

Higher Student Achievement

The most significant results of teaching using Challenge-Based Learning (CBL) and engineering design process (EDP), as evidenced in our 7-year CEEMS Project, are:

- **Student knowledge gains are higher:** 5% higher on the post-test versus comparison teachers' students, which is statistically significant at a 95% confidence interval.
- **Engineering design practice requires students use high-level cognitive demand, which involves making connections while solving problems:** 89% students (greater than 18,000 participated) reported successfully understanding and implementing EDP to seek and defend an optimum solution to a real-world problem with constraints.
- **Integration of CBL and EDP instructional practices ensure usage of a wider variety of active learning strategies:** [Classroom Observation and Analytic Protocol](#) data shows that CEEMS teachers used probative, open-ended questioning that encouraged critical thinking; the engineering design process; Challenge-Based Learning strategies; collaborative grouping; and use of external resources (e.g., videos) as a means to focus the lesson on real-world issues.
- **Increased student engagement:** In post teaching surveys, teachers report (100% strongly agreed or agreed) they saw increased classroom engagement compared to when non-CEEMS units were taught.
- **Teachers see the benefit of continued use of CBL and EDP teaching pedagogies with time:** Teachers' current instructional practices (CIP) surveys indicate significant increase of their usage of CBL and EDP teaching pedagogies during the project (from pre- to one year and pre- to post-project, two years) and one year after programming ended.
- **Over time teachers learn to negotiate successfully through barriers and lack of supports reported for student-centered reforms, and minimize their impact.**
- As the students work on real world applications related to the content taught, the teacher introduces them to what kinds of career tracks are open to those who pursue such real world applications and how the application of the content positively impacts society (ACS)