Graduate and Postdoctoral Program Development

Submitted by
NC State Task Force on Graduate and Postdoctoral Program Development

Excellence in graduate and postdoctoral training is fundamental to the stature of any major research university. Graduate students and postdoctoral scholars provide the intellectual input and activities essential to move research forward. When they complete their training, they are both the work force of tomorrow and the ambassadors that help recruit the next generation of scholars. The university must not only provide the education that maximizes their potential for success, but must also be prepared to respond to changes in societal needs, applicant interests, and funding opportunities. The challenges are to identify and improve components critical to scholarly success, to identify and use future areas of need to inform new strategic training efforts, and to enhance mechanisms that facilitate rapid yet well-planned change.

Although there is no single definition for graduate student and postdoctoral scholar success, our goal is to generate superb problem-solvers that are creative thinkers and knowledge builders. The process can be thought of as a cycle where intervention at any point in the cycle will impact all other points. A strong applicant pool and a rigorous and responsive educational and training program will generate an outstanding workforce, the result of which will be the excellent reputation that drives recruitment of outstanding new students and scholars. The training programs are our opportunities for intervention to initiate a cascade of change.

Areas of concern

NC State's graduate programs

- The overall average cumulative ten-year completion rate at NC State is 52 percent for doctoral students graduating with a Ph.D. (the degree they sought) or 61 percent for doctoral students graduating with at least a master's degree, with a wide range between different colleges or disciplines. These rates are not dramatically different from the national average, which ranges from 49 percent in the humanities to 64 percent in engineering (Council of Graduate Schools, Completion and Attrition Study, NC State presentation by Dr. Robert Sowell, November 9, 2010). "Average," however, is not what we strive for. Noncompletion represents a tremendous waste of talent and resources.
- Financial resources (stipends) are fundamental to graduate education, are currently a limiting factor for many graduate programs at NC State, and are one of the top two reasons doctoral students complete or fail to complete their Ph.D.s (based on both national and NC State exit interviews as well as research on doctoral completion). Moreover, students in science, technology, engineering, and mathematics (STEM) fields at NC State are 67 percent more likely to complete a degree if they hold a research assistantship (A. Jaeger, unpublished studies). There is currently no mechanism for

allocation of university-level resources to graduate programs based on merit. The majority of state resources for graduate education are in the form of teaching assistantships, which are allocated based on departmental undergraduate teaching load rather than size and merit of graduate programs, and which present tremendous barriers for funding students who desire training with faculty outside of the program's home department.

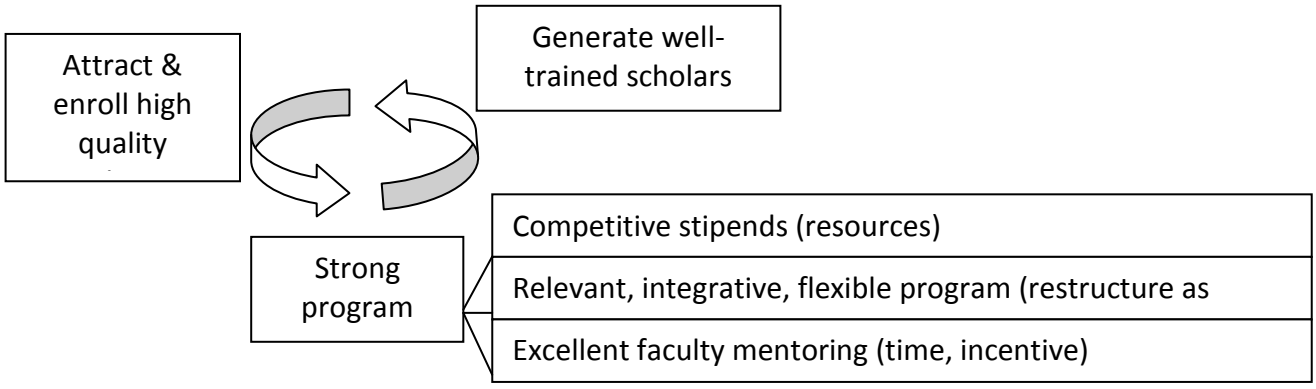
- Mentoring of graduate students is fundamental to graduate education, and is the other of the top two reasons doctoral students complete or fail to complete their Ph.D.s. Mentoring is the "softest deadline" faculty face in their very busy schedules, and is the effort that is perhaps least systematically rewarded. This concern will only increase with the projected enrollment increase in doctoral students.
- Many of our current graduate programs are strong (by qualitative and metrics-based assessments), but others have declined due to changes in societal needs, applicant interests, loss of tenure-track faculty positions, or other factors. Declining programs should be restructured or phased out and their resources reallocated to more effective programs. This requires greater rigor and candor in review of graduate programs and requires mechanisms to facilitate change.
- Greater than 90 percent of our graduate programs are department based (disciplinary), leaving a void in interdisciplinary areas, which leaves us less well-prepared to react to real-world problems and to extramural funding opportunities. Interdisciplinarity is already succeeding within several colleges, but faces much greater barriers across colleges.
- The current process for developing new graduate programs involves minimal academic planning. It is based entirely on individuals (faculty, department heads, deans) submitting proposals independent of other current or future plans for graduate education. Academic planning is succeeding within several colleges, but is lacking at the institutional level.
- The current process for developing new graduate programs is labor intensive and requires many years for approval. NC State needs mechanisms to develop new programs rapidly (to attract students while areas are still young, to take advantage of new and transient extramural funding opportunities, and to make best use of faculty enthusiasm and effort), flexibly (to accommodate the natural ebb and flow of student interest, faculty strengths, and societal relevance), and effectively (with vetted training plans, solid resources, and strong leadership).
- Not all NC State research-active faculty have access to training doctoral students. Many departments/disciplines are too specialized to warrant their own graduate programs, have had no opportunity to pursue graduate program development due to historic institutional priorities, or have had difficulties obtaining UNC-General Administration approval, resulting in both a waste of faculty talent and a potential risk to faculty retention. The only access to graduate students for faculty in those departments/disciplines would be interdisciplinary and / or multidisciplinary programs.

