"Making Articulation Work"
The NJIT- HCCC Interaction
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Abstract:

New Jersey Institute of Technology (NJIT) has articulation agreements with nineteen (19) county and community colleges in New Jersey which essentially ensures that their graduates can transfer into NJIT programs with a minimum of disruption. However, with the advent of Freshman Engineering Design (FED) and Freshman Engineering courses, which have been incorporated into the curriculum at NJIT, some difficulties arise for students transferring from the community colleges to NJIT. Some reasons for this are lack of staff familiar with subject areas, lack of resources and unavailability of space and equipment. To address these problems and continue to ease accessibility of transfer, NJIT has begun a cooperative effort to help develop inexpensive experiments; transfer non-laboratory based courses; and find industrial sources for equipment. These developments will allow the community colleges to incorporate the FED/FE component courses into their curriculum. One of the simplest areas of courses to transfer is the four environmental based FED/FE courses which deal with the location and design of a municipal landfill, a hazardous waste producing facility, connecting two major highways with an expressway and the design of a municipal water treatment facility. A second method is the design of simple units to illustrate experimental principles.

This paper will describe efforts between New Jersey Institute of Technology and Hudson County Community College (HCCC) to devise a course that meets the freshman engineering requirements.

Introduction:

Hudson County Community College [HCCC] is a comprehensive urban community college. The mission of the College is to offer high quality programs and services which are affordable, accessible, and community-centered. HCCC grants associate degrees and certificates in a variety of disciplines. The Associate in Applied Science (A.A.S.) degree programs are designed to prepare graduates for immediate employment or for continuing their education at a four year institution. The Associate in Science (A.S.) degree programs are designed specifically for transfer to a bachelor’s degree program.

Traditionally, HCCC’s Engineering Science graduates join NJIT and enroll in various engineering programs. HCCC grants an Associate in Science (AS) degree to its Engineering Science students. They then transfer to NJIT to enroll in various engineering disciplines. In the past the transfer was more seamless due to relatively similar curriculum for the first two years of engineering in both institutions. However, the new globalized industrial environment demands more than sound knowledge of engineering fundamentals from new engineers. A graduating engineer should have good communication skill, be capable of mastering common discipline specific, computer packages, understand statistical analysis, and be able to work well in a team environment. In short, industry has set new demands for our engineering graduates and
challenged engineering education with new standards.

Major engineering schools like NJIT have been proactive in adjusting their curriculum to the current needs of the industry. Incorporation of laboratory based Freshman Engineering Design (FED) and Freshman Engineering (FE) courses into the first year curriculum is an effort in the fulfillment of such requirement.

A number of community colleges with pre-engineering programs, while aware of the new atmosphere, have not been able to adapt as swiftly mainly because of logistical obstacles. The first and the most important one is resources. The development, preparation, implementation, and staffing these programs is all great but costly. These courses are often laboratory based and require facilities that are scarce in majority of community colleges, if not all of them. Unless a solution can be drafted, difficulties will soon be raised for students transferring from community colleges to four-year institutions, in this case from HCCC to NJIT.

In order to facilitate the transfer of students transfer from HCCC to NJIT, a cooperative effort to develop and integrate a course into HCCC’s Engineering Science program. This effort is within the framework of the NSF Gateway Coalition guidelines and being supervised by Dean Davis of NJIT.

In Summer 1998, with the initiative of New Jersey Institute of Technology, a number of community colleges gathered to discuss the possibility of developing a course similar to the Freshman Engineering Design (FED) and/or Freshman Engineering taught at this school. Hudson County Community College is utterly interested in the positive outcome of this project and has welcomed the opportunity to remove any future impediment that may arise in completing articulation agreement between the two institutions. In fact, with the full cooperation of chemical and mechanical engineering faculty of NJIT, we are in the process of developing a 2-credit course that contains two modules with content representing both disciplines.

In a seminar organized for this purpose, NJIT faculty presented details about their existing modules. The speakers shared with the participants their success stories, difficulties, needs, logistical issues involved, and students’ feedback.

Many interesting modules have been developed at NJIT by different departments. While we were very excited about the implementation of freshman-engineering course into HCCC’s curriculum, we have to confront and resolve a number of constraints.

HCCC is different from NJIT in two ways: student population and lack of facilities and resources. HCCC is an open admission college and majority of our students take remedial courses before enrolling in any college level classes. Depending on their placement score or upon satisfying some foundation course requirements, students may enroll in one or two college level courses. It became necessary to identify the prerequisite for this course and it was agreed that the students must complete college level algebra to enroll in this course. The same requirement applies to our current engineering graphics course.

The Associate of Science degree program at HCCC is limited to 70 credit hours. Courses like freshman engineering design demand more contact hours than due credit hours. The new freshman engineering course will probably replace the engineering graphics, a two-credit course, in the HCCC’s Engineering Science program. This may create two sets of problems: students complain for not earning deserved credit for the amount of work they do and the administrative objection to the extra compensation required to offer the course.

With the above limitations and issues in mind, the NJIT and the HCCC teams have identified two modules, Chemical and Mechanical Engineering. These modules were also identified within the confines of availability of staff in subject areas, available resources including those to share with various NJIT departments and students population. The HCCC team identified their EGS 100 (Introduction to Engineering Graphics) for possible modular integration or running the FED module as an elective.
Course Objective: The proposed modules will among other things,
(i) Enhance students' interest in engineering,
(ii) Improve critical and logical thinking,
(iii) Explore and work on practical engineering problems,
(iv) Encourage collaborative and in team work,
(v) Prepare them for transfer into four-year institutions,
(vi) Introduce technical report writing,
(vii) Expose them to the disciplines of Engineering,
(viii) Facilitate their assimilation into other Institutions Higher Learning.
(ix) Introduce computer applications (word processing, spreadsheet, database, and power point).
(x) Enhance writing across the curriculum.
(xi) To improve oral communication skills

The Course: The course will have an engineering graphics component throughout the semester (free hand and CAD). In addition, there are two engineering modules (chemical and mechanical).

