The Curriculum Technology Enhancement Program at Embry Riddle University

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Abstract

Most of the faculty now teaching engineering at US institutions grew up with the vacuum tube, slide rule, and punch card. Over the past ten years, however, there has been a paradigm shift in the nature of computing technologies far different from those that faculty have spent the majority of their life's experience getting comfortable with. Computer network-based engineering technologies have been, more or less, implemented throughout industry. The Curriculum Technology Enhancement Program (CTEP) at Embry Riddle is a University program created by faculty for faculty who teach engineering and science. CTEP is designed to provide engineering faculty at both ERAU campuses with incentives and opportunities to advance their skills in the use of professional-grade engineering software as well as in the use of other contemporary educational technologies. It is hoped that this project will foster and encourage enthusiasm among the engineering faculty for the implementation of technology within the courses they teach. It should also help them identify opportunities within the curriculum for the application of modern engineering technologies that could enrich course delivery, enhance student-developed design skills and advance the level of understanding attained by the students enrolled in their courses. Through involvement in CTEP, interested faculty members may become sufficiently familiar with a host of new technologies and attain enough experience using them to generate meaningful transformations within the engineering curriculum.

I. Introduction - The State of Engineering Education

With the arrival of the new century many engineering institutions find themselves struggling with numerous problems associated with modern engineering education, one of which is technology. There have been a host of books, articles and papers written on the significance of the technology age and how it could inevitably effect education. The information age, the Internet, computing power, the windows environment and the accessible computing have all changed the way we operate. While speculation continues about the impact technological changes may eventually have on education, we hear repeated calls for universities (faculty and administrations) to come to grips with the reality of the information age. However little has been offered as to how this could be accomplished.

At least one element that has hindered acceptance and rapid assimilation of modern technology at institutions in the U.S. has been our faculty culture. The faculty of U.S. institutions of higher education are aging. According to the Digest of Education Statistics, 1999[1] / Chapter 3, "Post-secondary Education/1999-036/" the age distribution of full-time faculty in 1992 was concentrated in the middle age brackets with 62-percent of the faculty in all disciplines over the age of 45 at that time. Hiring has been relatively flat since 1992 so the average faculty age has increased by about eight years. In engineering the average age is even slightly older - around 55 years old. The significance of this is most of us now teaching engineering grew up with the slide rule, vacuum tube and punch card as our "technologies." We were educated in an environment that was in transition as a result of the Grinter Report,[2] New Math and the Cold War. In time discussions began to focus on the effects these changes made on our product -graduates.[3] Technological education was changing from a practitioner-oriented to a science-based pedagogy. In the '60's we entered the space age where mathematics and science began displacing practice and design in the majority of engineering curricula.

II. Engineering Educators and Instructional Training

Since 1960 the need for more science compelled universities to seek young Ph.D.'s as new faculty members. Like their predecessors, they entered their teaching positions without formal training in educational sciences and tended to teach engineering in the same manner they had learned it. Their teaching expertise was developed from their experiences as long-time students.

At that time computers represented emerging technological tools that one had to program to use and programming was something one learned by doing. After a time, consensus was reached and the language of choice came to be FORTRAN. For years to come a course in FORTRAN programming became a standard feature in most engineering curricula. Also during that time most developments in computational technologies were a direct result of efforts and activities by engineering faculty and thus fell well within their grasp. Students were expected to learn what was presented and to also become proficient users of the slide rule; the handheld calculator had not yet arrived on the scene. The scenario was the professor served as the principal knowledge source and dominated the classroom environment while the students were expected to be quietly attentive and essentially survive academically on their own. Unfortunately this situation has changed very little today and its impact is only now being understood.

In his editorial "One Size Does Not Fit All," John W. Prandos[4] listed three situational characteristics associated with professors' attitudes that it is the student's job to learn and that the failure to do so is the student's fault. These characteristics are

- Lack of formal educational training and an awareness of different learning styles on the part of the faculty members.
- Pressure by the university to establish funded research in the discipline that in turn reduces the available time for research in education.
- Cultural orientation toward military base industry that reinforces the notation of "forming our students in our own image."

At least one more characteristic, or at least a consequence of teachers' attitudes, could be added to this list:

- "A awareness on the part of faculty to regularly upgrade curriculum relative to the student learning abilities and to include rapidly advancing technologies used in the profession."

