# Sustaining a physics teacher preparation program at a major research university: challenges and strategies

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# Physics teacher preparation programs: Some inconvenient truths

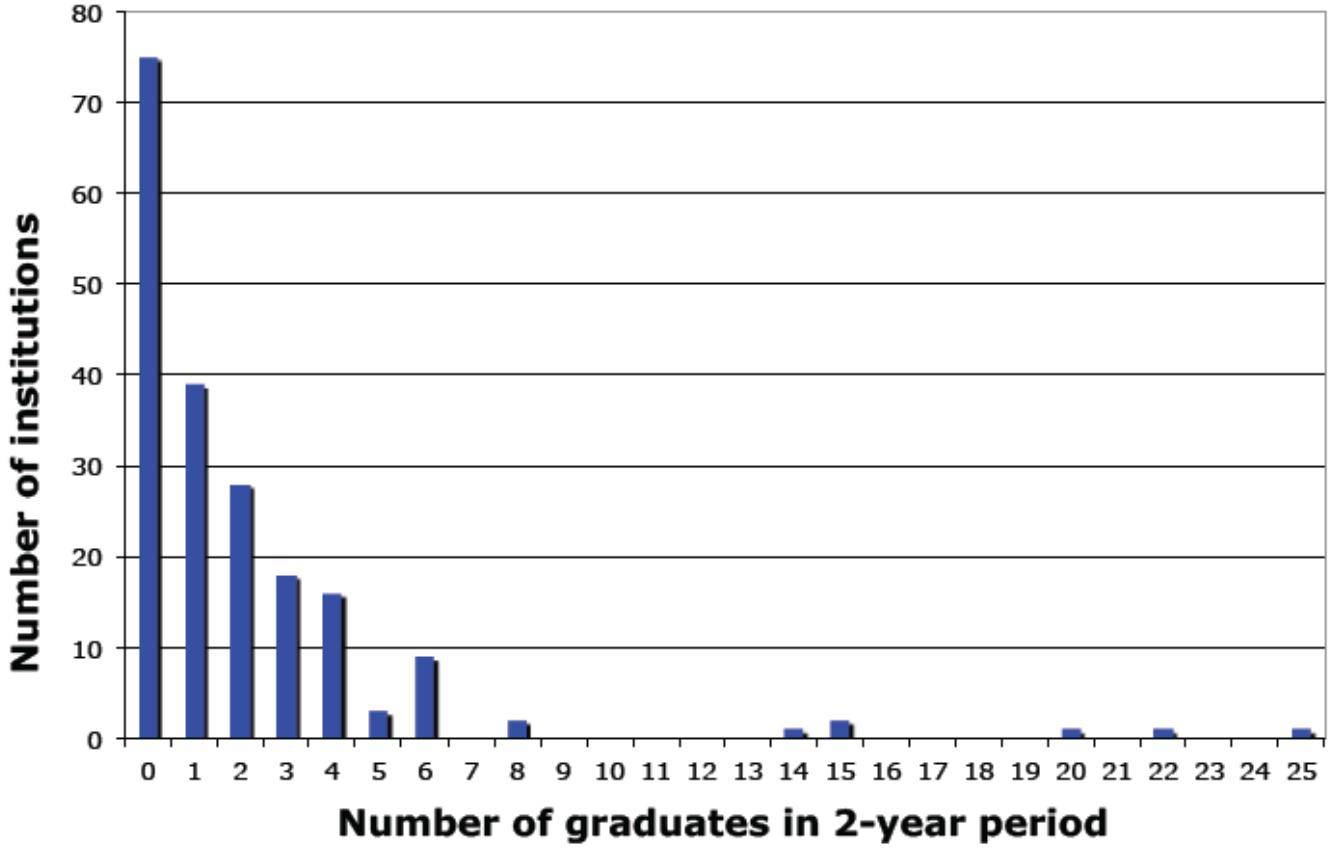

*Fact #1: Few students major in physics*

**2010: Physics degrees were 0.3% of all US bachelor's degrees awarded**

*Fact #2: Few students at major research universities enter college intending to be teachers*

**~40% of teachers from UNC system schools come from two former teacher's colleges, < 10% from the two R1 institutions**

# *Even physics departments with teacher preparation programs graduate very few physics teachers*



## *Fact #3: Major research universities typically do not see producing large numbers of teachers to be a central mission*

**UNC-CH Mission Statement**: "Our mission is to serve as a center for research, scholarship and creativity and to teach a diverse community of undergraduate, graduate and professional students to become the next generation of leaders...we invest our knowledge and resources to enhance access to learning and to foster the success and prosperity of each rising generation. We also extend knowledge-based services … to the citizens of North Carolina and their institutions to enhance the quality of life for all people in the State."

