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Part I

The aim of this paper is to present the use of the Internet in developing the curriculum of a manufacturing engineering technology programme in Turkey. The programme was implemented in the curricula of 15 two-year colleges over six months to provide seamless progression from vocational high school to two-year colleges and meet the needs of Turkish and global industry. A curriculum development committee, administrative board core group and curriculum development commission were established at the beginning of the project. The roles and responsibilities of the board, committee and commission were determined in January 2002. Members of the curriculum development commission for the manufacturing engineering technology programme were selected: three instructors from two-year colleges, two teachers from vocational high schools, one representative from manufacturing and industry. Two-year colleges, non-governmental organisations, the industrial sector of manufacturing, the chamber of industry and trade and some international vocational and technical educational institutions (USA and UK) contributed to developing a manufacturing engineering curriculum, as well as 14 other developed programmes. A special web page was designed, to provide fast and interactive communication between stakeholders in the curriculum development project and a user name and password were given to each member of the project team to monitor the progress of the project. The curriculum development process was completed on 30 May 2003 and submitted to the Turkish Higher Education Council. It was implemented during the 2002–2003 education year in all the two-year colleges in Turkey.

This paper aims to report a model adopted and implemented at Syracuse University to foster a multidisciplinary approach to manufacturing engineering. The background and rationale behind the establishment of the Institute for Manufacturing Enterprises, a revision of the MS degree curriculum in Manufacturing Engineering, and the establishment of an alliance program with a major enterprise solution company, are explained. The institute was created with the mission of promoting learning in manufacturing enterprises through teaching, application, integration, discovery, and service. The new MS degree curriculum is a result of realizing the vision of the Institute for Manufacturing Enterprises. It provides a unique curriculum addressing discipline-specific fundamentals as well as multidisciplinary knowledge and skills by drawing courses from various units on campus. A full-scale enterprise resource planning software was adopted as a tool to realize the vision of the institute.

A recent Society of Manufacturing Engineers (SME) grant received by the Manufacturing Engineering Program at Cal Poly has provided funds to strengthen its curricular focus on supply chain management, flexibility, business skills, quality, and process controls. New courses and laboratories are developed in electronics manufacturing, information technology, and supply chain management. A functioning supply chain environment has been developed to provide vertical integration among several courses. A software tool being developed in-house integrates the activities of the students who play the roles of customers and suppliers. Details of the various components of this comprehensive project are presented in this paper.

Simulation is increasingly being used as an educational tool in manufacturing classes, especially in the area of automation. However, no simulator currently exists that integrates all aspects of a machining workstation (i.e. physical machine, cutting process, and controller software and hardware) into one simulation in a modular manner. In this paper, the architecture of an integrated, modular machine tool simulator is introduced. This architecture provides the structure to create machine tool simulations with modular components that may be efficiently modified as required. Further, this architecture provides for an integrated machine tool simulation where the interactions between the machine, process, and controller may be efficiently investigated. A detailed two-axis lathe simulator is created from this architecture and examples are provided to present the performance and utility of this simulator as a tool for manufacturing automation education.

Part II

This paper highlights two different outlooks on creative thinking: disordered thinking and idea-generating methods, versus systematic inventive thinking and idea-focusing methods. Several methods of systematic inventive thinking are reviewed and examples are discussed. The experience from industry shows that, through courses for inventive thinking, people observe that this skill can be learned and enhanced. However, methods for systematic inventive thinking complement traditional approaches such as brainstorming or lateral thinking and are not meant to replace them. Teaching methods for inventive thinking are especially important for novice engineers, since only experts develop their own original methods and adjust their behavior to the perceived constraints.

Engineering education has traditionally offered problem-based, project-organized courses with a view to preparing students for their future career. Several universities have engaged in collaborative projects that offer courses in an international educational setting. In this article we present the results of an exploratory study of one such program involving students enrolled in separate Masters programs in Mechatronics and Mechanical Engineering at KTH, Sweden, and Stanford University, USA. The empirical data collected indicate improved interdisciplinary learning and increased knowledge and skills in related areas. It is argued that the problems posed by differences in time and space present learning opportunities.