NC State's postdoctoral scholar programs

- The mentoring match between postdoctoral scholars and faculty advisors is as critical as it is for graduate students and faculty advisors, yet the process of recruiting and selecting postdoctoral scholars is conducted by faculty on an ad hoc basis with no institutional support or guidance. While many cases are successful, there are many cases where either or both parties are disappointed with the outcome. This represents a tremendous waste of scholarly talent and individual faculty's extramural funding and time.
- NC State provides the first U.S. experience for many international graduate students and postdoctoral scholars, and this can present cross-cultural communication issues that neither the scholar nor the faculty member is prepared to handle. This impedes progress.
- Postdoctoral scholars seek not only to strengthen the skills they obtained from their graduate work, but also to develop the new skills necessary for success at the next level, i.e., to transition from learning how to do research to learning how to run research. The postdoctoral experience at NC State is ad hoc. The recently developed Office of Postdoctoral Affairs is working to help at an institutional level, but would like to offer many more opportunities.

Goals and strategies

NC State's overarching goals for graduate students and postdoctoral scholars for the next five to ten years should to enhance graduate student and postdoctoral scholar success. We can attract and enroll stronger applicants by offering more flexible and integrative graduate programs that are not impeded by disciplinary barriers, by offering more competitive graduate student stipends, and by offering additional professional development opportunities for postdoctoral scholars. We can decrease attrition and generate stronger graduates and scholars by improving faculty mentoring of trainees. Finally, we can use resources more effectively to build to our current strengths and develop new ones by focusing more on university-level academic planning.



Specific recommendations

1. Increase funding for graduate education
    - by increasing state funds directed to graduate education;
    - by increasing the proportion of NC State funds directed to graduate education;
    - by increasing extramural support for graduate education.

There is no single action that would have as profound an impact on NC State graduate education as increasing both the number and the size of graduate student stipends. Increased support would render NC State more competitive for the top applicants and would thereby increase completion rates. Increased intramural support, however, should be linked to an expectation of extramural support. Mechanisms to increase extramural support, e.g., training grants or corporate funding, require substantial faculty time and effort, and must be appropriately prioritized, supported, acknowledged and rewarded.

