

## A KALEIDOSCOPIC PERSPECTIVE ON PKAL'S FUTURE: GRAND CHALLENGES IN UNDERGRADUATE STEM EDUCATION

– A distillation as a resource for discussions at the 2006 PKAL F21 National Assembly, taken from the PKAL National Steering Committee 'White Paper'

### I. THEMES RELATING TO CURRICULA/ACADEMIC PROGRAM

- A. A most compelling argument is made for PKAL's leadership in advancing national discussions and activities relating to "...exceptional models of undergraduate interdisciplinary curricula in areas at the forefront of current interdisciplinary research in STEM fields."

Suggested approaches to be explored:

- a mechanism for PKAL/PKAL F21 faculty to collaborate across institutional/disciplinary boundaries in the design, implementation, and assessment of new interdisciplinary programs that serve 21<sup>st</sup> century undergraduates and science
- a national effort of STEM faculty leaders to gather, analyze, use, and disseminate data about the effectiveness of ID programs (*what works and how do we know?*)
- discussions with disciplinary societies to jointly sponsor seminar/colloquia at national meetings on cross-disciplinary research and teaching (*see II, below*)
- capturing the expertise and passion of newly-minted faculty, whose graduate experience is ID (*see II & III, below*).

Building on experience and expertise and visions within PKAL:

- this mirrors PKAL's earliest focus on spotlighting programs that work, promoting their adaptation and further assessment. The difference is that in 1990, our focus was primarily on pedagogical issues, now it is time to connect pedagogical/content issues from PKAL's Leadership Initiative (PKAL LI), by summer of 2007, we will have available carefully-gathered data about *what works* in building robust interdisciplinary learning environments
- the PKAL F21 network includes many current leaders at the national level in undergraduate ID programs
- 2006 F21 members visions of 2016 are significantly about ID
- a large number of the Chicago assembly sessions are about ID programs
- 250+ PKAL workshops, since 1992, on topics of identified interest to STEM leaders, including gathering and posting of relevant materials.

- B. An equally compelling argument calls for a national discussion about curricular programs that best serve the preparation of K-12 math/science teachers (*see III, below*).

Suggested approaches to be explored:

- a *Roundtable on the Future* to promote dialog at the 'cutting-edge' among national STEM leaders and to convert emerging innovative ideas into tangible approaches for K-20 collaborations (how to design curricula that recognize different learning styles, use technologies to assess student learning, shape ID K-12 collaborations, etc.)

Building on experience and expertise within PKAL:

- record of biennial *Roundtables on the Future*, from which emerged new ideas and resources for PKAL and for the larger community of stakeholders
- PKAL F21 and PKAL connections to the MSP initiatives.

## II. THEMES RELATING TO NEW KINDS OF CONNECTIONS

- A. Several 'challenges' make the explicit or implicit case that PKAL must seek aggressively to serve (connect to) the broader higher education community, building on its traditional base of liberal arts colleges and its current demographics (significant involvement of leaders from comprehensive universities in PKAL, and the contribution of leading R1 academics as presenters/advisors), and honoring PKAL's aversion to 'reinventing.'

Suggested approaches to be explored:

- with interdisciplinary research as a "carrot," explore connections between 2-year/4-year/comprehensive/research universities to provide a seamless involvement in 21<sup>st</sup> century S&T that attracts student interest in STEM fields, helps them succeed, and motivates them to pursue graduate school/careers by making them competitive candidates for post-baccalaureate success
- identify faculty leaders— on minority-serving campuses and all others— already concerned about the seamless advancement of undergraduates into the S&T community, document *what works*, for whom, and gain their perspective on what now needs to be done
- identify leaders on R1 campuses already concerned about the 'graduate-student/post-doc/early faculty' careers stages and explore feasibility of/need for greater attention to persons in these career stages: document *what works*, for whom, and gain their perspective on what now needs to be done (*see III, below*).

Building on experience and expertise within PKAL:

- since 1994, attention to assisting early-career faculty (F21) in pursuing a satisfying academic career
- examples of multi-institutional development of research centers for undergraduates
- 'models' of networks orchestrated by PKAL-folk: Faculty in Undergraduate Neuroscience (FUN); Genomic Consortium for Active Teaching (GCAT), etc. involve all educational sectors
- PKAL activities and wisdom relating to leadership development (Baca Summer Leadership Institutes, etc.)
- PKAL's emphasis on identifying, distilling, and disseminating *what works*.

- B. Threaded throughout the white paper are calls for new kinds of formal and informal connections to co-conspirators.

Suggested approaches to be considered:

- link to the work of disciplinary societies/professional associations so not to duplicate but rather to enhance individual and collective efforts to strengthen undergraduate STEM (program/faculty/etc.)
- design future faculty development programs to serve faculty at all types of campuses (*see III, below*).

