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The Scholarship of Teaching Engineering at San José State University: a Faculty Member's Perspective*

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In the article, the author presents highlights from the scholarship of teaching engineering at San José State University (SJSU) in San José, USA, and he discusses the driving forces that have helped shape this scholarship. Significant quality improvements in several programmes have resulted from this effort. Although faculty initiative has played a key role in the success of these activities, it was the support from department chairs, the College Dean and the University Provost that helped create an atmosphere where the scholarship of teaching was encouraged, valued and rewarded through the retention, tenure and promotion process.

WHAT IS THE SCHOLARSHIP OF TEACHING?

Ernest Boyer, in his now very well known report, states that while

> *…scholarship means engaging in original research, it also means stepping back from one's investigation, looking for connections, building bridges between theory and practice, and communicating one's knowledge effectively to students* [1].

Thus, he sees scholarship as having four separate, yet overlapping functions. These are listed as follows:

- The scholarship of discovery (discipline research), which seeks to advance knowledge;
- The scholarship of integration, which seeks to make connections across disciplines and give meaning to isolated facts, putting them in perspective;
- The scholarship of application, which seeks to put knowledge in the service of the community, the nation and the world;
- The scholarship of teaching, which seeks to find effective ways to communicate knowledge to students.

THE SCHOLARSHIP OF TEACHING IN ENGINEERING

Engineering faculty have always been involved in curriculum and laboratory development. Innovation may well be present in developing new courses and laboratories; however, without rigorous assessment and dissemination, it cannot be considered scholarship.

Several recent developments have brought about the need for assessment and dissemination, and have contributed to a change in attitude towards the scholarship of teaching among engineering faculty and administrators; these are:

- Increased pressure from parents, taxpayers and legislators who are dissatisfied with the de-emphasis of undergraduate education at major universities;
- Employer complaints about the lack of professional awareness, communication and teamwork skills in engineering graduates;
- Challenges posed by the changing needs of student populations and, in particular, the diversity of native ability, background, motivation, attitudes and learning styles. These challenges seem to escalate considering the shrinking pool of applicants for engineering schools;
- The realisation that *traditional instructional methods will not be adequate to equip engineering graduates with the knowledge,*

skills, and attitudes they will need to meet the demands likely to be placed on them in the coming decades, while alternative methods that have been extensively tested offer good prospects of doing so [2];
- The new accreditation requirements in the USA (ABET EC 2000), which – as a response to the reasons given above – now hold engineering schools accountable for the knowledge, skills and professional values engineering students acquire (or fail to acquire) in the course of their education [3].

These forces, especially the new accreditation requirements, brought about assessment as a way of accountability. In addition, the need for dissemination and peer review of proposed innovations has led to a boom in the scholarship of teaching and education research in engineering in the USA and around the world. The following sections present highlights of the scholarship of teaching engineering at San José State University (SJSU) in San José, USA.

AEROSPACE ENGINEERING DEPARTMENT ACTIVITIES (1987-1996)

The need for extensive curriculum and laboratory development in new programmes offers many opportunities for faculty to pursue scholarly activities related to teaching. Dr Dick Desautel founded the Aerospace Engineering (AE) Department at the SJSU in spring 1987 with encouragement and support from Dr Jay Pinson, Dean of Engineering at the time [4]. Highlights of the AE programme developments, presented at AIAA and ASEE conferences, and published in the ASEE's *Journal of Engineering Education*, are listed below:

- Several core subjects were (and still are) taught as integrated lecture/laboratory courses. This required the development and integration of ten modern laboratories to provide students with hands-on experience in the major flight vehicle disciplines [5-7]. Several of them were unique at the time, such as:
  - The Gas Dynamics Laboratory (hypersonic shock tunnel to Mach = 10, supersonic blowdown tunnel to Mach = 4);
  - The Dynamics and Control Laboratory (spacecraft attitude determination and control experiments);
  - The Space Systems Engineering Laboratory (space power system, space communication system).
- In many core courses (eg aerodynamics, compressible flow, space systems engineering, aerospace structures, aircraft and spacecraft design), students were (and still are) taught to approach engineering problems using any appropriate combination of analytical, computational and experimental tools. Thus, AE laboratories include not only physical experiments, but also a variety of computer hosts with commercially available software for design and simulation of various subsystems [5][8][9];
- Laboratories were designed to integrate both research and instructional activities [10]. Students, both graduate and undergraduate were (and still are) encouraged to participate in research projects with faculty and present their results in student, as well as professional conferences.

