

The Boyer Commission Report and Stony Brook... two years after

[A talk presented by Robert McGrath at the Symposium Celebrating the Opening of the Reinvention Center at Stony Brook. April 28, 2000]]

There is an overarching call in the Boyer Commission report for integration, while it lists many factors that have tended in the opposite direction. The report recalls a quote from Einstein to the effect that “the history of discovery teaches us the human race is poor in independent thinking and creative imagination. Even when the external and scientific requirements for the birth of an idea have long been there, it generally needs an external stimulus to make it actually happen; man has, so to speak, to stumble right up against “*the thing*” before the right idea comes.”

The report laments that while a research university (RU) should be a place where stumbling against “*the thing*” should happen with the greatest ease and frequency, RU’s often consist of archipelagos of intellectual pursuit rather than connected and integrated communities. That fragmentation has increased dramatically during the last fifty years. Not only do the students and faculty often not interact much, but also faculty from not all that great disciplinary separations don’t interact very much either. The report suggested the possibility that a RU could be a synergistic system in which faculty and students are learners and researchers, whose interactions make for a healthy and flourishing intellectual atmosphere.

RU’s have broad missions. Stony Brook’s is probably typical: providing education at essentially all levels in a wide range of disciplines, creating new knowledge about the universe and about ourselves within the universe, serving as a technical and intellectual resource base, and being a service provider for health and economic welfare.

As research has increasingly become the driver for much of society gains most, if not all, RU’s have concentrated more and more on their capabilities to create research results, and in so doing to bring in more funding, and improve reputations in terms of widely used metrics. These days, universities do the major part of basic research in the nation. The question in all this is where are the undergraduates? The Boyer report achieved notoriety in calling for a re-examination of where they indeed are. It of course wasn’t the only voice calling for re-examination... and change.

We at USB were especially interested in the NSF’s competition in the spring of 1996 whereby ten RU’s would receive recognition awards for the integration of research and education (especially UG since graduate education is typically so tied to research in the first place). Then director, Neal Lane, expressed the hope the awards (I’ll refer to them as RAIRE awards) would help NSF publicize innovative efforts at integration at all levels... from improved training of school science teachers to tenure policies based on classroom excellence as well as publications. I have to say that all parties didn’t greet the RAIRE competition with wild enthusiasm. For example, Science magazine reported Paul Martin, then dean of applied sciences at Harvard, thought the NSF was underestimating the community’s commitment to balancing teaching and research... that balance was already a key ingredient in his own performance rating. Science had some great

letters-to-the-editor! One writer proposed what he called an uncomplicated, cost-free and non-bureaucratic alternative to the competition... simply require all professors applying for NSF research funding to include on their grant proposals their undergraduate student evaluations!

The Boyer report called, of course, for a much more comprehensive re-evaluation and restructuring of UG education at RU's. Now there are RU's and there are RU's. They all have more or less the same missions, but obviously there are huge variations within the 125 Research I and II species. For example in:

- Public/private... (stockholders)
- Mission emphasis
- Size and quality of research enterprise
- Resources... size and mix (enrollments, research, etc.)
- Sheer size
- Mix of UG's versus graduate/professionals
- Student interests and characteristics ... liberal arts, engineering, business, pre-professional, adult learners, part-time, commuters, transfers, distance learners

The variations are enormous... I estimate factors of roughly three to ten in some of them such as enrollments, or resources available per student. Some have almost exclusively students who enter as Freshmen, some have lots of transfer and part time students. I am sure that members of the set of RU's were doing and are doing, to varying degrees of perfection, the sorts of things set out in Boyer. Of course there must obviously be a wide variation in approaches because of the dissimilarities in what we are referring to as RU's

Let me describe USB as an example. I'm not sure where it fits in the spectrum, but I'd like to illustrate some things we do pretty well, and then confess to what we haven't done. First let me give you a short profile of Stony Brook:

- It's a little more than 40 years old. It set out to be a serious RU on a very fast track, in the beginning NYS provided lots of grease for the track.
- We have CAS, CEAS, HSC, SPD, MSRC
- Our enrollments have grown about 10% recently to about 19,000, with about 7000 grad or professional students
- Our research volume has been doubling about every eight years, and about 30% of our graduate programs are ranked in the top quartile by NRC.
- Our budget (non-hospital) is about 400 M\$ with 120 M\$ from NYS, 70 M\$ from tuition, 120 M\$ external research support. The NYS and tuition revenue averages only about 7 K\$ per UG FTE depending on the discipline and level.
- Diversity: more than 10% African-American, 25% Asian-American, 8% Hispanic-American. We have many first generation college goers, many emigrants, and our students are often not from affluent families... 40% of our student's families have incomes of less than 40 K\$.
- Many transfers... about 35% of our upper division students.
- Campus administrative goals... what can I say? (Implement everything in Boyer, grow quantity and quality of graduate and research programs, develop stronger regional and state-wide impact)

- SUNY administrative goals... changing... budgets driven by enrollments and external research dollars.

How does USB measure up to what the Boyer report calls for?

Things we had done pretty well:

- Participation of UG's (and HS students) in research. Established URECA in 1987 to emphasize the connection between active involvement in research or creative activities and learning.
- Over the years several faculty have been influential in curriculum reform (e.g., in the calculus reform movement), and SB pioneered the federated learning community concept in the 70's... a year long program leading to an academic minor with courses clustered around a theme and with one or two faculty, so-called "master-learners".
- We've always done a huge amount of outreach to K-12 students, and community colleges, and through NSF REU's.
- We've had Living Learning Centers built around themes (e.g., now there are seven. Two topics are Environmental and International Studies), and an Honor's College. Both were started in 1988, and both have the kind of built-in community envisioned in Boyer. About 400 to 500 students participate in these.
- We've been leaders in programs designed to bring underrepresented minorities into science and engineering fields; we also pioneered a program sponsored by NSF which has been very successful in getting more women into science and engineering.
- Especially beginning about five years ago when Shirley Kenny became president, we've had an unmistakable institutional vision already articulated in her inaugural address call for a new model "based on the premise that undergraduate and graduate education are part of the whole in a major research university, that, properly conceived, both should be interdependent and strengthen each other, that the symbiosis between the two should improve both undergraduate and graduate education."

Because of these and other activities that I won't go into, Stony Brook was fortunate to have been chosen one of the ten RAIRE winners. Representatives from seven of the other winners are with us today... But how are we doing compared to the program laid out in the Boyer report?

- There is more systematic evaluation of teaching. [Teaching portfolios are now part of P/T cases, new faculty have two mentors, and teaching service such as undergraduate research mentoring is recorded in annual addenda.]
- We have a Center for Excellence in Learning and Teaching (CELT) which is rapidly becoming a genuine center for this!
- More students are becoming involved in research and creative activities. All departments have faculty research-liaisons and web sites describing how UG's can get involved. About 40% of our students do a research project or are in a research intensive course, wonderfully about 40% of these –work with faculty in our Health Sciences Center who certainly don't have undergraduate education as item one in their job descriptions!

