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Invited Panel Session:  
Issues Driving Reform of Faculty Reward Systems  
Relevant to Professional Graduate Engineering Education

Invited Panel Paper #1

### Draft

## **Issues Driving Reform of Faculty Reward Systems to Advance Professional Graduate Education: The Need for Criteria that Support Engineering Practice and Technology Leadership**

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### Abstract

This is the first of four papers in the special panel session focusing on issues driving reform of faculty reward systems to advance professional graduate engineering education for creative engineering practice and leadership of technological innovation to enhance U.S. competitiveness. This panel session is in direct response to the urgency of engineering education reform and improvement of faculty reward systems, voiced by Wm. A. Wulf, president of the National Academy of Engineering at the 2002-Main Plenary Address to the American Society of Engineering Education. Since the Grinter Report, scientific research has become a primary condition for tenure and promotion at many of the nation's schools of engineering across the country. In his seminal work, *Scholarship Reconsidered*, Ernest Boyer identified the need to broaden the range and the definition of scholarship beyond the limits of scholarship of research and discovery. As the panel overview paper, this paper introduces the need to implement a comprehensive faculty reward system for those professional-oriented adjunct faculty from industry and for those professional-oriented core faculty within schools of engineering and technology, who are at the leading edge of advancing the practice of engineering through their teaching, industrial engagement, and original professional scholarly work relevant to creative engineering practice and its leadership for technology development. The paper raises fundamental questions that must be answered to design a complementary faculty reward template of creative professional scholarly work, teaching, and engagement for high-caliber engineering professionals in parallel to the academic scientific research template, which predominantly exists at schools of engineering and technology across the nation.

## Rewarding and Recognizing Faculty Accomplishment

In a recent article entitled “My Job Lies over the Ocean”, in the December issue of *Prism*, the author outlines a concern about the relationship between economic growth and engineering education. The author states that if engineering and science educators (presumably at major research universities) only pay attention to producing graduates to maintain a technical workforce in support of economic growth, the ultimate outcome will be that of reducing the mission of universities to becoming technical training schools. The author of the article further advocates that economic growth requires a great educational system [1].

If a great educational system is truly valued then a great reward system will also be essential. Most academics would agree that the current reward system in place at universities reflects the value system and mission of universities. It is then probably safe to conjecture that faculty at all institutions tend to pursue activity which provides appropriate rewards and recognitions.

A good question to consider could be, shouldn't universities be engaged in the development of a technical workforce that understands the role of innovation and entrepreneurship in growing the national economy? Clearly industry leaders are advocating for universities to produce engineering and technology graduates, who possess the technical and applied research skills to translate new developments in science and technology into innovative products and services for the international marketplace. If the answer to the questions is yes, then universities should also provide a reward and recognitions system for engineering and technology educators.

Whether universities want faculty to focus on basic research or quality learning experiences for both undergraduate and graduate students, should not be viewed as an either/or strategy. Most administrators would agree that good teaching and innovative scholarship are activities, which are inextricably linked together. Promoting entrepreneurship and innovation, as key elements of the educational or learning process should be one of the primary goals of engineering and technology educators, especially at major research institutions.

Sustaining economic growth and world-class competitiveness in the United States will require the involvement of engineering, and technology faculty and industry partners dedicated to learning, discovery, and engagement. For decades, faculty performance and university reward system has focused on the development and performance of individual faculty members in engineering and technology.

Research or discovery in engineering education has significantly evolved over the past fifty years and will be discussed in greater detail in the next section of the paper. Scientific research in engineering has evolved from applied to a more basic scientific level. This evolution has occurred as a result of several factors, one of which is the enormous growth in scientific knowledge and capability of faculty to do basic research. Another important factor in the rate of acceleration has been a reward system to encourage success in basic scientific discovery and the publishing of these discoveries in journals and proceedings.

While the pursuit of basic research is vitally important to our nation in maintaining a competitive advantage in developing innovative technology, we must not forget the important role of other avenues of discovery. Moving scientific innovation from the laboratory to production requires an ambitious agenda for applied engineering and technological research as well as a reward system to encourage its development.

## Defining Scholarship

In his distinguished lecture at the 2003 ASEE Annual Conference, Dr. Joseph Bordogna called on engineering educators to change the way we educate engineers. Even the title of his talk, “*US Engineering: Enabling the Nation’s Capacity to Perform*” [2], has in it a call to application of the engineer’s knowledge for the nation’s well being. Is this a major new direction in engineering, or simply a reminder that we should consider our historical tradition? And what implications does this have for the role of engineering educators in the time-honored areas of teaching, research and service? Perhaps a brief review of this nation’s priorities in higher education would shed some light.

