

RESPONSE TO UTAH EPSCoR PTCs (EPS-1208732)

We welcome the opportunity to respond to the panel and DARB review of the iUTAH EPSCoR Track I Award to provide more details on our iUTAH EPSCoR Education Plan. Here we expand on the integration among our research, education, workforce development, and external engagement activities. Specifically, we respond to the key issues raised by the review and DARB panels, as highlighted in our PTCs. The specific comments we respond to here are numbered (corresponding to the PTCs) below.

iUTAH's Revised Education Plan

8.1.a. Include a framework for educational activities that clarifies the linkages between formal and informal education activities and outreach, clearly specifying how the individual activities combine together to form a cohesive whole. Specify how these diverse efforts will be coordinated and vetted with respect to both learning outcomes and systematic implementation.

Mission and goals of iUTAH:

The iUTAH Education plan was specifically designed to advance the mission and meet the overall goals of iUTAH. The mission of iUTAH is to enhance collaborative partnerships to better understand how to sustain Utah's water resources by developing novel approaches to integrated research and training and by expanding the state's economic, educational, and research competitiveness.

Within this mission, the overall educational goals of iUTAH are to **1)** increase the STEM pipeline in Utah, **2)** increase awareness of water issues in the Mountain West, and **3)** foster interdisciplinary collaborations and training. Using a combination of formal and informal science activities we will achieve these goals over the five-year timeframe of the project. As shown in Figure 1 below, the iUTAH research focus areas and associated facilities are central to the education plan and all of the planned activities.

1. Increase the STEM pipeline in Utah

Increasing STEM participation in Utah requires inspiring students to pursue STEM disciplines, retaining students in those STEM degree programs, and encouraging them to choose STEM careers after graduation. iUTAH's education plan has activities targeted at each of these potential leaks in the pipeline. In order to increase the size of Utah's STEM workforce, we will need to ensure participation by all segments of the population, including women, men, and diverse communities, so our activities also focus on including diverse audiences.

