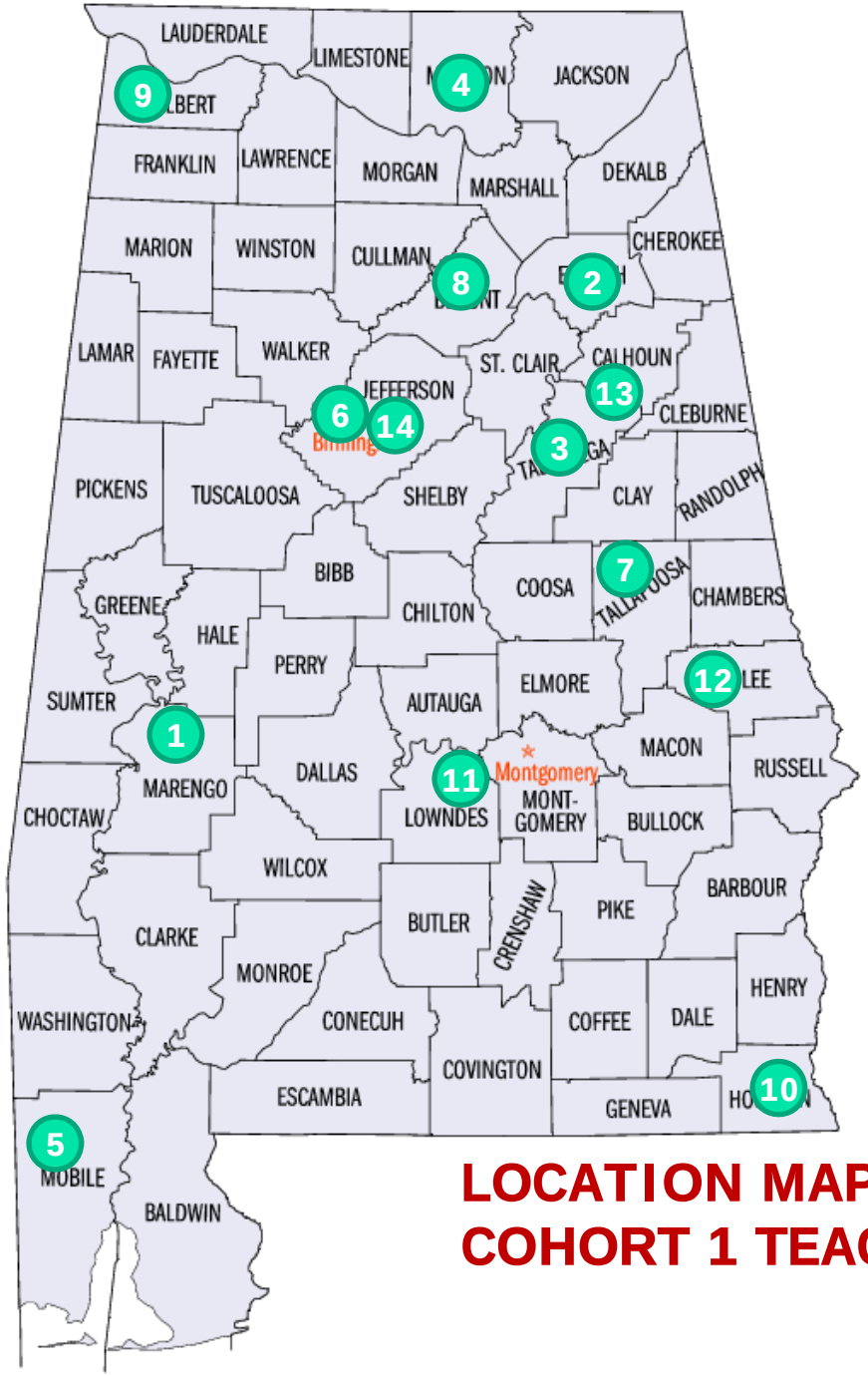
- 38 Physics teachers were selected from each of 11 Alabama Inservice /ASIM Centers



