AC 2005-307: DESIGNING AND IMPLEMENTING GRADUATE PROGRAMS IN ENGINEERING EDUCATION

Alex Aning, Virginia Polytechnic Institute and State University
Hassan Aref, Virginia Polytechnic Institute and State University
Hayden Griffin,
Janis Terpenny, Virginia Polytechnic Institute and State University
Jean Kampe, Michigan Technological University
Jenny Lo, Virginia Polytechnic Institute and State University
Marie Paretti, Virginia Tech
Mark Sanders, Virginia Polytechnic Institute and State University
Michael Alley,
Richard Goff,
Susan Magliaro,
Thomas Walker,
Vinod Lohani, Virginia Polytechnic Institute and State University
Designing and Implementing Graduate Programs in Engineering Education

O. Hayden Griffin, Jr.1, Alex Aning1, Vinod K. Lohani1, Jean Kampe1, Richard Goff1, Marie Paretti1, Michael Alley1, Jenny Lo1, Janis Terpenny1, Thomas Walker1, Hassan Aref 2, Susan Magliaro3, and Mark Sanders4

1 Department of Engineering Education/ 2 Dean, College of Engineering/ 3 Director, School of Education/ 4 Professor and Program Leader, Technology Education
Virginia Polytechnic Institute and State University

Introduction

Recent years have seen an increasing awareness of the lack of training of the majority of engineering faculty in topics involving human learning, appropriate pedagogical approaches for engineering topics, and design, implementation, and evaluation of curricula. The National Science Foundation addressed the issue by the creation of the engineering education consortia, and as a result significant changes took place on the landscape of engineering education in the United States. However, the changes seemed to be localized in some universities. In the years since the cessation of funding for the coalitions, there seems to have been a renewed interest in both applying what was learned from the coalitions and also to bringing to bear more recent knowledge developed by “education” researchers, knowledge that was developed sometimes in an engineering context and sometimes not.

Engineering as a profession in the United States is facing a number of challenges at the present time. Declining interest in engineering careers obviously poses a major challenge for engineering colleges charged to produce qualified engineers. A recent report from the U.S. National Science Foundation (NSF)1 indicates that the federal science and engineering workforce is shrinking and a significant number of scientists and engineers will soon retire. Further, a 2001 report from the U.S. Department of Labor2 indicates that women and minorities make up 60% of the total workforce, but they are dramatically underrepresented in science and engineering careers. As engineering educators, it is a great challenge for us to make engineering careers attractive to a diverse section of society. We must devise innovative ways to attract a broad range of students to pursue engineering careers. With the explosive growth in data/information transmission, a part of the challenge is for instructors to adapt to the learning styles of the individual students, not focus on the teacher’s preferred style. In fact, since every class is somewhat diverse in personality and learning styles, every engineering instructor should be using multiple teaching techniques known to be effective for different learning styles for all of the material in order to reach the entire class with most of the material. While almost everyone would agree with the last statement, very few engineering instructors truly understand how people learn, so they are not capable of designing courses to match learning styles. Effective use of technology to reduce the cost and broaden the reach of engineering education is yet another important issue for which general approaches are well-known in the education community, and not so well known in the engineering education community.
According to a February 4, 2004 (Contact: David Thomas) press release of the U.S. Department of Education, “Currently, doctoral-level training in education research is located primarily in schools of education and is not producing sufficient numbers of researchers who are qualified to meet the burgeoning demand for rigorous, quantitative research on the effectiveness of education programs and practices.” This shortage of educational researchers is critical in the area of engineering education, since very few doctorates in engineering have an education focus, and even fewer have significant assessment content in their educational programs.