***Challenge #1: At a major research university, the number of students who will pursue a physics teacher preparation program will be small***

*Fact #4: Universities have seen significant budget cuts in recent years, and the future isn't looking so great either*

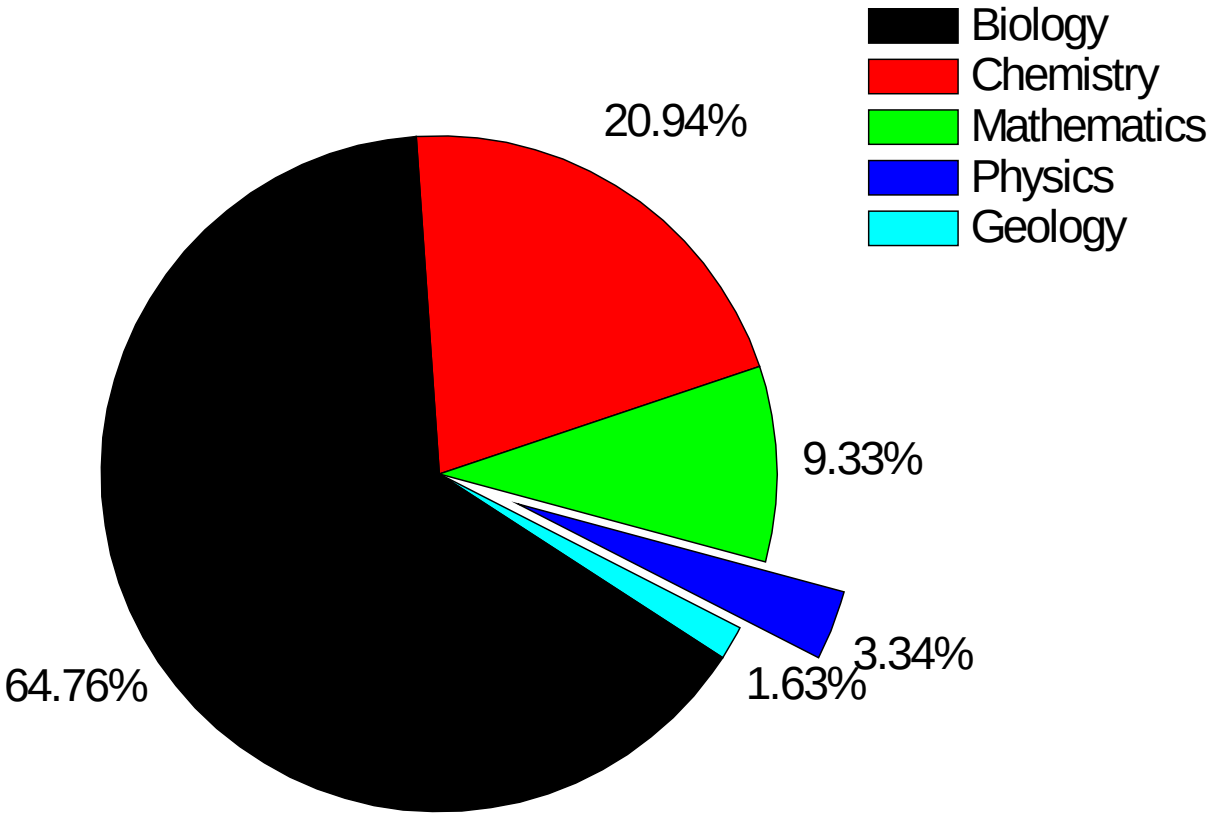
**UNC-CH: 18% cut in state appropriations in FY2012, 29% over 2008-11**

*Fact #5: When money is tight, "low-performing" programs are likely targets for cuts*

*Fact #6: There is a baseline cost for teacher preparation, regardless of how many you produce*

