A Model Program for Promoting Effective
Teaching in Colleges of Engineering

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SUCCEED (Southeastern University and College Coalition for Engineering Education) is a National Science Foundation-sponsored coalition of engineering schools. The participating institutions are Clemson University, University of Florida, Florida A&M University–Florida State University, Georgia Institute of Technology, North Carolina A&T University, North Carolina State University, University of North Carolina at Charlotte, and Virginia Polytechnic Institute and State University. The coalition began its second five-year funding period in 1997 with a mission of scaling up and institutionalizing the educational reforms developed and pilot-tested in the first five years.

A major component of the Year 6–10 effort is the design and implementation of a coalition-wide faculty development (FD) program. The program objectives are (1) to promote faculty adoption of instructional methods and materials that have been proven effective by classroom research; (2) to improve institutional support for teaching at each of the coalition campuses; and (3) to have a sustainable engineering FD program in place on each campus by the end of Year 10.

Many universities throughout the United States have faculty development programs, usually coordinated by a campus-wide teaching center. Some of these programs have played an important role in raising the quality of instruction in colleges of engineering, but most have had relatively little impact on the engineering faculty. For various reasons, many engineers lack respect for pedagogy as a discipline and consider programs sponsored by campus teaching centers as largely irrelevant to their courses, students, interests and problems. The problem is exacerbated by the fact that most faculty development personnel come from backgrounds in education or the social sciences, and so are not prepared to use the terminology and provide the concrete examples that would convey a sense of relevance to the engineers. Part of the task of the SUCCEED faculty development program is to overcome this disconnect—to help build effective faculty development programs in engineering that have strong and synergistic links to existing campus-wide FD programs.

The SUCCEED institutions are at widely varying points in their faculty development efforts. Some colleges have well-developed institutional support structures (campus-wide teaching centers, funds to support innovative teaching and curriculum changes, significant financial recognition of effective teaching), while others lack even the most basic support elements. Rather than trying to define a "one-size-fits-all" faculty development model, we have attempted to identify key FD program elements that should be in place at each institution and to offer

examples of forms the elements might take. In this paper we outline the model and give examples of its implementation on three SUCCEED campuses. Since we are now only in the second year out of the five we have planned for full implementation of the model, what we report here should be viewed as a preliminary stage of a work in progress.

OVERVIEW OF THE MODEL

The components of the SUCCEED faculty development model are shown schematically in Figure 1, following which the elements of the model are described.
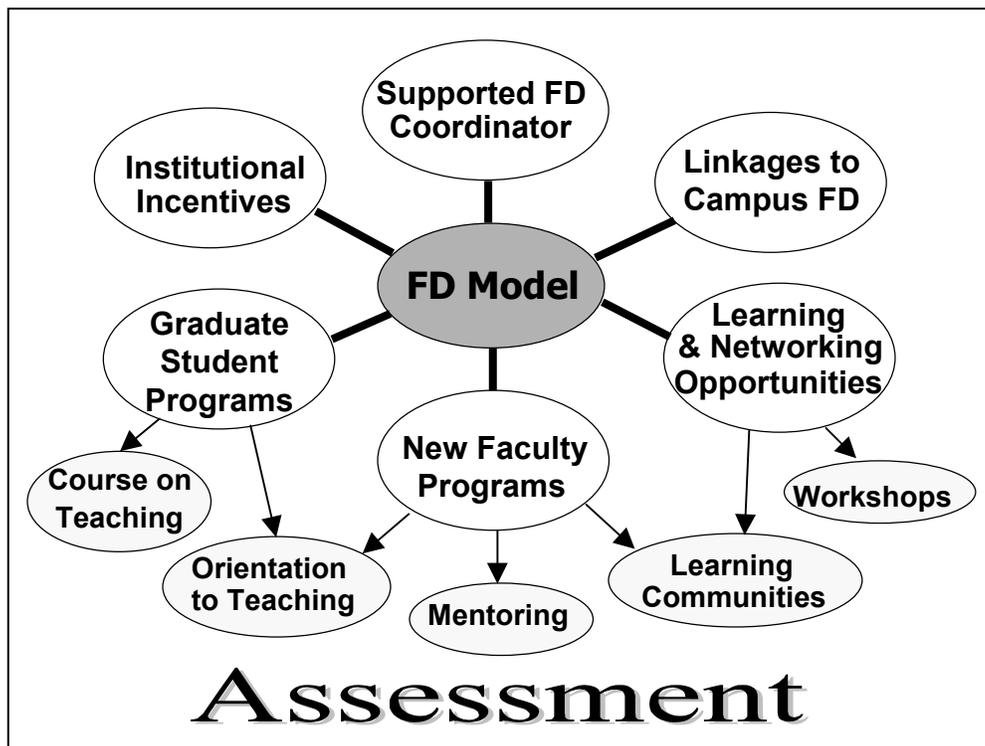

