

Teaching & Research-NSF

Themes

Research and Education: NSF's Impact
Research "vs" Education...or, better yet, "learning"

Popular Quotes

"Higher education is underaccountability and underproductive, in a sickening tailspin and a national disgrace."
"The universities have mortgaged the nation's scientific future and its economic competitiveness...by ignoring undergraduates."
"The professors--working steadily and systematically--have destroyed the university as a center of learning and have desolated higher education, which no longer is higher or much of an education."
"Undergraduate education has been accused of "winding down toward mediocrity with a curriculum described as 'chaotic', a "disaster area", or "rotten to the core".
Critics condemn the bulk of scholarly writing either as the sterile product of requirements imposed by philistine administrators or as a form of private pleasure that selfish professors enjoy at the expense of their students.

Outside the Academy

Observers condemn:

- Formless nature of UG curriculum
- Lack of personal attention from senior professors
- Huge classes broken into sections taught by inexperienced graduate students
- Low or nonexistent faculty teaching loads (6 hours per week!!!)
- Flight from classrooms to research
- High priced consulting, businesses, etc.
- Costs of education
- Gross materialism on part of universities (fund-raising, lobbying, etc.)

Particular Concern: Teaching vs. Research

Next to college curriculum, no aspect of university education has provoked more complaints than the faculty's preoccupation with research at the expense of teaching.

It is widely believed that institutions slight their students when they emphasize research in making appointments and refuse to promote unproductive professors even though they are highly successful classroom teachers.

Critics condemn the bulk of scholarly activity either as a sterile product of requirements imposed by philistine administrators or as a form of private pleasure that selfish professors enjoy at the expense of their students.

Clear that public doesn't understand the term "research" university...
...Indeed, "research" is perjorative...

Washington Post

The tension between research and teaching in universities goes back almost as far as the American research university itself. But that tension has been higher than usual lately, what with cost-cutting pressures on campuses and increasingly sharp scrutiny by outsiders on the quality of undergraduate learning.

Despite frequent affirmations of the importance of teaching, most of the prestigious research universities still emphasize research and publication--not teaching ability--for tenure,

for promotion and in the general ethos that shapes reputations.

Despite widespread lip service to the notion that teaching ability is just as important as research, and that it ought to be commensurately rewarded, the opposite emphasis persists to a dramatic extent in graduate schools and academic departments.

It begins with the way graduate students are recruited, trained, and funded--with, for instance, the most attractive fellowships offered so students can afford to finish their dissertations without the distraction of teaching to earn money.

"The faculty in research institutions admit that teaching is of less important to them than research...that their interests are in research. I am not attempting to make a value judgment but wish to convey that there must be a balance if our institutions are held accountable to the public." (Governor James Thompson, Illinois)

"The public has a right to know that it is getting...the right to know and understand the quality of undergraduate education. They have a right to know that their resources are being wisely invested and committed."

(National Governors Association)

"Let me be blunt: universities are not fulfilling their obligations. Universities have to return to giving more than lip service to the importance of teaching. Ezra Cornell declared that he was founding "an institution where any person could find instruction in any study." His stated intention was not to found an institution where any researcher could find grants from any funding source. We at the federal level have to figure out some way to structure research grants so that they do not become disincentives to teach."

(Rep Sherwood Boehlert, NY)

Within the Academy

General

The university research enterprise places too much emphasis on research at the expense of teaching.

Grant-funded research has seriously distorted the faculty culture in such a way as to erode the quality of undergraduate education.

Major changes in the "corporate culture" of universities are necessary to rebalance the relative priorities of teaching and research.

Sigma Xi

"Undergraduate education is trapped in an infrastructure that rewards research and denies those same rewards to those fulfilling the mission of undergraduate programs. The practices of the research community, college and university administrators, state and federal governments and agencies, and private foundations have created and reinforced the value system that produced and sustains this dichotomy."

There has been a serious erosion in science education over past 20 years. Science majors have developed an alarming tendency to alienate students, resulting in the decline of over 50% of freshman interest and 60% of science majors.

Urges "an open and forthright discussion and evaluation of the reward factors that make the reward system for excellence in undergraduate teaching non-competitive."

"The language of the academy is revealing: professors

...speak of teaching loads and research opportunities,
never the reverse.”