During the last few years there has been a trend toward establishing “centers” for engineering education in universities. A casual internet search reveals at least a dozen such centers in both small and large post-secondary institutions. In some cases those centers are located in engineering colleges, in some cases in other colleges, and in some cases in truly interdisciplinary organizations set up to cross internal institutional boundaries (e.g. colleges or departments). In most cases the centers are led by graduate faculty, with the natural result that graduate students are advised and earn degrees under the auspices of the center, often with the focus of the research being a topic in education, in an engineering context. It is also interesting, although not surprising, to note that the large majority of these centers are led by women, most of who appear to have been the designer/creator of the center. Data presented later continue this trend.

Using FirstSearch for dissertations, with keywords “engineering” and “education” resulted in over 3,000 hits. Examination of a small portion of these hits reveals a number of “education” related dissertations advised by engineering faculty, with degrees granted through traditional engineering departments. In addition to those centers, there are other national-level activities aimed at fundamental progress in engineering education and creating efforts to contemporize engineering education in order to get/keep students excited about potential engineering careers and thus help maintain U.S. leadership in engineering. For example, in 2002 the National Academy for Engineering (NAE) established a Center for the Advancement of Scholarship on Engineering Education (CASEE) to foster a climate of continuous improvement in engineering education. Based on a survey of engineering education researchers, CASEE has identified the following four focus research areas: i) identifying what engineering students should know and what engineering knowledge should contribute to broad technological literacy; ii) improving how engineering is taught, learned, and assessed; iii) improving diversity in engineering programs; and iv) encouraging the widespread use of educational innovations. Further, CASEE has identified a number of research questions in a recent report. Some examples include: “Why are so few high school graduates well informed about engineering careers?”, “Why are so few women electing to study engineering?”, “How can the public’s understanding of engineering and technological issues be improved?”. Our proposed graduate programs will undertake studies that will help provide answers to these questions and will provide graduate degree opportunities in graduate education.

We must therefore conclude that not only is there great interest at the national level in making progress in engineering education, but also that there are a significant number of de facto engineering education graduate programs that exist in the United States at the present time. While these programs are working, and we congratulate those faculty members who have created them, some appear to lack the coherence and critical mass that will lead to training of a
generation of engineering educators with backgrounds in both “engineering” and “education.” We believe there are significant needs and opportunities that require full-fledged engineering education programs. At Virginia Tech, we have established a new Department of Engineering Education (EngE), which will develop such programs while pursuing rigorous educational research, primarily in an engineering context.

**Degrees in engineering education**

When we met for the first time to discuss creation of the degrees we began to discuss exactly what a degree in engineering education would consist of and how it would incorporate the two, seemingly disparate, disciplines into a coherent whole that would qualify the graduates for jobs. One of the early first questions was, “Where will the graduates work, and what will they do?” After that discussion we decided to define target audiences for the degrees and speculate on what careers they would pursue after graduation. We have developed a Graduate Certificate in Engineering Education and drafts for three Engineering Education degree programs: a non-thesis master’s degree, a thesis master’s degree, and a Ph.D.

Before discussion of the proposed degree programs, it is necessary to present our current thinking on the overall administration of the degree programs, which are inherently interdisciplinary. During our discussions in groups of faculty (primarily from Engineering, Education, and Science and Technology Studies) and administrators (including the Dean of the Graduate School), we came to realize that creating engineering education degrees that were developed “by engineers for engineers,” with education faculty, principles, and courses (of the “standard” education variety) added as somewhat “external” influences was not the best approach for Virginia Tech. As a result, we are currently in the early stages of developing a university-level “program” (somewhat similar to our local Science & Technology Studies Program or our new School of Biomedical Engineering & Science), governed by faculty from all participating units, that will oversee the degrees. As a part of the creation of the Program, which is currently being referred to as the “Education-Engineering Collaborative” (EEC), we plan to redefine and include our existing Technology Education graduate program, which has been ranked as one of the top such programs in the nation. This is not a radical combination, since as engineers, we feel an instant kinship when we visit the Technology Education laboratories and see wind tunnels and polymer fabrication equipment in use. We have employed two Technology Education Ph.D. students, one with an engineering background and one with a technology education background, as teaching assistants for the freshman engineering courses, and the result has been outstanding. Some of the other benefits of this interdisciplinary Education/Engineering arrangement include:

- Cross-listing of courses that will be taken by a mix of EngE and Education students and taught (and co-taught) by a mix of EngE and Education faculty
- Recruitment of “career switchers” both ways; i.e., Technology Education teachers seeking a masters in Engineering Education to become community college faculty; and disillusioned engineers looking for a more “people-oriented” slant such as teaching, industrial training, technical representative, etc.
- Joint advising opportunities
- Engineering access to public schools (recruitment, engineering outreach, etc.)
The mixing of engineering and education “cultures” (among both faculty and graduate students from both sides) could yield some subtle but significant benefits (e.g., informal sharing of teaching pedagogies, advising practices, outreach efforts, life experiences).

Enhance research proposals with genuine interdisciplinary research communities of engineers and educators with an established track record of working together. (In fact, we are already doing this, and it works much better than we would have dared to hope.)

At this point we emphasize that these degrees and courses are under development, and that changes are inevitable, but we are determined to succeed, and we firmly believe that the degrees and courses will exist in the near future. The Graduate Certificate in Engineering Education is currently in governance approval and should be in place by May 2005, and indeed one student will complete the requirements by then.

Our proposed graduate programs are targeted to: a) address the quality and quantity of the teaching of engineering topics (possibly as a subset of technology education topics) in public school through college, and b) develop first-rate, cross-disciplinary, rigorous and quantitative educational research programs that will produce graduates prepared to teach or to assume leadership positions that will shape engineering, science, and math education curricula and policies at the college, local, state, and federal levels.

The engineering education degree programs currently being developed are:

- A Certificate in Engineering Education to supplement graduate work in a traditional engineering discipline or provide advanced study to licensed K-12 teachers and postsecondary teachers. Required and elective courses focus on teaching practices specific to engineering courses/topics. The target audience is graduate students from a wide array of engineering and non-engineering disciplines.

- A Non-thesis Master of Engineering Education to supplement doctoral work in a traditional engineering discipline or provide advanced study to licensed K-12 teachers and postsecondary teachers. Courses will focus on teaching practices specific to engineering in both academic and corporate settings. The target audience includes teaching faculty - Certified public school teachers (or those pursuing certification) in K-12 who wish to focus on engineering; engineering PhD students interested in faculty positions; community college teachers; corporate training staff.

- A Thesis Master of Science in Engineering Education focusing on current issues in engineering education as well as basic research methods designed to address those issues. The Thesis Master's option will address both pedagogical issues for faculty in the classroom and research issues for those in educational policy and related fields. The target audience includes students who wish to pursue careers in engineering policy; possibly those who wish to teach at community colleges; students with a strong interest in engineering education research; corporate training staff; university staff with assessment responsibilities. Though the MS may be a sufficient degree for students focused on policy/administrative careers, it should serve primarily as a lead-in to the PhD.

- A PhD in Engineering Education focusing on current issues in engineering education as well as advanced in-depth research methods designed to address those issues. While this option will address pedagogical and assessment issues for faculty in the classroom, its primary focus will be on cutting edge research needed to advance engineering education. The target
audience includes students who wish to pursue careers in engineering policy, those who wish
to teach at non-research colleges and universities, engineering students with a strong interest
in educational research, corporate training management, university assessment staff or
administrative faculty.

Graduate program survey

Some of the first questions we were asked by our administrators were, “How many programs like
this are there now, where are they, how many graduates do they produce, and where are the
graduates employed?” The answers are very simple and uninformative. We know that Purdue is
also developing such programs, scheduled to begin in Fall 2005. We speak with them on a
regular basis, we have no secrets, and we are investigating ways to collaborate with them. We
know of no other programs in place, although there seems to be discussion ongoing across the
country regarding the development of such programs. In order to gather data on how many
potential students and employers there are, we created a survey, which can be found at
https://survey.vt.edu/survey/entry.jsp?id=1095872314608. If you have not completed our survey,
we would appreciate it very much if you would do so. To date, 71 participants have responded.
Themes referred to the site by a variety of sources, including academic advisor/faculty mentor,
professional listserv, word of mouth, Internet searches and professional publications.