Figure 1. Elements of the SUCCEED Faculty Development Model

Faculty development coordinator

Two of the authors have had occasion to present teaching workshops on almost 100 campuses, many of which have teaching centers or other faculty development programs. Few of those programs seem to have had a significant impact on engineering education, but those that did had one common characteristic: an individual affiliated with the College of Engineering who had faculty development as his or her primary responsibility. Funds within the college were allocated to provide the coordinator's salary, staff support, and a reasonable level of support for FD program activities.

In the far greater number of schools where faculty development activity in engineering was minimal or nonexistent, one of the following situations was observed: (1) no one in engineering assumed more than token responsibility for faculty development, with professors and administrators arguing either that faculty development was not needed or that the campus teaching center was sufficient; (2) engineering faculty development was one of many charges given to an associate or assistant dean but no one had FD as their principal assignment; or (3) an individual was designated as engineering FD coordinator and charged with improving teaching in the college, but was not given adequate staff support and funding to accomplish anything meaningful.

Effective faculty development does not take place in a vacuum. Either a respected engineering faculty member or an education specialist must be in charge of it, be provided with adequate resources to accomplish it, and be held accountable for its success or failure. The coordinator should not be expected to do all the work in FD but should involve engineering faculty as *teaching leaders* in seminars, workshops, and discussion or study groups.

Linkages to campus-wide faculty development programs

The fact that campus-wide teaching centers have not had a major impact on engineering education on many campuses does not mean that they cannot have one. The centers are frequently sources of pedagogical expertise that complements the disciplinary expertise of engineering faculty members. Engineering FD programs should therefore coordinate their activities with campus programs to the greatest possible extent. Teaching center personnel should be invited to participate as co-presenters or co-facilitators with engineering teaching leaders and to coordinate participation of other non-engineering faculty members. The engineering FD coordinator should keep engineering faculty informed about opportunities available to them through the teaching center and other campus-wide programs.

Learning and networking opportunities

Active/interactive workshops of three hours or longer specifically designed for engineering may be organized and facilitated by engineering teaching leaders working collaboratively with campus education specialists. Shorter and less interactive seminars may be useful additions to an instructional development program, but they are generally less effective at promoting change and should not be used as substitutes for workshops. The programs may be offered to all interested faculty members, or separate programs may be designed for new faculty members (and graduate students), experienced but traditional faculty members, and faculty members who seek advanced instruction on the topics to be covered.

Learning communities are formed by groups of two or more faculty members who agree to support one another in their efforts to improve their effectiveness as instructors. The brown-bag lunch forum or teaching circle is a popular structure for such programs. Sessions of this type may be department or college-based or campus-wide and are often organized around specific pre-announced topics, such as a recent paper or book chapter, a specific instructional method or device, or a problem that one of the community members wishes to discuss. Communities may also take the form of teaching support groups that include mutual observation and critiquing of classes, assignments, and tests.

Programs for new faculty

Workshops and learning communities should be open to both new and experienced faculty members; however, the unique technical and personal problems faced by new faculty members are significant enough to warrant support programs specifically tailored to them.

Pre-semester workshops and/or periodic seminars during the semester might be offered to introduce new faculty to student learning styles, basic classroom instructional techniques, learning assessment and evaluation practices (including but not limited to testing and grading), and survival skills. Learning communities might be designed specifically to provide new faculty members with opportunities for small group discussions, networking, and support. The most effective support mechanisms might be mentorships, in which experienced faculty members provide guidance to new faculty members on matters such as planning and presenting courses, starting and building research programs, and balancing the inordinate time demands that are part of every faculty member's life.

Programs for graduate students

An important part of an engineering faculty development effort is helping to prepare the future professoriate. Many of the adjustment problems faced by new faculty members could have been minimized if some orientation to the profession had been provided when they were graduate students.