***Challenge #2: Teacher preparation is relatively expensive per graduate produced, and a small physics teacher preparation program is a likely target for budget cuts***

## *Fact #7: Other science departments (especially biology and chemistry) have many more majors than do physics departments*




**UNC-CH science degrees, selected disciplines**
**May 2009-May 2013 (total 2818)**
**13% of all bachelor's degrees**

## *Fact #8: Qualified teachers in other sciences are also scarce*

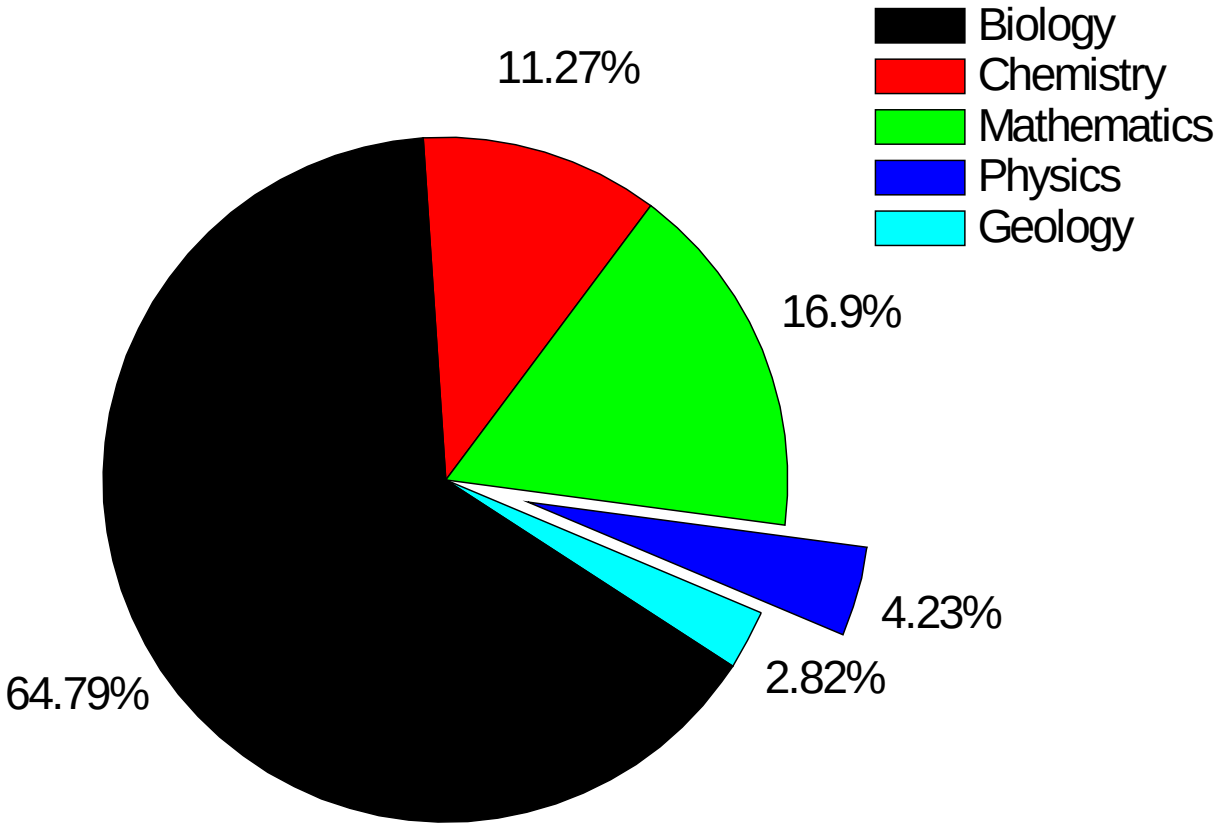
Shortage of qualified high school instructors
(5.00 – 4.21 = Considerable shortage, 4.20 – 3.41 = some shortage)
All regions

Physics: 4.26
Mathematics: 4.13
Chemistry: 4.12
Biology: 3.78
Earth Science: 3.74

**All science fields > 4.33 in Hawaii!**

Source: *Educator Supply and Demand in the United States* (ASEE 2010)

## *Fact #9: Biology and chemistry departments often have many "post-pre-meds" who still want to do good in the world*




**UNC-BEST degrees by discipline:**
**May 2009-May 2013 (total 71)**
**2.5% of all degrees in those disciplines**
**0.3% of all bachelor's degrees**