In the survey, a series of questions were asked about the proposed graduate programs. When
asked, “What is your interest in the programs (check all that apply)”, 79% of the respondents
indicated they were a prospective graduate student interested in teaching at the college level,
37% indicated prospective graduate student interested in teaching engineering at the high school
level, 30% were interested in teaching engineering in a corporate setting, and 25% were
interested in pursuing educational research in science, technology, engineering, and mathematics.
When asked, “Please briefly describe what you hope to gain from this degree”, 35 of the 43
respondents thought they would obtain pedagogical background to allow them to teach K-12 or
college. (Our engineering education programs will probably not offer a means of licensure for K-
12 educators, although the greater EEC Program will provide pathways for licensure.) It is also
evident from the survey that the Certificate and Ph.D. degrees are preferred by prospective
students. When asked the question “If you are interested in pursuing one of the proposed
degrees, which degree would you be most interested in, 18 (25%) of the respondents chose the
Certificate, 27 (38%) chose the Ph.D., 11 (15%) chose non-Thesis Master’s, and another 7 (10%)
chose Thesis Master’s. A number of the respondents (15%) are considering changing careers and
thought that the degree would help them to accomplish that goal. An inordinately large
percentage (44%) of the respondents is women, and 25% reported their ethnicity as Asian (14%),
Black (10%), or Hispanic (4%). While this diversity is not surprising, it leads us to believe that
engineering programs of this nature, at the undergraduate level, may be a way to increase
participation by women and members of ethnic minority groups that are historically
underrepresented in engineering.

The number of prospective employers taking the survey was small. Fourteen responded to the
question, “If you would be interested in hiring a graduate of one of the proposed programs,
which type of graduate would you find most useful for your organization? The Ph.D. received
36%, the Thesis Master’s received 29%, the Certificate received 21%, and the Non-Thesis Master’s degree received 14%.

It is clear from the survey responses to date that the pedagogy component is what attracts prospective students to the programs, and that the Certificate and Ph.D. degree are what most people are interested in. They are interested in teaching at K-12 or college levels. A large number of the respondents are currently graduate students who want the Certificate or Non-Thesis Master’s degree to learn more about teaching practice and/or enhance their chances for faculty job opportunities in higher education. With the current outsourcing of industrial research, the number of job opportunities in corporate and government research laboratories has diminished greatly. Thus, those students obtaining a Ph.D. in engineering increasingly look to academia for positions. There are also others who are interested in teaching engineering in corporate settings, as well as those who are interested in pursuing educational research in engineering and science. While the sample population of prospective employers is very small in this survey, it is apparent that employers view all the four graduate programs as useful. In the next section, we provide more details of our proposed programs.

Pedagogy-based programs

The first part of our plan addresses the needs of traditional engineering doctoral students who have interest in becoming university or community college professors in their chosen fields, and also certified high school teachers who do not have an engineering background but are already teaching pre-engineering courses or have interest in doing so. Our planned graduate certificate in engineering education and a professional Master of Engineering Education (MEngE) degree will satisfy these needs. The certificate program requires 12 credits and is designed for traditional engineering graduate students, although there will be courses designed to allow students with non-engineering degrees to be assimilated. It focuses on theories of learning, instruction, and evaluation and how to properly implement those theories in an engineering classroom. The MEngE program is a non-thesis degree, which will require a minimum of 30 credits, including three to six credits for a project report.

