COCKRELL SCHOOL OF ENGINEERING
THE UNIVERSITY OF TEXAS AT AUSTIN

*UTeach*Engineering • *1 University Station R7100 • Austin, Texas 78712*
(512) 471-6196 • Fax (512) 471-1720 • www.uteachengineering.org

September 17, 2015

Dear _____,

Thank you for your support of UTeach*Engineering's* efforts to prepare secondary school educators to teach design-based engineering courses. Please accept this letter as our official request for data collection and for permission to conduct research and evaluation within _____ as it relates to the UTeach*Engineering* project. Details on the project and associated research activities are listed below.

Project Dates:

June 1, 2015 through August 31, 2017

Project Director/Supervising Professor:

Name & Title:	David T. Allen, Ph.D. Melvin H. Gertz Regents Professor in Chemical Engineering; Director of the Center for Energy and Environmental Resources; UTeach*Engineering* Principal Investigator
Address:	Cockrell School of Engineering The University of Texas at Austin 1 University Station, MC: C0400 Austin, TX 78712
Phone:	512-471-3017
E-mail Address:	allen@che.utexas.edu

Other Participating Researchers:

Dr. Catherine Riegle-Crumb
Assistant Professor of Curriculum and Instruction
College of Education
The University of Texas at Austin

Dr. Jill Marshall
Assistant Professor of Curriculum and Instruction
College of Education
The University of Texas at Austin

Purpose of Study:

The University of Texas at Austin's Cockrell School of Engineering and UTeach Natural Sciences program are collaborating to develop, deliver, and conduct research and evaluation on the effectiveness of innovative, design- and challenge- based curricula.

Project Overview:

UTeach*Engineering* was established in 2008 with support from the National Science Foundation to address an emerging need for well-prepared high school engineering teachers. Building on the successes of the nationally recognized UTeach Natural Sciences program, UTeach*Engineering* offers degree programs and professional development opportunities for future and current high school teachers, as well as a high-quality, low-cost high school engineering course, *Engineer Your World*.

Our project goals are:

- To attract and retain more students from diverse backgrounds in K-12 science, technology, engineering and math (STEM) education career paths;
- To prepare current secondary science and math teachers to become effective teachers of high school engineering courses;
- To develop, pilot, and refine an exceptional year-long high school engineering course (*Engineer Your World*) that can be deployed at low cost in a variety of high school settings;
- To build partnerships that enable school districts across the nation to offer high-quality engineering courses;
- To carry out cutting-edge research that contributes to an understanding of how people learn engineering; and
- To develop a viable national model for preparing and supporting secondary engineering educators.

The UTeach*Engineering* project is firmly rooted in current research in engineering education and affords a much-needed opportunity to study how students best learn engineering. This project also offers the prospect of producing pedagogical measures to ensure student learning and foster science and technology interests. Impacts will be examined on three specific groups: engineers involved in the course design and creation of curricular materials, current teachers and college students (possibly future teachers) enrolled in the proposed courses, and the students of these teachers.

The following _____ schools are currently participating in UTeach*Engineering* programs:

For campuses implementing the *Engineer Your World* curriculum, we seek your approval to collect data about students of participating teachers and to conduct research and evaluation that will help us evaluate and improve our programs.

Research Questions:

The following are our core research and evaluation questions:

1) How does participation in this program enable students and teachers to develop more sophisticated understandings of engineering design; engineering as a profession; and, in the case of the teachers, pedagogies for supporting engineering?
2) What factors facilitate or constrain teacher implementation of the challenge-based instruction model of engineering-focused education in the classroom?
3) What is the quality of support for the enacted *Engineer Your World* curriculum (*i.e*., implementation support)?
4) What is the diffusion and impact of the *Engineer Your World* curriculum?
5) Do *Engineer Your World* students gain an appreciation of cooperative work in the classroom over the course of the year? Does this differ by gender, such that boys may start the year lower than girls, but subsequently have a greater increase in their appreciation for such work?
6) Are female students less likely to exhibit a preference for competitive behavior and risk-taking in the classroom, and does this relate to their intentions to pursue an engineering or related college major or occupation?
7) Is there evidence that *Engineer Your World* students increase their endorsement of a growth mindset over the course of the year, such that they are more likely to feel that intelligence is a characteristic that can increase via hard work and effort? How does this differ by gender?

8) To what extent does participation in the *Engineer Your World* curriculum enable students to improve their spatial reasoning skills? To what extent are gains associated with students' gender, social background, or attitudes towards engineering?
9) To what extent does participation in the *Engineer Your World* curriculum enable students to improve their understanding of mathematics and science content? To what extent are gains associated with students' gender, social background, or attitudes towards engineering?

