Midwest CUWiP Conference

20 January 2013

The Physics Teacher Education Coalition (PhysTEC)

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Education and Diversity
American Physical Society
My career path

• BS Engineering Physics, University of Illinois
• PhD Physics (nanomagnetics), Cornell University
• Instructor of Mathematics and Physics, Wells College
• Director of Education, Center for Nanoscale Systems
• Associate Director of Education and Diversity, APS
### Relative Demand by Field: Highest Demand Fields

#### Considerable Shortage (5.00 - 4.21)

<table>
<thead>
<tr>
<th>Field</th>
<th>Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics</td>
<td>4.26</td>
</tr>
</tbody>
</table>

#### Some Shortage (4.20 - 3.41)

<table>
<thead>
<tr>
<th>Field</th>
<th>Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spec. Ed. – Multi-categorical</td>
<td>4.15</td>
</tr>
<tr>
<td><strong>Mathematics</strong></td>
<td><strong>4.13</strong></td>
</tr>
<tr>
<td><strong>Chemistry</strong></td>
<td><strong>4.12</strong></td>
</tr>
<tr>
<td>Spec. Ed.</td>
<td>4.06</td>
</tr>
<tr>
<td>Spec. Ed. – Mild/Moderate Disabilities</td>
<td>4.04</td>
</tr>
<tr>
<td>Spec. Ed. – Learning Disability</td>
<td>4.03</td>
</tr>
<tr>
<td>Spec. Ed. – Mental Retardation</td>
<td>4.03</td>
</tr>
</tbody>
</table>

2010 AAEE *(American Association of Employment in Education)*  
Educator Supply and Demand in the United States Report
High school classes taught by teacher with degree in the field

Source: 2007-08 Schools and Staffing Survey

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Concept exam scores for first-year college students (before physics)

High School Students Studying Physics

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
• 275 member institutions

Demonstration Projects

• Comprehensive (<$300k)
  • All key elements
  • Teacher in Residence
• Targeted sites (<$75k)
  • Innovative ideas, smaller sites
• National models
• Institutional support
• 27 supported sites
PhysTEC Supported Sites

*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.

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Early Teaching Experience: Learning Assistants

LA program
• Undergraduates serve as peer instructors
• Concurrent pedagogy course
• Early teaching experience

Impact
• Teacher recruitment
• Class performance improves
• LA knowledge increases
Teachers in Residence

TIR Activities

- Interact one-on-one with prospective teachers
- Mentor pre-service and in-service physics teachers

- Implement Learning Assistant programs
- Co-teach courses for future teachers
- Build professional learning communities
- Serve as an ambassador for physics teaching
Key Components

• Key leadership components
  • Champion
  • Collaboration (physics, education, schools)
  • Institutional commitment
  • Assessment

• Key program components
  • Recruiting
  • Pedagogical content knowledge
  • Early teaching experiences
  • Mentoring and induction

• Supportive program structures
  • Teacher in Residence (TIR)
  • Learning Assistants (LA)
  • Teacher Advisory Group (TAG)
PhysTEC Member Institutions
(www.ptec.org)

Updated April 2012

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PhysTEC annual conferences
(223 institutions)
National Task Force Report

- Few departments actively engaged in teacher education
- Low support for teachers in the classroom
- A few models of thriving programs
- Recommendation for regional centers

Number of institutions
Number of graduates in 2-year period

National Task Force on Teacher Education in Physics: Report Synopsis

www.ptec.org/taskforce

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Undergraduate Physics and STEM majors

Source: NCES

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Why Biology Doesn’t Have Our Problem

![Bar chart showing the number of physics bachelor degrees per year (2005-09).](chart.png)

Source: NCES

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We advocate doubling the number of bachelor degrees in physics to address critical national needs including K-12 education, economic competitiveness, energy, security, and an informed electorate

• An essential area of increase is in the number of highly-qualified high school physics teachers

• An essential area of increase is in the fraction of both women and under-represented minorities who major in physics
Percentage of Women in Physics

Source: IPEDS, AIP SRC
Percentage of Women in Physics

Source: IPEDS, AIP SRC
APS Programs for Women

- Female-friendly graduate programs
- WIPHYS, LinkedIn groups
- APS/IBM research internship
- Childcare grants to attend meetings
- Travel grants / Speakers list
- Woman physicist of the month
- Professional Skills workshops
- Climate site visits

www.WomenInPhysics.org
Minorities in higher education

![Bar chart showing URM percentages in different education and career stages.](chart.png)

- College Age Population: ~1.5M
- All Bachelor Degrees: ~200k
- Physics Bachelor Degrees: ~450
- Physics Doctoral Degrees: ~35
- Physics Faculty: ~12

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• APS Minority Scholarship
  • Support under-represented minorities majoring in physics
  • Scholarship and mentoring

• APS Bridge Program
  • Increase under-represented minorities with PhD in physics
  • Stipend, mentoring, research, rigorous coursework, application coaching

www.MinoritiesInPhysics.org
GRE Quantitative Scores

Source: ETS, "Factors that can influence performance on the GRE General Test 2006-2007"

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Admissions Bias?

### GRE Scores for Physics Subject Test

<table>
<thead>
<tr>
<th>Before Graduate Admission</th>
<th>After Graduate Admission</th>
<th>Graduate GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>Male</td>
<td>Female</td>
</tr>
</tbody>
</table>

Source: PhD Recipients from Oregon State University