- We award a number of summer research fellowships, and small research grants to students.
- Shamelessly copying Carnegie-Mellon University, we have a celebration of research and creative activity day each April where students from across the disciplines give poster or verbal presentations, exhibit their art, or give performances. It's a fine day! Two weeks ago we had about 200 student entries, outside judges, and awards. All agree it's not only an absolutely excellent thing for the participants, but the excitement and prominence of it all clearly draws more and more students into the process.
- About two years ago a group of faculty supported in part by a Hewlett grant developed the concept and curriculum for what we call Freshman Learning Communities. A year ago the first ten were launched. There are communities of science, and of ideas. The structure is that students take a four-credit seminar linked with science, math, and writing courses (science), or with philosophy, social science, and writing courses (ideas). This year we've added sections in engineering, and one for transfer students. Groups of students (25 or less) take all the courses together. So far, we find that students in these sections do better... GPA, have better retention, and have a better sense about what they are doing in the University. We have about 450 students in these courses.
- More care in teaching large lecture courses. An example is in the introductory chemistry sequence. We now identify "at risk" students and take corrective action in improved advising and by running a drop-down course in parallel. We use technology-based interactive assignments which seems to improve learning outcomes. We have workshops and help sessions where as much inquiry-based learning takes place as possible. We use multimedia technology to broaden learning experience. Similar sorts of things are happening in some of our other large courses. We are finding that the CELT is really an important nexus for faculty innovators in teaching.
- Especially through the RAIRE project, we've seeded development of a number of research and inquiry-based courses.
- We've revamped our entire biology curriculum, it strives to get the research aspect in early. There is a new inquiry-based course for Freshmen which feeds into tracks in E&E, Environmental Biology, Marine Biology, Bioengineering and Developmental Genetics. The tracks have easy links to our research faculty in these areas
- We have improved standards and training for TA's. [Many other, universities do MUCH more than this, but at least we have begun.]
- Finally, we've just begun a new project that really links undergraduate and graduate education. It's supported by a NSF-VIGRE grant and links our Math and Applied Math departments. It aims to broaden the research training and educational experiences of UG's, GS's and Postdocs. Very briefly, in education the GS's will be involved in curriculum development and new pedagogy, and help in infusing discovery learning principles throughout. In research, deliberately integrated teams from undergraduates though faculty will take on interdisciplinary or industrial research projects.

Challenges (or worries):

- Have many large enrollment, relatively unchanged courses.

- Faculty reward system is not so different than before.
- Graduate education hasn't changed very much.
- Communication skill development isn't imbedded in the curriculum.
- Quality of learning experience is strongly correlated with students' entering skills.
- Most students do not yet have the kind of "building on the Freshman year" experience set forth in the Boyer report.

Boyer... two years after...

A variety of practical factors including inertia, funding, and the complex set of missions inevitably will slow down institutions bent on implementing the full set of Boyer report recommendations.

Some elements are surely more urgent to put in place than others (e.g., excellent teaching, universal Freshman academic experience). Others depend more on individual student needs, and university capacity (e.g., student research in faculty labs).

I've told you about some of the things going on at Stony Brook. I've described some good results, but I've also confessed that we certainly aren't done.

I want to finish with stories from two of my faculty colleagues.

David Ferguson is a professor in our Technology and Society department, director of CELT, and director of the Stony Brook-led SUNY-wide AMP. He tells me that there are the order of 100 faculty who in one way or another participate in some of the teaching activities sponsored by CELT; he estimates up to 100 additional faculty are really engaged in some sort of innovative teaching efforts (but don't figure they need CELT). I think those are spectacular numbers when you consider that there are only about 650 tenure track faculty excluding the HSC. He's on his college PTC... he knows how it's functioned over the years. He says the committee now looks for genuinely more teaching professionalism than was the custom, say, ten years ago. He sees changes happening non-linearly driven largely by the urgings of reports such as Boyer... and the Stony Brook administrative vision. He says the climate has changed... that faculty who harbor interests in innovative teaching or simply in improving teaching skills are now "out of the closet".

Miriam Rafailovich, is a professor in our Materials Science and Engineering department and director of our NSF-MRSEC in Polymer Science. She has amazingly many undergraduate and high school students in her lab. [She hosted eight of the 300 Intel semi-finalists this year!] I asked her whether the younger students really make a difference in her research... and for that matter a good difference. Her philosophy is that it helps people at all stages of research to teach and explain what they're doing to the less advanced... in her lab she has tiers of students, postdocs, faculty all explaining! She emphasizes that they aren't just being altruistic. She makes sure the younger students are really doing some kind of research, often the very exploratory and high risk projects... if things work on a qualitative level then it may go on to a graduate student who's looking for a more conservative, longer haul project. Several important findings have started this way. By the way, she also has high school teachers in the lab that she character-

izes as the cement between her lab and the schools. So her answer to my question is an absolute “yes”. Integrating is the way to go!

So... change is happening. I think the Boyer Commission report has helped stimulate the many efforts and results to improve the whole education that goes on at RU's, and I look forward to learning today about many of them. At the beginning of this talk, I cited the Einstein reference used in Boyer... about stumbling into “things”. That's what I hope we all do today!