

Expanding the Science Teacher Pipeline

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Introduction to Presenters' Organizations

**National Association
of State Universities
and Land Grant
Colleges (NASULGC)**



**Physics Teacher Education
Coalition (PhysTEC)**



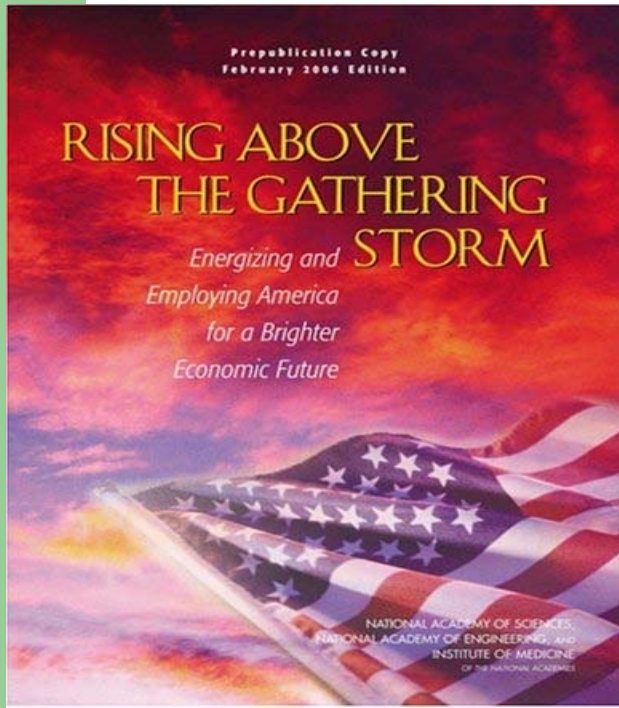
PhysTEC is a project of the American Physical Society, the American Association of Physics Teachers and the American Institute of Physics.

Topics to be covered today

1. **The national scope of the issue**
2. **Recruiting and retaining science teachers**
3. **Expanding interest in teaching for college students**
4. **Existing programs that may serve as models for other institutions**

1. National Scope of the Issue

Critical Shortage of Science and Math Teachers



Rising Above the Gathering Storm

Action A-1: Annually recruit 10,000 science and mathematics teachers by awarding 4-year scholarships and thereby educating 10 million minds

Legislative response

America COMPETES Act (2007)

Supplemental Appropriations (2008)

✓ \$40 million for Noyce scholarships

“..that's all well and good, but who is going to provide the 75 physics teachers I need next year?” --Judy Jeffrey, Director, Iowa Department of Education

“Think about this: in the past four years, our 15 schools of education at the University of North Carolina turned out a grand total of three physics teachers. Three.” --Erskine Bowles, President, University of North Carolina

In Georgia, out of 25,000 public college graduates in 2006, just three became high school physics teachers. Nine accepted jobs as chemistry teachers.... By 2010, Georgia will need more than 4,500 middle and high school math and science teachers, according to the University System of Georgia (“Teacher Recruitment Paying Off,” The Brunswick News, March 13, 2008).

Teacher Shortages by Field

Fields with Considerable Shortage (5.00 - 4.21)