Building on experience and expertise with PKAL:

- PKAL's formal DSEA network (disciplinary society-educational association) meets several times a year to share ideas, visions, etc. (attempts at common program development have, heretofore, fallen flat)
- number of PKAL-active people as leaders in national disciplinary societies
- PKAL's nascent 'leadership development' connections to the undergraduate engineering community
- PKAL's desired image as a broker of intelligence.

### III. THEMES RELATING TO PEOPLE

For all obvious reasons, all challenges described in this white paper have at their core the need to focus on people— at all stages in a career as learner, at all stages in a career as an S&T professional.

- A. Preparing first-rate K-12 math and science teachers is the keystone of the growing effort to “build a nation of learners,” a “nation of innovators” in the context of recognizing the importance of the STEM workforce and an informed citizenry to sustaining a robust economy/strong democracy.

Suggested approaches to be explored:

- gather, assemble, distill, and disseminate *what works* when there are K-20 connections focusing on the education of future K-12 teachers in math and science, recognizing the variety of successful (but isolated) programs that work
- host a PKAL roundtable on the future, assembling 30 of the cutting-edge reflective practitioners in shaping K-20 partnerships
- orchestrate this dimension of PKAL in concert with representatives from the National Science Teacher’s Association (NSTA), the National Research Council’s Teacher Advisory Council, etc.

Building on expertise and experience within PKAL:

- identify the significant number of PKAL connections to the NSF-funded Math/Science Partnerships
- PKAL’s ten-year history of *Roundtables on the Future*

- B. The most direct focus on undergraduates, in the description of what was called the “3+G” program, can be generalized for a broader set of collaborative efforts to ensure the success of students from under-represented groups from institutions of all types. In addition, the curricular initiatives described above (interdisciplinary/K-12 science/math) have a direct impact on student learning.

Suggested approaches to be explored:

- exploring the feasibility of a program such as “3+G,” beginning with some environmental scanning to identify existing models of successful programs.

Building on expertise and experience with PKAL:

- reflect on Shirley Malcom’s 1991 PKAL challenge: “...that any problems in securing the persistence and success of students currently under-represented in the study and practice of STEM are but the canary in the mine...”

- C. One challenge makes it clear that: “Undergraduate student learning in STEM disciplines relies directly on the quality and success of faculty that students encounter.” The multi-faceted nature of this challenge is evident throughout, anticipating the potential for PKAL to have a significant role in:

- the preparation of graduate students and post-docs for roles as undergraduate STEM faculty
- considering changing definitions of faculty roles, particularly in R1 institutions, given the increased presence of teaching faculty in those settings
- giving faculty experience/expertise with research, teaching, and learning in an interdisciplinary undergraduate STEM learning environment
- giving faculty at all career stages experience/expertise with new ways of teaching, new pedagogies, new visions of learning communities, leadership theories and practice, etc.

Suggested approaches to be explored:

- establish a series of year-long professional development seminars designed to serve faculty at four career stages: pre-career; early career; mid-career; and late career (four weekend events annually; one week-long event)
- encourage the establishment of virtual and actual learning communities engaging seminar participants to foster continued exchange of expertise and mentoring
- review existing programs with similar scope and intent, such as Harvard Graduate School and Byrn Mawr HERS, as well as those sponsored by disciplinary and professional societies
- continue to expand PKAL's web/print leadership and faculty development resources, capturing materials prepared for and emerging from these seminars
- assess all activities relating to faculty development to determine *what works*– impact on learning of students; impact on institution; impact on faculty careers.

Building on expertise and experience with PKAL:

- 225+ workshops addressing similar issues
- summer leadership institutes
- PKAL F21 network
- large number of presidents, deans, provosts in PKAL leadership (270+ F21 deans and departments chairs)
- PKAL's focus on leadership at the institutional level
- PKAL's Volume IV postings.

#### IV. THEMES RELATING TO DISSEMINATION

Ideas relating to expanding PKAL's dissemination efforts, in face-to-face meetings, print publications, electronic publications are threaded throughout the white paper. Thus, imbedded in the various individual activities for the future will have to be plans for dissemination, including approaches such as:

- series of published papers on specific topics relating to a specific initiative (building interdisciplinary learning environments; enhancing the transition of graduate student in STEM faculty; leadership; etc.)
- handbooks for each seminar/workshop
- a peer-reviewed journal (general or topical) on leadership in undergraduate STEM
- roundtables on the future
- regional clusters/virtual clusters of faculty learning communities
- gathering, analyzing and disseminating documentation of *what works*.

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More to come, lots more to think about: ideas ready for implementation; ideas that will need further research; new collaborators and partners to identify; etc.

Jeanne