The proposed minimum entrance requirement for these two programs is a Bachelor of Science (BS) degree in engineering, physics, mathematics or any of the natural sciences and a 3.0 GPA in the last 60 hours of the undergraduate program. Other applicants will have to meet specified required mathematics and science courses. Typical courses for these degrees include: Preparing for the Engineering Professoriate (3 credits), Design in Engineering Education and Practice (3 credits), Foundations of Engineering Education (3 credits), and Communication in Engineering and the Sciences: Theory, Practice and Pedagogy (3 credits). The first three of the above were taught in the 2003/4 and 2004/5 academic years, and one or two graduate students from most of the engineering departments in the College of Engineering were enrolled in these courses. In addition, students will have the option to select courses from a variety of graduate level courses that are under development. Some examples of courses under development are given in Table 1, and Table 2 shows existing “education” courses planned for inclusion in the list of courses that can be used toward the degrees. A Practicum is required for both, and we are piloting a Practicum in Spring 2005.
Research-based degrees

The second part of our plan offers the Master of Science and the Doctor of Philosophy degrees in Engineering Education. Both degrees will be based on cross-disciplinary, rigorous and quantitative educational research. The MS degree requires 30 credits, including 6 credits for thesis work and a 3-credit Practicum. The target audience for the MS degree is students who wish to pursue careers in engineering policy; possibly those who wish to teach at community colleges; students with a strong interest in research; corporate training staff; and university staff with assessment responsibilities. Though the MS degree may be a terminal degree for students focused on policy careers, it should serve primarily as a lead-in to the Ph.D. degree program. This latter degree addresses the need for and shortage of individuals with academic assessment background, especially in engineering. Pre-engineering programs in community colleges in many states are expanding, including those in Virginia, which are responding to the Governor’s initiative to have students receive college credit while in high school.

The Ph.D. degree is designed for students who wish to pursue careers in engineering policy; those who wish to teach at non-research colleges and universities; engineering students with a strong interest in educational research; corporate training management; and university assessment staff or research faculty. Another sector of our target Ph.D. audience may include people with interest in a teaching career who hold BS and/or MS degrees in engineering with good industrial experience, but who do not wish to pursue a Ph.D. degree in their traditional engineering discipline. This degree is primarily designed with the following issues in mind: i) a large increase in requirements for assessment of academic programs and difficulty in finding faculty with that expertise and ii) shortage of quantitative academic assessment professionals for policy and consulting positions. A Practicum will be required for all PhD candidates.

Candidates for these two degrees may also opt to take graduate courses from their traditional or other engineering departments.

Table 1: Graduate Courses Under Development by the Department of Engineering Education

<table>
<thead>
<tr>
<th>Course Name (credit hours)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparing for the Engineering Professoriate (3)</td>
<td></td>
</tr>
<tr>
<td>Design in Engineering Education and Practice (3)</td>
<td></td>
</tr>
<tr>
<td>Communication in Engineering and the Sciences: Theory, Practice and Pedagogy (3)</td>
<td></td>
</tr>
<tr>
<td>Using Virtual Reality and Visualization Tools in Engineering and Science Education (3)</td>
<td></td>
</tr>
<tr>
<td>Object-oriented Concepts for Engineering Education (3)</td>
<td></td>
</tr>
<tr>
<td>Design of Laboratory Courses for Engineering and Science Education (3)</td>
<td></td>
</tr>
<tr>
<td>Foundations of Engineering Education (3)</td>
<td></td>
</tr>
<tr>
<td>Contemporary Issues in Engineering Education (3)</td>
<td></td>
</tr>
<tr>
<td>Quantitative Research Methods in Education (3)</td>
<td></td>
</tr>
<tr>
<td>Assessment in Engineering Education (3)</td>
<td></td>
</tr>
<tr>
<td>Presenting Engineering Research (1)</td>
<td></td>
</tr>
<tr>
<td>Issues in Engineering Education Research (3)</td>
<td></td>
</tr>
<tr>
<td>Practicum in Engineering Education (3)</td>
<td></td>
</tr>
</tbody>
</table>
Table 2: Suggested Interdisciplinary and “standard” Education Courses