Some of the most significant achievements in the early years of the AE programme include:

- Full accreditation in 1991 – only four years after its initiation;
- An enrolment growth to nearly 400 majors in 1991, with four full-time faculty members; one of the contributing factors was the concentration of several aerospace companies and government research facilities in the San Francisco Bay area, such as Lockheed (currently Lockheed-Martin), Ford Aerospace (later renamed Space Systems Loral), NASA Ames Research Centre, and a host of smaller aerospace engineering firms specialising in defence electronics;
- Several local, national and, in some cases, international student paper awards;
- The development of a microsatellite (SPARTNIK) by several teams of aerospace, mechanical, electrical and computer engineering undergraduates, the first ever multi-year, multidisciplinary project in the College of Engineering;
- Dr Desautel, the first Chair of the Department, was recognised with the *1993 AIAA Leland Atwood Award for* Outstanding *Aerospace Educators*, for his role in establishing the BSAE and MSAE programmes at the SJSU [11].

COLLEGE OF ENGINEERING ACTIVITIES (1996-2003)

Felder, Woods, Stice and Rugarcia have articulated the need for alternative teaching methods in their pioneering articles [12-14]. They stated that

> *...focusing lectures, assignments, and tests entirely on technical content and expecting*

> *students to develop critical process skills automatically is an ineffective strategy. Instructors who wish to help students develop problem-solving, communication, teamwork, self-assessment, and other process skills should explicitly identify their target skills and adopt proven instructional strategies that promote those skills* [13].

In 1995, the new Dean of Engineering Dr Don Kirk, recognising this need, initiated the Faculty Instructional Development Programme (FIDP). The Programme's goal was to create a learning community within the College, with a focus on improved instruction to better meet the needs of engineering students. The specific objectives of the Programme were to:

- Foster a reflective attitude towards teaching and learning;
- Introduce, promote and implement the use of student-centred teaching methods (such as, but not limited to, active and cooperative learning, project-based learning, problem-based learning, and inquiry-based learning) to address the students' diverse learning styles;
- Explore effective uses of technology in engineering instruction (eg multimedia, World Wide Web);
- Promote teamwork and leadership in instructional development by encouraging interested faculty to become mentors/coaches for their peers in any area related to innovative pedagogy and the use of technology;
- Promote engineering education research by developing a community of teacher-scholars;
- Seeking funding to advance course, curriculum and laboratory development.

In addition, Dr Kirk established criteria for assessing teaching effectiveness, as well as the scholarship of teaching [15]. The FIDP offered several workshops/seminars every semester under the title *Conversations on Teaching*. The complete list is shown in Table 1. Some of these workshops were offered by COE faculty, while others by outside experts. The FIDP was quite effective in introducing engineering faculty to alternative teaching methods. The results of this effort were presented at two UICEE-run conferences [16][17].

With the Dean's encouragement and support, several teams of engineering faculty collaborated in innovative, interdisciplinary curriculum and laboratory development projects, several of which resulted in grants from the National Science Foundation (NSF) and the Course, Curriculum, Laboratory, and Instrumentation (CCLI). With changing accreditation requirements for engineering programmes, the FIDP also served as a vehicle for training faculty in the new criteria, particularly in course, outcome and programme assessment [3]. Numerous engineering education papers were authored by COE faculty and presented in the USA, as well as at international venues. The most prevalent topics of these publications are detailed below.

