High School Physics Teacher Preparation: PhysTEC and National Solutions

Theodore Hodapp
Director of Education and Diversity
American Physical Society
## Need for High School Teachers

### Relative Demand by Field: Highest Demand Fields

#### Considerable Shortage (5.00 - 4.21)
- **Physics** 4.26

#### Some Shortage (4.20 - 3.41)
- Spec. Ed. – Multi-categorical 4.15
- **Mathematics** 4.13
- **Chemistry** 4.12
- Spec. Ed. 4.06
- Spec. Ed. – Mild/Moderate Disabilities 4.04
- Spec. Ed. – Learning Disability 4.03
- Spec. Ed. – Mental Retardation 4.03

---

2010 AAEE *(American Association of Employment in Education)*
Educator Supply and Demand in the United States Report

www.PhysTEC.org  
©2012, T. Hodapp, Email: hodapp@aps.org
High school classes taught by teacher with degree in the field

Source: Schools and Staffing Survey
HS Physics Teacher Education

Source: AIP Statistical Research Center

www.PhysTEC.org
High School Students Studying Physics

Source: AIP Statistical Research Center
Demographics of High School Physics Teachers

- 27,000 Physics Teachers Nationwide
- 1,400 new physics teachers each year
- ~450 of these have a physics major or minor

*Fraction* of students taking physics growing by 8% per decade

Source: AIP Statistical Research Center
PhysTEC Project Goals

• Transform physics departments to engage in preparing physics teachers
• Demonstrate successful models for increasing the number of highly-qualified physics teachers
• Spread best-practice ideas throughout the physics teacher preparation community
PhysTEC Project

National Coalition

- National conference
- Community leaders
- Topical workshops
- Sharing innovative ideas
- Broad dissemination
- 263 member institutions

Demonstration Projects

- Comprehensive (<$300k)
  - All key elements
  - Teacher in Residence
- Targeted sites (<$75k)
  - Innovative ideas, smaller sites
- National models
- Institutional support
- Now 27 supported sites
PhysTEC Key Components

• Recruitment
• Teacher-in-Residence
• Course Reform
• Learning Assistants (exposure to teaching)
• Collaboration
• Teacher Advisory Groups
• Induction / Mentoring
• Sustainability

It's not rocket science…
Key Element: Champion

- Promote/lead program from **within Physics Dept.**
- Contact with administration to build long-term support
- Faculty advocate
- Student advocate
- Obtain funding
- Bridge between Physics/Education/K-12 schools
- Knowledge of issues/literature
- Recruiting lead
PhysTEC Project Outcomes

*Number of physics certifications averaged over 319 institutions in 15 states. Note that all PhysTEC teachers are more highly qualified than the minimum standard in most states.
Seattle Pacific began funding in 2006; all other sites represented began funding in 2007. Florida International and North Carolina graduated no teachers during the pre-funding period.
Arkansas Success Story

Dramatic increase in majors enabled a large increase in physics teachers

PhysTEC funding starts

PhysTEC funding ends; program sustained locally
Undergraduate Physics and STEM majors

Source: NCES
Why Biology Doesn’t Have Our Problem

Physics Bachelor Degrees per Year (2005-09)

Source: NCES

©2012, T. Hodapp, Email: hodapp@aps.org
Project Activities

- National Conference on Physics Teacher Education:
  - **Feb 2010** Theme: *Policy/Diversity* (Washington DC)
  - **May 2011** Theme: *Building Sustainable Programs* (Austin)
  - **Feb 2012** Theme: *New Paradigms* (Ontario, Calif.)
  - **Mar 2013** Theme: *Preparing the Next Generation* (Baltimore)

- Physics Teacher Education Digital Library [www.PTEC.org](http://www.PTEC.org)
- National workshops of exemplar programs (RTOP, LAs, PCK, Increasing majors)
- Regional workshops
- Book: Scholarship of Physics Teacher Education
- Sponsoring: National taskforce on teacher education
- Collaborative Associations (ACS, APLU, NMSI)
PhysTEC Member Institutions

Supported Sites  Member Institutions

Updated April 2012
Teacher Education is a Local Issue

Teach within X miles of their institution
- 60% 50 miles
- 25% 50-200 miles
- 15% >200 miles

PhysTEC Teachers: 54 respondents
PhysTEC Book

• Collection of scholarly articles on teacher education in physics
• All articles published in peer-reviewed journals
• Review article on research in physics teacher education
• Hardcopy sent to all physics departments
Policy Directions

1) All US students should have the opportunity to take at least one year of high quality physics in high school.

2) Colleges and universities should expand and intensify their efforts to prepare physics teachers to achieve a national goal of educating 3,000 new physics teachers per year.

3) Teachers should be prepared at least at an acceptable level, and preferably at recommended or exemplary levels, described below:
The *acceptable* professional preparation needed for a beginning teacher of physics is:

a. An undergraduate major or minor in physics.

b. University-based pedagogical preparation, including physics-specific teaching experiences mentored in person by an experienced teacher, leading to initial licensure.
The **recommended** professional preparation needed for a beginning teacher of physics includes:

a. An undergraduate major or minor in physics through courses employing teaching practices informed by findings published in the physics education research literature.

b. University-based pedagogical preparation in a program leading to licensure, with preparation that includes physics-specific teaching experiences mentored in person by an experienced physics teacher and preparation in physics-specific pedagogy.

c. Continued mentoring and professional development of novice teachers in “learning communities” that link the initial preparation of teachers (at a college or university) with the long-standing practice of teachers in their classrooms. These learning communities will include both K-12 and university faculty and provide forums in which physics teachers can collectively address instructional challenges, share lesson ideas, and continue to grow and develop professionally.
The **exemplary** professional preparation of beginning teachers of physics includes the following physics-specific characteristics, as described in further detail in the recommendations of the Task Force on Teacher Education in Physics. [http://www.ptec.org/webdocs/TaskForce.cfm]:

a. An undergraduate major or minor in physics through courses employing teaching practices informed by findings published in the physics education research literature.

b. A program that leads to deep conceptual understanding of general physics and the ability to apply concepts to quantitative problems and real life applications.

c. A program that incorporates experiences, and development of facility with physics experiments, including designing, implementing and analyzing results of physics experiments.
d. Multiple physics-specific pedagogy courses and physics-specific clinical experiences mentored by individuals with deep knowledge of high school teaching context, high school physics curriculum, relevant student ideas, productive instructional approaches, and effective assessment methods.

e. Continued mentoring and professional development of novice teachers in “learning communities” that link the initial preparation of teachers (at a college or university) with the long-standing practice of teachers in their classrooms. These learning communities will include both K-12 and university faculty and provide forums in which physics teachers can collectively address instructional challenges, share lesson ideas, and continue to grow and develop professionally.