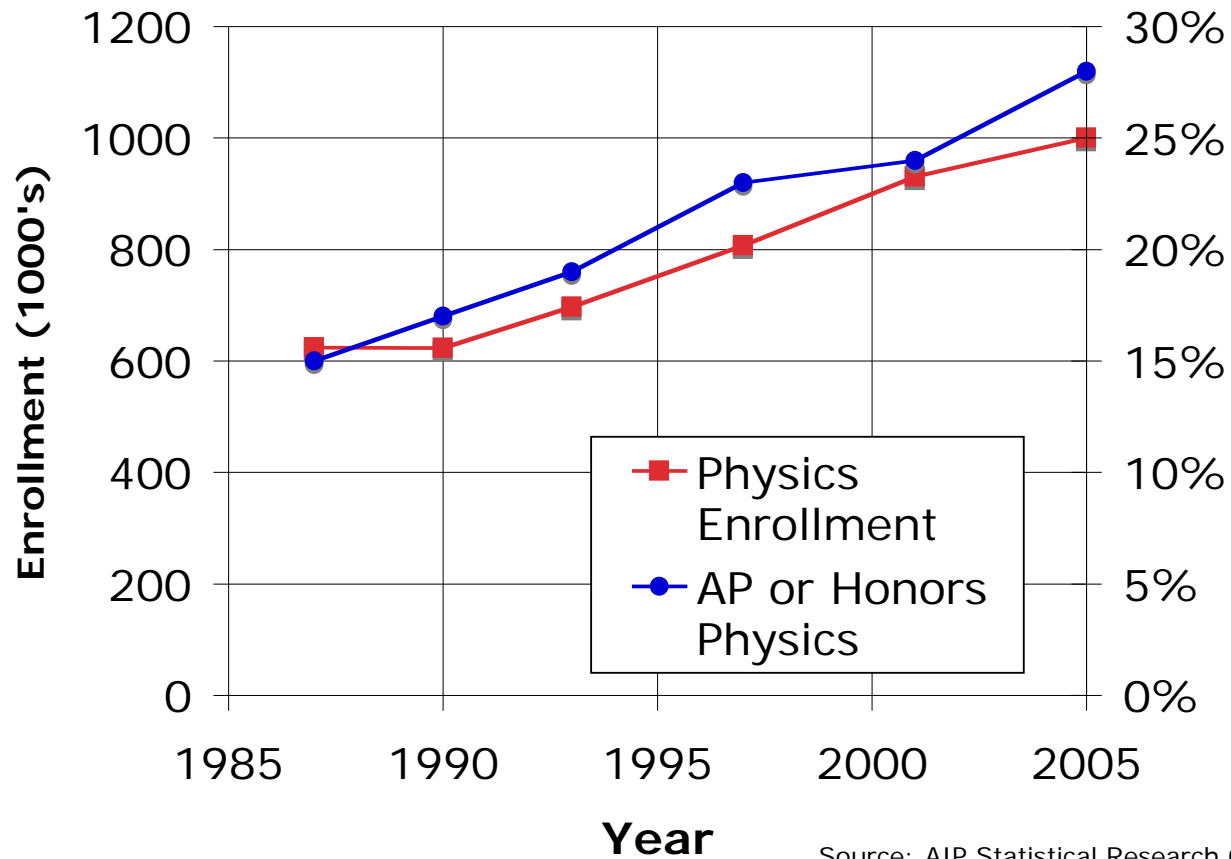
Severe/Profound Disabilities (Spec. Ed.)	4.42
Multi-categorical (Spec. Ed.)	4.36
Emotional/Behavioral Disorders (Spec. Ed.)	4.32
Mild/Moderate Disabilities	4.32
Physics	4.31
Mental Retardation (Spec. Ed.)	4.23
Learning Disability (Spec. Ed.)	4.22
Mathematics Education	4.21

Fields with Some Shortage (4.20 - 3.41)

Visually Impaired	4.20
Chemistry	4.16

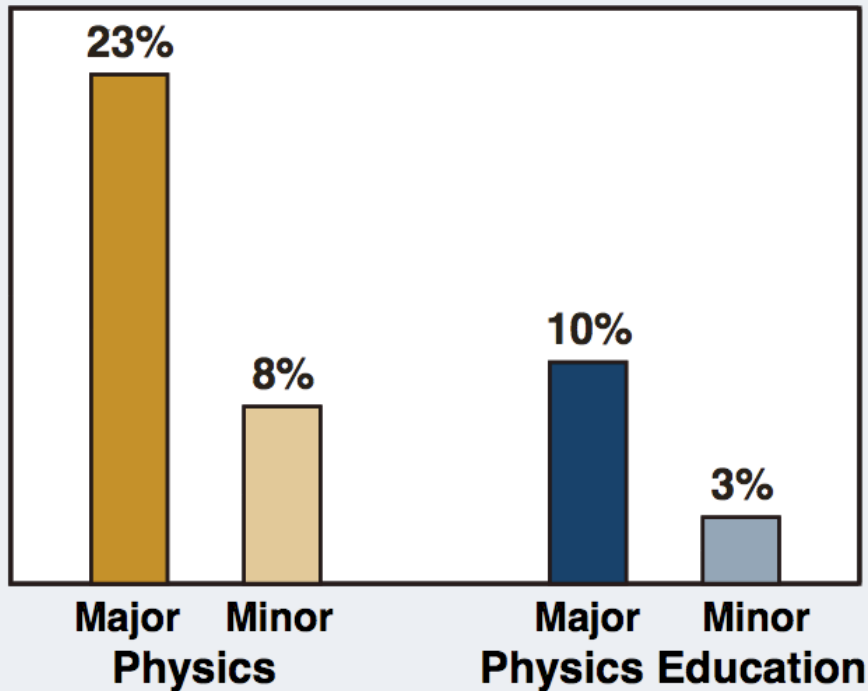
2004 AAEE (*American Association of Employment in Education*)
Educator Supply and Demand in the United States Report

