

A Dozen Years and a Thousand Participants: The Workshops for Preparing New Faculty in Physics and Astronomy*

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<http://www.aapt.org/Events/newfaculty.cfm>

The Problem:

“...The research universities have too often failed, and continue to fail, their undergraduate populations....Some of their instructors are likely to be badly trained or untrained teaching assistants who are groping their way toward a teaching technique; some others may be **tenured drones** who deliver set lectures from yellowed notes, making no effort to engage the bored minds of the students in front of them.....

....Advanced research and undergraduate teaching have existed on two quite different planes, the first a source of pleasure, recognition and reward, and the latter a burden shouldered more or less reluctantly to maintain the viability of the institution.”

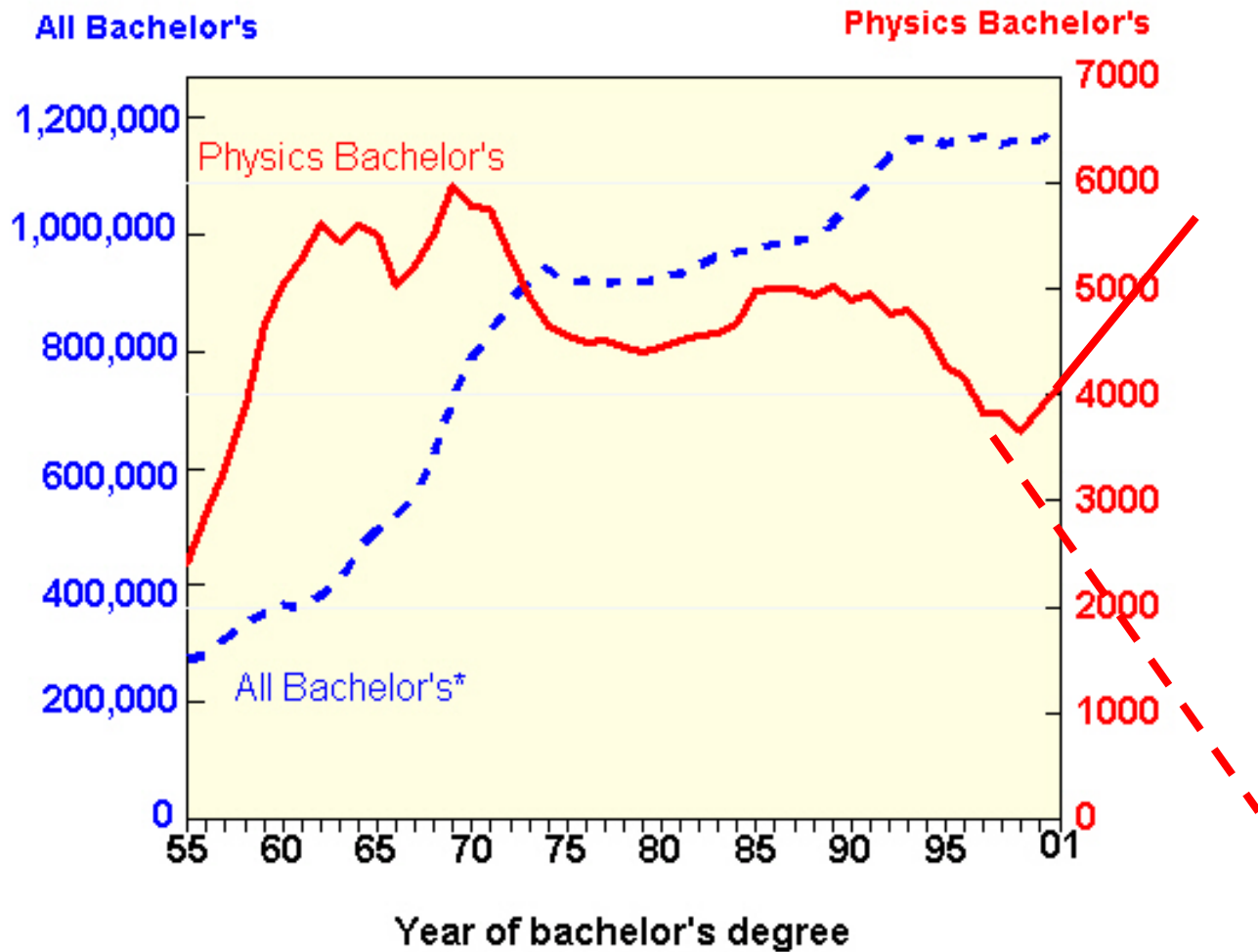
Reinventing Undergraduate Education: A Blueprint for America's Research Universities (Report of The Boyer Commission on Educating Undergraduates in the Research University, 1998. <http://naples.cc.sunysb.edu/Pres/boyer.nsf/>)

The Student's View

“Students were very clear about what was wrong with the teaching they had experienced and had many suggestions about how to improve it. They strongly believed that the source of these problems was that SME faculty do not like to teach, do not value teaching as a profession, and lack, therefore, any incentive to learn to teach effectively....”