For example, it was during the middle 1970's that engineering and science professors nationwide debated whether students should be permitted the use of new electronic calculators - an item considered by some as novel and faddish technology – rather than slide rules on exams. Many of those who opposed calculators prophesied doom in the profession as a result of students' inability to think, assimilate, and process information. Essentially they argued students had not learned the basics in the same fashion they had. This prophecy proved false and today no one would think to remove the all-powerful programmable handheld calculators from our students or us. We would not necessarily be helpless without them but we would be significantly less productive.

Many of these same professors, now senior in rank as indicated by the NCES data, compose the majority of our engineering faculty nationwide. And now new debates loom regarding the value of web-based instruction, software/technology in the classroom and distance learning. Over the past ten years there has been a paradigm shift in the direction computing technology has taken which is far different from that faculty grew comfortable with. In contrast, their counterparts in industry are individuals who, while having been educated in the same system, by the necessities of their trade have learned the value of modern computing and communications and are far more at home with integrated technologies in their day-to-day business. Technologies which represent computing capabilities considerably different from those their teachers had promoted in earlier years.

III. The Profession and Technology

Today computer-based engineering technology has been, more or less, implemented throughout the industry. For engineers, the heart of this technology appears to reside in 3D, feature-based, parametric solid modeling or 3D-CAD. In the current market 3D-CAD serves as the database for almost all engineering-product development. Products developed in cyberspace through the use of such three-dimensional modeling tools provide the fundamental data for nearly all subsequent engineering and manufacturing activities. Most analytical tools to some degree (FEA, CFD, dynamic modeling, kinematic simulations, etc) can now import solids modeled via 3D-CAD. Assembly and maintenance investigations are also now possible long before the first chip is cut from raw stock to make an actual part. Rapid prototyping through the applications like Stereolithography (STL) or computer-aided high-speed machining makes direct use of solid model data to produce accurate part representations. Models fabricated by these systems are often used for testing, mock-up, demonstrations and for the development of system attributes. Computer-aided Manufacturing (CAM) converts 3D-CAD data into tool path information for manufacturing real hardware straight from the computer. Paperless (i.e. no 2D drawings) operations have nearly been realized in some arenas. All of this technology supports modern concepts of design and product manufacturing and requires totally new skill-sets of the individuals involved in order for them to be productive.

Beyond 3D-CAD, systems like Unigraphics, Catia, Varimetrix and Ideas, other software and technologies that are used in industry could greatly enhance the teaching of engineering and design. Cost estimation programs associated with CAM and Computer-aided Assembly programs used to deal with material costs and material-handling problems could be instructionally employed. Web-based and CD-rom record keeping used for inventory control and to promote efficient reporting would also be useful. The inclusion of these technologies in courses students take while studying engineering could greatly enhance their preparedness for the field. Unfortunately we have not kept pace our industrial counterpart in using this technology within our pedagogy.

In all honesty this computer-based technological paradigm has developed with such speed that it has been nearly impossible for faculty to stay abreast of the science much less maintain mastery of it. Teaching engineering fundamentals has taken place for decades with a chalkboard, chalk, and a book - a process that has been historically successful. As a result, implementing technologies into our curriculum has lagged behind what industry has accomplished in many related areas and the reasons, while understandable, will likely be seen in the future as unacceptable.

IV. The Problems: No time! Too risky! No incentives!

Among educators there are differences in opinion regarding the value of time spent mastering different codes and altering existing pedagogy to implement them. Some feel such an investment is simply not worth the effort. If asked why they have not taken action to implement technology almost all faculty indicate that there is insufficient time available for mastering the use of any one software code much less deciding where in an already packed curriculum it could be inserted. To make matters worse, there has recently been a national push to reduce overall degree credit hours – something that compresses even further our jam-packed curricula. There is also concern that it may be hopeless attempting to keep up with this rapidly changing computing field where obsolescence seems to occur with ever-increasing frequency.

Some professors feel that inserting software applications into courses can occur at the expense of tried and proven teaching methodology and the all-important course content. Others may actually fear technology because they do not have a complete understanding of how it works or how to handle it calmly. In fact an American Press report[5] published out of Washington D.C. in October of 1999 made claims that 2 of 3 faculty actually claimed to experience a type of "techno-stress" associated with their inability to keep up with emerging technology. The result was based on a national survey of 34,000 faculty members that represented 378 of the nation's colleges and universities.

