

IOWATER: A Freshman Research Initiative for geology and meteorology majors



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hhmi | Howard Hughes
Medical Institute

ISU Freshman Research Initiative



- Started in 2015 with HHMI funding
- Simplified version of FRI at University of Texas, Austin
 - Undergraduate peer mentors
 - Part-time graduate TAs
- Thirteen streams/courses from 9 disciplines and three colleges
 - SETUP: Safe & Efficient Transportation
 - Dancing for Parkinson's
 - Stem Cells for Neuroregeneration
- Semester or half-semester experiences
 - Between 5 and 35 students in each stream

Earth Wind & Fire Learning Community



- First-year meteorology and geology students
- Field trip in August for new students, peer mentors, and faculty
- Fall and spring 1-credit orientation courses
- Fall covers introduction to university, academic services, and department
- Spring focuses on resilience and professionalism with research experience



Astronomy - 2012



River ecosystems - 2010



Glacial deposits - 2015



Lake sediments and soils - 2014

Iowa DNR - IOWATER



- Volunteer water quality monitoring since 1998
- Network of easily accessible sites along streams in Iowa
- Developed protocols for stream habitat and physical/chemical assessment; provided starter kits
- Results stored in database
- Lack of funding reduced and eventually stopped data collection in 2015



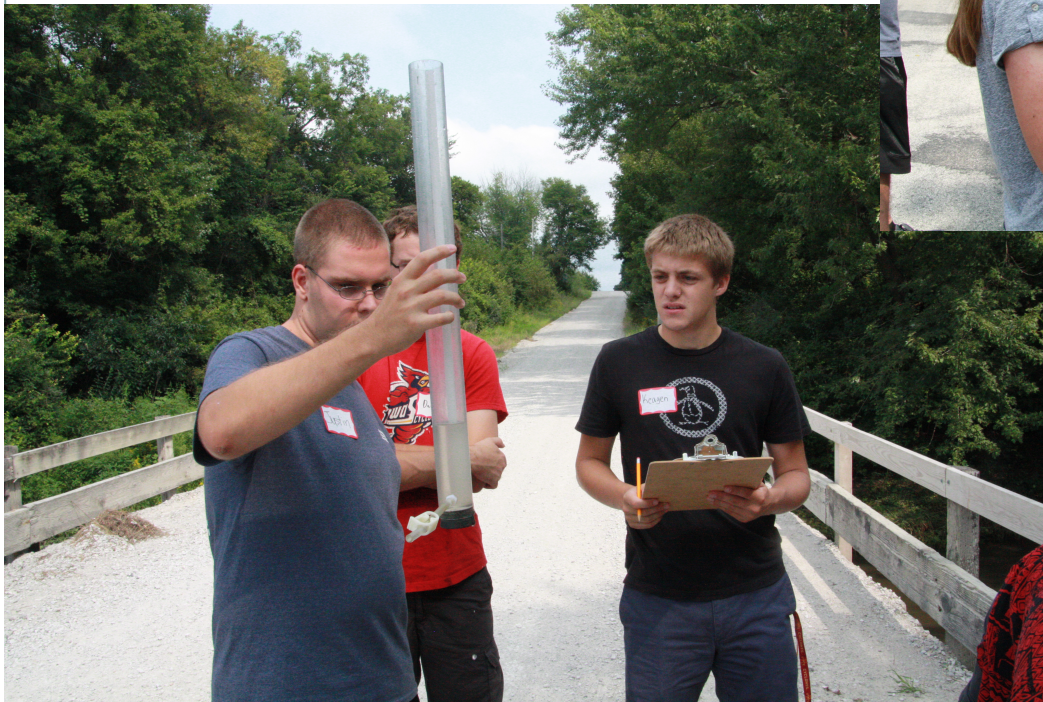
Volunteer Water Monitoring

IOWATER FRI experience

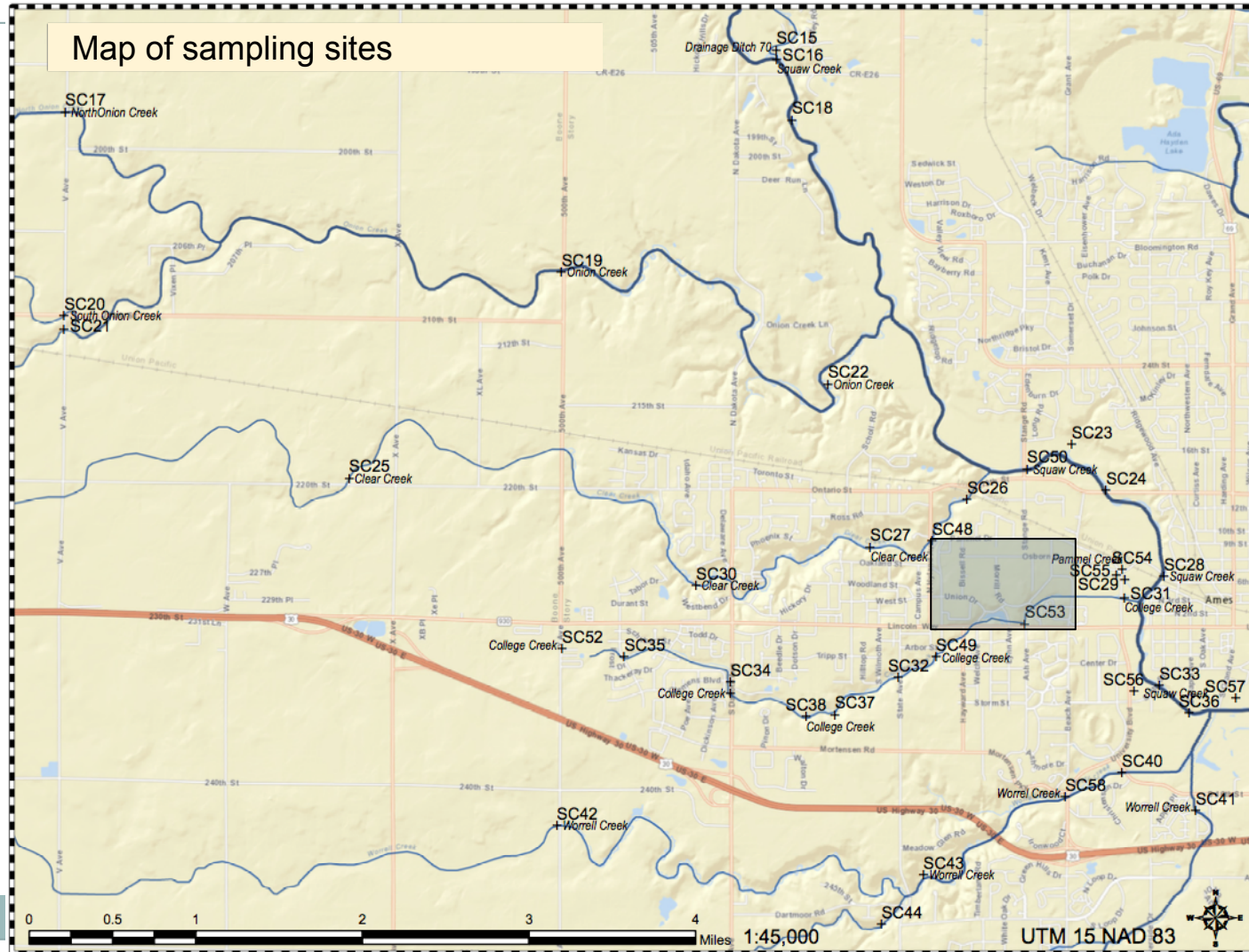


- Adopted IOWATER assessment protocols
- Assembled starter kits
 - pH, nitrate/nitrite, and chloride test strips
 - Transparency tubes
 - Meter sticks
 - Bailer and rope
- Learning community funds used for consumables - costs are kept low
- Offered spring 2016 and 2017 to class of approximately 20 students