“The sign of real success is not having to teach at all. Teaching is looked at not as the advancement of knowledge, but the interruption of research.”

“The exclusive concern with research in the training of PhD students--to the neglect of any concern with teaching or with any professional responsibility other than to scholarship--has encouraged college faculties to abandon the sense of corporate responsibility.”

Competition among universities is creating situations in which teaching load has now become a negotiable item in luring star faculty.

At some doctoral institutions leading researchers have no obligation to teach...or they teach only graduate seminars. Even in non-doctoral institutions, there is encouragement for faculty to compete for grants to “buy release time” from teaching.

Students contend that professors are so busy pursuing their research interests that they neglect undergraduate life. Most frequently mentioned as missing are little things like keeping regular office hours to see students, volunteering to be academic advisors, and just having a cup of coffee with students.

NSF:

“There is an unfortunate (pernicious) tendency both inside and outside of NSF to regard activity in research as more valuable than activity in education.”

“A number of strong factors have had major impacts on UG education at Cornell and similar institutions during the past 20 years. A push toward excellence in research and the phase-out of several NSF programs for support of undergraduate in science and engineering.”

(Joe Ballantyne, VP Research, Cornell)

Dangers

A paradox: How can our system of higher education be regarded so highly abroad and still encounter such biting criticism at home.

While American research university is clearly the envy of the rest of the world, its unique character and role are clearly neither understood nor appreciated by the American public at large--or by most of their elected public leaders.

In all advanced societies, our future depends to an ever increasing extent on new discoveries, expert knowledge, and highly trained people. Like it or not, universities are our principal source of all three ingredients.

There is a growing sense that the competitive demands of specialized scholarship and other developments have placed an irreparable rift between graduate and undergraduate education and may have impaired the capacity of research universities both to remain centers of modern scholarship and to fulfill their broader educational functions.

Myths and Realities

Some Quantitative Data

Peter House, Division of Policy Research and Analysis (STIA) Study

Sample: Over 50,000 students majoring in S&E whose 1987 GRE score (quantitative and verbal) could be matched by ETS with SAT score

Variables: GRE, SAT, gender, race, UG major, UG school

Value Added: Average addition to a student's total GRE score associated with going to a particular school, irrespective of SAT, gender, minority, or UG major.

Taxonomy of Academic Institutions:

Doctoral 1: 20 largest R&D Performers

Doctoral 2: next 40 R&D performers

Doctoral 3: 125 remaining doctoral institutions

Education 1: 24 highly rated liberal arts colleges

Education 2: 80 largest feeders into NS&E PhD pipeline

Education 3: 1112 remaining 4-year colleges

Raw Results of Value Added

Doc 1: 43

Doc 2: 37

Doc 3: 19

Edu 1: 37

Edu 2: 12

Edu 3: 0

Results:

1. The most prominent research institutions have the highest average scholarly quality rating.
2. Doc 1 had the highest value-added, followed by Doc 2 (Note that even Doc 2 were higher than Edu 1)
3. Average education index is positively related to average number of S&E bachelors degrees awarded, except for institutions granting more than 3,000 degrees annually (note that UM awards about 2,500, so it peaks for UM and UCB)
4. Average education index is positively related to R&D intensity as measured by R&D spending per undergraduate
5. Average education index is positively related to scholarly quality of faculty

Other points:

1. Doctoral institutions are only 13% of all institutions, but account for:
 - ...45% of total enrollment
 - ...nearly 50% of total degrees
 - ...over 90% of academic R&D
2. There does not appear to be much different in undergraduate enrollment-to-bachelors degree conversion ratios among most institutional types (although a very modest advantage to Edu 1 institutions...but very modest)...
E.g:
 - Cornell: 90%
 - UM: 80%
 - Reed: 80%
 - T A&M: 80%
3. Within each institution type, per student spending declines from type 1 through type 3 (although Edu 1 is slightly higher than Doc 1).

What are real issues?

General Relationship between Teaching and Research

Of course there is a great deal of misguided rhetoric on the tensions between research and teaching. Countless distinguished reserachers are devoted to teaching and do a marvelous job.

Biggest issue relates to the meaning of changes for the relationship between scholarly commitments and undergraduate educaiton...and to our obligations to research and our responsibility for graduate education.