## *Strategy #1: Partner with other science disciplines to create a joint program*

**Each discipline only needs to support one dedicated course (discipline-specific pedagogy).**

**Embed the physics pedagogy course in the physics major curriculum (as an elective) to increase enrollment and "regularize" it.**

## *Fact #10: High-quality physics teacher preparation programs require specialized resources and expertise not generally available in physics departments at major research universities*

**Of 32 standards required by NCDPI, only one addresses content knowledge!**

- *Teachers understand how students' cognitive, physical, sociocultural, linguistic, emotional, and moral development influences learning and address these factors when making instructional decisions.*
- *Teachers work collaboratively to develop linkages with parents/caretakers, school colleagues, community members and agencies that enhance the educational experiences and well being of diverse learners.*
- *Teachers understand the social, ethical, legal, and human issues surrounding the use of technology in PK-12 schools and apply those principles in practice.*

## *Fact #11: Pedagogical content knowledge is discipline-specific, but other specialized expertise is common for all high school teachers*

# *Strategy #2: Partner with the School of Education to handle the things they know well*

## *Fact #12: There is a national movement for improving the quality of university science teaching, especially in "gateway" courses and for underrepresented groups*

National Science Foundation
WHERE DISCOVERIES BEGIN

BHEF BUSINESS-HIGHER EDUCATION FORUM
*Creating Solutions. Inspiring Action.*

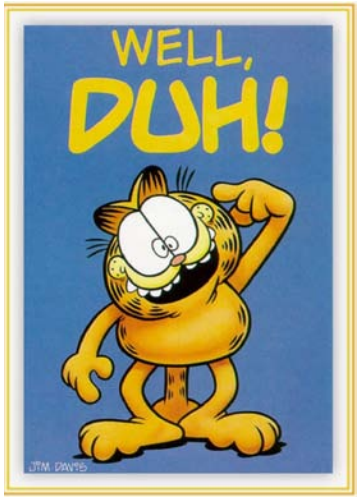
RESEARCH CORPORATION for SCIENCE ADVANCEMENT
*A foundation dedicated to science since 1912.*