Active, Cooperative Learning and Team-Building

By the early 1990s, engineering faculty were becoming more aware of the need to train students in team and small group communication skills. In addition, a plethora of literature demonstrated that students learned better when working with each other than when working in isolation or competing against each other. The author was the first COE faculty member to use cooperative learning in the classroom in the spring 1993 offering of the AE167 course (Aerospace Propulsion) with 80 students. The results were presented in a journal article, which received the 1998 SJSU Institute for Teaching and Learning Award for Research on College Teaching and Learning [18]. McMullin discussed teambuilding in civil engineering, while Allen and Gleixner presented cooperative learning as a way to engage students in the classroom [19-22]. Approximately 25% of the COE faculty currently use cooperative learning in their classes on a regular basis [23].

Like any new idea, cooperative learning was opposed by some faculty. One wrote a front-page article in a local newspaper calling cooperative learning *glorified cheating*. The Dean, supported with statements from several faculty members, responded promptly the next day providing scientific data in support of cooperative learning.

Laboratory Development

The COE at the SJSU has always emphasised hands-on work in the form of laboratory experiments, as well as design/build/test projects. Hence, it is not surprising that some of the scholarly work produced relates to the development and assessment of laboratories. Some of these laboratories (eg Mechatronics and Semiconductor Manufacturing) were developed to support new curricula, while others (eg Materials Engineering and Mechanical Design) were developed to support student projects [24-30].

Table 1: Workshops offered through the Faculty Instructional Development Programme in the College of Engineering