Faculty Priorities

Increasing concern about the distortion of the culture by sponsored research policies.

We hear time and time again that there is a strong and possibly accelerating change in the culture of the professoriate that has led to an increasing withdrawal from undergraduate and often also formal graduate teaching by beginning as well as fully established researchers.

One increasingly hears from faculty that they would rather work with postdoctoral students than with graduate research assistants because it allows them to accomplish their immediate scholarly objectives.

Cultural factors in the academic community now place a low premium on teaching, and the philosophy of teaching as a "weeding out" process were obstacles that must be addressed.

Nature of Undergraduate Education

Moreover, the increased disciplinary specialization of the faculty also has an important impact on the structure of our educational programs.

The predicament is that they are transmitting what they know--and love--with little awareness of what the student needs to learn.

The real problem is that teaching and research are TOO CLOSELY RELATED. At the root of our unmet challenge in undergraduate education is the failure to distinguish between the transmission of knowledge and the development of a capacity for inquiry, discovery, and continued learning.

The difficulty is that the specialized focus of our scholarship may have given us a misguided notion of what teaching is supposed to be. We need to focus our pedagogical efforts on the spirit and capacity for learning, and on the excitement of inquiry and discovery, rather than on the transmission of knowledge.

We need new approaches to undergraduate education that are less focused on the transmission of knowledge and more sensitive to the need to infuse students with both the excitement of discovery and a capacity for analysis and continued learning.

Quality of Undergraduate Education

There has been a serious erosion in science education over past 20 years. Science majors have developed an alarming tendency to alienate students, resulting in the decline of over 50% of freshman interest and 60% of science majors.

Many freshmen view entry-level courses in science, mathematics, and engineering as inaccessible--or if accessible, unrewarding to them.

The common practice of using entry-level courses as barriers to protect more advanced from all except the most able and the most committed still persists, and at worst, students view these classroom environments as destructive and hostile.

Cost

The "research driven" nature of education requires us to invest a lot more capital for each student, scholar, degree if we are to continue to operate at the scholarly frontier (e.g., 5% increase per year during 1980s)

Public Understanding

Perhaps we need a better term...

Not "research universities" ...
...but "learning universities" ...

What is NSF role and responsibility?

Problems:

NSF pressures which distort university cultures

The question of NSF's effect in helping (or hindering) the ability of faculty and institutions to develop human resources and teaching was discussed.

"There is an unfortunate (pernicious) tendency both inside and outside of NSF to regard activity in research as more valuable than activity in education."

Has NSF investment in "glitter", in itself, driven students away?

Imbalance in NSF programs:

"A number of strong factors have had major impacts on UG education at Cornell and similar institutions during the past 20 years. A push toward excellence in research and the phase-out of several NSF programs for support of undergraduate in science and engineering."

(Joe Ballantyne, VP Research, Cornell)

Distortion of university funding priorities

"Another major concern is the increasing tendency at NSF and other federal agencies to require cost-sharing or matching on grants. This, in effect, prys funds away from other priorities such as teaching."

General Observations

Could it be that the imbalance between the research and educational role within the NSF...and other federal agencies...have led to the imbalance in our academic institutions?

What do people suggest we do?

Changes in the nature of the research university

This may require that faculty separate their teaching functions from their research responsibilities.

Will we have to choose between a key role in the nation's research enterprise and our traditional educational functions?

Who will set the research agenda and what impact will this have on the university's role in society?

Changes in the "corporate culture"

Bok Suggestions

Emphasize teaching in appointments

Create a climate that favors teaching...

Intervene when poor teaching is spotted

Require all junior faculty to have training in teaching skills

Require all graduate students to have evidence of teaching included in dossiers

Ask faculty to develop norms on faculty teaching behavior--office hours, homework, etc.

AAU should agree that recruiting faculty by promising reduced teaching loads is bad practice

Should make more effort in controlling excessive absence from campus

Foster a more systematic effort to evaluate teaching and how to improve it.

NSF Responses

Actions taken thus far:

Requirements in proposals:

A statement specifying the potential of the proposed research to contribution to education at the postdoctoral, graduate, and especially

undergraduate levels.