Growing Need for Physics Teachers



Source: AIP Statistical Research Center

Few High School Physics Teachers Have Physics Backgrounds



- Only 1/3 of all physics teachers have a physics or physics education major
- 39% of all physics teachers took 4 or fewer semesters of physics

2. Recruitment and Retention

Relatively Low Teaching Salaries

Median annual salaries of full-time school teachers and selected other professions: 1993 and 2003 (2003 constant \$)

Full-time professionals	1993	2003	Change (%)
Teachers			
High school mathematics and science	40,000	43,000	7.5
Elementary school	38,000	41,000	7.9
Selected other professions			
Computer systems analysts	56,000	72,000	28.6
Accountants, auditors, and other financial specialists	50,000	61,000	22.0
Engineers	62,000	75,000	21.0
Protective service workers	46,000	50,000	8.7
Social workers	36,000	40,000	11.1
Retail sales occupations	34,000	40,000	17.6
Clergy and other religious workers	35,000	38,000	8.6

Source: Science and Engineering Indicators 2008

Teaching a Revolving Door?

Five Year and Return-Adjusted Attrition Rates (Illinois Teachers)

•Attrition from teaching is **less severe than is typically believed** when return rates are included.

•College graduates go into teaching **more likely to stay** than those who enter most other professions requiring comparable education.

Field	Return-Adjusted Attrition Rate from the Profession (%)	Percent Who Leave and Return (%)	5-Year Attrition Rate Without Returns (%)
Overall	27	13	40
English	32	14	46
Math	30	12	42
Science	31	12	43
Self-Contained Elementary	24	12	36
Social Science	28	10	38
Special Education	26	15	41
25 or younger	28	14	42
35 or older	23	12	35

1987-1997 New Teacher Cohorts in Illinois Public

Schools.

Source: Leaving Schools of Leaving the Profession: Setting Illinois' Record Straight on New Teacher Attrition. (2007) Karen J. DeAngelis and Jennifer B. Presley. Illinois Education Research Council, Edwardsville, IL

Most Teachers are Satisfied, but ...

- **90% of public M&S middle and high school teachers are happy about being teachers**
- **Positive school environments influence commitment**
 - Supportive and encouraging administrators
 - Safe environments
 - Collegial cooperation
 - High parental involvement
 - Sufficient learning resources
 - Students ready to learn
- **Most teachers do not leave because of salary**

Why Teachers Stay

- 81% of teachers who participated in the survey said they entered the profession because they **wanted to make a difference for children and society**. This overwhelming number indicates that teachers want above all to be effective teachers.
- Teachers willingly stay because of **strong collegial supports** and because they have an important say in the operation of the school; they also seek strong input in what and how they are allowed to teach.

K. Futernick. *A Possible Dream: Retaining California Teachers so All Students Learn*. Sacramento: California State University (2007).

Why Teachers Leave

- Many teachers leave schools because of **inadequate system supports**, e.g. too little time for planning, too few textbooks, and unreliable assistance from the district office.
- **Bureaucratic impediments** (e.g., excessive paperwork, unnecessary meetings) were cited frequently by leavers. The data also showed that teachers were not asking to be left alone but instead wanted efficient and responsive bureaucracy that supported their teaching.
- **Better compensation** matters to teachers, but unless their classroom and school environment is conducive to good teaching, better compensation is not likely to improve teacher retention.

K. Futernick. *A Possible Dream: Retaining California Teachers so All Students Learn*. Sacramento: California State University (2007).

3. Increasing the Pipeline

Turning the Tide: Strategies for Producing the Mathematics and Science Teachers Our Schools Need.

- Engaging **arts and sciences faculty** as leaders of reform
- Developing **new pathways and incentives** to enter the teaching profession
- Establishing ambitious, widely shared and measurable **goals** with support and accountability for action

Charles R. Coble, Catherine Walker, Katy Anthes, Ned Erickson and Arika Long. The Third Mile Group (2006). www2.edtrust.org/NR/rdonlyres/7DCD6A7C-980C-4EA7-BE99-80D0EA3734AF/0/TurningTheTide.pdf