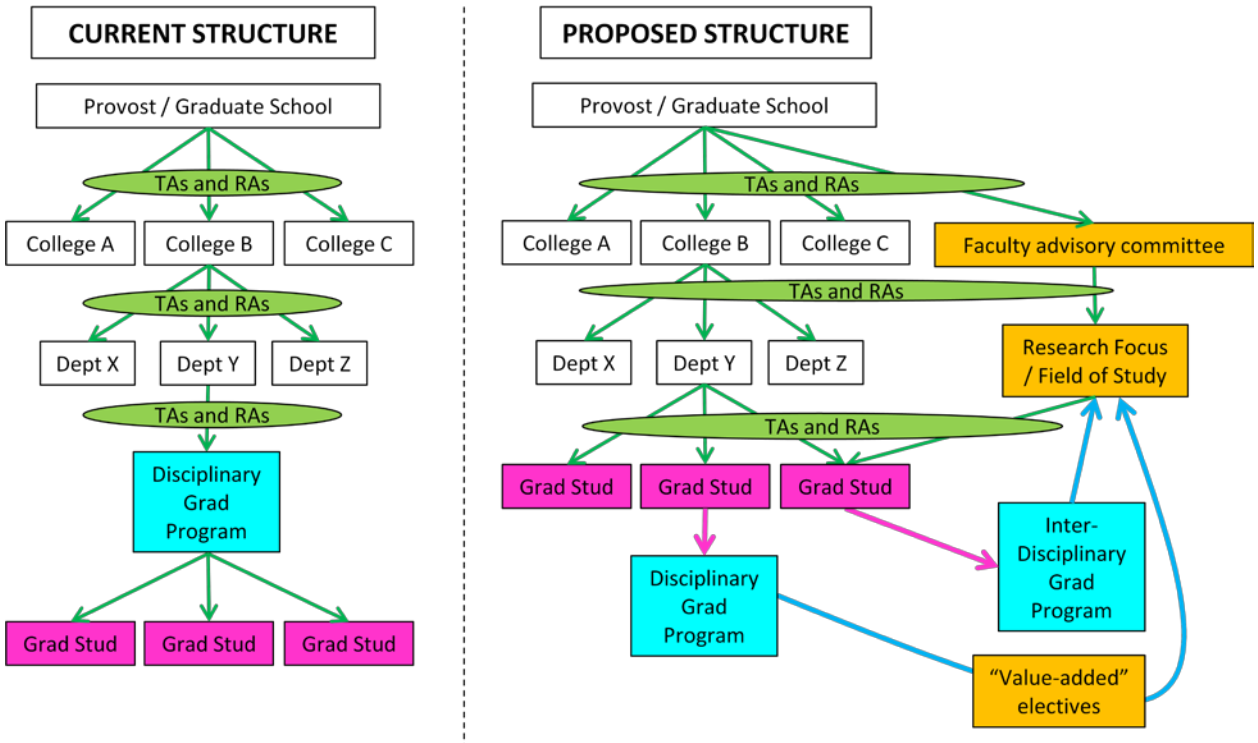
The best mechanism for prioritizing allocation of university resources to graduate education remains unclear, but funding must be tied to merit. Attrition rates would decline if research assistantships were favored over teaching assistantships (A. Jaeger, unpublished studies). Stipends may be allocated to departments (as they are now for teaching assistantships), to graduate programs, or directly to applicants / graduate students, but they must be used to support the best graduate training (see diagram below).

2. Use university-level academic planning to identify focus areas and facilitate structural change in graduate education
    - to respond to changing societal needs, extramural opportunities, and applicant interests;
    - to respond to rigorous graduate program reviews;
    - to prioritize resource allocation and to shape graduate enrollment;
    - to incentivize faculty and to offer all research-active faculty access to doctoral students, regardless of department;
    - to encourage cross-disciplinary efforts.

The university must assess and prioritize its graduate education programs and focus areas, and must be more flexible to make timely changes in the graduate education process. Mechanisms would include use of existing entities such as the Graduate School, the Graduate Advisory Board, and the Graduate Operations Council, or development of new entities. The report from the Task Force on Interdisciplinary and Interdepartmental Academic Programs generated February 1, 2008, by Dean Larick and committee provides a useful framework for reference. Obstacles include the current funding structure which allocates graduate funding (teaching assistantships) based on undergraduate rather than graduate education, and which does not include a mechanism to resource new programs. Obstacles also include the administrative disincentives for supporting graduate students enrolled in degree programs outside of the home department (e.g., credit for the faculty member and the department). Development of

new programs and restructuring of existing programs would best be originated and driven by faculty, with institutional academic planning oversight. These programs could be degree granting or "value added," in which students pursue existing degrees but enroll in additional courses to expand their training, as in the Molecular Biotechnology Training Program. Obstacles include the numerous disincentives for use of faculty time on such efforts. Obstacles also include resistance from UNC-General Administration for approval of new graduate programs, although this would not be an issue for value-added programs.

An example of new graduate program structures and new resource allocation models is provided below. These could be in addition to existing structures, and emphasize: 1) the possibility of an alternative method for flow of resources to encourage cross-disciplinary efforts (faculty advisory committee), and 2) the possibility of allocating stipends to graduate students rather than specific graduate programs for increased flexibility in program choice. A faculty advisory committee would provide faculty with a new opportunity to influence decisions relating to graduate education at a university level. Mechanisms must ensure that the allocation of resources through an alternative path is not detrimental to department-based disciplinary graduate programs. Effective allocation of resources will strengthen disciplinary and interdisciplinary graduate programs, and should seed efforts to seek major extramural funding.