Universities offer little by way of support in training or provide incentives for faculty who may wish to shoulder an extra burden to stay up with a rapidly advancing field. Faculty must research with in their discipline in order to achieve promotion and tenure. And teaching is not their discipline even though, by national statistics, they spend more than fifty percent of their time doing it.

V. Other issues

Dr. Wallace Fowler in his November 2000 President's Message in the ASEE Prism offered his view regarding the problems encountered when attempting to implement technology in curricula. He listed six.

- The speed with which the technology market develops.
- Lack of coordination in acquisitions at universities.
- No provisions (time-wise) for training.

- The “comfort factor” for faculty.
- Tenure and promotion incentives.
- Counter-educational technologies and the plagiaristic potentials.

For these and other reasons, some very understandable, few engineering faculty nationally have embraced the use of modern technology in their day-to-day teaching. Web-based instruction, electronic presentations, use of on-line electronic grade-books, high-level software applications, standardized codes, electronic conferencing and distance learning can all be included on the list of the technologies frequently passed over. Reasons for these omissions include those listed by Professor Fowler but also include the following:

- The lack of confidence regarding the benefits trade between the times spent using software verses the need to cover all the required course material.
- Many of the faculty have question the value of web-based instruction and some have little web-use knowledge[6].
- Many individuals are concerned about work overload (they have heard about all the “work” required to use technology) and choose to avoid it.

There are those among faculty who do see a need for implementing modern technology with in curricula. They are not the dominant group and are almost always those who are closest to the professional practice. Often they are individuals who consult professionally or who have come from industry. Sometimes they also are the teachers of capstone design courses who can visualize possible increases in student productivity that may be realizable when modern computational tools are at their disposal.

VI. Our problem – Diagnosis

We at ERAU, like our cohorts nationwide, have been slow in implementing modern technology within our teaching even though the University has made limited software and hardware available. At ERAU we are primarily a teaching institution and thus the faculty shoulders a heavy teaching load (12+ credits per term). As a result there is little time available for anyone to become accomplished in the use of new technology through self-instruction. Our Information Technology center, from time to time, has offered introductory volunteer workshops for faculty in some areas but, for a multitude of reasons, most faculty have not elected to participate. Lack of attendance to these workshops may only be only a matter of timing and time available. There could also be a stigma associated with participating in “introductory-level” training one the part of some of our highly educated teachers. Or it could be that culturally-related problem; our more-senior faculty members grew up using slide rules, integration tables and trig tables and some may be uncomfortable with the modern PC environment. Regardless of the reasons the results are the same. Most of our engineering faculty have not used in their classes software that is presently on the University network and that could better prepare students for their profession.

Meanwhile, in contrast to the faculty, our students tend to be agile in their use of computer-based technologies many of which are like those currently used by industry. Students have grown up in the PC era and are extremely comfortable with modern computing. As for programming skills, most of our students enter as freshmen with some programming ability and many are quite accomplished programming in more than one language. Many of them eagerly anticipate making use of their skills throughout their education and come to the University expecting to experience the latest technology. Imagine their disappointment when they discover classes will be spent almost exclusively on developing fundamental concepts with derivations and without inclusion of the technology they are so familiar with.

So the pedagogical debate between faculty members continues, here and on many campuses across the nation:

- Should we use these new technologies in the classroom?
- Will it endanger engineering education?
- Are we compromising the quality of instruction?
- Isn't there a danger in promoting "push-button" engineering?

As the debate goes on those who oppose technology implementation often find sympathy for their position among their peers at other institutions because of all the reason discussed. However some schools and a large number of corporations are moving forward with technology-based learning endeavors.[7] While debating issues like "is web-based instruction a good idea," we could very well be losing sight of our reason for existing – delivering meaningful, timely and applicable education to enthusiastic customers; our students.[8]

VII. CTEP: One possible solution

Our design faculty originally sought to address a persistent problem that stifled their ability to advance the caliber of design activity students encounter in the capstone design courses. It was apparent to them that a good deal of the technology needed to successfully accomplish modern design could also be useful in teaching students fundamental principles in pre-requisite courses allowing them to become acquainted to the environment and to also appreciate the pit-falls each technology had. The problem was convincing the faculty members who teach the lower level courses that they too could realize a net pedagogical benefit by investing their time in learning the use of a particular code and then change their well-developed course syllabi to accommodate its inclusion. In preliminary conversations it was clear that many of the faculty viewed this as fixing something that was not broken.