Date	Workshop Title	Presenter	Duration
3 Nov. 2004	Using inquiry-based learning to meet ABET outcomes	Partnership for student success in science (NSF-sponsored collaboration between COE faculty, industry and 9 San Francisco Bay Area school districts)	2 hr
15 Sep. 2004	Inquiry-based learning	Partnership for student success in science	3 hr
18 Nov. 2003	Engineering education research: design and funding	Nikos J. Mourtos, FIDP Coordinator	2 hr
9 Apr. 2003	Development of a multimedia module for a general education course	Pat Backer, Chair, Dept of Aviation and Technology, SJSU	2 hr
14 Mar. 2003	Helping new faculty members get off to a good start: a workshop for administrators and mentors	Richard Felder and Rebecca Brent, North Carolina State Univ./SUCCEED Coalition	4 hr
19 Feb. 2003	1. Use of computer simulation for design, analysis and optimisation of thermal systems 2. Web-based thermodynamics laboratory	Nicole DeJong and Jinny Rhee, professors, Mechanical and Aerospace Engineering	2 hr
31 Oct. 2002	Mediated Learning Experience: teaching the new generation of students	Myron Tribus, former Director, MIT Centre for Advanced Engineering Study	2 hr
23 Aug. 2002 22 Aug. 2001	Teaching engineering in the new millennium: a teaching effectiveness workshop for new faculty	Nikos J. Mourtos, FIDP Coordinator	1 day
2 May 2002 7 Dec. 2001	Multimedia in engineering education: integrating equations, graphics, and animations in *PowerPoint* presentations	Art Davis, professor, Electrical Engineering	2 hr
12 Apr. 2002	Mechanical Design Laboratory development for teaching	Raymond Yee, professor, Mechanical and Aerospace Engineering	2 hr
20 Mar. 2002	Development of a modular robot assembly for robotics education	Winncy Du, professor, Mechanical and Aerospace Engineering	
21 Feb. 2002	Transition or transformation: the role of teaching and learning in the 21st Century	Marshall Goodman, provost, SJSU	2 hr
31 Oct. 2001	Virtual laboratories in engineering education	Klaus Schilling, professor, Univ. of Applied Sciences, FH Ravensburg-Weingarten, Germany	2 hr
19 Oct. 2001	What constitutes good teaching? Assessing teaching effectiveness and educational scholarship [15]	Nikos J. Mourtos, FIDP Coordinator	2 hr
21 Sep. 2001	The future of engineering education, part III: developing critical skills [13]	Nikos J. Mourtos, FIDP Coordinator	2 hr
4 May 2001	The future of engineering education, part II: teaching methods that work [12]	Nikos J. Mourtos, FIDP Coordinator	2 hr
16 Mar. 2001	The future of engineering education, part I: a vision for a new century [2]	Nikos J. Mourtos, FIDP Coordinator	2 hr
22 Feb. 2001	Backward course design: a book review and discussion	Emily Allen, professor and Chair, Chemical & Materials Engineering	2 hr
22 Jan. 2001	Teaching design to freshmen	Nikos J. Mourtos, FIDP/E10 (Introduction to Engineering course for freshmen) Coordinator	4 hr
19 Jan. 2000	1. Exploring teaching and learning styles: the Felder-Silverman model 2. Bloom's taxonomy/instructional objectives	Nikos J. Mourtos, FIDP Coordinator	4 hr
21 Jan. 1999	Introduction to engineering: a time for change	Nikos J. Mourtos, FIDP/E10 Coordinator	2 hr
4 Dec. 1998	Setting-up e-conferencing on the World Wide Web	Ping Hsu, professor, Electrical Engineering (currently Associate Dean for Undergraduate Studies)	2 hr
30 Oct. 1998	Developing Web pages for your courses	Buff Furman, professor, Mechanical and Aerospace Engineering	2 hr
1-3 Oct. 1998	Improving teaching and learning processes	Dan Apple, Pacific Crest Teaching Institute	3 days
15 Sep. 1998	Portfolios: what are they good for?	Gloria Rogers, Institutional Research, Planning and Assessment, Rose-Hulman IT, NSF/ASEE visiting scholar	2 hr
16 Apr. 1998	Shaping the future of undergraduate education in science, mathematics and engineering	NSF workshop facilitated by COE faculty	1 day
12 Mar. 1998	Outcomes assessment in engineering education	Gloria Rogers, Institutional Research, Planning and Assessment, Rose-Hulman IT, NSF/ASEE visiting scholar	1 day
16 Oct. 1997	The Internet and higher education: silicon and fiber replacing bricks and mortar	Burks Oakley II, Assoc. Vice President for Academic Affairs, Univ. of Illinois	2 hr
2 May 1997	ABET Criteria 2000: programme outcomes and assessment	Mike Jennings, professor, Chemical and Materials Engineering	2 hr
11 Apr. 1997	Teaching with style: enhancing learning by understanding the diversity of teaching and learning styles	Tony Grasha, professor, Univ. of Cincinnati	1 day
15-16 Jan. 1997 15-16 Jan. 1995	Cooperative learning	Karl Smith, Centre for Interfacial Engineering, Univ. of Minnesota	2 day
31 Oct. 1996	Multimedia in engineering education – hype or help?	Buff Furman, Institute for Teaching and Learning (ITL), SJSU, fellow, professor, Mechanical and Aerospace Engineering	
30 Sep. 1996	Cooking without recipes: team teaching and team learning	Emily Allen, Chair, Chemical and Materials Engineering	2 hr
17 May 1996	Exploring our own learning	Nikos J. Mourtos, FIDP Coordinator	2 hr
15 Mar. 1996	Cooperative learning	Nikos J. Mourtos, FIDP Coordinator	2 hr

Multimedia in Engineering Education

Several faculty members took advantage of user-friendly courseware and the World Wide Web, and created innovative teaching tools for enhancing student learning of difficult engineering topics. Among them, Furman developed a computer-assisted approach for teaching mechanical design [31]. He developed animated tools for microelectronics [32]. Rhee presented Web-based teaching methods for thermodynamics [33].

Distance Learning

In fall 1999, the COE offered the first two courses online. The author taught fluid mechanics (ME111), which is an undergraduate required course for AE, CE and ME majors, and McMullin taught advanced seismic design (CE265 – a graduate elective for CE majors) [34]. The preliminary results from these two courses generated much discussion regarding the feasibility of online engineering courses and, in particular, the characteristics of students who might succeed in an online environment [35].