3. Enhance faculty mentoring
   - to improve completion rates;
   - to generate strong graduates;
   - to attract stronger applicant pools.

Some faculty would be outstanding mentors but are limited by demands on their time, while others may mean well but perform poorly (whether due to poor prioritization or poor skills). Clearly, solutions will not be "one size fits all." Mechanisms would include better engaging postdoctoral scholars and staff in traditional faculty efforts including mentoring, which would not only free faculty time for mentoring but would also aid in scholar and staff professional development. Mechanisms would also include properly acknowledging (rewarding) faculty time spent mentoring, reviewing graduate faculty appointments periodically, developing specific mentoring plans for high-risk students, and establishing milestones during the graduate process (i.e., accountability broken down into steps). Finally, mechanisms would also include hiring additional tenure track faculty in growth areas.

4. Enhance the postdoctoral experience, through additional efforts by the Office of Postdoctoral Affairs:
   - Offer guidance to faculty for effective interview and selection processes for postdoctoral scholars.
   - Offer a program for international postdoctoral scholars relating to cross-cultural difference.
   - Expand professional development programs for postdoctoral scholars on topics such as grant writing, managing a research laboratory, teaching, and other skills associated with transitioning to the next level. Although the Office of Postdoctoral Affairs currently offers such programs, it would benefit postdoctoral scholars to have campuswide support from faculty to take part in these professional development activities.
   - Encourage faculty to find creative ways to enhance the postdoctoral experience. For example, have postdoctoral scholars assist with teaching classes, mentoring students in the lab, or assisting with responsible conduct of research endeavors.

Metrics

Examples of outcomes for NC State graduate programs

- A faculty member in CALS Poultry Science could train a graduate student in the CVM-based Comparative Biomedical Sciences program, using funding associated with that program
- The interdisciplinary programs Living Green and The Biology of Food would be developed and resourced in response to a growing societal and applicant interest, and the tremendous faculty time involved in developing such a program would be appropriately rewarded
- The creation of an interdisciplinary doctoral program in digital humanities would link humanities faculty and doctoral students with computer science research; and/or the

multidisciplinary program Language, Literature and Culture in CHASS could have concentrations in Hispanic studies, international studies, sociolinguistics, political science, etc. Such programs would provide research faculty who currently do not have access to doctoral students the opportunity to train doctoral students in graduate programs consistent with the mission of the university and with sufficient critical mass for success.

Examples of Measures of Graduate Training Assessment

(modification of proposal from Dean Larick)

Student data

- Enrollment[1] per number of faculty[2] (both averaged over five years)
- Enrollment yield (number enrolled divided by number accepted; averaged over five years)
- Publications/presentations per student
- Average time to degree (averaged over five years)
- Six-year completion rate
- Six-year doctoral attrition rate (left without doctorate)
- Degrees awarded over past five years per number of faculty (averaged over five years)

Diversity data

- Applications over past five years from underrepresented minorities (African-Americans, Hispanics, native Americans) per number of faculty (both averaged over five years)
- Percentage of enrollment of underrepresented minorities (averaged over five years)
- Degrees awarded over past five years underrepresented minorities per number of faculty
- Percentage of enrollment of women (averaged over five years)
- Degrees awarded over past five years to women per number of faculty (both averaged over five years)

Faculty data

- Number of published scholarly works (articles and chapters listed together and books listed separately) per number of faculty (during most recent year)
- Number of new proposals for external competitive funding[3] submitted by (tenure-track/tenured) faculty per number of faculty (during most fiscal recent year)

[1] Enrollment is defined as students in degree programs who have registered by census day, including distance education degrees.

[2] Except for interdisciplinary/interdepartmental programs, faculty is defined as the AAUP number under personnel in UPA database. The number of faculty will be the average over the years in the data range specified. For I/I programs, faculty is defined as those associated faculty listed in SIS.

[3] External competitive funding is defined as funding that comes from sources outside the university, which excludes internal funding, such as from centers based at NC State.

- Amount of funding from competitive external grants per number of faculty (during most recent year)
- Distribution of doctoral advisees (percentage of faculty chairing or co-chairing doctoral committees of students in the program)
- Faculty engagement in interdisciplinary and interdepartmental education (number of current advisees outside program) per number of faculty
- For interdisciplinary programs only: faculty support for interdisciplinary programs (number of faculty formally associated with an interdisciplinary program who serve on doctoral committees in the program divided by number of program faculty)