Alabama Inservice/AMSTI Center Areas



LOCATION MAP OF APEX COHORT 2 TEACHERS



LOCATION MAP OF APEX COHORT 1 TEACHERS

Background

APEX Cohorts 2 & 1 School Characteristics

- 38% (45%) under-represented minorities (AL=42%)
- 52% (56%) free lunch (SES) (AL=47%, US=39%)
- 83% (70%) graduation rate (AL=72%)
- 17% (17.6) Student/Teacher ratio (AL=14.3, US =14.2)
- Average school size = 1058 (1009) students
- Average school type = grades 9-12, most common

Background

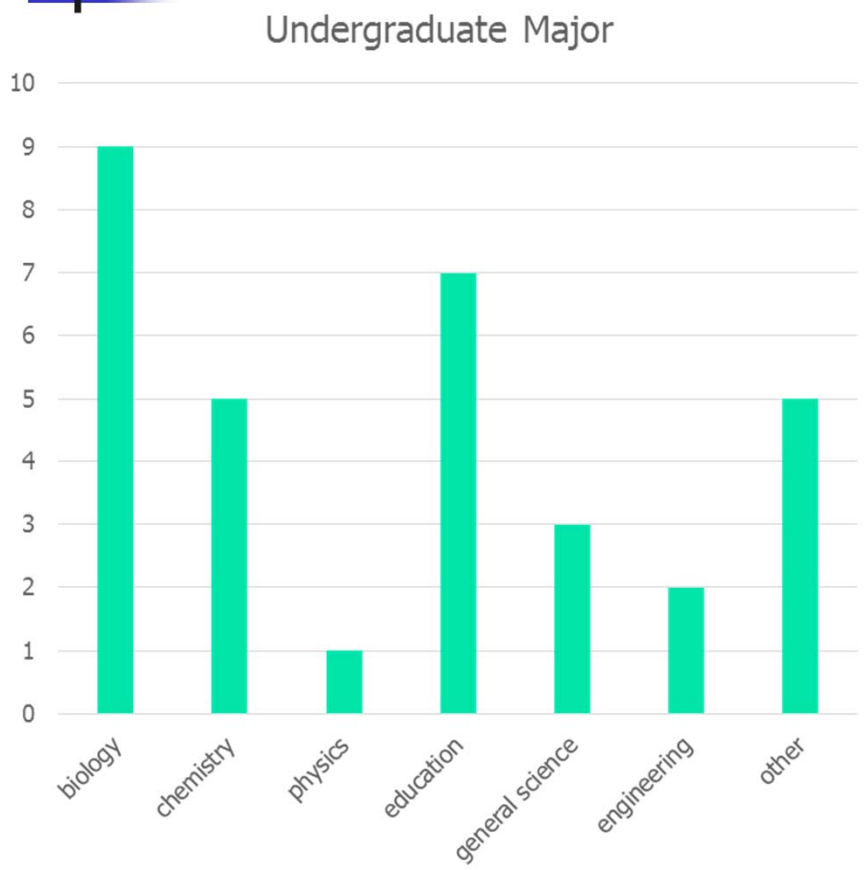
APEX Cohorts 2 (&1) Physics Teachers

- Years teaching science
  - Sample total = 332 (149) years
  - Average = 11.45 (10.6) years
  - Range = 2-34 (2-19) years
- Years teaching physics of total
  - Sample total = 182 (81) years
  - Average 6.52 (5.8) years
  - Range = 1-28 (1-15) years
- Physics teachers
  - 68 (71) % Female
  - 32 (29)% Male

Background

- **Undergraduate college major-primary**
  - 37 (57)% Biology (or biology with general science)
  - 16 (7)% Chemistry
  - 3 (14)% Physics
  - 44 (14)% Other

