The High School Research Initiative: Engaging Teachers and Students in a Dual-Enrollment Research Course

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Introduction
At UT-Austin’s College of Natural Sciences, undergraduate students dive into scientific research right from the start through the Freshman Research Initiative (FRI). Now high school students can do the same. The pioneering HRI program provides high schools students the opportunity to initiate and engage in real-world research experience with faculty at The University of Texas at Austin. The HRI offers a dual-enrollment course, which is part open-inquiry and part University-collegiate research for high school students. The resulting course provides high school students both college credit for the HRI-Research Methods course (NSC 300) and high school credit for Scientific Research and Design or Project Based Learning.

The SEPA-funded HRI program is the result of partnerships between nationally recognized UT programs: UTeach, FRIs, and OnRamps. UTeach specializes in STEM teacher preparation, while the FRIs specialize in undergraduate research experiences and OnRamps offers infrastructure and experience in hosting dual-enrollment courses throughout Texas.

The HRI seeks to leverage the benefits of these partnerships, obtaining similar outcomes in the FRI and UTeach. That is - FRI students are more likely to earn a STEM degree, graduate within 6 years (Rodenberg et al., CB Science Edu., 2016), earn an estimated 16% more in lifetime earnings (Wallcott et al., CB Science Edu., 2018), and (we believe) graduate better prepared to pursue advanced degrees or jobs in industry. Similarly, UTeach is a model for outreach, professional development, and science education. UTeach-prepared teachers provide an advantage of 5-9 months of schooling over other teachers (Mander, UTeach blog) resulting in greater STEM interest and participation in science.

How does it work?

Summer: Teacher Professional Training
High school teachers who have partnered with the HRI, complete an intensive 3-week professional training over the summer. Led by HRI and UTeach master teachers, the training offers the course curriculum, a first-hand experience to the inquiry-based approach, and instructor guidance. Additionally, the HRI provides equipment and materials support (i.e. access to equipment inventory and financial support), ongoing professional training and support, UTeach campus events and opportunities to present research findings to a broader audience, as well as other means of research and education support.

Fall Semester: Student Inquiry Research
High school teachers who have partnered with the HRI, complete their 9-week student research projects, providing opportunity for students to ask and answer questions in a scientific way.

The latter of these two inquiry-based projects is entered into the high school’s district and/or regional science fair in the spring.

High school teachers develop a number of follow-up training sessions on the high school campus and UTeach campus.

High school students interact with UTeach instructors through the course management system (i.e. Canvas), this includes evaluation of work, announcements of assignments, and feedback for their work.

High school classes visit the UTeach campus, sitting in UTeach courses, visiting UTeach professors, talking with students, and visiting labs.

High school students are assessed for their readiness for the dual-enrollment/collage credit option. Students satisfying the requirements will be given the option to enroll in the course as well.

Spring Semester: Student-UT Collaborative Research
High school students conduct research in collaboration with their partnered UT-Austin lab in the Freshman Research Initiative (FRI).

High school students complete technical reports, present their findings, and present at the UT College of Natural Sciences Undergraduate Research Forum (April), as well as at the high school and/or regional science fair.

High school students and teacher host an HRI Student Showcase event at their campus. (May) UTeach teachers present their research findings in the form of an oral presentation with slides to their fellow students, parents, and school administrators.

Enrolled high school students may receive the dual-enrollment course credit: collage credit course HRI-Research Methods (NSC 309) and high school credit course in Scientific Research and Design (SRD, PETMS 827A Section 805) and BSTA 210C (spring) or Project-based Learning in Project Lead the Way. However, students may withdraw from the University course at any point during the semester.

Summer: Student Fellowship Research
Over the summer, research fellowships are awarded to fund one student from each course section to conduct research at the partnered FRI lab.

Results

Current Evaluation Phase: Formative

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<th>Year 1</th>
<th>2016-17</th>
<th>Year 2</th>
<th>2017-18</th>
<th>Year 3</th>
<th>2018-19</th>
<th>Year 4: projected</th>
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Evaluation Plan

Summative Phase: Years 3-5

To determine the extent program participation affects: 1. Students’ knowledge and skills, including their scientific literacy skills (Formally et al., 2012), knowledge about experimental design, complexity of scientific reasoning, and scientific communication skills (program developed rubric for examining student knowledge and skills); 2. Students’ attitudes, including their science motivation and as well as their scientific self-efficacy, science identity, and scientific values orientation (Extra et al., 2011; Brussard and Carlson, 2014); 3. Students’ educational pursuits, including their enrollment in higher education immediately after high school and their persistence in science majors; 4. Teachers, research collaborators, and near-peer mentors’ abilities to mentor students in scientific inquiry (focus groups and interviews); and 5. Teachers’ self-efficacy in using active learning and facilitate pedagogical techniques (Winston and Calligham, 2014).

Example Question: What impact does participating in HRI have on students’ knowledge and skills?

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