August 2015 – Learning
Community Field Trip



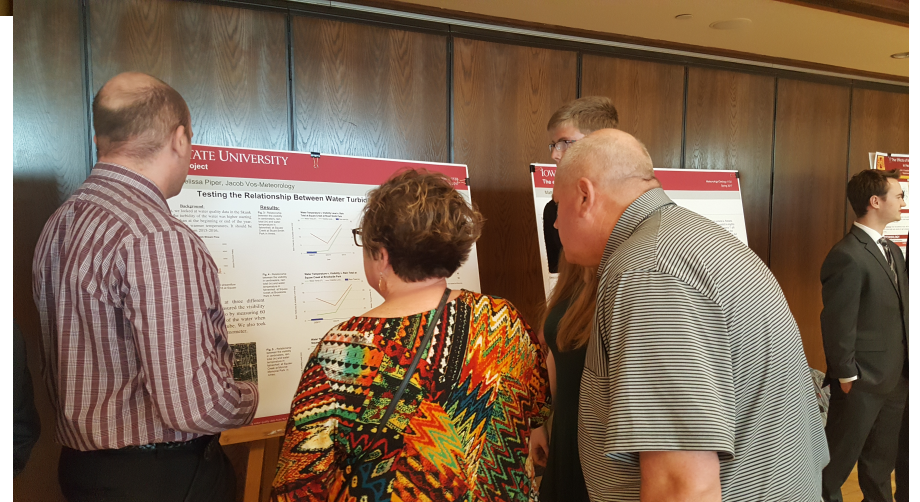
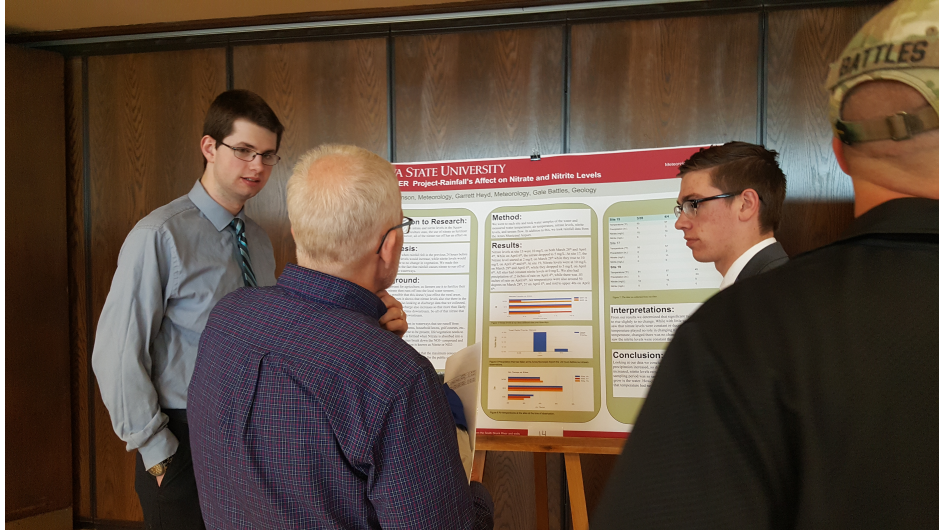
