


Pre-Engineering Newsletter

November 2009

In this e-mail:

Purpose of Teaching Engineering

One of the most serious issues confronting K–12 engineering education is establishing its purpose in the schools. On the one hand, many believe that engineering should be a pathway to post-secondary engineering education. From this perspective, content and curriculum should be designed to maximize and enrich the mathematics and science backgrounds of highly capable students, typically in applied design situations, to prepare them for the rigors of college-level engineering. At the other extreme, many believe that K–12 engineering programs should advance technological and scientific literacy, thus helping to prepare students for informed participation in a world permeated with technology.
From the first perspective K–12 engineering is appropriate "for a select few." From the second perspective, engineering is important "for all students." Resolving this issue will have profound implications for content, curriculum.

By Charles M. Vest, Former MIT President, published in K-12 Engineering Education Vol. 39, #3 - Fall 2009

http://www.nae.edu/Publications/TheBridge/16145/16150.aspx

Dear Kent School student,
The Kent School Pre-Engineering Program will host its first Pre-engineering lecture of the year.

Anytime, Anywhere: The Wireless Revolution

An all-school lecture on November 2nd from 7:00PM to 8:00PM Mattison Auditorium by Dr. H. Vincent Poor, Dean of the School of Engineering and Applied Science at Princeton University.

ABSTRACT

Wireless communication is one of the most advanced, and most rapidly advancing, technologies of our time. The pace of adoption of wireless technology has been breathtaking: one wireless technology alone – cellular communications – is now used by half the world's population, after less than twenty-five years in existence. This unprecedented growth in the use of wireless has been driven by the freedom afforded by the "anytime, anywhere" connectively that it makes possible. Wireless is also one of the most valuable technologies to society, both in terms of applications and in terms of the trillions of dollars of investment and revenue it generates worldwide. After addressing the question "what is wireless, and why should we care?" this talk will discuss the current landscape in wireless, some of the technical, social and political challenges it presents, and some of what the future holds for this technology.

"Engineering Design" has been approved as a new course by the Kent School Faculty Committee.

On Wednesday, October 14th, 2009 the Kent School Faculty Committee approved a new course as part of Kent's Pre-Engineering program, "Engineering Design". This course will add to the breadth and depth of our curriculum and will be offered this Spring. Mr. Austin of the Mathematics department will be teaching the course. Please contact Mr. Austin with any questions.

The Incorporation of Technology/ Engineering Concepts into Academic Standards in Massachusetts

Efforts by Massachusetts over the past decade to develop academic technology/ engineering standards and implement related programs has become a reference point for a number of other states and countries looking to support K–12 engineering education.

… Massachusetts has undertaken and describes some successes and challenges related to the development and implementation of engineering programs in K–12 schools. The development of state technology/engineering standards was made possible by the enactment of the 1993 Massachusetts Education Reform Law, but it was begun in earnest as a result of the advocacy of teachers of technology education and engineers interested in education. In Massachusetts, technology/engineering is now considered a science discipline equivalent to physical science, life science, and earth and space science, and a number of state policies, such as policies related to licensing and assessment; support the implementation of school technology/engineering programs. However, a number of challenges must still be overcome before technology/engineering will have developed to a point equivalent to traditional science disciplines.

http://www.nae.edu/Publications/TheBridge/16145/16207.aspx

The Relationships between Students' Conceptions of Learning Engineering and their Preferences for Classroom and Laboratory Learning Environments

A study revealed that conceptions of learning for science could be represented by the seven categories:
"memorizing,"
"testing,"
"calculating,"
"increasing knowledge,"
"applying,"
"understanding," and
"seeing in a new way."
The first four factors (i.e., "memorizing," "testing," "calculating and practicing," and "increasing one's knowledge") are more oriented to less advanced learning, namely "quantitative" views focused on how much is learned.
The last three factors (i.e., "applying," "understanding," and "seeing in a new way") are viewed as more sophisticated learning, namely "qualitative" views which emphasize how well the material is learned.
… the conceptions "memorizing," "testing," and "calculating and practicing" are reproductive learning strategies and reflect a lower-level view of learning. By contrast, the conceptions "applying," "understanding," and "seeing in a new way" are constructive learning strategies and reflect a high-level view of learning.
Studies have revealed that students with a high-level view of learning are better able to understand, explain, and reorganize different materials into existing knowledge structures, whereas those with a lower-level view of learning tend to view learning as knowledge acquisition and accumulation of content. These studies have also indicated that variations in conceptions of learning are contextually dependent. For example, research by Eklund-Myrskog (1998) showed that nursing students conceptualized learning as "understanding," whereas students in automobile mechanics conceptualized learning as "applying." Thus, students with different majors or educational contexts can possess quite different conceptions of learning with respect to their domain of knowledge. Furthermore, Tsai (2004) showed that students may possess different conceptions of learning within knowledge domains. By CHIA-CHING LIN
Graduate Institute of Engineering, National Taiwan University of Science and Technology

The Status and Nature of K-12 Engineering Education in the United States

K–12 engineering education has significant implications for the future of STEM education.
K–12 engineering education has slowly been making its way into U.S. K–12 classrooms. Today several dozen different engineering programs and curricula are offered in schools around the country. In the past 15 years, several million K–12 students have received some formal engineering education, and tens of thousands of teachers have attended professional development sessions to learn how to teach engineering-related coursework.
The presence of engineering in K–12 classrooms is an important phenomenon, not because of the number of students impacted, which is still small compared to other school subjects, but because of the implications of engineering education for the future of science, technology, engineering, and mathematics (STEM) education.
In recent years, educators and policy makers have reached a consensus that the teaching of STEM subjects in U.S. schools must be improved. The focus on STEM topics is closely related to concerns about U.S. competitiveness in the global economy and about the development of a workforce with the knowledge and skills to address technical and technological issues (e.g., CCNY, 2009; NAS et al., 2007; NSB, 2007). To date, most efforts to improve STEM education have been concentrated on mathematics and science, but an increasing number of states and school districts have been adding technology education to the mix, and a smaller but significant number have added engineering.
In contrast to science, mathematics, and even technology education, all of which have established learning standards and a long history in the K–12 curriculum, the teaching of engineering in elementary and secondary schools is still very much a work in progress, and a number of basic questions remain unanswered. How should engineering be taught in grades K–12? What types of instructional materials and curricula are being used? How does engineering education "interact" with other STEM subjects? In particular, how does K–12 engineering instruction incorporate science, technology, and mathematics concepts, and how are these subjects used to provide a context for exploring engineering concepts? Conversely, how has engineering been used as a context for exploring science, technology, and mathematics concepts? And what impact have various initiatives had? Have they, for instance, improved student achievement in science or mathematics? Have they generated interest among students in pursuing careers in engineering?
In 2006 the National Academy of Engineering (NAE) and National Research Council Center for Education established the Committee on K–12 Engineering Education to begin to address these and other questions. Over a period of two years, the committee held five face-to-face meetings, two of which accompanied information-gathering workshops. The committee also commissioned an analysis of many existing K–12 engineering curricula; conducted reviews of the literature on areas of conceptual learning related to engineering, the development of engineering skills, and the impact of K–12 engineering education initiatives; and collected preliminary information about a few pre-college engineering education programs in other countries. This article summarizes some of the committee's findings and presents selected recommendations from the committee's report.
For full article go to http://www.nae.edu/Publications/TheBridge/16145/16161.aspx

Thank you for your time and feel free to contact me if you need more information.

Sincerely,

Dr. Nadire
Wentz Pre-Engineering Program Director
Kent School