APEX Cohort 2 Physics Teachers



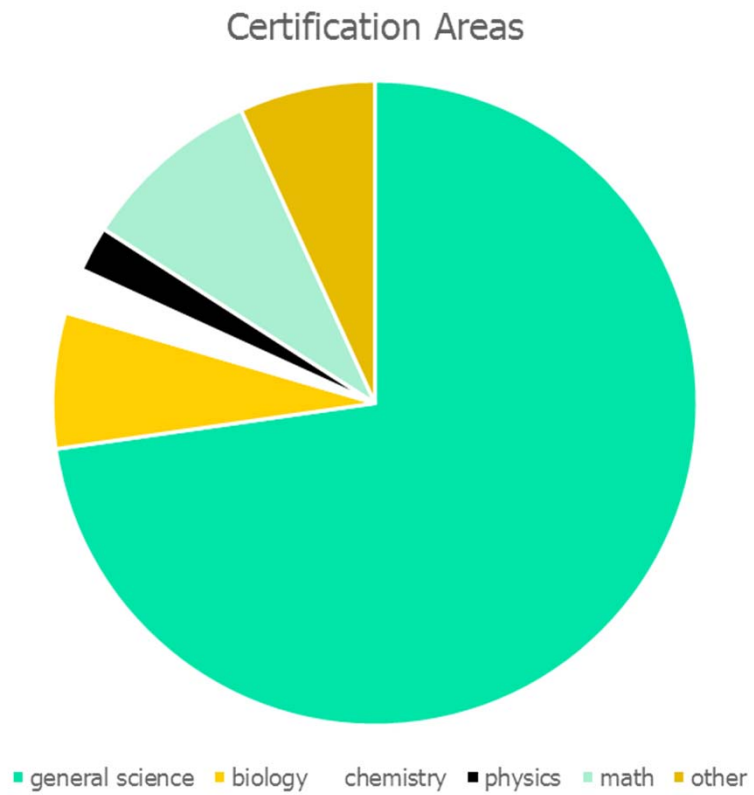
Undergraduate College Major

- Biology = 28%
- Chemistry = 16%
- Physics = 3%
- Education = 22%
- General Science = 9%
- Engineering = 6%
- Other = 16%

Background

- **Teacher certification**
  - 94 (86)% General science
  - 6 (7)% Physics & Mathematics
  - 0 (7)% Physics/General science

All areas of certification represented by percentage



Background

College / University degree

- Bachelors = 45 (90)%
- Masters = 48 (90)%
- Ph.D. = 3%
- Other = 3%

Professional development experience

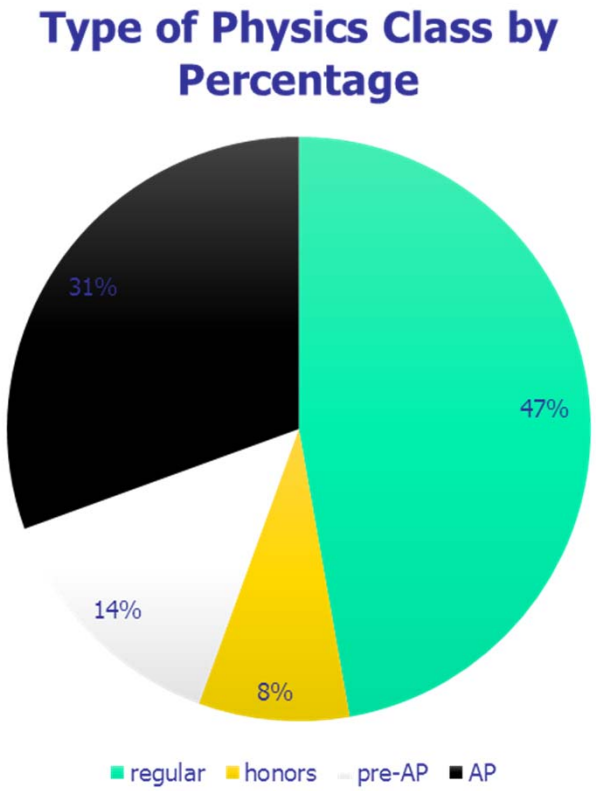
- Science = range 0-20, avg. 6.67
- Physics = range 1-10, avg. 3.05

What Happens in our Alabama Physics Classrooms?