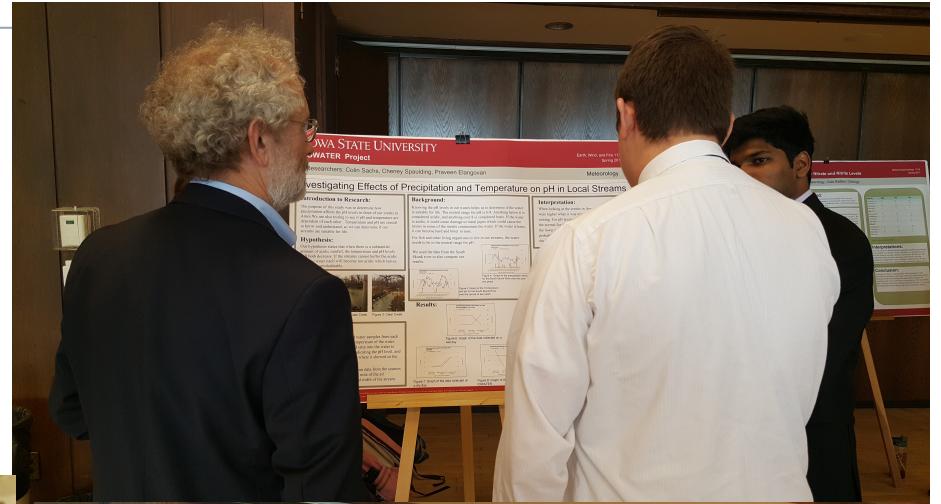
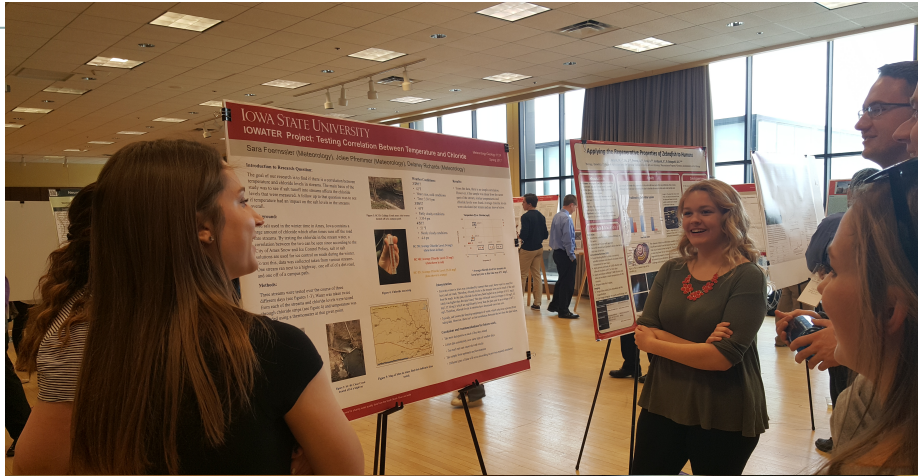
Map of sampling sites