Changing the Climate for K-12 Teaching in Math and Science Departments

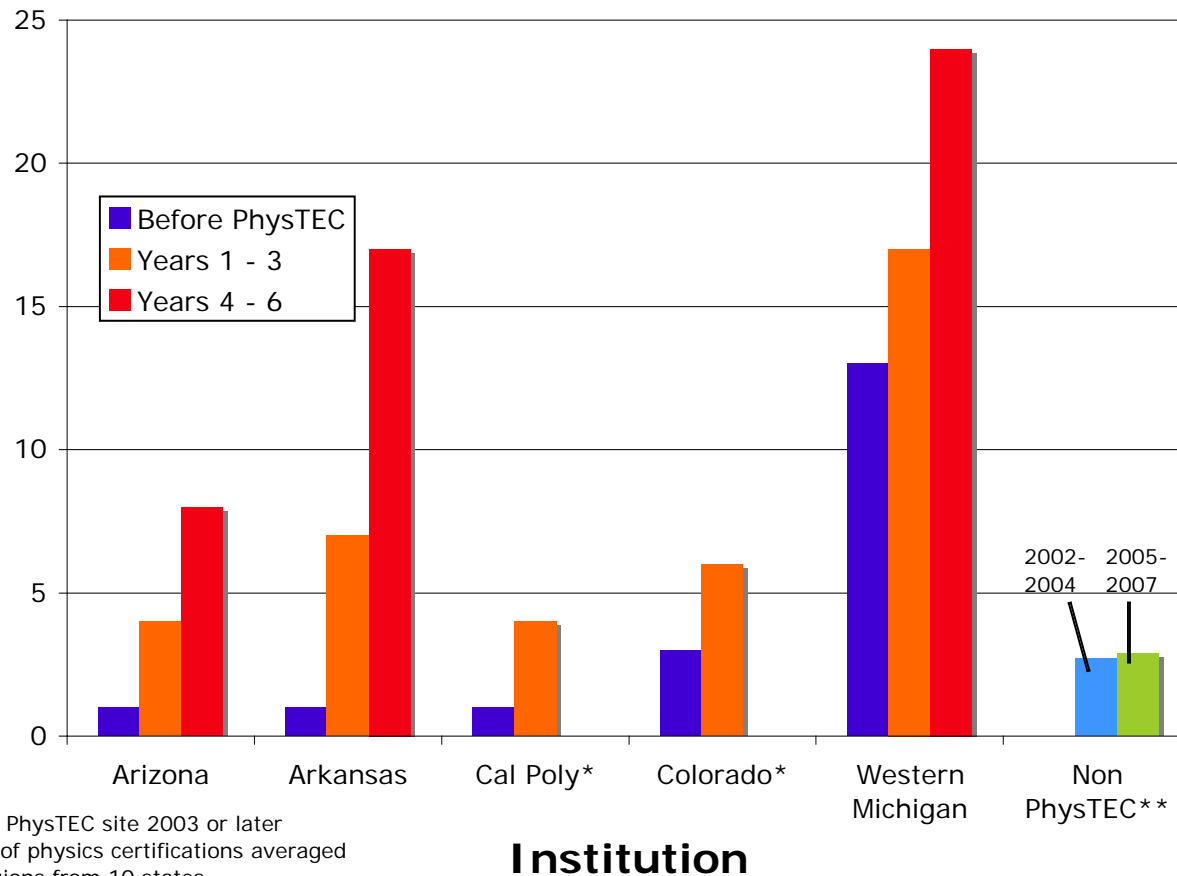
What would your professors in your major (math and science) department say if you told them you wanted to be a high school teacher?

Some of the student responses:

- Professors at our university don't value teaching
- There is a lack of respect in departments for K-12 teaching
- It is not considered a "full blown career"
- Professors would be angry
- Professors would say, "You're wasting your talent"
- Professors would say, "Don't do it"

Encouragement from faculty to consider K-12 teaching was an important factor in students' decision to pursue certification.

PhysTEC Project is Increasing the Pipeline for Physics Teachers



*Became a PhysTEC site 2003 or later
**Number of physics certifications averaged over institutions from 10 states

NASULGC's Science & Mathematics Teacher Imperative

- **107 NASULGC institutions so far have signed on to**
 - **Substantially increase the number and diversity of high quality mathematics and science teachers in middle and high schools**
 - Identify the immediate and longer term needs for science and math teachers in their states
 - Build partnerships among universities, community colleges, school systems, state government and other stakeholders to address statewide needs for teachers on a sustained basis.
- **We will monitor progress and share strategies as they are developed and documented.**
www.teacher-imperative.org

4. Some Examples of Program Innovations

UTeach – now replicated as the National Math & Science Initiative (NMSI) at 13 institutions.