Benchmark Indicators

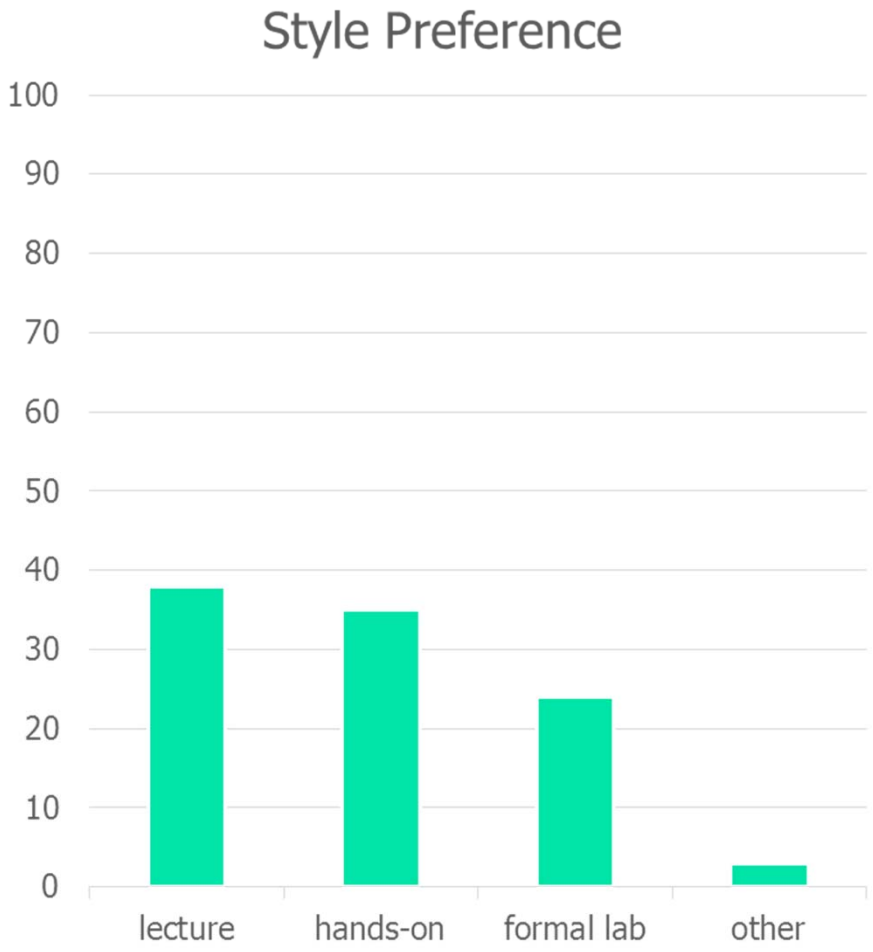
The Sample of Alabama physics classes- APEX Cohorts 2 (& 1)

- Types of physics courses represented
  - 31 (14)% AP Physics
  - 8 (29)% Honors physics
  - 14 (14)% Pre AP
  - 47 (43)% “General” Physics



Benchmark Indicators

- **Physics teacher preferences** (priority order) (from APEX application) Cohorts 2 (1)
  - 38 (31)% lecture
  - 24 (17)% formal lab
  - 35 (31)% hands-on activity
  - 3 (21)% other (individual work & problems)



- **Physics teacher preferences** (priority order)(from Appliction)
- Cohort 1
  1. Hands-on
  2. Formal labs
  3. Lecture
- Cohort 2
  1. Lecture
  2. Hands-on
  3. Formal labs

Cohorts 2 (1)

- **Number of <u>physics classes per day</u> per teacher**
  - Average = 1.82 (2)
  - Range = 1-6 (1-6) classes

Benchmark Indicators (from interviews)

- **Goal in teaching physics** (priority order)
  1. Gain basic content for college
  2. Understanding of how the world works
  3. Problem solving skills
  4. Critical thinking skills
- **Important content in physics to cover**
  - Newton's Laws
  - ALCOS physics topics

Benchmark Indicators (from interviews)

Best way to teach physics

- All referred to different descriptions of “hands-on approaches” =
  - Activities
  - Labs
  - Problem solving
- Inquiry
- Experience
- Discovery
- Hands-on

Benchmark Indicators (from cohort 1 teacher interviews)

- **Challenges to teaching physics**
  - Lack of time for planning hands-on lessons (inquiry) and grading by providing feedback in a meaningful way
  - Lack of knowledge of physics concepts
  - Lack of mathematics knowledge

What do the interview results mean to you as a member of a collaborative group of physics teachers?