IOWATER Research Experience Layout



- **Learning outcomes**
 - Students in small teams will study water quality and stream discharge near Ames
 - Students will present their research results at the FRI Poster Symposium
- **Learning goals**
 - Locate, download, and perform simple statistical analysis on web-based data (USGS stream discharge from gauges, weather data from Iowa Environmental Mesonet)
 - Plot daily precipitation and stream discharge data over a 3-month period
 - Analyze water samples in the field using established protocols to answer specific research question
 - Compare results with historical data from IOWATER database and data from City of Ames Water Treatment Plant
 - Interpret water quality results within the framework of stream discharge and precipitation



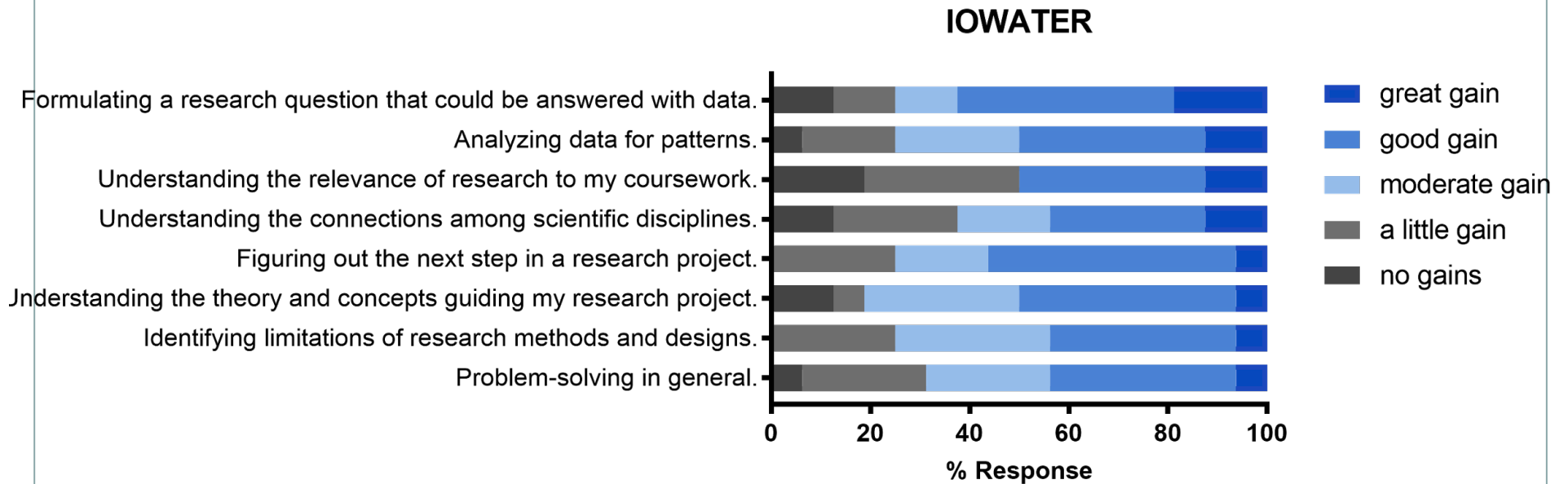
FRI Assessment



- Undergraduate Research Student Self-Assessment (URSSA)¹
 - Thinking and working like a scientist
 - Personal gains
 - Gains in skills
 - Assessment of research experience
- STEM retention
 - All students from spring 2016 (N=9)
 - 89% of students from spring 2017 (N=18)

¹ Weston, T. J., and S. L. Laursen. 2015. "The Undergraduate Research Student Self-Assessment (URSSA): Validation for Use in Program Evaluation." *CBE Life Sci Educ* 14 (3). doi: 10.1187/cbe.14-11-0206

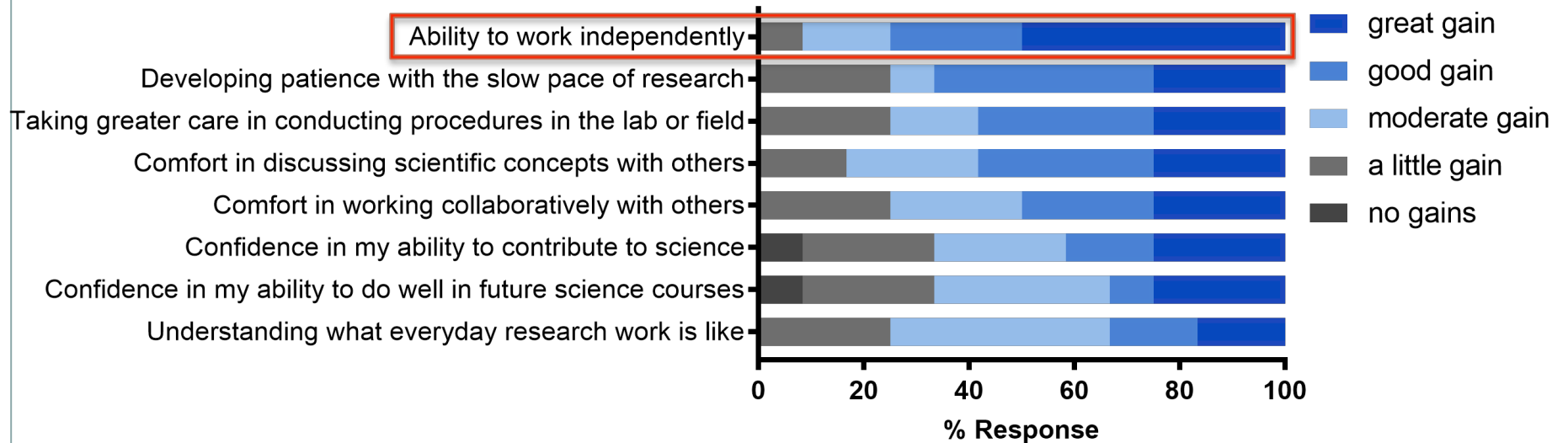
Thinking like a scientist - IOWATER (N=16)



Personal gains – IOWATER (N = 12)



