Cooperative learning (working together to solve a problem) and problem-based learning are often introduced for the first time in the senior design project, when students are tested on their ability to solve complex engineering problems.

Students are given opportunities to practice what they learn and as they learn and use their education in practice.

The measure of success includes knowledge acquisition, retention, problem formulation, thinking with reasoning and problem solving.

We have developed hands-on experiments that can be integrated in mathematics extensive courses, such as Microwave and Antenna design.

**IMPLEMENTATION OF EXPERIMENT-BASED PEDAGOGIES**

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**METHODOLOGY**

- We propose introducing real world engineering designs and technology in classrooms where students are learning the basics of science and engineering.
- Students will work together to understand well-defined projects and further develop possible solutions. Though step-by-step instructions are not provided, students are guided whenever needed.
- Well defined designed parameters and limitations:

**TRADITIONAL ENGINEERING EDUCATION APPROACHES**

- Engineers work with rules and laws. Engineering faculty teach basic science and the fundamentals, such as the properties of material, along with rules and limitations.
- Lab courses promote active and problem-based learning.
- Teacher-oriented lectures and blackboards are still commonly used in many engineering classrooms.
- “Trust me” approach: “trust me, you need to know this to be successful in your field” (Felder, 2000).
- Lab courses usually have manuals to assist students. Lab manuals, with step-by-step instructions on how to conduct an experiment, hinder students’ creative thinking.
- Note: Many electrical and computer engineering courses, such as microwave and antenna design, cannot be taught with mathematical derivation in details.

**CONCLUSIONS**

- Real life engineering examples should be implemented in engineering classrooms.
- The Design Project should stimulate, challenge, and empower students.
- Lab courses should be designed to promote active and problem-based learning.

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