University faculty today is typically evaluated based on their performance in teaching, scholarship and service. And increasingly “scholarship” has come to mean discovery-based research. This, however, is a relatively recent development. As noted in a concise summary in Ernest Boyer’s “*Scholarship Revisited: Priorities of the Professorate*” [3], the focus of scholarship has changed over time. In the colonial period, the focus was on the student, and teaching was the primary measure of the faculty. As the nation was being built in the early 1800s, the scholarship of action [4] and applied research were stressed. Discovery based research was actually begun outside the academy in the 1800s. It was not until 1945, with publication of Vannevar Bush’s “*Science: The Endless Frontier*” [5] that discovery-based research began to come into predominance in academia. With the increase in interest in technical education after WWII, and the surge of returning GIs to higher education under the GI Bill, there was a concurrent increased demand for faculty to teach them. The fresh PhDs were brought directly into the classroom. This was a significant change from earlier in the century, when faculty in engineering and business were drawn from practitioners with extensive applied experience. Now, faculty were entering the professoriate without this applied experience and, fueled by the interest in science and their recent discovery-based research experience, the model for higher engineering education was set. As a result, the standards used to measure academic prestige narrowed and “established a too narrow definition of scholarship” and “too limited range of instruction” [5] for engineering education.

To address this narrowing definition – not just in engineering but also in all fields – the Carnegie Foundation published in 1990 Ernest L. Boyer’s “*Scholarship Revisited: Priorities of the Professoriate*” [3]. In it, Boyer makes the case for considering not just the scholarship of discovery, but the scholarship of integration, application and teaching as well. While there clearly is need for discovery-based scholarship, it should be equally clear that the other three areas should be included – particularly in engineering. Paraphrasing Theodore von Karmen’s often quoted “Scientists discover what is, Engineers create what has never been”, it seems obvious that to create something requires integration and application, and certainly teaching. The type of scholarship considered important should fit the mission of the particular university and discipline, the constituencies and the times. One electrical engineering faculty member recently stated “there’s enough theory in my field for 100 years – what we need is to apply it.”

## Rewarding and Recognizing Faculty Contributions to Applied Research and Scholarship

Since recent experience has been dominated by discovery-based research, with the measure of importance being publication in prominent journals, the question arises “how do you assess the scholarship of integration, application and teaching?” What are the metrics?

To respond to this question, the Carnegie Foundation published “*Scholarship Assessed: Evaluation of the Professoriate*”[7] as a sequel to Boyer’s “*Scholarship Reconsidered*.” In it, a summary of six standards is presented to provide new metrics on what should be considered. These standards are: Clear Goals, Adequate Preparation, Appropriate Methods, Significant Results, Effective Presentation and Reflective Critique. Each university needs to develop standards appropriate to their needs. Indeed, each college and school should have the right to set their own standards, consistent with the university’s standards.

Many universities are doing just that. California State University at Monterey Bay has developed a statement of “*Professional Application*”[8]. It is worth considering their definition, which goes as follows:

*Faculty engaged in Professional Application use their academic training and experience to serve the public and contribute to the CSU Monterey Bay vision. The diversity of external needs, as well as faculty training and experience, leads to many different forms of Professional Application; however, the Professional Application activities share all of the following distinguishing characteristics:*

- a. They contribute to the public welfare or the common good;*
- b. They call upon faculty members’ academic and/or professional expertise;*
- c. They directly address or respond to real-world needs; and*
- d. They support the CSU Monterey Bay vision.*

The faculty member’s contributions to Professional Application shall be evaluated using the Performance Evaluation Standards for scholarly achievement.

Michigan State University has also adopted guidelines for evaluating outreach. In its publication “*Points of Distinction: A Guidebook for Planning & Evaluating Quality Outreach*”[9] published in 1996, they note that “The Provost’s Committee on University Outreach defines outreach as ... a form of scholarship that cuts across teaching, research, and service.” “It involves generating, transmitting, applying, and preserving knowledge for the direct benefit of external audiences in ways that are consistent with university and unit missions.” In Ernest Lynton’s “*Making the Case for Professional Service*”[10] it is stated that “The argument for faculty to provide professional service turns ... on the more general benefits of becoming more central to the life of the larger society ...” Lynton goes on to establish the case from professional service as a scholarly activity and the importance of the combination of the scholarships of integration, application, teaching and discovery.

The general requirements for promotion at Purdue University’s School of Technology states; “that a candidate will have demonstrated and documented excellence and continuous improvement in teaching as evidenced by student learning. In addition, consistent with the University’s promotion criteria, candidates are expected to have demonstrated accomplishments in the areas of discovery and engagement [11].”

Other schools, including the University of Dayton, School of Engineering, have also expanded the definitions for evaluating faculty for tenure and promotion.

It seems to us that now is the time to expand the role of scholarship broadly for engineering education in the United States, to respond to the health of academia and the needs of our constituencies. In particular, we need to emphasize the professional role of the engineer and enhance programs that develop the holistic engineer called for by Dr. Bordogna. In closing his ASEE address, he used a quote from John F. Kennedy: *“Let us think of education as a means of developing our greatest abilities, because in each of us there is a private hope and dream which, fulfilled, can be translated into benefit for everyone and greater strength for the nation.”* We, as the leaders of engineering education in the United States, need to set the example by creating the education experience that liberates this dream in our students and ourselves.

## References

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