At the same time, an interdisciplinary team of faculty (B.J. Furman and the author from Mechanical and Aerospace Engineering, P. Hsu from Electrical Engineering and K. McMullin from Civil and Environmental Engineering) explored the possibility of offering laboratory courses via the Internet, where students would build and perform simple experiments at home and report their results online [36].

Freshman Engineering

The importance of freshman engineering as a way to recruit and retain engineering students has been discussed extensively in the literature [37][38]. In fall 1998, a COE Task Force introduced a new course (E10), which was designed to give students a taste of engineering through hands-on design projects, case studies in engineering failures and ethics, and problem-solving using computers [39]. E10 is the only lower-division engineering course required by all engineering majors, and, as such, it serves a very important role in retaining engineering students, especially in their first year. In addition to leading the Task Force that designed E10, the author served as the Course Coordinator from the first course offering in 1998 through to 2003.

Integrated Curricula

Following national trends, in spring 1997, the author led an interdisciplinary team of five faculty members (T. Shubin from Mathematics and Computer Science, K. Arya and A. Tucker from Physics, M. Hambaba (currently Associate Dean for Graduate and Continuing Studies) from Computer, Information, and Systems Engineering) in the design and implementation of a 10-semester unit Problem-Based, Integrated Calculus, Physics and Engineering course (E96A). The course was offered for the first time in fall 1997.

Interdisciplinary Programme Development

Several faculty teams have been involved in the development of modern, interdisciplinary engineering programmes, such as:

- *Mechatronics*: A faculty team from Mechanical and Electrical Engineering received NSF and industry funding to develop curriculum and state-of-the-art laboratories [40-44];
- *Microelectronics Process Engineering*: A faculty team from Materials, Chemical, Mechanical, Electrical and Systems Engineering received NSF and industry funding to develop curriculum and state-of-the-art laboratories [45-52];
- *Biomedical Devices*: A faculty team from Materials Engineering, Biology and Mechanical Engineering is currently creating this programme (four courses offered so far).

ABET EC 2000 RELATED TOPICS

The areas of scholarship listed below emerged from the 11 outcomes of ABET EC 2000, Criterion 3, which requires engineering programmes seeking accreditation to demonstrate that their graduates possess the following:

a. An ability to apply knowledge of mathematics, science and engineering;
b. An ability to design and conduct experiments, as well as to analyse and interpret data;
c. An ability to design a system, component or process to meet desired needs within realistic constraints, such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability;
d. An ability to function on multidisciplinary teams;
e. An ability to identify, formulate and solve engineering problems;
f. An understanding of professional and ethical responsibility;
g. An ability to communicate effectively;

h. The broad education necessary to understand the impact of engineering solutions in a global and societal context;
i. A recognition of the need for, and an ability to, engage in life-long learning;
j. A knowledge of contemporary issues;
k. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

Design of Experiments (outcome 3b)

The ability to conduct experiments, as well as the ability to analyse and interpret data, have been addressed by traditional laboratory courses. On the other hand, the ability to design an experiment presents a new challenge for engineering educators and students alike. In response to this challenge, several COE faculty members re-designed laboratory exercises to address the new requirements. For example, two teams of faculty introduced open-ended laboratory experiences in semiconductor processing, along with the design of experiments and the statistical analysis of data [53][54]. Du, Furman and the author used the principles of inquiry-based learning as the foundation for the design of experiments in mechatronics, experimental methods and aerodynamics [55]. Subsequently, they classified engineering experiments in three broad categories and presented a general process for the design of experiments along with specific examples from their courses.

Engineering Design and Optimisation (outcome 3c)

The words *engineering* and *design* are sometimes used interchangeably, as the ultimate goal of engineers is to create things that improve the quality of people's lives. The old ABET requirements specified a minimum number of design units in the undergraduate curricula. The new requirements include one outcome pertaining to design, as well as specific programme requirements (Criterion 8), which place additional emphasis in the design and integration of subsystems [3].

