K-12 Teacher Lab and Field Externships, Hosted by University Researchers: Description for EarthRef.org Digital Archive (ERDA)

Author: Katharine W. Huntington, University of Washington

Developed in collaboration with high school teachers and educators in Washington state, and University of Washington students, colleagues and laboratory members, with assistance from administrators from Highline School District (WA) and the UW in the High School program. Supported by U.S. National Science Foundation grants EAR-1252064, 1156134, and 0955309 to Huntington.

I. Introduction

University researchers host K-12 teachers for field and/or lab "Externships" during the summer. Teachers fulfill professional development requirements and learn about research methods and findings through hands-on activities. Researchers practice explaining their science to a broad audience, and participants work together to design activities, projects or assignments for their students to enrich the classroom curriculum. The Externship model is easily adaptable for middle and high-school teachers, and a wide range of science topics. Example materials for high school teachers working with geologists studying paleoclimate and geochemistry is provided.

II. Goals of the Externship Program

The goal of the Teacher Externship program is to bring together university researchers and K-12 science teachers in mutually beneficial activities that lead to lasting impacts in the classroom. Successful Externship programs are thoughtfully designed to minimize effort, maximize benefits, and encourage follow-through for everyone involved. To this end, Externship programs should:

- Require limited PI time to set up, manage and document.
- Rely on school district or university outreach staff to recruit teachers.
- Benefit teachers by satisfying district professional development requirements, fostering collaboration among teachers, and providing a stipend if grant support is available.
- Involve and benefit university students by providing mentorship and teaching opportunities and field/laboratory assistance.
- Benefit high school students via lasting curriculum enhancements.
- Benefit PIs by providing an efficient means to enhance the impact of their research, satisfy funding agency “Broader Impacts” requirements, and hone their own science communication and teaching skills.

III. Example Externship Program and Timeline

First, the PI defines the scope of the Externship and identifies research activities that are appropriate for teacher participation and fit naturally into the activities of the research group. For example, the scope might be~ 40 hours over 10 days of teacher participation, spread out over the summer or accomplished during a continuous period to accommodate the type of activity and the schedules of the participants. Appropriate activities may include shadowing research group members who conduct sample preparation work and analyses in a laboratory setting, or participating in fieldwork to collect samples, install sensors or conduct surveys. The activities should accommodate *two or more teachers at a time*; this makes it easier for the teachers to work together without direct supervision from research group members for many activities and for the curriculum development phase of the Externship.

A successful example conducted at the University of Washington included a 3-day fieldwork and camping experience followed by a laboratory experience and curriculum development project for two teachers. The Externship activities were conducted at the university lab and within driving distance of the university and school district. The example timeline and overview of activities is provided below:

Set-up: *A couple of months into the academic year*, the PI asked around the university for contacts at local school districts that serve highly diverse, underprivileged high school students, or university staff who work with such schools. The PI emailed and found a contact willing to help advertise the project and recruit teachers. *In January*, the PI confirmed with the district that the activity would qualify to earn the teachers Professional Development clock hours to fulfill their ongoing education requirements for employment (note: each state has its own requirements and procedures). The PI made a simple flier advertising the Externship experience, Continuing Education clock hours, and $1500 stipends for two teachers (supported by a NSF grant to the PI), and the district advertised the project. In *March* the PI received and evaluated applications from teachers, and in *April* informed the selected participants and met via Skype for a brief introduction and to schedule mutually acceptable dates for the summer activities.

Summer activities: *In June-July, teachers participated in the camping field trip, and met for 3-4 hours of activity per day (total ~25-30 hours) on campus.* The fieldwork was already planned as part of the PI's research program, minimizing the additional effort needed to include the teachers as field assistants. The on-campus activities primarily involved the teachers shadowing research team members in the lab, helping with simple sample preparation tasks, and collaborating with each other to design learning activities for their high-school students. These activities provided ample opportunity for hands-on learning and high-level discussions about research and teaching between participants and the research group, while requiring very limited research team supervision.

Day 1: The teachers met with the PI for an orientation to the research project, met research group members, and toured the lab with graduate students.