Orientation workshops and/or periodic seminars might be offered to teaching assistants and graduate students contemplating academic careers, covering topics such as addressing different student learning styles, effective lecturing techniques, active and cooperative learning, dealing with common student problems, and survival skills. Mentorship programs might also be structured in which graduate students interested in teaching are paired with experienced faculty to complete short teaching experiences and/or to conduct classroom research studies. Finally, a semester-long course on college teaching might be offered for credit.

Institutional incentives for improving teaching.

Designing and implementing any of these programs on a continuing basis will require a substantial commitment of faculty time and energy. For systemic changes to take place (as opposed to isolated changes made by a few dedicated individuals), the institution should demonstrate with more than rhetoric that it values efforts by faculty members to improve the institution's instructional program. The demonstrations might involve providing support for teaching improvement efforts, educational scholarship, or professional development activities.

Funds might be allocated to provide release time, summer support, or travel or equipment grants to teaching leaders, mentors, and other faculty members who participate actively in faculty development programs. Guidance and support (again possibly including release time and/or grants) might be provided to individuals or groups of faculty members engaged in revising courses or curricula, developing multidisciplinary projects, developing or adapting instructional technology, preparing distance course offerings, carrying out systematic program assessment and evaluation, or conducting classroom research. Funding might be provided for faculty members to attend national and regional conferences and workshops such as the ASEE Annual

Conference, Frontiers in Education, or the National Effective Teaching Institute. Special programs might be instituted to identify campus teaching leaders in engineering, perhaps past winners of outstanding teaching awards or faculty known for their effective use of innovative instructional techniques. These teaching leaders might receive a salary supplement or release time to take a leadership role in faculty development activities on campus, whether it be leading a workshop for new faculty, convening a monthly teaching circle, or mentoring new faculty. Above all, a clear message should be sent that a commitment to effective teaching is a requirement for all individuals in faculty positions that involve teaching, and that participation in teaching improvement or professional development programs will be an important indicator of such a commitment in annual reviews and in promotion and tenure dossiers.

Program assessment and evaluation

Each program element will be assessed and evaluated. Various assessment methods will be used, including recording levels of faculty participation, collecting participant evaluations of workshops and seminars, administering follow-up surveys to participants and monitoring changes in their teaching practices and student ratings, and analyzing data from biennial coalition-wide assessments of faculty teaching practices and perceptions of institutional support of teaching (Felder, Brent, Miller, Brawner, & Allen, 1998).

ILLUSTRATIVE IMPLEMENTATION PLAN: N.C. STATE UNIVERSITY

The SUCCEED model defines elements of an engineering faculty development program but does not prescribe details of implementation, and a wide variety of FD programs are currently being developed on the eight coalition campuses. This section outlines the planned program for North Carolina State University (NCSU) as an illustration. Some of the support for the program features to be listed will come from SUCCEED funding and much of it will come from institutional matching funds. If the objectives of the development effort are met, however, by August 2002 the program will be totally supported by N.C. State University, the NCSU College of Engineering, and individual engineering departments.

The planned faculty development program for the N.C. State University College of Engineering will have the following components:

1. A clearly stated administrative responsibility for faculty development at the Associate Dean level, a designated faculty development coordinator for the College of Engineering who reports to the designated administrator, staff support for the coordinator, and committed resources for FD programs and activities.

2. Strong links to the NCSU Faculty Center for Teaching and Learning (FCTL), including joint sponsorship of workshops and seminars for engineering and science faculty, collaboration between engineering faculty and FCTL personnel in the presentation of these programs, and promotion of FCTL activities within the College of Engineering.

3. Ongoing learning and networking opportunities for faculty members.

   - A minimum of one teaching workshop each year. The workshops will include a general teaching effectiveness workshop offered to all faculty, a refresher workshop

for alumni of the first workshop, and shorter workshops on specific topics. Topics currently contemplated include addressing diversity in the classroom, effective teaching with technology, assessing learning outcomes, and teaching to address ABET Engineering Criteria 2000.

- COE-Teach, a monthly lunchtime teaching discussion group

4. Programs for new faculty

- Orientation to Teaching Workshop (also given to graduate students)
- FCTL New Faculty Seminar Series
- Mentorship program for new faculty members

5. Programs for graduate students

- Orientation to Teaching Workshop (also given to new faculty)
- NCSU *Preparing the Professoriate* mentorship program
- FCTL Graduate Teaching Assistant seminar series

6. Rewards and incentives for effective and innovative teaching

- University-sponsored small grants for course and curriculum redesign and other educational projects

- Support at the college level for course and curriculum redesign and other projects intended to improve teaching and learning

- Support at the department level for attendance at education conferences and workshops

- Well-defined plan for assessment and evaluation of teaching and educational scholarship and a policy of incorporating the results in the decision-making process for promotion, tenure, and raises

7. Program assessment.

The following outcomes will be achieved by the end of Year 10 if the faculty development program objectives are met.