Several COE faculty members have discussed engineering design and optimisation. For example:

- Moriarty discussed the content and context of engineering design [56];
- Furman introduced hands-on design in a course on mechanisms [57];
- Hsu introduced MEMS design and manufacture [58];
- DeJong incorporated cycle optimisation in a thermodynamics course [59].

Multidisciplinary Teaming (outcome 3d)

Although teamwork and team skills were introduced in the COE in the 1990s when cooperative learning gained momentum, providing multidisciplinary teaming opportunities for all engineering students remains a challenge to this day. Some of the interdisciplinary programmes mentioned earlier presented opportunities for students to work in multidisciplinary teams [60-62].

The SPARTNIK micro-satellite project and the ICARUS solar-powered, autonomous UAV project were introduced through the Aerospace Engineering Programme and provided additional opportunities for students to work on multidisciplinary projects under the guidance of industry mentors. Student teams for these two projects included mechanical, electrical and computer engineers, as well as business majors who developed plans for product marketing.

Problem-Solving Skills (outcome 3e)

Problem-solving is defined as a process used to obtain a best answer to an unknown or a decision subject to some constraints. Problem-solving is not the same as textbook exercise solving, which is very common in engineering curricula. The author, with DeJong-Okamoto and Rhee, defined engineering problem-solving and in particular what it means to *identify and formulate* a problem [63]. This definition set the stage for identifying the skills students need to possess to be classified as competent problem solvers. That joint paper was presented at the *7th UICEE Annual Conference on Engineering Education* in 2004 and received the UICEE Silver (Fourth Place) Best Paper Award.

Engineering Ethics (outcome 3f)

Two common places in the SJSU curricula where ethics are discussed are in the Introduction to Engineering and the senior design courses [39]. Case studies, often presented by student teams, form the basis for in-class discussions on the ethical issues raised. This is an area where much work still needs to be carried out to ensure that engineering students not only have a good grasp of what is ethical and what is not, but, more importantly, they fully understand the consequences of their decisions and feel prepared to act ethically.

It is worth noting that when ethics was first introduced as a required topic by the ABET, it proved to be another contested subject, as some engineering faculty claimed that they did not feel qualified to teach ethics in their courses. Moriarty has published extensively on engineering ethics and related topics [64-71].

Technical Writing (outcome 3g)

Oral and written communication skills are now taught and assessed not only in General Education and Technical Writing courses, but also in a variety of engineering courses, from the freshman year all the way to senior design projects [18][39]. Many faculty members are looking for more effective and, at the same time, more efficient (ie less time consuming) ways to assess student writing skills. Furman introduced an innovative way to evaluate student reports in an Experimental Methods course using a calibrated peer review method [72].

Global and Societal Issues in Engineering/ Contemporary Issues (outcomes 3h and 3j)

In this era of market and workforce globalisation, engineers need a solid understanding of the impact that their products have locally and globally. Nevertheless, with a few exceptions, these topics were not included in engineering curricula until ABET EC 2000 made it a requirement. These outcomes are difficult to achieve since they require not only a strong technical understanding, but also an informed societal and historical perspective. DeJong-Okamoto, Rhee and the author identified some of the skills students need to be able to evaluate the impact of their solutions in a global/societal context, and discussed course design elements that help students master these skills [73]. The paper was presented at the 2005 *8th UICEE Annual Conference on Engineering Education* as a keynote address and received the UICEE Diamond (First Place) Best Paper Award.

Life-Long Learning Skills (outcome 3i)

The author presented a paper in which he defined a set of attributes/skills necessary for students to develop as life-long learners [74]. He postulated that the *recognition of the need* requires skills in the affective domain, while the *ability to engage* requires skills in the cognitive domain. In the paper, he offered course design elements that enhance students' life-long learning skills, along with methods for assessing these skills. One of the key ideas that came to light was the need for students to truly engage in what they do and to take responsibility for their own learning [75].

Course and Programme Assessment

As was mentioned earlier, the new ABET EC 2000 accreditation requirements provided a new impetus for innovation, assessment and dissemination in engineering education. The faculty of the COE have taken advantage of this opportunity and published their assessment in a variety of venues. Examples of course assessment are reported in references [76][77], while programme assessment results are discussed in [78-83].