<table>
<thead>
<tr>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Statistics For Education</td>
</tr>
<tr>
<td>Feminist Perspectives on Pedagogy and Academe</td>
</tr>
<tr>
<td>Introduction to Science and Technology Policy</td>
</tr>
<tr>
<td>Advanced Topics in Science and Technology Policy</td>
</tr>
<tr>
<td>Preparing the Future Professoriate</td>
</tr>
<tr>
<td>Training System Design</td>
</tr>
<tr>
<td>College Teaching</td>
</tr>
<tr>
<td>Distance Education</td>
</tr>
<tr>
<td>Applied Theories of Instructional Design</td>
</tr>
<tr>
<td>Advanced Educational Psychology</td>
</tr>
<tr>
<td>Advanced Topics in Technology Studies</td>
</tr>
<tr>
<td>Cognitive Psychology</td>
</tr>
<tr>
<td>Qualitative Methods in Educational Research</td>
</tr>
<tr>
<td>Quantitative Research Methods in Education I &amp; II</td>
</tr>
<tr>
<td>Foundations of Educational Research &amp; Evaluation</td>
</tr>
<tr>
<td>Institutional Effectiveness &amp; Outcome Assessment in Higher Education</td>
</tr>
<tr>
<td>Critically Engaged Teaching with Advanced Technology</td>
</tr>
<tr>
<td>Pedagogical Practices in Contemporary Contexts</td>
</tr>
</tbody>
</table>

During the process of designing these courses and programs, and in the early stages of implementation (i.e. putting things through governance), we have identified a number of unique opportunities as well as some challenges.

**Opportunities**

- The most interesting opportunity is to create programs which are innovative, effective, and work within available resources and structures. This opportunity is also a challenge, since resources are limited, and university structures are sometimes rigid and difficult to “stretch” to fit new things. We are fortunate to have support at all levels, including the highest levels of the university. Without that support “impossible” might be a better word than “challenging.”
- We believe we are on the leading edge of a national movement that will redefine engineering education and lead to fundamental reforms of engineering programs and how they are designed and presented to learners (formerly referred to as “students”). This is both a challenge and an opportunity, which must be approached with creativity, willingness to take risks, respect, and determination.

**Challenges**

- **Vocabulary.** Two major issues related to vocabulary have emerged.
  - One issue is obvious – the vocabulary inherent in our relative disciplinary knowledge bases. Engineers have a vast vocabulary related to the science, mathematics, and culture of engineering. Educators’ vocabulary is deeply connected to theories of
learning, pedagogy, and assessment – as well as specific vocabulary used to connect to the everyday language of practice.

- The second issue is less obvious, and relates to the meanings that certain commonly used words have within either engineering or education. The term “technology”, for example, conjures up different meanings and relative status for engineers than educators. The whole notion of educational theory and research may be seen as an oxymoron for individuals who may not be aware of the depth and breadth of this long-standing enterprise.

- Our preliminary solution to addressing both of these issues is two-fold. First, we have elected to have on-going conversations, with an open and unthreatening aim to understand the meanings behind the words. We look for intersections of meaning and ways that the collaboration can extend these meanings in productive ways for our program.

• **Rigor.** Both internal and external audiences and constituencies are concerned about the rigor of the program and the employability of students who complete the program. Our planning group is well aware of the need to ensure that the goals of the program are clearly articulated and supported by standards across the disciplines. And, given the novelty of this program, the questions arise about who will take a chance on the graduates from our program. How will we demonstrate and ensure their competence in both engineering and education? Our plan is to build rigor into the admission process, the program itself (e.g., basing the coursework and program experiences on disciplinary standards and research), and the faculty and instruction.

**Concluding remarks**

The fact that you are reading this paper says that you have an interest in engineering education. We would welcome feedback, information on developments you know of, or expressions of interest in collaboration. We are building a highly interdisciplinary, collaborative community, which should have no limits.