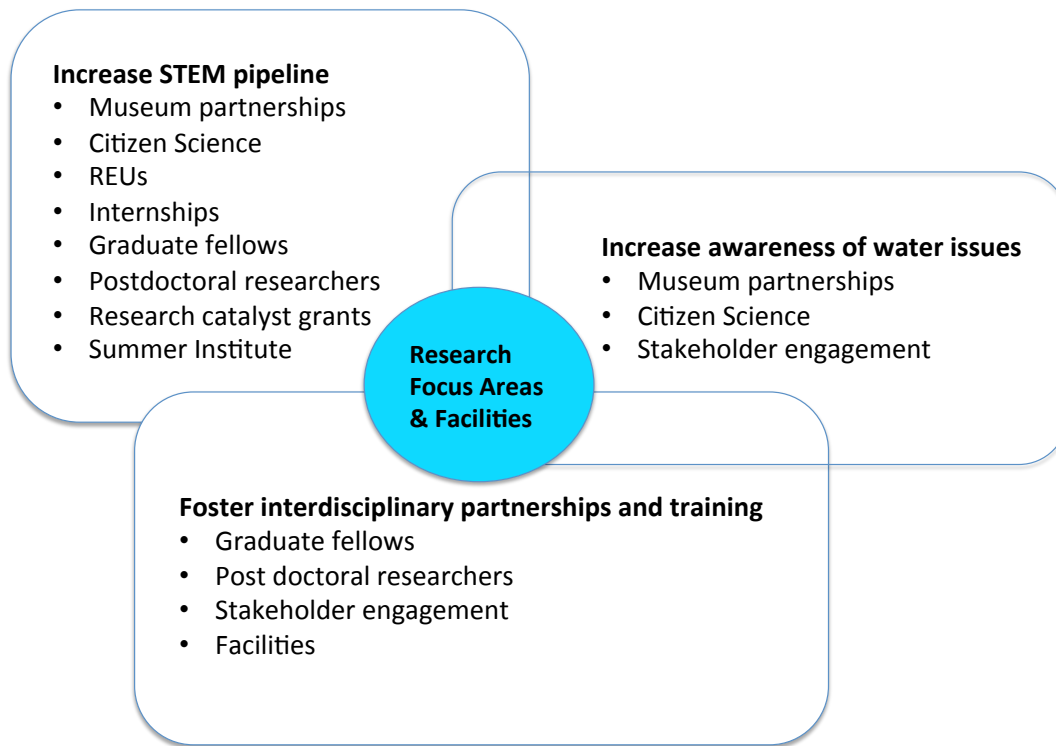


Figure 1: iUTAH Education Framework

1a. Inspire students to pursue STEM disciplines

Inspiring students’ interest in science needs to occur early in their education. Our K12 programs aim to use iUTAH research topics related to water to pique students’ interests in STEM. Specifically, through *iUTAH’s Museum Partnerships*, K12 students and their teachers will participate in NHMU’s Taking Learning Outdoors program and the Leonardo’s Water Workshops. Taking Learning Outdoors will enable teachers to use the instrumented watersheds as living laboratories to incorporate concepts of water availability and quality from our core research into their classroom activities. The Leonardo workshops directly expose K12 students, primarily from underserved communities, to the cultural context of water and its values to society. iUTAH researchers will work with our museum partners to incorporate their research results into these museum programs and serve as mentors during the planned activities.

iUTAH’s *Citizen Science* program will build upon the success of Utah Water Watch to engage students, teachers, and the general public in participatory science at the watersheds instrumented by iUTAH. We will train teachers and students; boaters, fishermen, and other outdoor enthusiasts; church and community groups, as well as both rural and urban residents to monitor water quality and quantity, informed by iUTAH research focus areas and mentored by iUTAH researchers.

1b. Promote the retention of students in STEM

iUTAH's **Research Experience for Undergraduates (REU)** program (funded wholly within our EPSCoR Award) will provide summer research experiences for undergraduates to work jointly with iUTAH scientists and graduate students, with special emphasis on recruiting from primarily undergraduate institutions and those with high enrollment of diverse groups. The program will emphasize cohort building, which provides peer support for the participants and encourages retention in the program.

Graduate Research Fellowships will be available so students can pursue interdisciplinary research projects with iUTAH researchers. These competitive research fellowships will provide funding so that students can conduct the research needed to complete their graduate degrees.

Both the REU students and the graduate fellows will be matched with faculty mentors and near peer mentors to provide the support needed to retain students in their respective STEM programs.

1c. Encourage students to choose STEM careers

We will match students through the **iUTAH Internship program** with private sector or government agencies that work in areas related to iUTAH's RFAs. This will provide them real-world job experiences and role models, as well as integrate the knowledge and theory learned in the classroom with practical application of skills in a professional setting.

The iUTAH REU program will include a **K12 experience** for students after their summer of research. Undergraduates will work with K12 students and teachers during the school year to gain experience with K12 education, serve as near-peer mentors for students, and help teachers incorporate iUTAH research into the curriculum, as appropriate. This program will expose students to the opportunities available to them in K12 STEM education and provide them with STEM teachers as mentors.

1d. Enhance the success of faculty in STEM research areas

We will employ a **Post-doctoral Fellowship program** that allows fellows to work within an iUTAH research team while spending significant time with at least two mentors from different disciplines and institutions. This opportunity will give them the interdisciplinary research experience and co-mentoring that will enhance their ability to succeed in a subsequent faculty position as well as interacting with a maximum number of faculty and graduate students.

We will offer **Research Catalyst Grants** for faculty at primarily undergraduate institutions (PUIs) and for early career faculty to work with iUTAH researchers on one of the three RFAs. The grant recipients will be mentored by established faculty

and encouraged to submit NSF proposals based on their research, either individually or in collaboration with iUTAH colleagues.

Graduate students supported by iUTAH fellowships will enhance faculty's ability to pursue research projects and submit additional research proposals to funding agencies.

1e. Integrate research and education activities

Facilities developed by iUTAH, including the instrumented watersheds, green infrastructure research facility & network, and participatory modeling platform will provide the nexus for K12, undergraduates, faculty and stakeholders to interact with researchers. They will also provide intersection opportunities for interdisciplinary interactions among researchers.

The annual **Summer Institute** will be one of our highlight activities for integrating research and education activities. Teams of K12 students and teachers will spend one week working with iUTAH researchers (undergraduates, graduate students, and faculty) at the watershed observatories or other iUTAH facilities. After the field experience, the teams will report their results and work with an informal science specialist to develop materials that translate the research results into materials for community use, including formal science curriculum and informal science exhibits or publications.