- **Active recruitment** by offering the first two courses free of charge
- **A compact degree plan** that allows students to graduate in four years with a degree in math or science and a teaching certification
- A focus on acquiring **deep content knowledge** in math and science as well as teaching skills
- Courses taught by **faculty who are actively engaged** in the teaching and learning of math and science
- **Early and intensive field experiences** from the first semester
- **Personal attention and guidance** from highly experienced master teachers, faculty, and successful public school teachers

For additional information: www.nationalmathandscience.org/index.php/uteach-programs/uteach-program.html

University of Colorado-Boulder Learning Assistant (LA) Program



Valerie Otero, Education faculty member and expert in physics education research, instructs LAs enrolled in a 1 credit pedagogy course

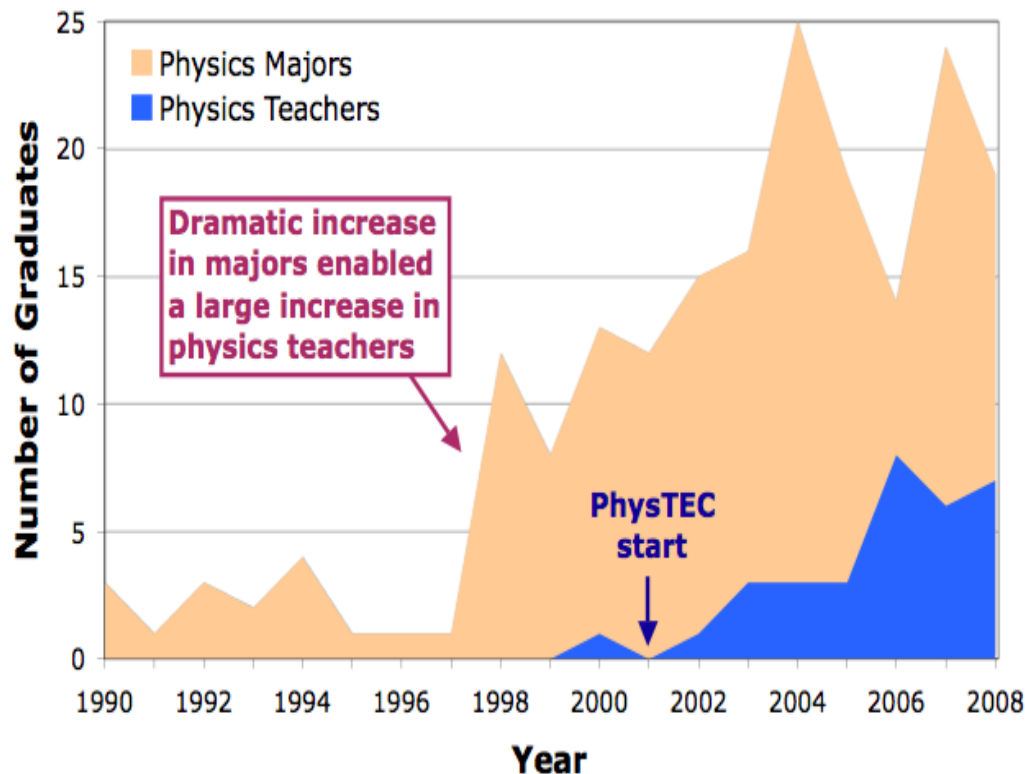
LA program

- Early teaching experience
- Concurrent pedagogy course
- 9 departments, 35+ courses

Impact

- Teacher recruitment - more than doubled number of undergraduates certified to teach math and science
- Class performance improved
- LA knowledge increased

Leadership in Physics Education at University of Arkansas



“University of Arkansas’ philosophy has been that you never know who is going to be a future teacher, so you should treat all students as if they might be, modeling good pedagogy in introductory physics classes. *This has the beautiful side effect that if all students experience an intro class taught the way we would like future teachers to teach, you end up with more MAJORS!*”

--Gay Stewart, Physics

For additional information:

www.phystec.org/institutions/arkansas/index.php

UNC Baccalaureate Education in Science and Teaching (UNC-BEST)

- Physics and biology majors earn degree plus certification in four years
- Education courses also fulfill degree requirements
- Departmental teaching methods courses
 - In-depth understanding of the big ideas of biology/physics
 - Most effective strategies for teaching these ideas
- Scholarships for UNC-BEST students
- Math, geology and chemistry will join program

For additional information: www.phystec.org/institutions/northcarolina-chapelhill/index.php

Next Steps for NASULGC's SMTI

- We will systematically collect information from all institutions on the structure of teacher preparation programs and innovative ideas.
- We will help a sub-set institutions identify and address organizational barriers to strengthening science teacher preparation.
- We will share lessons learned via www.teacher-imperative.org, webinars, etc.

PhysTEC Resources



- Physics Today article
- Conference on physics teacher education
 - Theme: *Institutional Transformation*
 - March 13-14, 2009, Pittsburgh, PA
- National coalition of 120 institutions
- Task force report coming February 2010
- Digital library

Visit www.phystec.org for more information.