Method:

To answer the research questions about how teachers and students learn engineering in the context of UTeach*Engineering*, we will conduct mixed methods research. Most questions may be answered best through rigorous quantitative methods such as Hierarchical Linear Modeling and regression analysis, whereas some may require rich qualitative methods, such as interviews, observations, and case studies. For the quantitative questions, we will consider how various attributes (*e.g.*, demographics, pre-intervention attitudes, pre-intervention achievement) relate to changes in other variables (*e.g.*, post-intervention attitudes, post-intervention achievement). ***We do not intend to conduct any student interviews or classroom observations within _____ at this time.***

Project Results:

The data collected will inform the broader educational community about the benefits of the challenge-based instruction approach to teaching and learning engineering at the high school and university levels. In addition, the study will highlight possible difficulties and/or drawbacks of this approach. The study will also provide educators with critical feedback on the long-term effects of challenge-based instruction.

Additionally, data collected will provide useful information to the project for revision of the current *Engineer Your World* curriculum and creation of future course materials.

Benefits to the School and District:

As seen in the National Research Council's framework for the Next Generation Science Standards, there is an increasing call for a comprehensive, integrative approach to science education—one that includes engineering. The *Engineer Your World* curriculum is designed to support students in thinking critically and analytically about the world around them by providing realistic problem solving experiences for students. Through this, students will better understand and apply engineering principles that align with emerging local, state, and national standards for student achievement in science and engineering.

In addition, the course is designed such that *all* students, regardless of their long-term career goals will develop a "designing to learn" perspective (Barnett, 2005[1]). That is, our goal is to provide all students with opportunities to develop design and interaction skills, and to practice applying traditional math and science content. These experiences will prepare students to be successful in an engineering career should they choose one, and will enhance their lives and participation as global citizens in a technological society, even if they do not.

Data Gathering Plan:

The UTeach*Engineering* program is a research project that that will involve multiple research and evaluation activities. UTeach*Engineering* will partner with participating teachers on the administration of instruments as needed. ***Please note that each student instrument will take approximately 30 minutes to administer and will not place an undue burden on participating teachers or students.*** A timeline is included below and sample instruments and consent forms are attached.

[1] Barnett, M. (2005). Engaging Inner City Students in Learning Through Designing Remote Operated Vehicles. Journal of Science Education and Technology, p. 88.

Intervention	Academic Years 2015-2016 and 2016-2017			
	Fall (Sept-November)	Winter (Dec-February)	Spring (March-May)	Summer (June-August)
Various student surveys on attitudes, engineering knowledge and design skills	**X (estimate 1-2/year)**	**None Anticipated**	**X (estimate 1-2/year)**	**None Anticipated**
Various teacher surveys on attitudes, engineering knowledge and design skills	**X (estimate 1/year)**	**None Anticipated**	**X (estimate 1/year)**	**None Anticipated**

Plan for Obtaining Informed Consent:

UTeach*Engineering* will obtain written consent from all participants (in-service teachers, high school students and/or parents/guardians) consistent with The University of Texas at Austin Institutional Review Board and school district policies and in compliance with the federal Family Educational Rights and Privacy Act of 1974 (FERPA), 20 U.S.C. 1232g implemented by federal regulations found in 34 CFR Part 99 Subpart D *§* 99.30. Sample consent forms for teachers, parents, and students are attached. A Spanish consent from is available, as needed. If consent is revoked for any participant or student that person's data will no longer be collected by the project.

UTeach*Engineering* will partner with participating teachers on the administration of consent forms.

Assurances:

If our request to conduct research and evaluation activities is granted, UTeach*Engineering* agrees to abide by all policies, rules, and regulations of the district including securing written parental permission, when applicable, and maintaining the confidential nature of records, and the privacy and rights of the individual and school.

Based on the information provided above, please indicate your response to our request on the following page.

Should you have any questions, please feel free to contact me at tdobbs@mail.utexas.edu or 512-471-3017. Again, thank you for your support of UTeach*Engineering*.

Sincerely,

Theresa Dobbs
Sr. Program Coordinator
UTeach*Engineering*
The University of Texas at Austin

District Acceptance:

_____ I approve UTeach*Engineering*'s request to conduct research and evaluation within _____ for the duration of the project.

_____ I deny UTeach*Engineering*'s request to conduct research and evaluation within _____ based on the following reasons:

Signature: _____ Date: _____

Printed Name: _____

Please keep a copy of this form for your records.

Please return the signed and dated form via mail, fax or scan to:

Theresa Dobbs
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