We believe we are at the leading edge of something that will not be completed within the span of our careers, or possibly our lifetimes. We must think it through completely and set it off on the right direction so that those who follow us can take it the next part of the way.

**Bibliography**

3. CASEE Chronicles, Progress and Accomplishments, 2002-2004, National Academy of Engineering, USA.

**Author Information**

HAYDEN GRIFFIN is currently professor and head of the Department of Engineering Education at Virginia Tech. He holds BSME and MSME degrees from Texas Tech and a Ph.D. in Engineering Mechanics from VPI&SU. He
had 13 years of experience in industry and government laboratories prior to joining Virginia Tech in 1985. Prior to moving into his current position, he was associate dean for academic affairs in the College of Engineering.

ALEX O. ANING is an Associate Professor of Engineering Education, and Materials Science and Engineering at Virginia Tech. His research interests include the influence of socio-economic background on the education of engineers, phase transformations, and synthesis and processing of metallic and ceramic materials.

VINOD K. LOHANI is an associate professor in the Department of Engineering Education at Virginia Polytechnic Institute and State University (Virginia Tech). He received a Ph.D. in civil engineering from Virginia Tech in 1995. His areas of research include engineering education and hydrology & water resources.

J. C. MALZAHN KAMPE is an associate professor in the Department of Engineering Education at Virginia Polytechnic Institute and State University. She received her Ph.D. in metallurgical engineering from Michigan Technological University, M.Ch.E. in chemical engineering from the University of Delaware, and a B.S. degree in chemical engineering at Michigan Technological University.

RICHARD M. GOFF is an associate professor and assistant department head of the Department of Engineering Education in the College of Engineering at Virginia Tech. He is also the Director of the Frith Freshman Engineering Design Laboratory and the Faculty Advisor of the VT Mini Baja Team. He is actively involved in bringing joy and adventure to the educational process and is the recipient of numerous University teaching awards.

MARIE C. PARETTI is an Assistant Professor in the Department of Engineering Education. She directs the Engineering Communications Program for the Departments of Materials Science and Engineering and Engineering Science and Mechanics, and teaches technical communication, professional development, and capstone design courses. Her research focuses on the pedagogy of engineering communication, assessment, and design pedagogy.


JENNY L. LO is an assistant professor in the Department of Engineering Education in the College of Engineering at Virginia Tech. She received her Ph.D. in chemical engineering at Carnegie Mellon and her B.S. in chemical engineering at Tulane University.

JANIS TERPENNY is an Associate Professor in the Department of Engineering Education with affiliated positions in Mechanical Engineering and Industrial & Systems Engineering. She is co-Director of the NSF multi-university Center for e-Design. Her research interests focus on conceptual design of engineered products and systems. She is currently a member of ASEE (chair of the Engineering Economy Division), ASME, IIE, SWE, and Alpha Pi Mu.

THOMAS WALKER, Associate Professor of Engineering Education at VPI & SU. He earned his BSEE degree from Purdue University and his MSME from the Naval Postgraduate School. His primary academic and pedagogical interests are in the areas of distance/asynchronous learning technologies and methods, object-oriented programming, modeling, and design.

HASSAN AREF is Dean of Engineering and Reynolds Metals Professor of Engineering Science and Mechanics. He joined Tech in April 2003 after ten years as department head at University of Illinois, Urbana-Champaign. He has a long-standing interest in engineering education and arranged for the first ever session on “Education in Mechanics” at the 2004 International Congress of Theoretical & Applied Mechanics in Warsaw, Poland.

SUSAN MAGLIARO is Director of the School of Education at Virginia Tech. She holds an Ed.D. in curriculum and instruction from Virginia Tech. She has experience as a classroom teacher in general and special education. Her research interests include professional development for practicing teachers and teachers’ models of instructional design.