Benchmark Indicators (from cohort 1 student group interviews)

APEX Cohort 1

Physics Students

- Number of students in PTR observed classes
  - Total=267
  - Class average=18
  - Range =12-28

Benchmark Indicators (from cohort 1 student group interviews)

Interest in Physics (priority order)

1. Interest in physics related to college career goals and success in college
2. Interested in physics (no reason)
3. Not interested in physics (no reason)
4. Attracted (enjoyed) to laboratory experiences in physics
5. Interested (appreciated) in real world applications

Benchmark Indicators (from cohort 1 student group interviews)

Definition of science (physics) (priority order)

- Concept of physics not changed due to course
- Physics more complex

Attitude toward science (physics) (priority order)

- Felt worse – anxiety or more challenging than expected
- Felt the same- however more curious, now easier (met the challenge); both related to hands-on, lab, & project experiences

Benchmark Indicators (from cohort 1 student group interviews)

Career plans (priority order)

- Most interested in college STEM fields
- chemistry, engineering, medicine

Source of career interest

- Early school experiences, parents
- Specific experiences – health in family, TV shows, museum visits
- Physics course – science less boring, more relevant

What do the student results mean to you as a member of a collaborative group of physics teachers?

Benchmark Indicators (from classroom site visits)

Cohorts 2 (& 1) Reformed **Lesson Observation** Protocol

- Maximum rating possible = 100
- Average rating= 47.9 (52)
- Range = 13-87 (10-87)

65 = moderate level of classroom innovation with NSES/NGSS

50 = presence of some reform characteristics

20= low level of reform, traditional teaching

MacIsaac & Falconer, 2002

What do the results mean to you as a member of a collaborative group of physics teachers?

Benchmark Indicators (from classroom site visits)

Cohort 1 **Observation Sub-score** rating.

Maximum =20

- 9.1 -Lesson Design & Implementation
- 12.3 -Propositional Knowledge
- 9.6 -Procedural Knowledge
- 8.2 -Communicative Interactions
- 12.6 -Student/Teacher Relationships

What do the results mean to you as a member of a collaborative group of physics teachers?

Benchmark Indicators (from classroom site visits)

- **Teacher reported classroom learning environment** (Context) Cohorts 2 (& 1)
  - Total rating = 56 (95) (maximum = 125)
- **Student reported classroom learning environment** (Context) Cohorts 2 (& 1)
  - Total rating = 86 (86) (maximum = 125)

No difference between gender of teacher or students

What do the results mean to you as a member of a collaborative group of physics teachers?

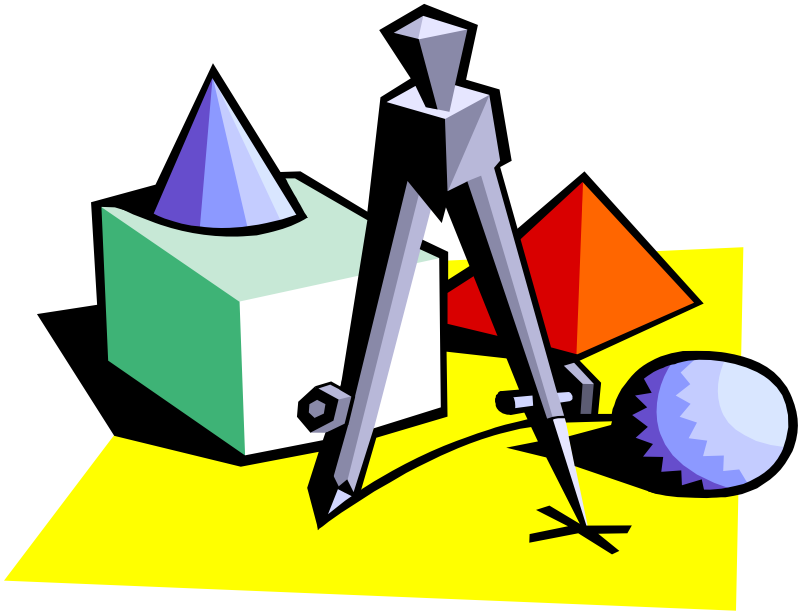
Benchmark Indicators (from classroom site visits)

Cohorts 2 (& 1) **Learning Environment Sub-score** rating.

T – S (Maximum =25) *Significant difference p<.05

- 11-18* (20-18) - Learning about the world (relevance)
- 13-17* (18-18) - Learning about science
- 12-18* (19-17) - Learning to speak out
- 12-11 (17-12) - Learning to learn
- 09-20* (22-20) - Learning to communicate

What do the results mean to you as a member of a collaborative group of physics teachers?



- **What do the benchmark measures mean to you as a member of a collaborative group of physics teachers?**

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