Ultimately the goal was to have students achieve some level of proficiency and attain a limited amount of experience in using specific software along with applications to engineering problems and then be given follow-on opportunities to continue applying these skills in courses as they progressed through the curriculum. To do so required offering incentives and opportunities for faculty to educate them to a level of mastery and understanding where they would readily grasp the benefits associated with including technology in their course deliveries as well as enhancing the design content of those courses. There is sufficient evidence that simply making the software available without incentives would not produce the desired results.

So two program objectives were targeted. The first was to find a means for enhancing students' abilities in the use of existing computer software packages – codes like 3D-CAD, CFD and FEA codes or programs like MatLab, Maple, and Working Model. The second was to increase the amount of design content found in the preparatory courses. For example, most of our students now learn Maple to some extent in their math classes during the freshman and sophomore years. However, by the time they get to the senior design courses they have mostly forgotten what they learned or have not matured in its knowledgeable use because they have not been treated to examples or given opportunities to make engineering application along the way. Similarly, all of our students take an engineering graphical communications course as freshmen where drawing fundamentals are introduced along with some 2D&3D-CAD. Without any further use during the ensuing semesters this skill too withers by the time they make senior status. To accomplish these two objectives it was necessary to discover a way to obtain faculty buy-in for the technology component. As for the design content increase, ABET 2000 requirements for demonstrating design throughout the curriculum provided compelling arguments.

VIII. CTEP Concept Program Description

Our Curriculum Technology Enhancement Program (CTEP) is a University program developed by faculty for faculty. The goal being to have faculty attain enough experience in using various technologies to generate a meaningful transformation of our engineering curricula. Selected faculty from five different degree programs can participate in funded summer programs that offer training in the use of software and other technologies in support of teaching design throughout the curriculum at both ERAU campuses.

The concept is simple:

1. Identify those members of our faculty at both campuses who support the notion of increasing the use of technology in the classroom.
2. Select technologies most likely to serve as a viable starting point for the project: like 3D-CAD, Mat Lab, Spread Sheets and Distance Learning technology.
3. Determine who among the faculty have limited skills in the areas of interest and who would agree to serve, as local leaders and mentors helping others get onboard with technology.
4. Provide significant professional training for the selected individuals.
5. Define expectations for participants
6. Conduct and outcomes discussion activity
7. Provide attractive financial incentives to those who participate.

Program objectives were written to solidify the concept and a three-year plan developed with separate goals defined for each year. The goals are listed along with outcomes achieved to date in the Conclusion.

IX. CTEP Objectives:

1) Provide ERAU engineering faculty at both campuses with incentives and opportunities to advance their skills in the use of professional-grade engineering software and the use of other educational technologies.
2) Foster and encourage enthusiasm among the engineering faculty for the implementation of technology within the courses they teach.
3) Increase the "comfort level" of our faculty for using technology in the classroom.
4) Encourage and support pedagogical enhancements that integrate technology throughout the curriculum.
5) Improve student opportunities for using up-to-date engineering software as part of their educational experience.
6) Assist faculty members with identifying opportunities within the curriculum for the application of modern engineering technologies that could enrich course delivery, enhance student-developed design skills and advance the level of understanding attained by the students.
7) Boost the caliber of the design experience students encounter in capstone courses.

To accomplish these objectives we would have to negate as may of the known deterrents as possible to nurture, encourage and persuade faculty to the notions that technology in the classroom can be accomplished without compromising the quality of education- the old “calculator argument.” For this we needed to find a common time when serious training could take place without distractions, a time when faculty would be available but not encumbered by the massive teaching or service responsibilities of the regular term. Fortunately there is roughly a one-week slack period between our spring term and the beginning of our summer session on both campuses. So we surveyed the faculty and found those interested in and receptive to training at the selected time.