ASSOCIATION OF AMERICAN UNIVERSITIES 1900

ASSOCIATION OF PUBLIC AND LAND-GRANT UNIVERSITIES

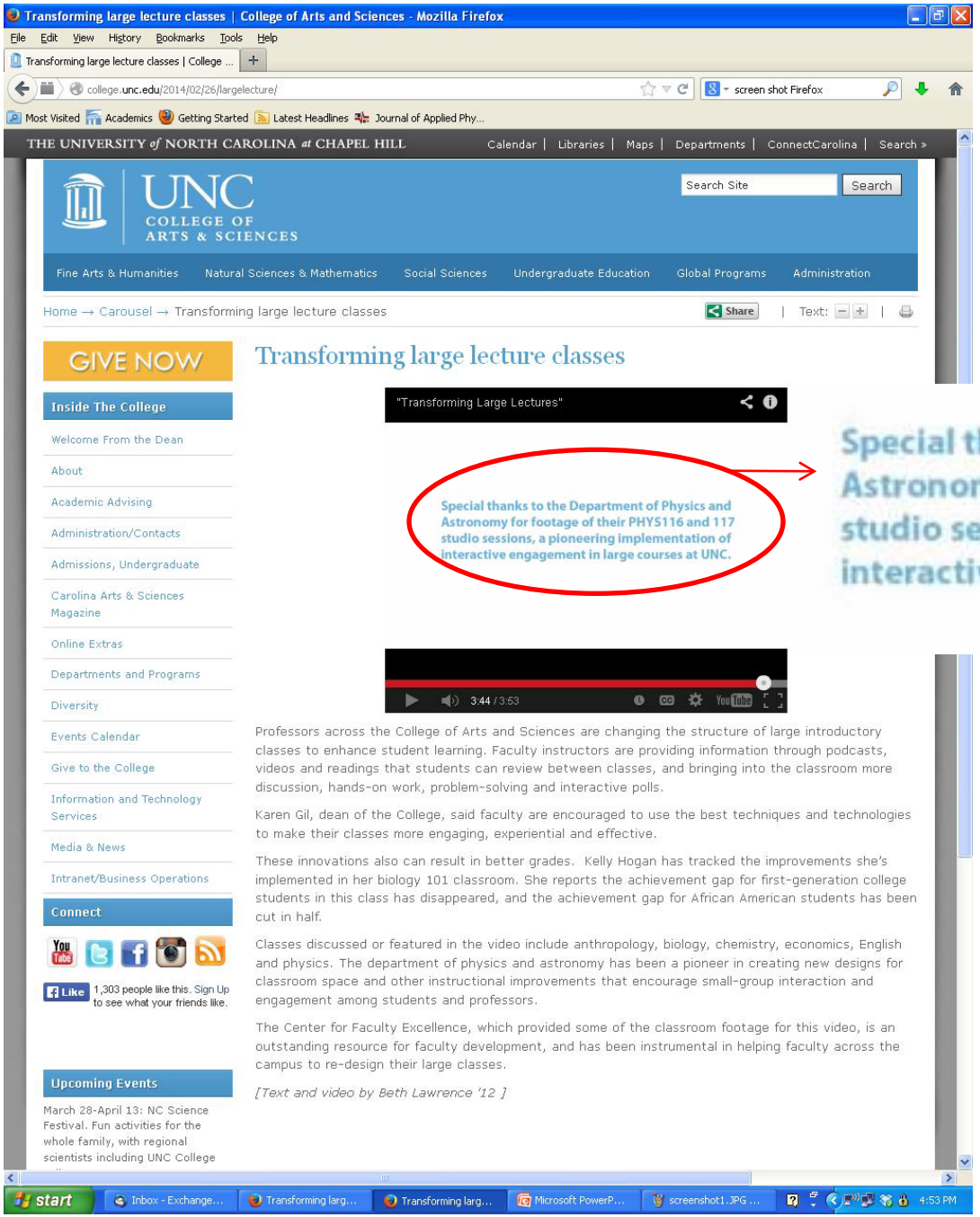
HHMI
HOWARD HUGHES MEDICAL INSTITUTE

## *Fact #13: Physics pedagogy experts are invaluable in the reform of physics instruction*



## *Strategy #3: Use the expertise of pedagogical specialists to help in reform of the teaching in your department (and grant-writing to support that reform)*

**It's the right thing to do—and it can pay off.**




UNC COLLEGE OF ARTS & SCIENCES

Special thanks to the Department of Physics and Astronomy for footage of their PHYS116 and 117 studio sessions, a pioneering implementation of interactive engagement in large courses at UNC.