We will host an annual **iUTAH Symposium** after the Summer Institute to bring together all iUTAH participants, as well as our External Advisory and Assessment Teams. The Symposium will include presentations by participating students (from all levels of education), teachers, researchers, and other partners, as well as discussions among the participants about future plans for iUTAH, including lessons learned from the previous year's activities. Our external Educational Assessment expert will also attend to help the iUTAH team use evaluation results to inform plans for the next year's activities. This will also provide a unique opportunity for all iUTAH participants to revisit and modify our Strategic Plan.

The **iUTAH Management Team (MT)** will ensure coordination between research and EOD activities. The MT consists of the Leaderships Team (including the PIs and Co-PIs of iUTAH) plus the co-leads of each EOD team, co-leads of the research focus areas, and representatives from the primarily undergraduate institutions. The MT holds biweekly meetings either in person or through video conferencing via 'go-to-meeting' to ensure regular communication and coordination, as well as to vet any proposed changes in activities and/or budgets.

2. Increase awareness of water issues in the Mountain West

As described above, iUTAH's **Museum Partnerships** and **Citizen Science** programs will work with multiple audiences, including students, teachers, and the general

public, to increase their understanding of iUTAH's research areas and the water resource issues facing Utah and the Mountain West.

iUTAH's external engagement plan also includes a component of **Stakeholder Engagement**, in which Utah's water resource managers work with iUTAH researchers on defining research questions of interest to both parties. In addition, they will share data sets of interest to both groups and define data collection strategies that are mutually beneficial (see CI section of strategic plan).

3. Foster interdisciplinary collaborations and training.

Both iUTAH's **Graduate research and Postdoctoral fellowship programs** will require interdisciplinary projects for the fellows, thus promoting their ability to work across disciplines, including the natural and social sciences.

iUTAH's participatory modeling and visualization platform will provide opportunities for not only integrating across different disciplinary modeling platforms, but for engaging natural scientists, social scientists, engineers and stakeholders in discussions of water resource issues in the Mountain west.

Facilities developed by iUTAH, including the instrumented watersheds (GAMUT), green infrastructure research facility (GIRF), and participatory modeling platform will provide opportunities for interdisciplinary interactions among researchers, undergraduates, faculty, stakeholders, and K-12 students and teachers.

8.1.b. Describe ties to research activities and how these efforts inform, complement, and reinforce one another.

As highlighted in Figure 2 below and in each of the activity logic models (see iUTAH strategic plan), there is a tight integration between the proposed research activities and the planned EOD (Education, Outreach, Diversity) programs.

All iUTAH research scientists will be required to participate in at least one of the EOD activities each year. Scientists will actively participate in the EOD activities, including the activity planning, the activity itself, and the follow-up, including a formal debrief of the activity to inform and improve the next round. The participants in the EOD activities will also inform the scientists' work through feedback collected during the activity. Our External Educational Assessment expert will be present at as many of the EOD activities as possible and will help us incorporate this feedback, in coordination with a designated member of the activity team. The feedback loop can be closed in the regularly scheduled (bi-weekly) **iUTAH Management Team (MT)** meetings that ensure coordination between research and EOD activities.

