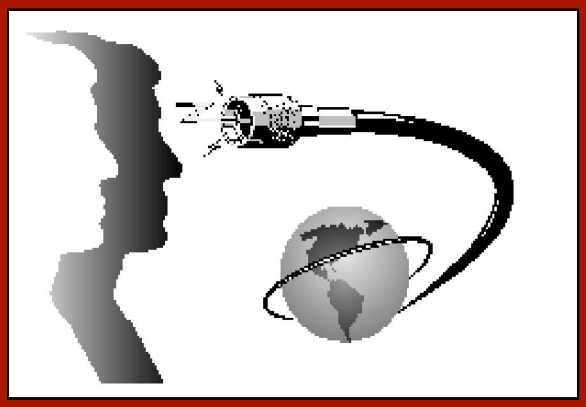
Center for the New Engineer



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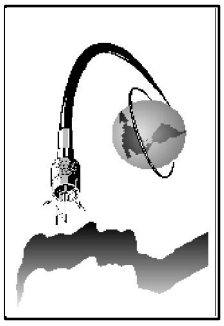

Purpose

The Center for the New Engineer (CNE) was established in August 1993 as an ongoing, interdisciplinary investigation into the education of engineers and scientists who operate from a new common sense about profession, education, research, innovation, and work. Engineers have an opportunity to demonstrate that the Internet is not only a mechanism to transport data, but also is a place where communities form and where human concerns are dealt with. Our main strategies are to:

- Design new approaches to teaching engineering based on an interpretation of learning in which knowledge is the capacity for effective action in a domain.

- Design new approaches to engineering curriculum based on an interpretation of education as an unending process of increasing one's competence and as a social process in which one takes responsibility for one's own learning and for the group's learning.

- Design new approaches to engineering research based on an interpretation that research and teaching are coherent parts of education.

  Build social and technological mechanisms for maintaining strong links between research and curriculum.

- Design a collaboration among organizations to demonstrate a new social function for schools—K-12 and universities—jointly transforming the community's new knowledge into curricula at all levels.

Every project depends integrally on computing and telecommunications technology to support human practices and concerns. No project of the center is considered a success unless it results in new actions by our students, faculty, and others.

Background

Higher education in America is facing an enormous breakdown. Performance of students on standardized tests has been declining. Increasing numbers of students are dropping out of school. State legislatures have been cutting funds to universities.

Toward a New Interpretation

In "Educating a New Engineer" *(Communications of the ACM, 1992)*, Peter Denning proposed that these problems have been caused by massive shifts in the public's understanding not only of research, but of profession, innovation, work, university, and education. These shifts bring expectations that old curricula cannot meet. He proposed reforms that would adapt our curricula to the new realities.

In "Designing New Principles to Sustain Research in Our Universities" *(Communications of the ACM, 1993)*, Denning proposed further that we have allowed research and teaching to appear to be competing enterprises. To reconnect research to the educational mission, he proposed establishing an explicit "feedback path" from research into curriculum.

We need to design and practice a new engineering common sense in which engineers are not merely the receivers of specifications and solvers of problems, but are entrepreneurs who design technologies that make human action more productive.

CNE—Center for the New Engineer

This center was founded to create a working instance of an engineering curriculum that adjusts to feedback received from other schools, businesses, and government. The initial focus is the construction of a high performance computing lab for undergraduate students, offering them introduction to advanced computing and communication technologies. The Community Learning and Information Network (CLIN) is helping to extending the lab's capabilities to regional K-12 schools through a network called CNELink.

Projects

HPC in the Curriculum–The Feedback Path

This project creates a high performance computing (HPC) laboratory for undergraduates and a set of practices through which faculty transfer results from research domains into the lab. Through joint projects and tutorial modules, as well as the Internet, the results of this effort will be available to regional and other K-12 schools and to universities in the national HPC consortium. This project is supported by ARPA.

Educating Engineers to Design Complex Systems

This project augments the CNE HPC lab project by providing for curriculum development of tutorial modules specifically oriented to teaching students how to make sense of complex systems. Methods from computational science and organizational informatics are brought in and made available for students' "design portfolios." This project is supported by NSF.

CNE Tutorial Modules

The modules developed at the CNE HPC Lab include Workflow and Coordination Systems, Discrete Event Simulation, Scalable Parallel Algorithms, Genetic Algorithms, Network Protocols, and Virtual Memory Systems. More are under development. These modules provide tutorials, demonstrations, and workbenches for students seeking familiarity with current research results. They are accessible via the World Wide Web. This project is supported by ARPA and NSF.

CNELink and New Engineer Consortium

This consortium includes regional schools, businesses, and government to assist K-12 schools in working together to transform new community knowledge into curricula at all levels. It is a testbed for the results of the other projects, and a forum for members to discuss their concerns, proposals, and offers. The network connecting them to Internet via GMU is called CNELink. This project is supported by ARPA.

Exhibitions in the Curriculum

This program offers a design exhibition course as the capstone in the computer science curriculum. Seniors form teams to work on a project selected by a company in our Collaborative Partners Program. This program not only benefits students, but also offers a unique opportunity for industries to use state of the art computing technologies to solve company specific problems.

Collaborative Space Through Lotus Notes

This project creates and investigates "collaborative space" in which groups of students, faculty, and others can form, share work, and organize their interactions. Lotus Notes offers a medium accomplishing this. This project is a collaboration with Lotus Development Corporation and the GMU University Computing and Information Systems.

Improving Academic Organization Processes Through Workflow Technology

This project demonstrates how technology for collaborative spaces can be coupled with workflow management technology to produce significant improvements in academic work processes. It is a collaboration with Action Technologies.

Reinventing Teaching

This project is an ongoing investigation of teaching methods that take maximum advantage of new computing and networking technologies and cultivate more effective teaching and teachers. Technologies do not automatically make teaching better; we must also work with the practices and skills of faculty and students.

Sense 21

This project establishes a growing network of students and faculty devoted to developing a new shared (common) sense that would enable them to be much more effective engineers in the 21st century. The new sense is based in new interpretations of communication as coordination of action. An experimental course has been designed and is being offered every Spring.

Investigators

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[†]CSI – Institute for Computational Sciences and Informatics
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Affiliated Institutions

Consortium

The Consortium for the New Engineer consists of representatives from:

- Alexandria City School District, Virginia
- Arlington County School District, Virginia
- Fairfax County School District, Virginia
- Montgomery County School District, Maryland
- Prince William Country School District, Virginia
- Val Verde Unified School District, California
- Virginia State Education Department
- Advanced Research Projects Agency
- National Science Foundation

Business Partners

- Action Technologies
- Community Learning and Information Network (CLIN)
- Course Technology
- Lotus Development Corporation
- Media General
- Morino Foundation

Other GMU Groups

- Institute for Computational Sciences and Informatics
- Graduate School of Education
- School of Business Administration
- University Computing and Information Systems

For More about CNE

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To Access the CNE Home Page and Tutorial Modules set your URL to: http://cne.gmu.edu/

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