“Students also made very specific criticisms of the pedagogical techniques of their SME professors. The most common of these were that lessons lacked preparation, logical sequencing or coherence, and that little attempt was made to check that students were following the arguments or ideas. Students interpreted poor preparation as reflecting faculty disinterest in how well their students were learning.”

E. Seymour and N. Hewitt, *Talking About Leaving: Why Undergraduates Leave the Sciences* (Westview Press, 1997)



Physics/All = 0.5% (1973-1990)
 = 0.3% (1997-2001)
 = 0.36% (2006)

Motivation for a national program

- Improvement of teaching at research universities (MS and PhD granting)
 - 33% of physics baccalaureate programs, but 55% of undergraduate physics majors
 - 70% of introductory physics enrollments in degree-granting institutions
 - 70% of tenured faculty
 - 2nd-order effect on graduate teaching assistants

Motivation:

- Change bad habits at early stage in faculty member's career
- Provide a coherent and interconnected set of paradigms for improvement of instruction
- Promote adoption of PROVEN national reforms
 - Implement with minimal time commitment and minimal risk

Motivation:

- Reconnect with physics education after research-focused PhD and postdoc work
- Exposure to national role models
 - Support course reform efforts
 - Provide materials
 - Engage in dialogue
- Formation of cohort group
 - Share problems and ideas

The New Faculty Workshop is NOT:

- An attempt to develop a new generation of researchers in physics or astronomy education
- A physics education conference (no repeat attendance!)
- A vast smorgasbord of unrelated ideas for course improvements

Format

- National workshop at American Center for Physics in College Park, MD
- 3.5 days (Thursday – Sunday)
- Plenary sessions with breakout groups
- Common set of plenary leaders for 13 years
- Housing, meals, local transport arranged

Format:

- Participants nominated by department chair
- NSF grant pays all expenses other than transportation to the Workshop site
- Follow-up activities at meetings of AAPT, APS, AAS (in part supported by NSF grant)

Background and History

- NSF Undergraduate Faculty Enhancement program
 - small, specialized projects, not broad impact
 - little coherence or global follow-up
 - no significant role of professional societies
- Successful national programs of faculty development
 - Project NExT
 - Two-year college physics program

- May 1995 - submission of proposal to NSF by AAPT for 3-year program of national workshops to enhance physics teaching at research universities
- December 1995 – funded by NSF for 50 participants/year for 3 years (plus follow-up activities)
- November 1996 – first Workshop
- November 2000 – fifth Workshop, funded under remaining funds in original grant (limited attendance)

- April 2001 – renewal proposal to NSF for 5 years, open to all 4-year colleges and universities, with APS and AAS as co-sponsors with AAPT
- November 2001 – 6th workshop, funded by AAPT
- July 2002 – NSF renewal for 5 years at 70 participants per year
- June 2007 – first reunion workshop
- June 2008 – first summer workshop
- August 2008 – NSF renewal for 5 years
- November 2008 – 14th workshop

Record of Workshop Participants

Year	MS/PhD	BA/BS	Total	%Astr	%Fem
1996	45	5	50	16.0%	22.0%
1997	48	9	57	10.5%	22.8%
1998	45	13	58	8.6%	12.1%
1999	42	31	73	13.7%	24.7%
2000	31	9	40	12.5%	22.5%
2001	30	35	65	24.6%	30.8%
2002	36	42	79	7.7%	23.1%
2003	46	45	91	19.8%	20.9%
2004	49	43	92	21.7%	17.4%
2005	46	40	86	18.6%	26.7%
2006	43	36	79	13.9%	27.8%
2007	51	31	82	19.5%	20.7%
2008 June	52	37	89	19.1%	19.1%
2008 Nov	46	49	95	16.8%	25.3%
Total	613	422	1035	16.4%	22.6%

Examples of Plenary Sessions

“Research as a Guide to Improving Student Learning” –
Lillian McDermott

“Introduction to Peer Instruction” – Eric Mazur

“How to Get Your Students to Prepare for Every Class” –
Evelyn Patterson

“How to Help Your Students Develop Expertise in
Problem Solving” – Kenneth Heller

“Active Learning with Interactive Lecture Demonstrations”
– Ron Thornton and David Sokoloff

“Making a Difference: Teaching for Retention” –
James Stith

Other Plenary Sessions

Learner-centered teaching

Using technology in instruction

Assessment and evaluation

The Physics IQ Test

Breakout Sessions

(in addition to those coupled to plenaries)

- Courses: astronomy, intro. physics, quantum mechanics, upper-level physics
- Digital libraries
- Tenure and time management
- Instructional software (physlets, etc.)
- Institutional groups (BS/MS/PhD)
- Grant writing, funding opportunities

Workshop Goals

1. Involve a significant fraction of the newly hired faculty in physics and astronomy
2. Familiarize participants with recent and successful pedagogic developments
3. Effect an improvement in physics and astronomy teaching when new pedagogies are implemented at home institutions

HOW TO ASSESS?