A list of graduate students and postdoctoral scholars with whom the PI has had an association over the past five years, and

A limit of 10 publications, etc listed in PIs cv.

In charting policy for undergraduate education in science, mathematics, and engineering, bringing about changes in attitudes and perceptions must be a part of any effective policy.

What should be NSF role in addressing balance of teaching and research?

What is the impact of the NSF programs directed at UG education (curriculum and laboratory development, UG research participation, faculty development)

“Sponsored research culture”?...what should be changed

Should we develop programs aimed at modifying somewhat the present university culture which is heavily biased toward research?

How might one design programs which take advantage of the extraordinary nature of the environment provided by research education in a way that the UG experience would be benefited.

How do we take advantage of the extraordinary nature of the research university to benefit UG experience?

Is NSF asking the right questions, gathering the right data, understanding what is really going on?

“The most important think the NSF can do for science education is to increase the prestige and respectability of teaching.”

“The worth of a faculty member is often judged by his or her success in the competitive process of seeking research grants. A national competitive process for seeking funds for innovative teaching and curriculum improvements would also give young faculty visibility and “credit” in the tenure process. Without this there is less incentive for faculty to participate in innovative teaching.”

How can the NSF influence a change in the campus ambience that would lead to a proper balance between education and research.

How do we ensure that research grants have a positive rather than a negative impact on teaching?

Possible attack points:

Having NSF speak out on teaching

Competitive programs for teaching

Criteria for promotion and tenure

National awards for outstanding teaching

Presidential Young Teacher Awards

Presidential Science Teacher-Scholar Awards

NSF Medal of Excellence in Teaching

NSF Distinguished Professor

Fellowships

NSF Graduate Teaching Fellowships

Teaching Postdoctoral Fellowships

TA Training Workshops

Alter NSF programs to include an emphasis on the commtment to combined teaching and research for producing the scholarly leaders in academe.

Examples of interventions:

- i) Require each PYI to teach a one semester UG course each year, a one semester grad course, and serve as the reserach advisor for 2

- graduate students as a minimum on average over 3 to 5 years.
- ii) Could also have a minimum educational commitment to instruction and the guidance of graduate students of PIs.
 - iii) Might also encourage increased instructional participation by giving preference to instructional proposals by highly qualified research, in an effort to send the strongest possible signal that research and education are an integrated whole in the view of NSF.

Questions

General:

- What is the impact of research on quality of teaching?
- What is the impact of research on student preferences?
 - Attrition in majors
 - Postgraduate career decisions
- Does having lots of research in an institution disadvantage undergraduates? (Data strongly suggests NO!)
- Are professors who are good researchers also good teachers. (While there is not strong evidence that research and teaching are highly correlated, there certainly is not evidence that a good researcher is necessarily a bad teacher.)
- Can a university do good research and good teaching?
 - NSF data suggests that the answer to this question is yes.
 - However we need to look at specific cases.
- What happens to undergraduate education when one increases research? (a dynamic question). (Studies indicate that when a faculty member increases time spent on research activity, it usually does not come from teaching but rather from their private lives.)
- Real key:
 - How do we take advantage of extraordinary learning environment offered by the research university?

NSF:

- What is the impact of NSF policies on UG instruction?
 - Important that NSF research policies actively encourage rather than passively discourage attention to teaching by the researchers NSF supports
- Should the NSF try to influence the culture of academe to help define a proper balance between UG teaching and research?
- If yes, then what should be done and who in the Foundation should do it?
- What information is available on the effect that faculty research on the quality of undergraduate education?
 - Do we need additional studies?

The Need for a Study

- Is a major study needed to clarify the issues?
- Should the study be focused on undergraduate teaching or also on the effects of the research funding system on graduate education.
- If there is a study, what would be its products?
 - a comprehensive report (e.g., the "Neal-II" report)
 - A policy statement for consideration by the NSF
 - A public statement directed at NSF and universities?
 - Changes to particular NSF programs/
- Possible Data Needs

Longitudinal Studies:

How much of NSF research \$\$\$ going to:

- i) student support
- ii) PI support
- iii) equipment and supplies
- iv) overhead

Other time trends

- i) number of UGs supported per grant
- ii) number of Grads supported per grant
- iii) number of postdocs supported per grant
- iv) fraction of grant for PI support
(both summer and academic year)