Days 2-4: The teachers accompanied research group members on the field trip, participating in informal discussions about the research project and science education en route, and assisting with sample collection while in the field.

Days 5-7: A week later, the teachers returned to the laboratory to shadow and assist lab members in different aspects of sample preparation and analysis.

Days 8-10: Two weeks later, the teachers met at the university to design an activity related to their experience with the research group that would enhance the curriculum in their high school classrooms. In this case, it was a lab activity on paleoclimate for a 9th grade general science class, integrated with a field trip for students to visit the university laboratory and participate in hands-on activities and a panel discussion aimed at demystifying higher education and STEM for their diverse and underprivileged student body. The PI checked in with the teachers at the beginning and end of each day and arranged for research group members to take turns checking in and brainstorming with the teachers. On the last day, the teachers formally wrote up their lesson plans for the lab activity and field trip curriculum and logistics and presented them to the PI.

Follow-up: The teachers taught the lab activity and brought their students to campus to participate in the lab field trip activity they had designed. The teachers handled logistics and most content, with content support from research team members and undergraduate volunteers.

All participants in the Externship Program reported a positive experience. The PI and teachers elected to continue collaborating on curriculum development and an large-scale annual laboratory field trip program for high school students.

The field trip program design was later incorporated into a research proposal by the PI, which was funded by NSF, providing graduate student RA support to organize the activity as well as logistical support for expanding the lab field trip activities. The lab field trip program ended up being successful and sustainable, supporting 75-150 high school students per year with assessments showing significant student learning gains. The **Lab Field Trip program** to increase STEM literacy and participation and diversity in science is described elsewhere on this database.

IV. Example Teacher Recruiting Flier

Recruiting flier distributed to teachers by school district, university and other contacts:

Earth Science and Climate Change
Summer 2013 Field and Laboratory Experience for High School Teachers
at the University of Washington

Earth's climate is changing rapidly, and understanding past climate change is important for predicting future climate change and ecosystem response. Researchers in the Department of Earth and Space Sciences at the University of Washington are using new

geochemistry methods to measure past climate change in Washington, and want high school teachers and students to get involved!

Goals:

- Increase teacher and student knowledge of Earth science, geochemistry, and past climate.
- Offer hands-on field and laboratory experience for teachers.
- Strengthen teacher capacity for involving students in cutting-edge scientific research.
- Use hands-on experiences to increase student excitement about college and science.
- Create sustainable relationships between K-12 and higher education.

The following field and lab opportunities are paid for by the *National Science Foundation* and the *Quaternary Research Center* at the University of Washington, and include a **teacher stipend of $1,500 and 40 Continuing Education clock hours** for participation in the project.

Geology Field Experience in Eastern Washington

For High School Teachers (June 21-25, 2013)

- Observe and understand geologic features and evidence of past glacial climate
- Learn about the Palouse region soils of Eastern Washington, and the climate records they contain
- Survey outcrops and collect samples for geochemistry analysis to measure past climate change from the last glacial period to the present
- Depart UW Seattle campus the morning of June 21 and travel with research team to the Palouse region of Eastern Washington; return the evening of June 23
- Camp at Palouse Falls State Park

Laboratory Experience at the University of Washington, Seattle Campus

For High School Teachers (25-30 hours, July 8-26, 2013)

- Learn the science behind geochemical techniques used to measure past climate
- Gain hands-on experience with geologic sample preparation, vacuum systems, and geochemical analysis using a mass spectrometer
- Develop a laboratory activity for High School Students that uses geochemistry to investigate climate
- Work with University of Washington researchers, students, and laboratory staff

Field Trip to the Dept. of Earth and Space Sciences, UW Seattle Campus

For High School Students (Fall 2013)

- Experience first hand how geochemists measure past climate change
- Bring high school laboratory activity to life by analyzing samples in the lab
- Visit campus and get a feel for the college experience
- Talk with University students about college life and being a science major

How to Apply:

Interested high-school science teachers should submit the following by March 15, 2013:

- Current résumé and
- Completed application form

Submit these via email to [Name], [title], at [email]. Phone [number].