NFW Participants as a Fraction of New Hires in Physics

Year	Highest Physics Degree			Total
	BS/BA	MS	PhD	
1998	9.6%	8.7%	31.4%	22.0%
2000	7.8%	7.1%	15.2%	11.9%
2002	28.2%	9.4%	19.8%	22.1%
2004	35.7%	20.0%	19.6%	25.5%
2006	29.7%	19.2%	18.0%	22.2%
2008(?)	64.2%	43.3%	42.5%	52.6%

Leading Institutional Participants

BYU – 11

Cal Poly (Pomona) – 7

Colo. Sch. of Mines – 8

Geo. Wash. U. – 10

Kansas State U. – 9

Kent State U. – 8

Mich. State U. – 13

Okla. State U. – 8

Syracuse U. – 14

U. of Arkansas – 8

U. of Cal. Berkeley – 8

U. of Cal Davis – 14

U. of Delaware – 9

U. of Maryland – 19

U. of Md. Balt. Cty. – 9

U. of Nebraska – 9

U. of N. Carolina – 7

U. of Oklahoma – 7

U. of Tennessee – 9

Virginia Tech – 10

West Point – 10

Worcester Polytech – 7

Results of Survey of Participants

C. Henderson, American Journal of Physics **76**, 179 (2008)

- 93.7% of current participants desire to incorporate new ideas from NFW into their teaching
- 70% of former participants rate their teaching as more innovative than colleagues
- 73% of department chairs believe students in classes taught by NFW participants are better learners
- 60-80% of participants from first 10 years of NFW indicate that NFW: improved their teaching skills, had a positive impact on students, motivated them to work to improve teaching
- 96% report changes in teaching methods since attending NFW, and 40-60% of those indicate most or all of the changes are a direct result of NFW participation

An Evaluation from a Research I Participant (now tenured):

“Following the workshop I tried using several of the new ... tools that were presented... The results of these innovations have been so positive that other faculty who have subsequently taught the same courses have kept many of the same tools in place. **In this sense, the New Faculty Workshop has benefited not only my own classroom performance but my entire department.**

The Workshop also helped me formulate goals for the educational activities associated with my NSF CAREER award. For young faculty thinking about writing a CAREER proposal, the Workshop is an incredibly valuable opportunity to find out what's going on in physics education.”

A Participant from a Highly Selective 4-year Liberal Arts College:

“I consider this workshop to have been an invaluable contribution to my development as an effective physics educator. The workshop introduced me to a variety of cutting edge techniques in physics pedagogy, enabled me to develop a nationwide network of connections among new faculty members in physics, and introduced me to the community of physics education researchers.

I have adopted several of the teaching techniques discussed at the workshop in my own teaching....I am delighted with the changes in classroom dynamics resulting from better-prepared students and my own new insights into the particular difficulties with which my students are struggling...”

A Department Chair from a Research I University (> ¼ of faculty attended)

“As a department chair, I believe that these workshops are more effective than I could ever be at convincing new professors that both the teaching and research they do will be recognized by their profession... I believe the workshops have helped change the culture at XXXX University to place greater value on excellent physics teaching. Our younger faculty have come to believe this with an enthusiasm with which they are gradually infecting the entire faculty of my Department.

I offer, as an indication of the progress which a dedicated cadre of faculty can achieve, the statistic that the number of physics majors graduated at XXXX last spring was the largest in at least two decades. The improvement is not a statistical fluctuation, and represents a thorough reversal of the depressing decline in the number of majors at XXXX through the 80's and 90's."

Why is the NFW Program Successful?

1. Physics education research offers well-established set of “best practices” in teaching; national uniformity of introductory physics course guarantees commonality of challenges and remedies across institutional types
2. Small size of physics community means small (and thus highly interactive) workshop can impact a significant fraction of the professoriate
3. Strong support of professional societies with emphases ranging from mostly teaching (AAPT) to mostly research (APS and AAS)

Upcoming Workshops

June 25-28, 2009

November 12-15, 2009



<http://www.aapt.org/Events/newfaculty.cfm>