EXPERIMENTAL MEASUREMENTS - A METHOD TO INTRODUCE FRESHMEN TO ENGINEERING

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ABSTRACT

A concern of engineering educators has been why students lose motivation for engineering as a course of studies in or after their first year of study. Some feedback indicates that students do not get a feel for the integrated course of study and its relationship to engineering and also they have no feel for activities engineers undertake in their task functions. In an attempt to address these student concerns we, at New Jersey Institute of Technology developed a series of discipline based modules of seven (7) weeks length each meeting of one and a half (1-1/2) hours twice (2) a week. These modules integrate theory/design/experimental exposure in each course in order to enrich the students learning experience and reduce dropout numbers. Results of student evaluations indicate the chemical engineering measurement based module has been highly successful in achieving these goals. The approach of this module integrates the introduction of experimental measurements in a theoretical sense with actual measurements on pilot plant sized equipment in the areas of fluid (air and liquid) flow rates, flow in packed towers, flow through pipes and fittings, efflux time from tanks, and fluidization.Students are required to write reports and give oral presentations on their experimental undertakings.

Both Administrators and engineering educators are concerned about students dropping out of engineering, and their lack of motivation during their early years of study. Feedback from students indicates that in most cases it is not the workload related to courses as the culprit but a lack of vision or understanding of why they have to take certain courses. Students, being impatient to see the big picture, cannot grasp why they cannot jump into their discipline based courses immediately and how introductory courses will be of use later on as an outgrowth of faculty initiatives in conjunction with the NSF Gateway Coalition grant a discipline based freshman course development was undertaken to correct or address these student concerns and improve student retention and motivation.

The course developed is given the designation Freshman Engineering Design (FED) which is a six hour per week course for one semester required of all freshman engineering students. The course consists of what are three modular components. A three hour, fourteen week computer aided design module, required for all freshmen, is one of the modules and then their are seven week modules meeting three (3) hours a week in the disciplines of civil, electrical,, mechanical and chemical engineering. Students must take two of the discipline based modules in sequence during the semester. No choice is given to the students; they are simply assigned to modules.

The seven (7) week chemical engineering module meets twice (2) a week in one and a half (1-1/2) hour blocks and is a lecture-laboratory course. The class consisting of between fifteen (15) to twenty (20) students is divided into teams consisting of three (3) or four (4) individuals for both in classroom as well as laboratory work.

The course of study is broken down into 2-1/2 classroom meetings covering introduction to measurements, 4 laboratory periods for taking experimental data, 3 periods for calculations, 2-1/2 periods for written and oral report preparation, 1 period for oral presentations and 1 period for student course evaluation and a final exam.

Each student team must do two experiments of which all undertake calibration of a fluid measurement device and a second from a group composed of:

(a) Pressure drop in circular pipes
(b) Pressure drop in a non-irrigated/irrigated packed tower
(c) Fluidization of a packed bed
(d) Efflux time of a tank

Students work as a team in obtaining the experimental data, performing calculations and then analysis. Individual reports are required for each experiment undertaken but the oral presentations are a group effort with each member participating.

Analysis of the student evaluations indicate the course is well received, especially the hands on laboratory part but students have reservations about the oral and written reports. Analyses of faculty performances indicate that only the most experienced, "best", instructors should teach the course. This fact is a critical factors in the success of the endeavor.

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