PROJECT SUMMARY

This Pathways project, Using Technology to Research After Class (UTRAC), explores whether a combination of technology (iPad-enabled sensors, web-based inquiry-focused portal) and facilitation visits improves learning outcomes for rural and Native American elementary-age youth in afterschool programs. Expected outcomes include improved engagement, knowledge, skills, and attitudes (EKSA) toward science, technology, engineering, and math (STEM).

This project is distinguished by numerous innovative elements, including: (i) hands-on, real-time, crowdsourced **schoolyard data**; (ii) a pedagogic emphasis on **communication** of schoolyard data; (iii) testing of motivational **incentives**; and (iv) **partnerships** between afterschool providers, pre-service teachers, and university researchers.

Science represents an iterative process of discovery. To catalyze informal STEM learning, we propose deploying iPad-compatible sensors (e.g., repeat photography, microscope photography, soil and air temperatures, soil moisture, and soil gas fluxes) to explore Life Under Snow across Montana schoolyards. These types of sensors, combined with web-based tools to enable crowdsourced communication, have clear potential for advancing STEM fluency. While these sensors have been compared to Star Trek "tricorders" or technological Swiss Army knives (DeCarlo, 2012; Ponce, 2012; Kelion, 2014), to our knowledge *no studies have quantified STEM learning outcomes due to the facilitated participatory data collection, distillation, and communication modules—specific to informal settings—we propose here*.

Our STEM focal topic, Life Under Snow, includes elements of snow science as well as carbon cycle science a combination at the intersection of three recent literacy initiatives (e.g., Earth Science, Climate, or Energy). In Montana, school playgrounds lie blanketed under snow for the majority of the school year. To maximize relevance to students, UTRAC will pilot and evaluate snow science/carbon cycle science activities that couple real-time schoolyard data with tools patterned after those available through WISE (Web-based Inquiry Science Environment; wise.berkeley.edu).

Participants will collect and compare data with other youth participants; researchers will use formative assessments to define interventions with potential to maximize EKSA improvements among underserved youth. Overall project goals include advancing Informal Science Education and improving how technology is used for STEM learning.

Intellectual Merit: This project will advance our understanding of informal education's potential to improve STEM EKSA, by quantifying how—and to what extent—youth engage with emerging technologies like iPad-enabled sensors and crowdsourcing and visualization tools. While studies have examined the role of technology in advancing STEM learning (e.g., Nick ref?) or the effects of non-technology interventions for improved STEM outcomes (e.g., Feldman and Pirog 2011), this will be the first study to quantify the combined effects of technology and replicated, facilitated visits on learning outcomes in informal educational settings. Afterschool programs will be assigned to either 0, 1, or 2 facilitated visits. Effects of physical and virtual visits on learning outcomes will be quantified to define best practices for sustainable integration of technology in afterschool settings to advance informal STEM learning.

Broader Impacts: UTRAC will empower the collection, analysis, and communication of measurements from across Montana's schoolyards, broadening the participation of rural, underserved, and Native American youth as well as afterschool providers. The alliances we forge will establish a replicable model for underserved communities across America, and will showcase a cost-efficient way of also building capacity in the form of STEM-savvy pre-service teachers and afterschool program professionals.