SAN JOSÉ STATE UNIVERSITY ACTIVITIES (1995-2003)

The Centre for Faculty Development and Support (formerly ITL) on the SJSU campus has contributed greatly to the scholarship of teaching in all fields, including engineering. Many engineering faculty members participate in Centre's activities, which include workshops on teaching effectiveness (see Table 2), as well as a variety of programmes that promote the scholarship of teaching. These are detailed below.

Table 2: Two-hour workshops offered by the author through the SJSU Centre for Faculty Development and Support (formerly Institute for Teaching & Learning (ITL)).

Date	Workshop Title
19 Apr 2002 27 Apr. 2001	The Way They Learn and the Way We Teach, Part 2: the Kolb Learning Cycle
15 Mar. 2002 22 Sep. 2000 23 Aug. 2000 1 Oct. 1999 23 Aug. 1999 27 Apr. 1999 13 Nov. 1998	The Way They Learn and the Way We Teach, Part 1: the Felder-Silverman Model of Learning Styles
15 Feb. 2002 23 Feb. 2001 29 Oct. 1999 23 Feb. 1999	So What Exactly Does it Take for Your Students to Learn Something New?
26 Oct. 2001 27 Oct. 2000 20 Aug. 1999 16 Oct. 1998 19 Aug. 1998	Involving Students in the Act of Learning
14 Sep. 2001 17 Nov. 2000	Bloom's Taxonomy and Instructional Objectives

Teacher Scholar Programme

The purpose of the Teacher Scholar programme is to create a community of recognised, outstanding teachers on campus, to build opportunities to engage in mid-career, reflective discussion on teaching and learning, to examine and conduct research on teaching and learning, and to promote a collegial community that enhances teaching across the University. One faculty member from each of the nine colleges is selected every year to participate in the programme, which involves bi-weekly discussions on teaching and learning, peer classroom visitations, and participation in conferences.

Learning Productivity Programme

The Learning Productivity Programme (LPP) was initiated in fall 1996 with a budget of US$150,000 for the purpose of generating teaching strategies that improve student learning. Guided by a seven-member advisory board composed of former ITL fellows and teacher scholars, it funds faculty projects that have the potential to lead the campus in this endeavour. It includes planning and implementation grants. Reflecting current needs, the focus of the programme has recently shifted towards the assessment of course and programme effectiveness. Many engineering faculty have received funding from this programme to develop new courses and laboratories, and to perform classroom research.

Knight-Ridder Champions Programme

With funding from the Knight-Ridder Foundation, the focus of this programme was to provide release time for faculty to explore the effective use of technology in their courses. An interdisciplinary team of COE faculty (B.J. Furman and the author from Mechanical and Aerospace Engineering, P. Hsu (currently Associate Dean for Undergraduate Studies) from Electrical Engineering, and K. McMullin from Civil and Environmental Engineering) received funding through this programme to explore and create multimedia for engineering education [84].

CONCLUSION

Engineering faculty at the SJSU have been active in the scholarship of teaching for several years as a result of many factors, the most important being the need to modernise the curricula and new accreditation requirements. Their success is evident, not only from the number of publications and conference presentations, but also from a large number of NSF and other grants that have helped create and continue to support innovative curricula and laboratories. Significant quality improvements in several programmes have resulted from this effort.

Although faculty initiative has played a key role in the success of these activities, it was the support from department chairs, the College Dean and the University Provost that helped create an atmosphere where the scholarship of teaching was encouraged, valued and rewarded through the retention, tenure and promotion process.

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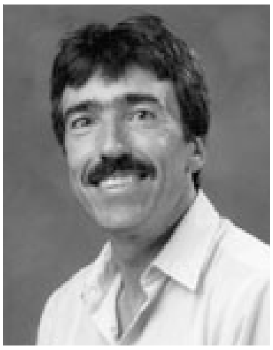
BIOGRAPHY



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