Program Structure: There are 15 weeks of activities. Two modules of engineering, Seven weeks each, and a final week activity.


Week 1. Orientation, overview, films on chemical engineering, discussion of a project, theory of measurements, units. Introduction of project (Project description)

Week 2. Building the teams. Conversions, Dimensional Analysis concept, report writing techniques. Discussion of the project. (How project works) Team time.

Week 3. Software applications (word processing, spreadsheet, database). Use of the application software in the presentation of the project.

Week 4. Chemical Engineering Equipment and Instruments: An overview, Continuation of project.

Week 5. Field trip.

Week 6. Computation, analysis, preparation of project reports, team work.

Week 7. Report and Oral presentation (State of project)

Week 8. Introduction to Mechanical Engineering.
Regroup team members (Select topics to be applied in ME e.g. CAD)
Continuation of project

Week 9. Internet application, Continuation of project and topical issues.

Week 10. ME Equipment and device (Assemble and disassemble) Continuation of project

Week 11. Fluids and fluid flow (Some Computer simulation) Project

Week 12. Definitions of terms and concepts relating to project. Project week (Guest presentation by external faculty)

Week 14. Continuation of project

Week 15. Final Presentation/ Course evaluation
Discussion of Sample Projects

The sample projects identified include the Exploration and design of a car coffee maker, the slider crank mechanism, the Universal crusher, and the Lawn sprinkler. The engineering project selection approaches to be employed are:

* Product Design Constraint Approach: which involves the use of scientific principles to develop and create a new product. This applies to the Universal crusher.
* Reverse Engineering Analysis Approach: the analysis of an existing product to aid in coming out with a new idea or improvement. This applies to the Car Coffee Maker, the Lawn sprinkler and the Mechanical linkage.

The projects and others to be formulated will enable students to sketch isometric and orthographic views, learn about displacement and velocity analysis, heat transfer, do feasibility studies, and other topics through hands-on experiences.

The application softwares we have available for use include

* Computer Aided Design (CAD) software
* Mathematica/MathCad
* MS Excel
* MS Word for word processing
* MS Power Point for Presentation.

We intend to explore more projects within the confines our limitations to address our set objectives and to increase students' interest in engineering.

Conclusion:

We intend to have this course approved for fall 1999. We will provide a transitional period to fully incorporate the new course into HCCC’s Engineering Science program. During this period, students will be given the option to take the traditional Engineering Graphics or the new Freshman Engineering Design course. In addition, students who are interested in pursuing their baccalaureate degree at NJIT will be strongly advised to enroll in this new course.

We believe that some of the obstacles to offering this course, such as students and administrative concerns, and lack of resources will be overcome through appropriate education, dialogue, and planning. Our modules have also been developed so that can provide all the required facilities. They will provoke students thought process and can be performed with minimal instruments. We intend to utilize the NJIT faculty and others for the attainment of our objectives and for future collaborative work.

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Biographies

DERAN HANESIAN served as chairman of the Dept. of Chem. Eng., Chem. and Env. Sci. from 1975-1988 and is Professor of Chem. Eng. He received a bachelor of Chem. Eng. in 1952 and a Ph.D. in Chem. Eng. in 1961, both from Cornell Univ. Dr Hanesian worked for DuPont from 1952 - 1957 and 1960 - 1963. He taught at the Algerian Petroleum Inst., Yerevan Poly. Inst., Armenia as a Fulbright Scholar, the Uni. Of Edinburgh, Scotland and Rutgers, the State Univ. of NJ. He was a recipient of the Robert van Houten award for teaching Excellence in 1977 at NJIT, the ASEE, Midland T&T Foundation Award for Excellence in Instruction in Eng. in 1986, the John Fluke Award, ASEE, 1994, and the Outstanding Tenured Faculty Award, NJIT, 1994. He is a fellow and Emeritus Member of the American Institute of Chemical Engineers and a fellow and a Life Member of the American Society of Engineering Education.

ANGELO J. PENA received his B.S. ChE degree from Clemson University in 1957 and his M.S. degree from there in 1962. He received his Ph.D. from the University of Connecticut in 1967. He worked as a production and development engineer with Union Carbide Nuclear Company in Oak Ridge, TN, and taught at VPI, and the University of Connecticut. He is currently Professor of Chemical Engineering, Chemistry and Environmental Engineering at the New Jersey Institute of Technology. In 1997, he...
received the NJIT award for Teaching Excellence in the Upper Division. He is a Fellow in both the American Institute of Chemical Engineers and the American Society of Engineering Education.

MOJDEH TABATABAIE, P.E has served as Associate Dean of the Math, Science & Technology Division of HCCC since July 1997. She is an associate Professor of Engineering Science. Prior to becoming the Associate Dean, she served as the coordinator of Engineering Science (1987-1997). She received her M.S in environmental Engineering from NJIT, M.S. in Chemical Engineering from University of Illinois in Chicago, and her B.S. in Chemical Engineering from Shiraz University.

JOHN J. NUTAKOR is an Instructor of Engineering Science in the Math, Science & Technology Division of HCCC since August 1998. He taught at Polytechnic Univ, NY, Medgar Evers College (MEC) of CUNY, and Long Island University, NY. He received his BS in Mechanical Engineering from University of Science & Technology in 1984. He did his M.S and Ph.D studies at Polytechnic Univ. NY from 1986 to 1993. He received the professor of the Year award from MEC in May 1998.