Next we needed to provide sufficient incentives for "being available" during this time. An internal seed money grant for $29,000 was obtained in the spring of 2000 to establish a pilot CTEP program between the aerospace engineering departments at Daytona and Prescott. The money would pay for the fees of the software provider for training ($9,000), allow machine upgrades ($4,000) and also to permit a small stipend ($1,000 each plus admin. costs) to be offered to each of the attending faculty members. It was a three-part training and mentoring exercise that involved nine ERAU faculty members, four from Daytona and five from Prescott, in an interactive/collaborative activity that extended from May until December 2000. This format worked very well and future phases will follow this same format.

The nine faculty members participated in a week long teleconferenced workshop in May to learn the basics for using of a 3D-CAD in teaching their classes. Each member subsequently created a CAD module during the summer months that they planned to implement in the fall and that could be shared between the participants. The Daytona-Prescott faculty involvement was, in part, accomplished using Distance Learning Technology (DLT) between our two campuses. In this way all involved had opportunities to learn how to use this technology, in addition to the focus technologies of the program, and to assess how it may be employed between our student groups for interactive design projects or in offering more courses via DLT in the future. This experience also proved helpful in identifying future improvements for our engineering laboratories on the two campuses to include DLT capabilities.

A second workshop was conducted in August to review each module developed. Participants provided comments and constructive feedback. During the August meeting each participant was asked to show, in written lesson plans or by web-based documentation, where and how they intend to use the software in one of their courses to be taught during the fall semester. They were also to produce a sample problem or project that could be used by students. The second part of the stipend ($500 each) was paid at the end of this work session.

Finally participants were contacted in December-January to discuss lessons learned, outcomes and to provide a measure of assessment for proposed continuation of the CTEP activities. Comments focused on insights that may have developed as to where within the curriculum other applications of software may be of benefit. All CTEP participants were encouraged to assist fellow faculty members in the implementation of software and design content in other courses and to promote technology use.

X. The Role of Each CTEP Team Member.

Prof. Chuck Eastlake, acts as the program coordinator for internal and external dissemination and a design professor, Dr. Ron Madler, at Prescott serves as the key liaison and contact between the two campuses and assisted in program dissemination in the western region. I am the program developer, fund-raiser and budget manager. All three team members have worked and continue to work collaboratively on creating the content and materials needed for each program year. We each make design-content contributions to the training/mentoring exercises and locally aid our peers with the implementation of the teaching modules developed during each program phase.

XI. Conclusions

The program goals are listed below. Comments are provided on the outcomes of those that have been address during the 2000 academic year. Difficulties were encountered- some internal and some external – with respect to goal attainment and, in themselves, provide some insight to the difficulties associated with trying to make a change in our established educational infrastructure.

Goals 2000-2001:

- Develop and implement the use of 3D-CAD/CAM solid modeling in the capstone design courses on both campuses by the end of the 2000-2001 academic year.

  Outcomes- 3D-CAD software (Varimetrix) has been installed in the design labs at both campuses and all but one faculty member (4 of 5) have received formal training in its use. However outcome discussions have indicated that only those faculty who were already using 3D-CAD prior to CTEP are still using it. Faculty who received training and who were supportive of the implementation notion fell short of actually implementing the software in their fall classes. This was primarily because of serious bugs in the new NT version of the software used that faculty simply did not wish to deal with in the course of their teaching. This goal has only partially been met

  Recommendations – As noted the Computing Industry in a high state of flux and software often occur faster than one can react. Finding a “stable” software and staying with it for a reasonable term – like two years - may remedy this problem. Another different 3D product (CATIA-NT) has been selected for the Spring 2001 training, although it too has had it share of bugs but it is hoped that it may better serve our aerospace mission.

- Introduce, to some limited extent, 3D-CAD/CAM solid modeling into the current freshmen Aerospace Engineering graphics courses.

Outcomes- While the instructors of our graphics courses at both campuses were enthusiastic participants during our 3D-CAD training sessions and they demonstrated the best performance of any attendee during training in the 2D areas they were reluctant to endorse the switch to 3D-CAD from the software they are currently using (Bentley MicrStation) and disagreed with the notion that graphics could be taught almost entirely in 3D with 2D introduced as a subset. They retained the notion that 2D drawing and ortho-graphics must be fully understood before 3D-CAD can be introduced. They backed up their position regarding visualization skills with anecdotal evidence from classroom experiences where students who demonstrated 3D proficiency could not, in turn, read or interpret a 2D-drawings.

Recommendations – We are recommending that a curriculum review be made of the graphics and computing components currently in the first two years of our AE program to determine what may be needed (see next Outcome).