1. 60% of engineering faculty involved in at least one FD activity (general workshop, topical workshop, learning community, SUCCEED conference mini-workshop).

2. At least 50% of new faculty entering between Y7–Y10 attending an Orientation to Teaching Workshop, involved in a mentoring program, or attending the FCTL New Faculty Seminar Series.

3. Changes in Year 10 faculty survey results[1]:

- A significant increase in the use of effective and innovative teaching techniques (specifically brief and extended in-class groups and required team homework).

- Faculty perceptions of increased support for teaching by colleagues and administrators and a greater role of teaching in the reward system.

4. Full institutional support of faculty development activities by the end of Year 10. A projected schedule for transfer of support from SUCCEED to NCSU is shown in Table 1.

Table 1. Faculty Development Program Institutionalization Timetable

	SUCCEED-sponsored activity	**College or dept.-sponsored activity**
Year 6	- Orientation to Teaching Workshop - Support for professional development - FD Coordinator for COE	- One teaching workshop (2.5-day general)
Year 7	- COE-Teach (lunchtime discussion) - Topical workshop - Support for professional development - FD Coordinator for COE	- One teaching workshop (1-day refresher) - Orientation to Teaching Workshop
Year 8	- Mentorship programs - Support for professional development - FD Coordinator for COE	- Assignment of administrative responsibility for FD - One teaching workshop (topical) - Orientation to Teaching Workshop - COE-Teach - Development of uniform teaching assessment & evaluation procedure
Year 9	- Mentorship programs - Support for professional development - FD Coordinator for COE	- One teaching workshop - Orientation to Teaching Workshop - COE-Teach - FD Coordinator for COE - Implementation of uniform teaching assessment & evaluation procedure
Year 10		- General teaching workshop - Orientation to Teaching Workshop - COE-Teach - FD Coordinator for COE - Topical workshop - Mentorship programs - Increased support for professional development (dept. level) - Incorporation of teaching assessment & evaluation procedure in review processes for promotion, tenure, and raises

IMPLEMENTATION PLANS ON OTHER SUCCEED CAMPUSES

Each of the SUCCEED campuses is working on creating a sustainable faculty development program. In this section of the paper, we highlight developments at two of the campuses and include a matrix of key components by campus to illustrate the wide range of applications across the different universities.

Clemson

At Clemson, a team of engineering teaching leaders including Douglas Hirt and William Moss have teamed with Debi Switzer, a faculty member from education, to deliver a series of introductory workshops for new engineering and science faculty. Based on the presentations of Felder and Brent, the workshops focused on topics including instructional objectives, active learning, Bloom's taxonomy, and effective testing. The team has also joined forces with Linda Nilson, director of Clemson's new Office of Teaching Effectiveness and Innovation (OTEI), to deliver additional workshops on assessing teaching effectiveness and on formulating a teaching philosophy and developing of a teaching portfolio. The plan is to offer this set of workshops each year with continued support from the College of Engineering and Science and OTEI.

Several other mechanisms are under way to promote effective teaching.

- OTEI provides a service in which they solicit mid-semester feedback from students in a course through written and/or oral surveys (an on-line version of the written survey will be available in the Fall) and communicates the results to the instructor. In the first year it has been offered, this service has been requested by several engineering faculty and the number of requests is expected to grow as word of the availability and value of the service spreads.

- This past year a Faculty Teaching Fellows Program was initiated in the College of Engineering and Science. The idea is to select from nominations faculty members to serve as teaching mentors in the College. Teaching Fellows will conduct workshops and seminars on education-related topics of interest to them (e.g., multidisciplinary design). Each Fellow will be provided $5,000 for summer support or academic release time plus $1,000 for travel. Thus far, the level of interest has not been overwhelming. Some have suggested that the incentive is not great enough, so the program is being re-evaluated to make it more attractive to experienced faculty who would be interested in providing mentoring in the College.

