

The Workshop for 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.”

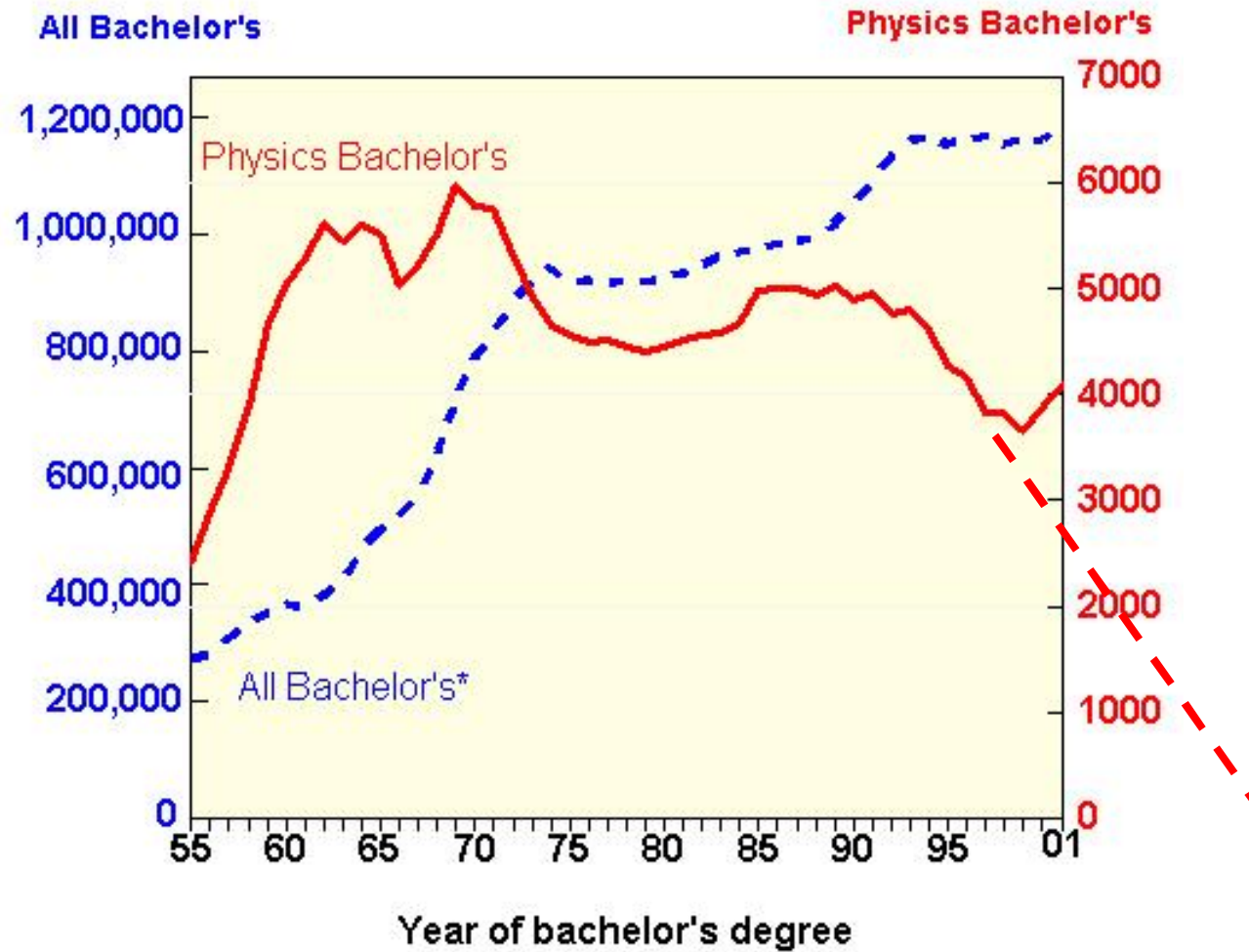
Reinventing Undergraduate Education: A Blueprint for America's Research Universities (Report of The Boyer Commission on Educating Undergraduates in the Research University, 1998. <http://naples.cc.sunysb.edu/Pres/boyer.nsf/>)

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)



$$\begin{aligned} \text{Physics/All} &= 0.5\% \text{ (1973-1990)} \\ &= 0.3\% \text{ (1997-2001)} \end{aligned}$$

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
- 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 Inst.	BA/BS Inst.	Total
1996	45	5	50
1997	48	9	57
1998	45	13	58
1999	42	31	73
2000	31	9	40
2001	30	35	65
2002	36	42	79
2003	46	45	91
2004	49	43	92
2005	46	40	86
2006	43	36	79
2007	51	31	82
2008	52	37	89
Total	567	373	940

Examples of Plenary Sessions

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

“Introduction to Peer Instruction” – Eric Mazur

“Using Technology in Physics Instruction” – Robert Beichner

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

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

“How to Increase the Number of Physics Majors at Your Institution” – Robert Hilborn

“Practical Advice from the Trenches” – Diandra Leslie-Pelecky

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

“The Physics IQ Test” – Richard Berg

Other Plenary Sessions

Learner-centered teaching

Interactive methods, lecture demonstrations

Assessment and evaluation

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)

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%

Leading Institutional Participants

BYU – 9

Colo. Sch. of Mines – 8

Geo. Wash. U. – 10

Kansas State U. – 8

Kent State U. – 8

Mich. State U. – 12

Okla. State U. – 8

Syracuse U. – 14

U. of Arkansas – 7

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 – 8

Virginia Tech – 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

“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."

--Department chair, Research I University
(more than 1/4 of total faculty have attended)

Why Physics: Is The NFW Program Exportable?

1. Physics education research offers well-established set of recommended “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)

10 Commandments for Changing the Culture to Improve Teaching

1. THOU SHALT require candidates interviewing for faculty positions to give, in addition to their research talks, a lecture to students on a suitable topic from the undergraduate curriculum.
2. THOU SHALT NOT award tenure nor promotion to faculty who are successful researchers but abominations in the classroom.
3. THOU SHALT establish an effective system of peer evaluation of teaching, including regular classroom visits and review of portfolios.
4. THOU SHALT NOT neglect the preparation of graduate and undergraduate students for careers in teaching.

10 Commandments for Changing the Culture to Improve Teaching

5. THOU SHALT distribute departmental and institutional perks roughly equally on the basis of creative research and innovative teaching.
6. THOU SHALT have regular participation by specialists in physics education in the department's weekly program of visiting speakers, and THOU SHALT likewise offer a weekly seminar in teaching on a par with the weekly research seminars.
7. THOU SHALT encourage and recognize faculty who participate in professional societies that focus on teaching.

10 Commandments for Changing the Culture to Improve Teaching

8. THOU SHALT honor thy curriculum and keep it holy, but THOU SHALT also engage in continual curriculum evaluation and development.
9. THOU SHALT involve students in meaningful evaluations of the effectiveness of the curriculum and the faculty.
10. Recognizing that good teachers are seldom born to excellence, THOU SHALT mentor new faculty to be effective instructors while demonstrating by example and by policy that the department values and rewards such achievement.