- Explore options and make recommendations to the faculty at both campuses regarding modifications to the freshmen graphics courses that could improve the level of preparation for higher-level engineering courses. This may include a recommendation as to what semester in the curriculum such courses may best serve achieving a timely development of needed student skills.

  Outcomes- We are approaching a consensus that we may wish to keep our graphics course essentially as it is but replace our required C-computer programming course with a new course dealing with modern analytical and design software of engineering.

- Pursue and secure additional funding sources to permit the expansion and continuation of CTEP.

  Outcomes- Corporate sponsorship for the program was attained through a grant from the Boeing Company that will allow CTEP it to expand and continue for another year or more.

- Identify other academic areas where applications using 3D modeling could enhance the delivery of course topics.

  Outcomes- this area is still being explored and will be finalized during our the 2001 CTEP discussions.

- Collect opinions, comments and ideas from engineering faculty members regarding interest areas for expanding the CTEP into other software codes for the 2001-2002 academic year.

  Outcomes- the areas decide upon for the next phase are Mat Lab, Catia, and Nastran/Ansys with continued involvement using web and DL technologies.

- Identify software products that would be common in serving the academic objectives of both the Prescott and Daytona campuses for engineering education. Work cooperatively with IT to define the hardware needed and that could, perhaps, be shared between the two campuses to support these objectives.

Outcomes- Varimetrix, Catia and MatLab have been acquired for both campuses and our IT department is coordinating their installations.

- Develop a plan with IT for the continuation of support for future growth in software needs and hardware applications.

  Outcomes- Work continues with IT to identify facilities, equipment and software that will meet the needs of our programs. On the Daytona Beach campus a 34 –seat computer lab is being developed for instructional use in computer-aided engineering software.

Goals 2001-2002:

- As a function of available funding, develop and offer a second summer CTEP focusing on those technology interests identified during the previous year.
- Undertake a review of the current curriculum in areas of structured programming, graphical communications and the engineering sciences. Explore options and make recommendations to the faculty at both campuses regarding possible modifications to the AE curriculum regarding the use of computers, software, programming and simulations that could improve engineering course delivery.
- Broaden the scope of CTEP into the sophomore and junior level course in engineering and possibly to courses in physics and mathematics
- Investigate the possibility of including secondary education teachers for mathematics, physics and graphical/industrial arts in some part or all of the proposed summer activities.
- Evaluate the potential for broadening the participation in CTEP to include teachers from other colleges and universities.
- Develop at least one major proposal for funding support from a national, regional or professional agency or organization.
- Solicit industrial collaboration and support of the CTEP concept. Perhaps attain some level of participation in CTEP from industry.
- Augment the DLT/web communications component of the CTEP during the independent summer activities to permit collaborations between participants in the development of their teaching modules.
- Establish a formal assessment process for evaluating post CTEP performance in the curriculum.
- Publish at least one paper regarding the CTEP program.
- Work with IT to upgrade servers and system hardware to better support technology enhancement initiatives.
- Institute a long range plan for program continuation

Goals 2002-2003:

The program goals for the third year will be a continuation of or dependent on the success of the first two years. It is anticipate that they may involve things like:

- Conducting a series of collaborative training sessions on related but different technological educational elements for teachers at ERAU, other universities and colleges and also high schools. Perhaps some portions of these activities could be accomplished entirely through DLT.
- Refine the assessment process for evaluating CTEP performance.
- Publish at least one paper regarding the CTEP program.
- Conduct a panel session at a national seminar on technology curriculum enrichment activities at ERAU.

Follow-on activities during the proposed second and third years of the program will hopefully include exploring ways to expand the concepts of the CTEP for the involvement of faculty from other universities in the summer training activities either as visitors or through DLT. Since the emphasis for advancement and merit at most universities do not favor faculty spending their time developing skills to use in the classroom over time spent publishing and conducting funded research, a program like CTEP may be one way to at least move in the direction of implementing technology in the classroom. In almost all institutions there is a critical push from administrations to have their faculty be productive in their "discipline"- implying some aspect of engineering. However, for the majority of individuals who hold terminal engineering degrees and who have been full-time teachers for twenty years or more, at least one aspect of engineering in their "discipline" is teaching. So time spent becoming a better teacher should be treated equitably with research and publication activities.

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