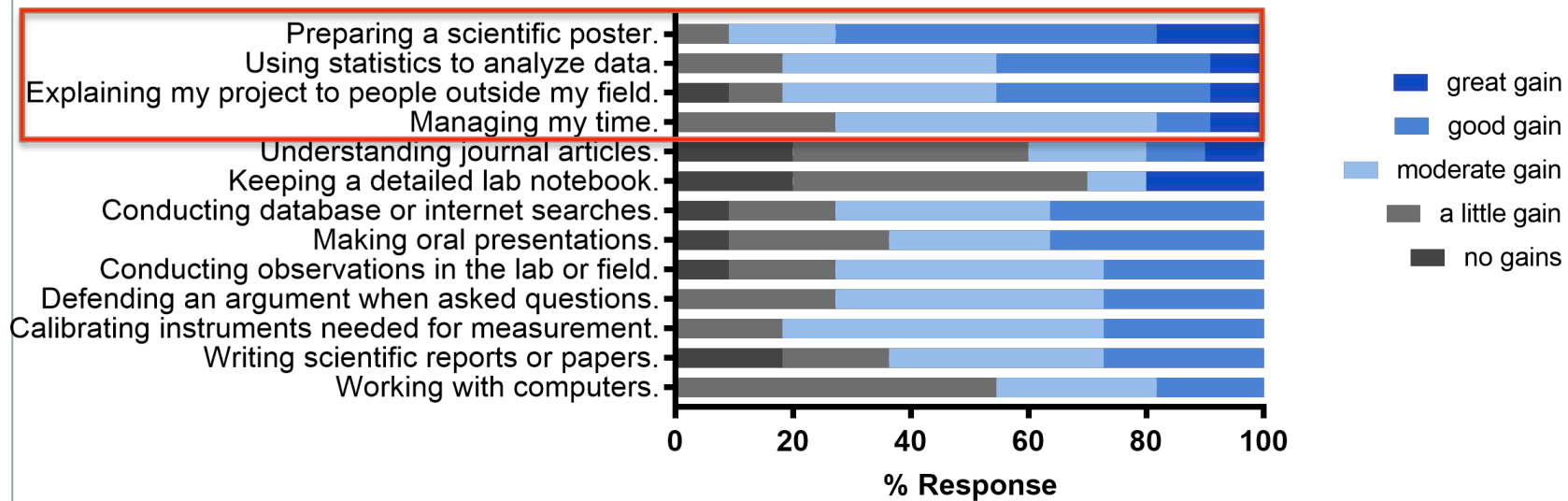
Fraction of total of IOWATER



Skills – IOWATER (N = 12)



Fraction of Total of IOWATER



Student Comments on Research Experience



These questions ask about your research experience. Please comment on any of these aspects.

I felt like I worked well with my peers and the research mentors did a good job providing help and advice. (4/5)

Did you make other gains from doing research that we didn't mention? If so, please briefly describe these.

It helped me work well with others on a research project which I need to do in the future. (3/4)

Student Comments on Future Plans



Please state your intended degree and, compared to your intentions BEFORE doing research, HOW LIKELY YOU ARE NOW to enroll in a graduate program leading to an advanced degree.

Geology. I'm very likely to enter a graduate program, I wanted to before but I want to more now. (10/11)

How did your research experience influence your thinking about future career and graduate school plans? Please explain.

It allowed me to get a glimpse of what my senior thesis would be like and how to conduct research in a professional way.

It helped me understand future science research projects that I may undertake.

It helped me learn how to conduct a good experiment and I believe this will help me for my future career.

It made me think more about what I like and what I don't which cancelled some things out for me. (6/13 positive, 7/13 neutral)

Summary



- Introducing freshmen to authentic research has a positive effect on their skills, appreciation of their major, and future plans
- Embedding a research experience in an orientation course/learning community is practical and ensures sustainability
- A project created around water quality and surface water recharge is easy to implement and low cost
- Implementing an assessment/revision loop allows to tune activity to student needs and interests

Questions?



For more details about the implementation of a freshman research initiative, email Cinzia Cervato - cinzia@iastate.edu