- The College's Teaching Effectiveness Committee is the major body that drives teaching improvement. The committee organizes workshops, seminars, and faculty forums that address a variety of issues related to science and engineering education (e.g., teaching with technology, integrated design, student retention, active learning, teaching tips from award-winning faculty). The College promotes effective teaching by allocating a portion of its budget to support these activities.

As with other SUCCEED institutions, the success of Clemson's FD program depends on the continuation of these activities after the coalition funding ceases. The keys to ensuring sustained faculty involvement include supporting and expanding the engineering teaching leader team, extending interactions with OTEI, and maintaining College support for FD activities.

Virginia Polytechnic Institute and State University

Virginia Tech has a strong faculty development program on campus in its Center for Excellence in Undergraduate Teaching. In addition, an interdisciplinary group within the university has been studying learning communities on campus and is encouraging their

establishment among faculty and students. Siegfried Holzer, the SUCCEED campus coordinator for faculty development, and Terry Wildman the CEUT director, are currently working together to support the development of an Engineering Learning Community at Virginia Tech. Representatives have been recruited in each engineering department to invite colleagues to participate in the ELC activities. Events are made accessible to all interested faculty by holding identical sessions on two consecutive days.

A core group of faculty is taking the lead in the planning of workshops and new faculty mentoring programs. Several of these individuals have attended coalition-wide seminars to develop their expertise as leaders in mentoring and new faculty orientation. These efforts are also being closely coordinated with existing campus FD programs.

Matrix of Planned Faculty Development Programs

Table 2 summarizes the elements of the planned FD programs on all eight SUCCEED campuses. Some of the items shown are already in place, others are currently being planned, and still others will be developed by the end of Year 10 of the coalition's funding. We look forward to providing reports on progress toward full implementation of the model in the years between now and then.

Acknowledgment

Reference

1. Felder, R. M., Brent, R., Miller, T. K., Brawner, C. E., & Allen, R. A. (1998). Faculty Teaching Practices and Perceptions of Institutional Attitudes toward Teaching at Eight Engineering Schools. *Proceedings of the 1998 Frontiers in Education Conference*, ASEE/IEEE, November 1998.

REBECCA BRENT
Rebecca Brent is an Education Consultant and co-director of the SUCCEED Coalition Faculty Development Program. She was an Associate Professor of Education at East Carolina University until 1996 where she taught undergraduate and graduate courses in classroom organization and management and instructional planning. She has published articles on writing across the curriculum, classroom and computer-based simulations, and effective teaching and together with Richard Felder has presented over 100 teaching workshops throughout the United States and in Europe, the Far East, Africa, and South America. Dr. Brent received a B.A. degree in music education from Millsaps College in 1978, a M.Ed. in education from Mississippi State University in 1981, and an Ed.D. from Auburn University in 1988.

RICHARD M. FELDER
Richard M. Felder is Hoechst Celanese Professor of Chemical Engineering at North Carolina State University and co-director of the SUCCEED Coalition Faculty Development Program. He is co-author of the introductory chemical engineering text used by most American universities and of over 100 papers on chemical process engineering and engineering education, and has won numerous national and regional awards for his teaching and writing on engineering education. In 1993 he was designated as one of five outstanding engineering educators of the century by the Southeastern Section of the American Society for Engineering Education.

DOUGLAS HIRT

Doug Hirt is Associate Professor of Chemical Engineering at Clemson University and has been active in the Communication-Across-the-Curriculum Program. He has been the recipient of a Dow Outstanding New Faculty Award from ASEE and the 1998 Raymond W. Fahien Award from the Chemical Engineering Division of ASEE. Dr. Hirt is the SUCCEED Campus Implementation Team leader and Faculty Development coordinator at Clemson University.

SIEGFRIED HOLZER

Siegfried Holzer is an Alumni Distinguished Professor of Civil Engineering at Virginia Polytechnic Institute and State University. He has developed a series of multimedia learning modules on statics and the mechanics of materials and is using them in a comprehensive learning environment that integrates physical models, interactive multimedia, and cooperative learning. He is also involved in building learning communities among faculty and students. Dr. Holzer is the SUCCEED Campus Implementation Team leader and Faculty Development coordinator at Virginia Tech.

