Engineering Exploration: Teaching Creativity In Engineering Courses

Abstract:

Rapid changes in engineering and technology, practices and skills have enthused educators to raise the curtains to an enterprising world of innovative and realistic gateway towards designing the framework of the curriculum in engineering education. Engineering exploration is a resourceful introduction to engineering concepts with a focus on creativity, teamwork, communication, and working across the available engineering disciplines. This course aims at enhancing students learning by doing and hence the entire course is designed to have activities which are active and collaborative. Students will be introduced to various disciplines as well as engineering design processes providing a design-build-test experience.

Introduction:

Engineering Exploration is an enrichment program designed to expose students in the interested field of engineering that provides an opportunity to work with multiple disciplines within the school of Engineering. Students also get to gain an understanding of how different engineering fields relate to one another. Ethics and sustainability are also essential part of this course. This innovate program connects students with industrially-sponsored capstone design projects for a cooperative, real-world engineering experience in specially-equipped campus labs.

It is imperative today that, engineering education needs a holistic view of the multi-disciplinary skills required for engineering problem solving, engineering design process, teamwork and collaboration. The ability to engage in a creative process to define or solve a problem or design a novel artefact is essential to engineering as a profession, and especially to future engineers. The fresher students develop a poise for graduation with a faculty adviser while earning invaluable experience prior to entering the job market.

The prime purpose of this innovative course is to document current practices in engineering pedagogy with regard to opportunities for students' creative growth by examining learning goals, instructional methods, and assessments focused on cognitive creative skills. This augments the need for curricula that enhance students' creative skills in engineering. The uniqueness of this effort is that it is done in a course project at freshman level of the undergraduate engineering program. This effort is observed to be having positive impact on student learning and has resulted in significant learning for faculty members as well.

This course is precisely offered to freshman engineering students of all disciplines. It is an introductory pursuit of the engineering design process through a "hands-on" project approach supported by instruction of fundamental engineering concepts. The Engineering Exploration assignment further establishes that students can affirm or clarify their future discipline before officially entering their major of choice and beginning to integrate academically and socially into the college of Engineering.

The engineering design process would be demonstrated by presenting a suitable engineering challenge. Through lecture, discussion, and problem-solving, students will acquire an understanding of the engineering concepts and skills necessary for all requirements of the challenge. The course content design and delivery therefore necessitate collaboration between team of instructors from multiple disciplines.

This exercise helps students to take up simple challenges by building upon their prior knowledge to provide feasible solutions to an improved understanding of the concepts. With repeated challenges through activities in this course, the students would engage themselves in finding solutions to real – world problems which in turn adds confidence in them. Besides this, mentors are also challenged to think creatively and guide students to do the same. Additionally, teaching freshman about engineering design enforces mentors to understand it better themselves. Furthermore, inclusion of multi-disciplinary team projects need to be mandated, drawing teachers from different faculties thereby flagging a innovative trail to the budding engineers.

The curriculum of this course strongly promotes active participation, collaborative learning, team spirit, self-assessment, etc, with a focus on learning by doing. Students in this course are provided with hands – on learning experience, wherein the students undergo activities with increasing complexity one after the other and students keep on building upon their prior knowledge as the activities provide an increased depth in understanding the concepts. With repeated challenges through activities in this course students engage themselves in finding solutions to a couple of real-world problems which in turn adds confidence in them. Engineering clinics, similar to their medical clinic counterparts, provide project-based experiences within the core of engineering education that enable the transformation of the entire curriculum towards an outcome-oriented, student-centered, total quality environment. Project-based learning approaches build skills within the individuals that give them confidence and motivation to continuously self-learn and adapt as the technologies around them give way to new, more effective paradigms. Perhaps more importantly engineering clinic experiences provide numerous opportunities for students to experience the holism of true engineering problem-solving approaches and ranges of potential technology solutions.

This course also demands a technical project submission which includes creating project timelines, gathering information and evidence in applying strategies to come up with solutions for specific problem statements. All these stages give an opportunity to the students to comprehend and practice decision making. The project planning and execution should be meticulous and also highly diverse in terms of their deliverables, collaborations, and nature of work performed. They are typically based on engineering measurements, in the comprehensive area of food processing and preservation techniques, exploration and sustainability. Deliverables for the course includes a report detailing the conduct and process of the technical projects, a midterm presentation that discuss low-cost and indigenous solutions, progress reports (both oral and written), and a final presentation and report to the facilities personnel and faculty that include an in-depth economic analysis of the various cost-effective solutions.

Conclusion:

Novel curriculum approaches as this deliver an improved understanding of the engineering profession, honing creativity reinforced by a positive learning environment, initiating students on

a lifelong learning trail in their particular course specialties. Multidisciplinary skills required in engineering problem solving, engineering design process and importance of teamwork and collaboration are the enduring outcomes of this course. Engineering exploration is, accordingly, an educational approach to learning that uses Science, Technology, Engineering, and Mathematics as access points for guiding student inquiry, dialogue, and critical thinking. The end results are students who take thoughtful risks, engage in experiential learning, persist in problem-solving, embrace collaboration, and work through the creative process. The Engineering Exploration concept in engineering curriculum is a promising assurance to ability to accomplish multidisciplinary design and to implement meaningful research experiences. Similarly, the use of project-based instruction would pave way to the development of a cadre of students who are design-ready. Communication skills, both oral and written, may also be strengthened through several writing and presentation activities. Student retention could be boosted due to the close faculty-student interaction, a facet of the Engineering Exploration experience. The percentage of students opting for higher education possibly will be significantly improved. The exploration drive is accordingly a successful tool for conducting and disseminating research results that are publishable in educational and technical conferences proceedings and peer reviewed journals.

Reference:

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