A state-of-the-art mechatronics laboratory, for use by both electrical engineering and mechanical engineering students, was recently developed at The University of Texas at El Paso through the assistance of the US National Science Foundation. This initiative was aimed at enhancing student interest and learning via a model-based, simulation-oriented approach to control systems analysis, design and development, culminating in the implementation of a digital signal processor-based controller for an inverted pendulum system. This paper describes the laboratory's development, its associated equipment and experiments, and provides details regarding project evaluation and its results that indicate the laboratory's positive impact on student interest in and learning of the controls subject.

Delta delays permeate the current VHDL 1076 standard and have been a source of much confusion and serious problems. The investigation in the paper turns to history and critically examines the contemporary scientific thinkings and technical developments, especially in modeling continuous electronic systems through discrete event techniques. This paper uncovers a plausible explanation, one that is logical and self-consistent, relative to the origin of BCL which, in turn, reveals the source of the problem with delta delays. The paper explains the scientific difficulties with delta delays and offers a solution to the problem that is practically realizable and, surprisingly, straightforward and simple.

This paper discusses the relevance of digital computation in Fuels and Combustion Laboratory Experiments used by the senior students of the Department of Mechanical Engineering, De La Salle University-Manila, Philippines. One of the students' experiments involved the determination of the most efficient CDOM fuel proportion as alternative fuel to diesel oil for steam generators and other industrial applications. Theoretical calculations show that it requires tedious and repetitive computations. A computer-assisted program was developed to lessen the time-consuming activities. The formulation of algorithms were based on the system of equations of the heat interaction between the CDOM fuel, combustion air and products of combustion and by applying the principles of mass and energy equations (or the First Law of Thermodynamics) for reacting systems were utilized. The developed computer-assisted program output verified alternative fuel selected through actual experimentation.

Water fountains have been used for thousands of years for utilitarian and aesthetic purposes. Fountain design provides an excellent opportunity for multidisciplinary projects for engineering and art students. In this paper, detailed design of an indoor fountain with a special effect feature is presented to exemplify what can be done with fountains in educational settings. Comprising of nine individual jets, the fountain produces letters of the alphabet, simple shapes, and symbols with water jets. A microcontroller is used and programmed to create and sequence through interesting arrangements of water displays. With a total material cost of $550, this design, or variations of it, can be adapted for various implementations in fluid mechanics and engineering design courses. Suggestions for student design projects are made.

Classical thermodynamics is restructured to start with practical applications where fundamental principles are introduced just-in-time and on a need-to-have basis. Theoretical information is presented to support the understanding of knowledge as students apply inquiry-based learning. Students assess their own knowledge in the process and produce concept maps linking fundamental principles to basic equations. This approach can be labeled as student-centered, concept-embedded, and problem-based. Students lead the lecture and discover knowledge (concepts) as they need it to solve practical real-world problems. They also gain practice in higher Bloom's Taxonomy levels of cognitive skills such as analysis, synthesis, and evaluation; skills that are much desired of engineers. The classroom format is interactive, somewhat informal, and revolves around students' needs. The traditional coverage of topics is packaged in the form of modules. Effectiveness of these modules is assessed using formative and summative tools and on a continuous basis. Undergraduate engineering students leave the course with enhanced thinking skills, and an increased level of retained knowledge.

Abstract mathematics courses have been difficult for many non-major students including engineering students. This article discusses the results of a study intended to improve students' understanding of abstract concepts in mathematics courses, and to better prepare students for advanced courses in disciplines such as engineering and, as a result, increase retention rate. The study implemented Mathematica, a computer algebra system (CAS), as a visual aid in learning basic linear algebra concepts. Overall, the results supported the role of visual demonstrations/representations in advancing students' understanding of abstract concepts.