DEBI SWITZER

Dr. Switzer received a B.A. in mathematics at the University of Texas at Austin and a Ph.D. in educational psychology at the University of Illinois. Since coming to Clemson in 1989, she has chaired the University Teaching, Resources, and Effectiveness committee and has conducted many effective teaching workshops and workshops on faculty teaching portfolios across the state. She was nominated for the Prince Award for Creative Teaching and for the Alumni Master Teacher Award and recognized by the South Carolina Commission on Higher Education for her contribution to improvement of teaching at Clemson University.

Table 2
Faculty Development Activities by Campus: 1999-2002

	Coordination of FD in Engr.	Learning Opportunities	New Faculty Programs	Graduate St. Programs	Rewards & Incentives	Linkages with Campus FD
Clemson	-Teaching Effectiveness Comm. in college	-Two annual wkshs. -2 annual seminars/fac. forums	-Orientation Wksh. series -Fac. Teaching Fellows Prog. to enhance mentoring	-Invite grad. st. to participate in workshops	-Fac. Teaching Fellows Program -Travel support -Inclusion of T'ching in P/T reviews -Evaluate best practices in assessing teaching	-Coordination with new university Office of Teaching Effectiveness and Innovation
FAMU-FSU	-FD Coordinator	-One annual workshop -Locally-led topical workshop -"On Shoulders of Giants" learning community	-Orientation Wksh. -Invite to attend "Program for Instructional Excellence"	-Invite grad. st. to attend Orientation Wksh. -"Program for Instructional Excellence" (univ.)	-Travel support -$500 grants for innovative teaching methods (travel or materials)	-Coordination with "Program for Instructional Excellence"
GA Tech	-Part-time position in college to provide input to CETL and develop engr-specific FD	-One annual wksh. -Community of fac. meeting regularly	-Annual Effective Teaching Workshop -Encourage new fac. to participate in existing programs -Voluntary mentoring prog.	-Program for TA's (univ.)	-Foundation Faculty of the Future Prog, -Inclusion of teaching in P/T and post-tenure reviews	-Representative from each dept. on Board for Center for Enhancement of Teaching and Learning (CETL)
NC A&T	-FD Coordinator in college	-Participation in university prog. of workshops -Brown-bag discussion group	-Orientation program -Mentor assigned	-Invite grad. st. to participate in workshops	-Travel support -Excellence in teaching awards -Inclusion of teaching in P/T reviews	-No existing teaching center
NCSU	-FD Coordinator under direction of Associate Dean	-One annual workshop -COE-Teach (monthly lunchtime discussion group)	-Orientation Wksh. -Mentoring program	-Orientation Wksh. (college)	-Course & curr. re-design grants -Travel support -Plan for inclusion of T'ching in evaluation system	-FD Coordinator represented on Advisory Board for Faculty Center for Teaching and Learning (FCTL)

	Coordination of FD in Engr.	Learning Opportunities	New Faculty Programs	Graduate St. Programs	Rewards & Incentives	Linkages with Campus FD
Univ. of FL	-Associate Dean as FD Coordinator with quarter to half time staff -FD representative from each dept. (rotating leadership)	-Annual series of workshops & seminars -Brown-bag discussion group -Interactive FD web site	-Orientation Wksh. -Teaching workbook -Assignment of mentor	-TA training (univ.)	-Mini-grants -Awards for innovation -Summer support	-Coordination with Center for Excellence in Teaching
UNC-C	-FD Coordinator at college level -Assessment & planning committee to oversee teaching assessment	-One annual wksh. -One annual teaching dialogue -Teaching circles	-Teaching circles -Improved mentoring program	-TA training (univ.)	-Travel support -Summer salary for teaching projects -Improve teaching assessment system	-Coordination with existing groups (Baklava, University Learning Center)
VA Tech	-Chair of T'ching Leaders, ELC -Y11: Assoc. Dean, CEUT Fellows & ELC core members ELC= Engr. Learning Community FDI= FD Institute CEUT=Ctr. for Exc. In Undergrad. Tching	-Three annual ELC workshops -ELC Networking mts. every 6 wks. -CEUT & FDI wkshs, seminars, study groups	-Improved mentoring program -Research familiarization prog. -New fac. invited to ELC activities	-TA training by CEUT -TA's invited to ELC activities	-Travel support -Excel. in Teaching awards -Inclusion of t'ching in P/T reviews -Academy of T'ching Excellence -University incentives (grants, computers)	-Strong link of ELC and CEUT -Joint sponsorship of ELC by SUCCEED and CEUT -CEUT-SUCCEED workshops -Developing link between ELC and FDI