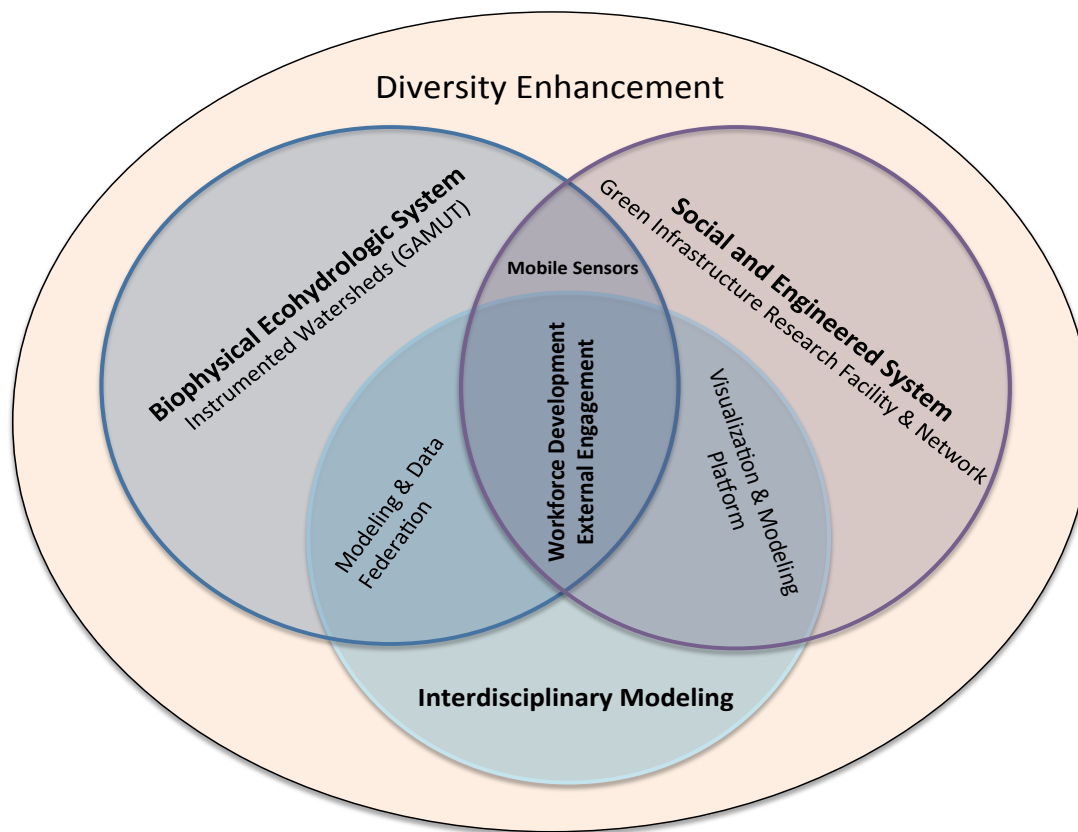


Figure 2: Integration of iUTAH Components

8.1.c. Define clearly what is meant by “engagement and participation.” Each of the activities listed should target a certain number of participants. List their associated recruitment activities, and retention strategies (for example, are there summer bridge programs at receiving schools? What academic and financial support is available beyond the research experiences? Are issues of implicit bias addressed?). Each should have clearly articulated implementation and outcomes plans (beyond outputs).

As highlighted in each of the EOD logic models (see iUTAH strategic plan), each of the EOD activities has targeted an anticipated range of participants annually in their activity. The co-leads for each planned activity are responsible for the implementation plans of each activity, including the recruitment and retention plans (see EOD logic models for specifics). Each EOD activity has or will develop a plan for addressing implicit bias issues in collaboration with our external education assessment expert. The Workforce Development team members have been chosen to represent each of the institutions involved in iUTAH, so each will be the person responsible for advertising iUTAH opportunities at their institution and helping

recruit for each activity. Our near-peer and faculty mentoring plans, which are highlighted throughout the strategic plan, will assist retention of students in each activity. Our engagement and workforce activities build logically upon one another with the explicit assumption, for example, that high school students will become REU students who will become iUTAH Graduate Fellows. While the duration of this award is too short to track such a trajectory, these programs will remain in place after iUTAH to provide for those long-term goals.

8.1.d. Specifically describe the resources needed, expertise available, and their relationship to implementation plans for the K-12 curriculum based on watershed research.

The major avenue for K-12 curriculum development is the ***iUTAH Summer Institute***. The lead for this activity is Louisa Stark from the Genetics Sciences Learning Center (learn.genetics.utah.edu/gslc/) who has many years of experience with curriculum development for the sciences. The GSLC has a staff of 12 with expertise in science, education, technology, and multimedia visualization. In addition, their numerous professional development and community programs have enabled K-16 teachers and diverse communities to develop culturally- and linguistically-appropriate educational materials. During the Summer Institute, teams of students and teachers will spend one week working with iUTAH researchers (students and faculty) at the watershed observatories or other iUTAH facilities. After the field experience, the teams will work with GSLC specialists to develop materials that translate the research results into formal science curriculum. This curriculum development with GSLC will continue during the school year following the summer institute, to guide each individual teacher's implementation of their iUTAH-related curriculum.

In summary, all of our EOD activities rely on existing and growing expertise from throughout Utah and build and leverage on past performance and experience. While the past focus has largely been associated with genetics, all of the previous experience and expertise suggests that using our watershed and green infrastructure research and facilities will be easily and successfully accomplished.