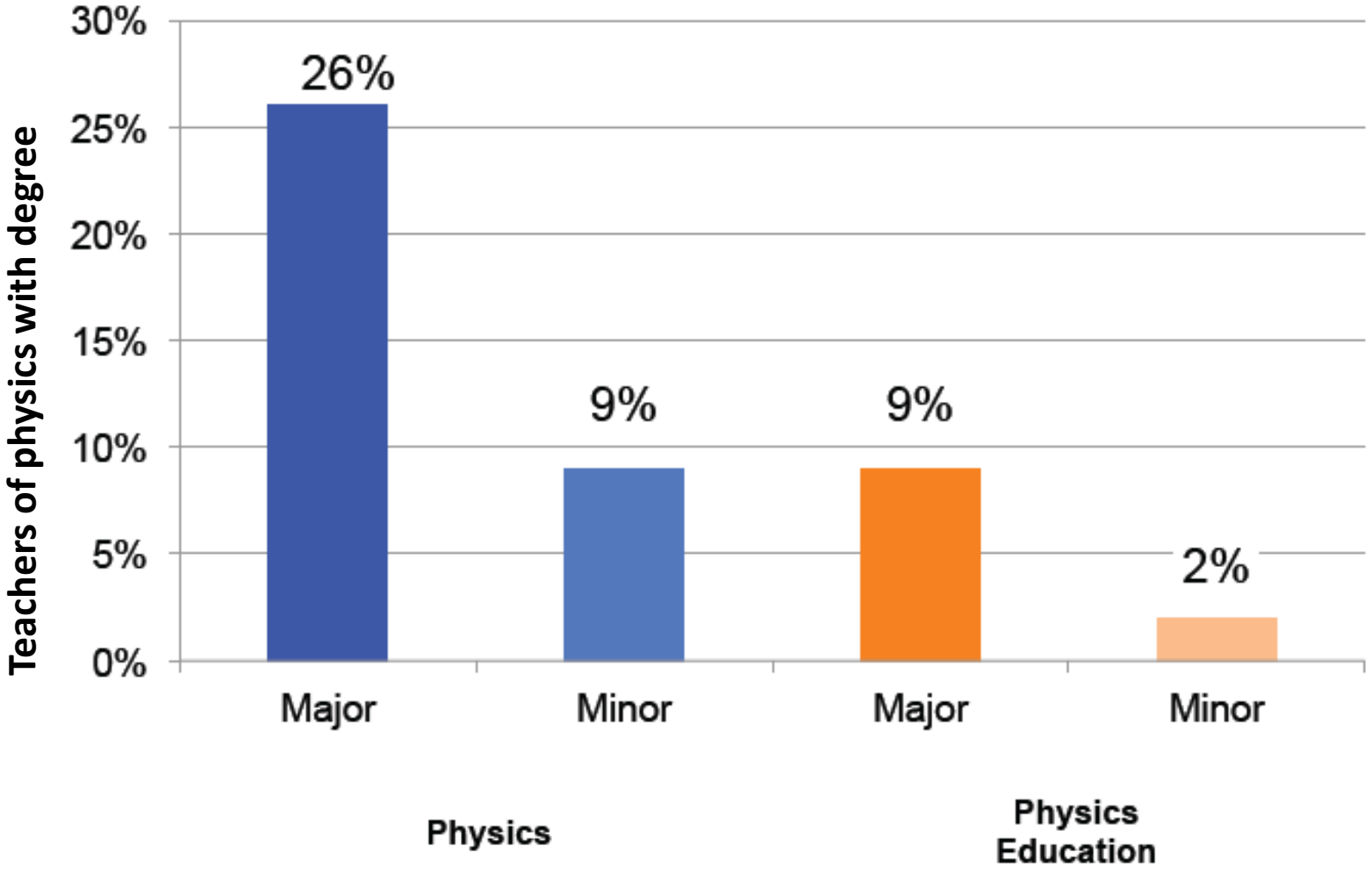
## *Fact #14: Public research universities are increasingly called upon to justify the taxpayer support they receive*

## *Fact #15: Taxpayers (and legislators) have children in public schools, and care about the economy*

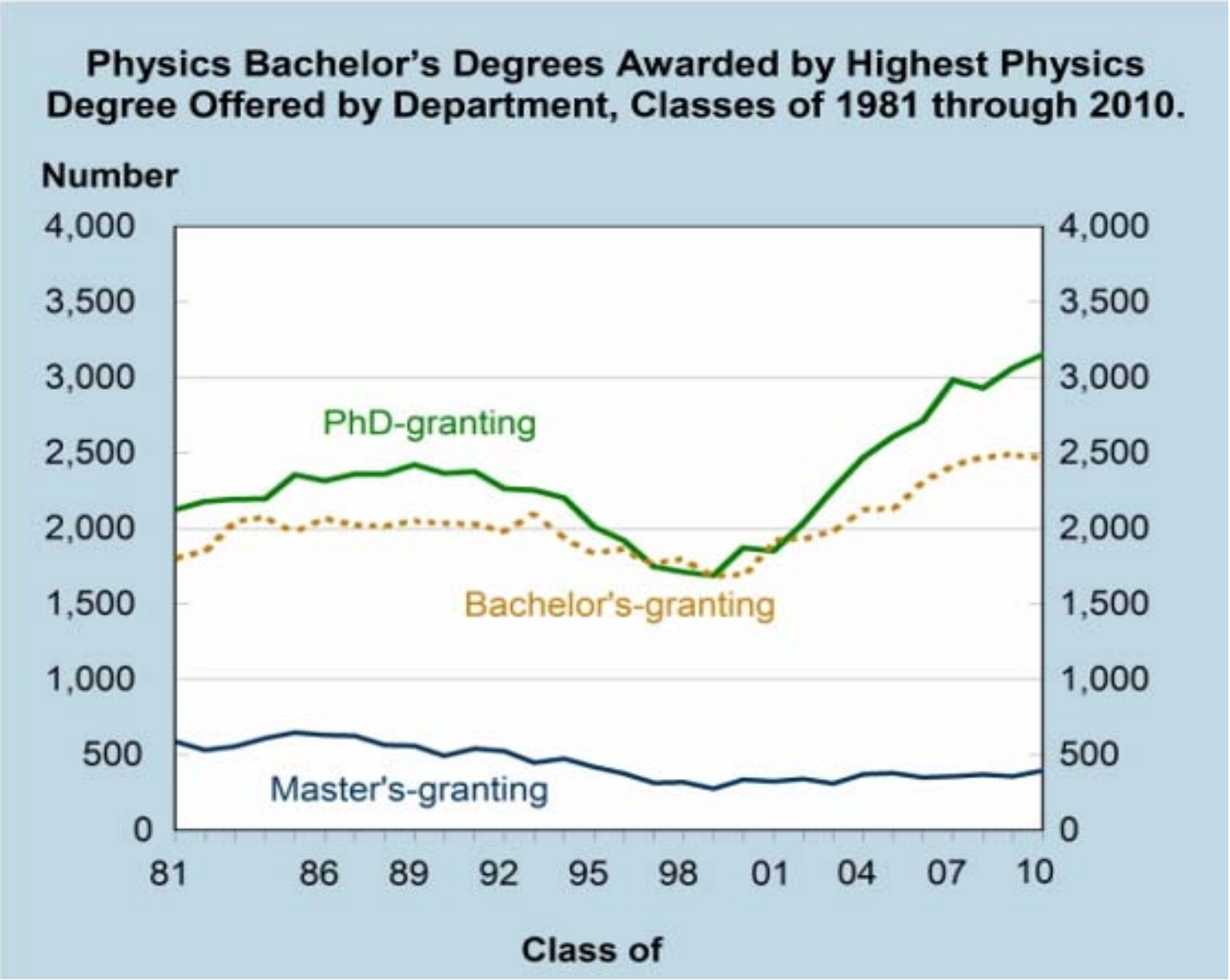
**Erskine Bowles in his inaugural speech as president of the UNC system:**
**"**At a time when the world is clamoring for science and engineering talent, about two-thirds of the students in U.S. high schools studying chemistry and physics are taught by teachers who are not certified in the field and didn't major in the subject. 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. And we're going to compete with these guys in Asia? Come on — not that way."

12 April 2006

# *Few physics teachers have a physics degree*



# *PhD-granting departments grant most of the physics degrees*




http://www.aip.org/statistics

## *Fact #16: The importance of inquiry in secondary science education is acknowledged—and research universities understand inquiry*

**NCSCOS**: "[E]ngaging students in inquiry-based instruction is a critical way of developing conceptual understanding of the science content that is vital for success in the twenty-first century… [T]he science process skills necessary for inquiry are acquired through active experience. The process skills support development of reasoning and problem-solving ability and are the core of scientific methodologies."

# *Strategy #4: Supply your top administrators with "talking points" about why teacher preparation is important at a research university*

***Do it often (they forget, or change jobs)***

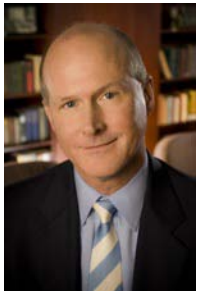
# Administrators at UNC-CH since 2007

## *Chancellors*

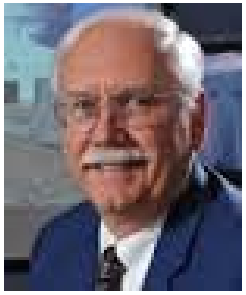


## *Provosts*

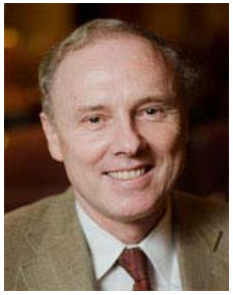




## *Arts & Sciences Deans*




## *Education Deans*




## *Associate Deans for Science*



**8 re-education campaigns and counting…**

# Challenges and strategies

## CHALLENGES

- The number of students in your program will be small
- A small program is a likely target for budget cuts

## STRATEGIES

- Partner with other science disciplines
- Partner with the School of Education
- Use your pedagogical specialists to help reform your department's teaching
- Supply top administrators with "talking points"